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P U G W A S H N E W S L E T T E R

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Editor : Prof. B.T. FELD

9, Great Russell Mansions
60, Great Russell Street
London WC1B 3BE, England

C O N T E N T S

REPORT OF THE DIRECTOR-GENERAL

(The following is an edited version of Dr. Kaplan's report as presented at the Mülhlhausen Conference)

In my baptismal report I do not intend to tax your patience more than is absolutely necessary. I cannot, however, proceed to the business at hand without paying tribute to my predecessors in the chief executive office, Professor Rotblat and Professor Feld, and to the Chairman of our Pugwash Council, Professor Nalecz. The care and devotion they have given to Pugwash activities and interests are known to all of us, and we are immensely grateful. I do not believe they would want more than this simple expression of thanks. They are here today, active as ever in the work of the organization, and this support eases considerably the tasks to be faced during the next year.

The Pugwash Movement originated in 1957, following the Russell-Einstein appeal for scientists of all sides to meet and dedicate their efforts to combat the peril facing humanity from nuclear war. Almost twenty years later we can claim to have made only little progress in lessening this peril, although we can at least be thankful for having been spared thus far from a nuclear conflict. This thanks, however, is meaningless to the millions who have died in scores of conflicts with conventional weapons that have occurred since World War II.

Pugwash can chalk up certain positive contributions towards arms control and disarmament, such as our work in relation to the Partial Test-Ban Treaty, the SALT talks, the Anti-Ballistic Missile Treaty, and the Convention on Biological Weapons.

But what do we witness today. As Epstein has pointed out, between 1960 and 1975 world military expenditures have increased from some 100,000 million dollars per year to three times that amount - which represents a magnitude of waste that is difficult to grasp. This is about three times as much as governments spend on health, about twice as much as they spend on education, and about thirty times as much as the rich countries provide as aid to the poorer countries for their development - all this in the face of hundreds of millions in the poorer countries living on the edge of death from disease, hunger and poverty.

Not one nuclear weapon, airplane, ship, tank or rifle has been destroyed by agreement. Nuclear weaponry has increased in sophistication to an almost unimaginable degree, thanks to continued and enhanced underground and missile flight testing.

And now we face the possibility of spread of nuclear weapons capability to perhaps 15 or 20 or more additional countries in the next decade. Not that this capability will necessarily mean that nuclear weapons will in fact be produced by countries capable of doing so. But the continuing mistrust, international tensions and actual conflicts that permeate our daily lives underline the basic instability of the world we live in - a precarious state of mankind that Russell and Einstein, were they alive today, would find equally, if not more disturbing, than when they issued their profoundly moving plea of "remember humanity, and forget the rest".

These facts dictate why the main preoccupation of Pugwash since its inception has been, and continues to be, to prevent mankind from destroying itself. But even the bare goal of self-preservation requires many approaches, and I shall try to review some of the paths we have taken during the period covered in my report, which dates from the 25th Pugwash Conference held in Madras, India, in January of this year.

One of these developments really has

its origin in the Pugwash Symposium on a New Design towards Nuclear Disarmament held in Kyoto, Japan, in August 1975. This is the Pugwash Workshop on the Feasibility and Implications for a Systems Approach Study to General and Complete Disarmament which will be held in Sukhumi, Georgia, USSR, next month from 25 to 30 September. Our colleagues in the Soviet Pugwash Group have kindly arranged to act as hosts for this meeting which is so central to the concerns of Pugwash. We look forward to the results of this meeting with great interest because of its importance to the future activities of our organization.

Three days ago we held here in Mülhausen the Fourth Pugwash Workshop on Chemical Warfare (see pp. 62-68). You will note in the report that we point to the recent tragic accident in Seveso, Italy, as an example on a very small scale as to what the consequences could be, should highly toxic CW agents be used in a future conflict. Dioxin, the chemical involved in this incident, and although not a CW agent, is comparable to some of the V-agents used in nerve gases in terms of its acute toxicity and with regard to its delayed toxic manifestations. Dioxin is cheap, easy to produce, persistent, and difficult to decontaminate; and there is no effective medical treatment for its toxic actions.

An increasing number of highly toxic lethal and incapacitating chemical substances are being produced which could be considered potential candidates as chemical warfare (CW) agents. Even though, as with dioxin, they are not at present suitable militarily for use as CW agents, their existence points to the need for prohibiting their possible development as such. This is a matter which requires continual surveillance.

Our continuous activity in striving towards a complete ban on this dreadful class of weapons of mass destruction, similar to what we were able to achieve with respect to biological weapons, exemplifies the unique type of contribution Pugwash is able to make on such difficult questions of disarmament - technical expertise, original ideas, mutual trust between scientists of different and often opposing political beliefs, and the possibility of a frank exchange of views without the constraints of official negotiations at governmental level.

The 44th session of the Pugwash Council, our governing body, met during the past two days. The discussions included the mapping out of our future activities until our 27th Conference which will be held in Munich in August 1977, exactly one year from now. The 1977 Conference will be a quinquennial one at which we take stock of where we are, and what policies and directions we shall follow during the succeeding five years. I shall take up some of the crucial questions we shall have to decide upon at that time towards the close of this report.

I should like now to describe as briefly as I can the remaining Pugwash activities since the Madras Conference eight months ago.

A. The Madras Conference

You will recall that the Pugwash Symposium on "Self-Reliance" held in Dar es Salaam in June 1975 (described in the Pugwash Newsletter of September 1975) was in a sense preparatory to the Madras Conference. In Madras the subject of self-reliance merged into a consideration of alternative development strategies for developing countries. The realization emerged that different approaches would be necessary because of the diverse socio-economic and political situations of these countries and the political and economic interests of the industrial powers.

In keeping with the concept of a new economic order that now preoccupies the UN and other bodies, but which continues

to receive a cool reception from most of the "have" countries, the main principle re-affirmed in Madras was the need for developing "a national capacity for autonomous decision-making and implementation on all aspects of the development process, particularly including science and technology".

A concrete suggestion for Pugwash action was in connection with the World Conference on Science and Technology scheduled for 1979, preparations for which are now getting under way. A project was proposed for Pugwash to identify possible breakthrough points in science and technology where concentrated collective efforts of scientists and institutions in both developed and developing countries could be expected within a reasonable time to make significant contributions to improving the economic and social levels of the poor countries, incorporating environmentally sound considerations. Possible examples noted were: increasing the efficiency of photosynthesis; pest-resistant crop varieties; direct nitrogen fixation; inexpensive sanitary procedures for water supply, waste disposal and housing problems; and improved procedures for dealing with tropical diseases including vector control, diagnostic, therapeutic and preventive agents (e.g. vaccines), especially for parasitic infections. This exercise would be accomplished by means of a Delphi-type enquiry using the expertise of Pugwash scientists in the first instance.

Since such an undertaking would be beyond the financial and secretariat resources of Pugwash we would have to seek outside finanical aid. If such aid seems likely to be forthcoming, the matter would be submitted to the Pugwash Council, along with a specific formulation of the enquiry, for decision.

Another major topic covered at the Madras Conference was social and professional responsibilities of scientists and technologists in relation to development. The Conference forwarded for Pugwash action Prime Minister Indira Gandhi's suggestion made in her welcoming speech.

The suggestion was that Pugwash take the initiative in formulating a set of guidelines or code of behaviour for international scientific cooperation. This would be analogous to the Pugwash initiative in 1974 of a code of conduct for the transfer of technology which laid the basis for negotiations now under way in the UN. The Indian Pugwash Group have signified their willingness to act as host for an international Pugwash Symposium on this ubject for the early spring 1977.

A third working group in Madras explored in some depth the complexities and difficulties of achieving the New Economic Order. The working group felt that Pugwash could be particularly useful in adjusting scientific research in advanced countries to the needs of developing nations. Four areas of research were singled out here: new sources of food in the developing countries themselves; health; non-traditional energy sources; and assisting developing countries in obtaining knowledge of their own resources. Several of these problems will be discussed in an international Pugwash Symposium entitled "Feeding Africa", sponsored by the African Pugwash Group and tentatively scheduled to be held in Ghana or another African country in the spring of 1977.

Another working group dealt with current issues of nuclear arms control and non-proliferation, with emphasis on these problems in developing countries.

The impact of programmes of peaceful uses of nuclear energy on nuclear proliferation was sharply discussed, and one aspect of this problem was considered in depth at the 26th Pugwash Symposium held in Wingspread, Wisconsin, USA, in May of this year, entitled "International Arrangements for Nuclear Fuel Facilities". The

proceedings of this Symposium will be published within the next few months.

B. Other meetings

Two recent meetings with Pugwash involvement should be noted. The first was the 6th Course of the International School on Disarmament and Research on Conflicts (ISODARCO), sponsored by the Italian Pugwash Group. This meeting was held in Nemi (near Rome) from 22 June to 7 July with some 70 participants. The ISODARCO courses have established a deservedly high reputation for their content and organization, and the Italian Pugwash Group are to be congratulated on this effort - a fine example for other national groups. The second meeting was the International Youth Science Fortnight (held annually in London) during which one afternoon was devoted to Pugwash. Several hundred budding scientists were exposed to a panel of six Pugwash veterans, with mutually informative results.

Your Executive Committee met in London on 23 and 24 April. It covered many housekeeping items arising from the Madras Conference and made decisions on the preparation and arrangements for the follow-up meetings mentioned previously, as well as two important meetings scheduled within the next few months. They are the meeting in Sukhumi, USSR, mentioned before; and the 27th Pugwash Symposium on "Problems of Militarily-Oriented Technologies in Developing Countries" in Feldafing (near Munich) on 23-26 November.

The item of most interest to our present Conference that was dealt with by the Executive Committee concerned the future activities and organization of Pugwash, which will be decided upon at our 1977 Conference in Munich. Specifically, a series of questions were posed for circulation to Council members soliciting their views for consideration by the Council meeting immediately preceding our Conference here. This questionnaire was published in the recent April issue of the Pugwash Newsletter in order to provoke thinking on this subject throughout the entire "membership" - a permissible term if defined as loosely as the Pugwash "Movement" itself. In April the Executive Committee decided to adopt this mechanism as part of a process which will continue until the 1977 Conference itself. Definite proposals will then have been formulated by the Council and Executive Committee for consideration, possible modification, and eventual adoption by participants in the 1977 Conference. In this way we may have the benefit of the experience of previous quinquennual Conferences when there was insufficient time to deal adequately with the subject of the future of Pugwash.

C. The Future of Pugwash

I respectfully advance a few personal reflections on this subject on the basis of my association with Pugwash since the memorable Third Conference in Kitzbühel and Vienna in 1958. During this time I have been, and remain, a working scientist in the field of microbiology and biomedical research - in the early days one of a sprinkling of biologists amongst the predominant physicists and chemists. I have had the privilege of associating with many of our colleagues active today, as well as with the Pugwash giants of the past - Russell, Powell, Topchiev, Millionshchikov, Artsimovitch, Szilard, Rabinowith, Sarabhai, Blackett, Cockcroft - amongst others. Merely to recite that roster of names, and the memory of their dedication to Pugwash ideals, is both inspirational and sobering, a feeling which I am sure you share. I shall do my best to fulfil the aims they envisioned for Pugwash, that it be worthy of their splendid contributions.

We are a unique organization amongst many that are working against war and social injustice. It is worth noting why we occupy

a special niche. There is little doubt that much of the impact Pugwash has had to date has come about from the high quality of technical analyses on the questions addressed. These analyses have been brought to the attention of decision-makers at top levels of governments of opposing viewpoints, who have given an attentive ear to our recommendations because of the scientific and moral authority behind the formulations. These are precious and perhaps the unique assets of Pugwash as an effective force, and their retention should be a principal concern in choices foralternative actions by Pugwash.

It is not enough to issues reports, make periodic declarations such as our Kitzbühel-Vienna statement, or to endorse the Helsinki agreement on détente. It is doubtful that exhortations per se have been very effective; concrete action is urgently required to implement them. Pugwashites need no reminder that time is running short. This is the most compelling reason for a re-appraisal to determine how we can function with maximum effect.

The questions formulated by the Executive Committee on the future of Pugwash take into account the realities of limited finances and staff and, most importantly, the nature and priorities of Pugwash and its modus operandi. This set of problems has been debated by your Council and Executive Committee for more than two years, in the course of implementing the mandate of the last quinquennial Conference in Oxford in 1972. On such matters it is to be expected that different views are held, and it is possible that difficult choices may have to be made in our 1977 Conference.

Let me sketch briefly what I consider to be the core problems and choices that must be resolved.

1. Should Pugwash attempt to expand its operations and "membership" to become a mass movement with a broad public base? Any marked change towards a mass movement would of course have to take into account our present constraints of limited finances and secretariat. This approach has been rejected in the past, a feeling that seems still to prevail today. This should not however exclude, and should actually encourage, much greater publicity of our findings and a widening of active participation by leading scientists, including younger ones, in its meetings and activities. And here the principle of universality is most desirable: scientists from all countries should be involved, including those of the People's Republic of China whose continued absence at our meetings is highly regrettable.

2. What should be our priorities? Our major area of preoccupation during the past decades has been the prevention of nuclear war and other forms of armed conflict. Linked with this during the past several years has been our increased concern for problems of the economically underdeveloped countries in achieving a betterment of their present low socio-economic levels. Our attention to environmental pollution, energy resources, population increase and technological developments such as genetic engineering should not be overlooked, but they have been subsidiary to the areas just mentioned. All are vast and highly complex fields, and Pugwash cannot make its unique contribution to all or even many of their aspects. Should we extend our presently limited resources and thereby perhaps dilute our contributions in certain areas, or should we concentrate on very selected problems?

3. In considering the questions just posed, we must face the increasingly important dimension of antagonisms between the "have" and "have-not" countries, and between the have-nots themselves, in the military, political and socio-economic spheres. Our views of the great powers as playing the central role in a possible generalized nuclear war may no longer be valid, particularly

insofar as trigger events are concerned. Should Pugwash give more attention and emphasis than it has to many aspects of antagonisms and conflicts of interest between the rich and poor countries? As presently constituted and financed, Pugwash probably could not do this with any degree of effectiveness. And even if our organization is substantially modified to meet this challenge, can a unique role for Pugwash in this area be identified?

4. Finally, the formal structure of Pugwash and the functions and interrelationships of its governing bodies, national groups, and secretariat must be re-examined. A decision must be taken as to whether it should remain loose and relatively informal, or assume a more concrete organizational form. In my view the rather informal basis that has existed until now is both desirable and sufficient to ensure effective functioning, and should continue. It appears to me that a larger and more rigid bureaucratic structure would be unwise and less adaptable in our rapidly changing world.

These, to me, are the major questions to be resolved at our Munich Conference in 1977. The other decisions to be taken according to the questionnaire cited previously will, I am sure, be much easier to make. Your Executive Committee, Council and officers rely on your active concern and participation, individually and through your national groups. And in this process, as in our meetings, we must avoid the scoring of points for this or that establishment or political viewpoint: the UN and other organizations are welcome to that. For Pugwash such an approach would be fatal.

I am sure you share my conviction that Pugwash has an important role to play at this crucial stage of world affairs when the alarm signals are insistent and increasing. On certain questions our role could well be a decisive one. Our clear duty therefore is to ensure that Pugwash can and does respond effectively to the formidable challenges facing it. Each of us must accept and discharge that commitment in the spirit of Pugwash - with scientific integrity, mutual respect, flexibility, and tolerance of opposing viewpoints.

STATEMENT FROM THE COUNCIL OF THE PUGWASH CONFERENCES ON SCIENCE AND WORLD AFFAIRS ON THE 26TH PUGWASH CONFERENCE

The 26th Pugwash Conference on Science and World Affairs met in Mühlhausen, GDR, on the 26th to 31st August 1976 on the theme "Disarmament, Security and Development". 87 scientists from 28 countries, as well as 6 observers from 5 international organizations, participated.

Our enjoyment of the splendid hospitality of our hosts, the Academy of Sciences of the German Democratic Republic, was enhanced by the beauty of our surroundings and the historical significance of Mühlhausen, where Thomas Müntzer led the Peasant's War of 1524-26. In this atmosphere of friendship and hope for the future, a visit to the former concentration camp at Buchenwald served to strengthen our resolve that such horrors will never recur. We were honoured to have our Conference opened by the Chairman of the Council of Ministers of the GDR, His Excellency Horst Sindermann, whose knowledge and understanding of our past efforts and our goals reinforced our strong feelings of urgency in seeking solutions to the complex and vexing world problems included in our agenda.

The work of the Conference was divided among four working groups according to the following topics: 1. Problems of limiting and reducing strategic nuclear armaments and other weapons of mass destruction; 2. Controlling the spread of nuclear weapons; 3. European security and cooperation issues; and 4. Development and security. In addition, we met in plenary sessions to hear reports on recent Pugwash activities, listened to a round table discussion on issues concerning a code of conduct for scientists, and heard and discussed a report on the recent development of molecular biological techniques of in vitro DNA recombination (popularly referred to as genetic engineering).

The Pugwash Council, in addition to concerning itself with many aspects of the Pugwash Movement, began the detailed preparation of next year's 20th anniversary Pugwash Conference, to be held in Munich in the Federal Republic of Germany on the 26-31 August 1977. At that Conference it is intended to review the past work and to set the course of the future programme and organization of the Pugwash Movement.

The following is a summary of the main conclusions of the Mühlhausen Conference based on the reports from the Working Groups and the special discussion on genetic engineering.

Problems of Limiting and Reducing Strategic Nuclear Armaments and Other Weapons of Mass Destruction

The SALT Negotiations

The exercise over the past 15 years in arms control has not prevented an increase in armaments; indeed, the arms race has become more intense. It was felt that a basic departure was needed from the concept of arms control towards real disarmament.

However, the positive aspects of the developments in the last decades should not be overlooked. A nuclear holocaust has so far been avoided. The factors which have favoured restraint in a most dangerous situation should be studied and strengthened. The psychological barriers, which stem in part from ideological roots, hinder further progress. They contribute, on both sides, to the failure to see and understand the points of view and the motivations of the other side, thereby creating tensions; they should be studied, made conscious, and removed as far as possible.

Many participants felt that in the interest of greater progress in arms control and disarmament, the countries involved in negotiations must provide more public information about their weapons programmes and strategies. In this way, those favouring and working toward such progress will be aided immensely as they attempt to influence their governments' position in this matter.

Although the SALT agreements contain some positive results in limiting ABM systems, in placing ceilings on the numbers of the most offensive weapons and in agreeing not to interfere with national technical means of verification, there was disappointment that SALT has not stopped the qualitative arms race and so far has done nothing to reduce the existing large numbers of strategic offensive weapons. The process of détente and the arms race cannot co-exist indefinitely. Further progress towards disarmament is essential.

Many noted that the secrecy, complication, and protraction of the SALT negotiations have resulted in a disenchantment and loss of interest by the general public, and therefore future negotiations should provide more information about the issues discussed, and the position of the two sides on them. A substantial and comprehensive reduction of all types of strategic weapons should be achieved.

Concern was expressed about the negative effect on SALT and on arms control and disarmament which the large scale deployment of cruise missiles could have. Cruise missiles represent a new and very efficient and precise carrier of nuclear as well as conventional warheads. The strategic long range cruise missile should not be deployed since it could undermine past SALT agreements and would jeopardize prospects for future meaningful strategic arms limitations, and open another channel for an upward spiral of the arms race of action and reaction. The testing and deployment of cruise missiles as a strategic weapon should be banned. It was suggested that the verification of a ban on testing may be possible since non-intrusive technical means of inspection could differentiate long range strategic from short range tactical cruise missiles, provided the latter were built with specific physical attributes such as a type of jet engine, and in the present technological environment, with limited total volume.

It was also suggested that such moves as banning the testing and deployment of cruise missiles, and not developing the Backfire bomber into a heavy, long range system, would help the conclusion of a SALT II agreement.

Other nuclear weapons powers should be encouraged to join at some point the process of substantial and comprehensive reduction of all types of strategic weapons.

It was noted that the continuing arms race by the nuclear weapons states stimulates the spread of nuclear weapons to more and more countries.

The nuclear arms race is, in part, promoted by the fears of the major nuclear powers in connection with imbalances in some strategic indicators (such as throw-weight and numbers of nuclear warheads), characterizing their relative strategic postures. Some regarded the preoccupation with such imbalances unjustified in view of the stability of the overall strategic balance, and particularly regretted that the concern about such imbalances appears to be given priority over the far greater danger represented by the prospect of the spread of nuclear weapons to additional countries.

Civil Defence

Many stressed the ineffectiveness of civil defence programmes designed against the nuclear threat, and the psychological damage they do to efforts at disarmament. Others felt that civil defence as such should not be attacked because it could save lives

in some conditions and in some countries in which it could not be a cause of misinterpretation as preparation for nuclear attack. The suggestion was made that governments should provide more information about their civil defence measures and the reasons for them, and thereby eliminate opportunities for misinterpretation.

World Disarmament Conference

There was a debate on the value of a proposed World Disarmament Conference, which might be preceded by a Special Session of the UN General Assembly. Most felt that this might well be fruitful in encouraging governments to achieve major progress towards disarmament. However, a few expressed concern that such meetings might become mere exercises in propaganda. A World Disarmament Conference or a Special Session preceding it must be most carefully prepared, and participation should be at high government level.

Military Research and Development

Curbing of military research and development is central to the halting of the arms race. A new development in the US was noted, whereby the US government was being required to prepare for Congress, for many of their weapons programmes, statements on the impact of these programmes on prospects for arms control. These statements may have the result of postponing the development of new weapons programmes or lead to the refusal by Congress to appropriate funds for them. Some participants suggested that if other governments producing new weapons systems would undertake to provide similar impact statements of their weapons programmes, this could have a positive result. Governments will however tend to claim their weapons programmes as not incompatible with arms control policy and negotiations, and therefore the view was expressed that such impact statements should be evaluated independently.

Test Ban

It was agreed that it was essential to ban the testing of all sorts of new weapons of mass destruction. It was pointed out that such testing can generally be monitored by national technical means of verification. This would impede development and production of such new weapons. It was suggested that unilateral steps of arms limitation and reduction by mutual example would facilitate the process of disarmament.

As a means for preventing nuclear proliferation and the development of novel types of nuclear weapons, all stressed the importance of achieving a comprehensive nuclear test ban treaty. This would also have an important psychological and political impact conducive to disarmament. However, there are two debatable points:

Peaceful nuclear explosions are held by some to have important economic potential, and at least exploration of this should not be foreclosed. A thermonuclear explosion with drastically reduced radioactivity might be technologically possible. Others argued that peaceful nuclear explosions have no real economic significance and the difficulty of ensuring that an ostensibly peaceful explosion is not used to acquire military information is so great as to require prohibition. A solution advocated by some: peaceful explosions would be prohibited unless conducted under international auspices in accordance with arrangements negotiated under Article V of the Non-Proliferation Treaty (NPT).

The other point of debate relates to the fact that some maintain that the comprehensive ban should not go into effect unless all nuclear powers - particularly France and China - are parties. Otherwise complying states will have no assurance that non-signers will not make significant gains. Others held that, although it would be desirable for other countries to adhere, a test ban for the US and USSR, who are conducting the great bulk of the testing,

would be valuable in its own right and could be accepted without risk. A solution advocated by some: a test ban for a limited period, say five years, after which the situation would be re-examined to see whether any problems had arisen because of the non-adherence of nuclear powers.

A similar divergence of views exists with respect to the Threshold Test Ban Treaty. Some maintain that this was a positive development and a step towards a comprehensive ban. Others think these aspects were outweighed by the height of the threshold (150 kT), and they feel therefore that the treaty should be re-negotiated.

Doctrines of Weapons Use

In the US, we are now seeing new formulations of the doctrine of flexible response, including renewed emphasis on possible first use of nuclear weapons. At the strategic level, a retargetting strategy has been proposed, which calls for selective attacks against a limited number of military targets at a certain stage of armed conflict. At the tactical level "mini nuclear-weapons" are being developed, which tend to obliterate the distinction between nuclear and conventional warfare.

Such concepts are dangerous, and we condemn them. The casualties from even a limited counter-force strike would be enormous. Moreover, there is no way to guarantee that limited resort to nuclear weapons- whether in the form of "selective response" or the battlefield use of "mininukes" - can be kept limited. It is much more likely that the conflict would become unlimited and world-wide. Such doctrines are themselves incentives to proliferation.

It is most desirable to reduce drastically the numbers of tactical nuclear weapons stationed in Europe and elsewhere, by agreement or otherwise.

Chemical Weapons

There is an urgent need for a ban on chemical weapons. With regard to the verification of such a ban, some degree of verification by satellite inspection might be feasible, although many considered this very ineffective and open to misinterpretations. All expressed the hope that governments might find it possible to follow the example of the 1972 Convention on Biological Weapons by initiating the process by unilateral action and foregoing on-site inspections. The argument was noted that the acceptance of the principle of non-inspection in this case might set a precedent for other cases in which application of this principle would be undesirable, but this argument was considered as non-overriding. The Pugwash Chemical Warfare Study Group will explore further the parameters of on-site inspection - an exercise which will be undertaken in 1977 at an organo-phosphorus plant producing pesticides in FRG.

Major progress towards a complete ban on chemical weapons and their renunciation by states could be achieved if the USA and USSR implemented their intention to submit a joint initiative to the Committee on Disarmament for the prohibition of super-toxic and other lethal agents of chemical warfare. The urgency of a ban on chemical weapons is convincingly illustrated by the development of so-called binary weapons, a new generation of chemical weapons, that could start a new loop in the arms race spiral.

We maintain our conviction that the final goal must be general and complete disarmament.

Controlling the Spread of Nuclear Armaments

The Non-Proliferation Treaty

We continue to believe that the acquisition of nuclear weapons by more states would present a serious additional danger to world peace. But there was widespread

agreement that there are major defects in the present non-proliferation regime, centering on what many call the discriminatory features of the Non-Proliferation Treaty (NPT); these seem to consign the non-nuclear weapons states (the vast majority) to a permanent status of inequality. At the same time, in a certain sense, the Treaty legitimizes the possession of nuclear weapons by the small handful of existing nuclear weapons states.

Nevertheless, most of us, although recognizing the validity and seriousness of the criticisms, still believe that the NPT makes an important contribution to the effort to prevent the spread of nuclear weapons. At the same time, we all feel strongly that the efforts of the nuclear weapons states for disarmament have been inadequate. No decisive progress has yet been made in the limitation of strategic weapons. The obligation of Article VI of the NPT, requiring the nuclear weapons states to negotiate in good faith for reduction of nuclear arsenals, is the reciprocal of the obligation of self-denial assumed by the other parties. Continued failure to achieve results will inevitably erode support and adherence to the NPT regime.

Time is growing short.

Nuclear Power and Nuclear Weapons

The connection between nuclear power and nuclear weapons was examined at length from the technical, political and psychological standpoints. There was widespread agreement that the operation of current generation power reactors, of itself, need not present a significant proliferation threat. Acquisition of bomb material from spent fuel is impossible without reprocessing. The discussion focussed, therefore, on problems associated with the possible spread of reprocessing facilities, either for recycling fuel for use in current generation reactors or to produce plutonium for future breeder reactors. The plutonium extracted from spent reactor fuel is concededly not the best material for weapons purposes, but it could be used to construct a nuclear explosive, especially if yield and performance requirements are not important. Such a feat would clearly be within the capacity of a country with a modest nuclear capability, such as that implied by the operation of power reactors and small-scale reprocessing facilities.

There was a division of opinion on the question whether bomb production was within the capacity of criminal or terrorist groups who might gain access to reprocessed plutonium. It was stated that there are formidable difficulties in such an operation, but most thought that a group with the proper composition and resources would have a considerable possibility of success.

This led to a discussion of the potential adequacy of safeguards against diversion and physical security measures in a "plutonium economy" - that is one in which there is extensive reprocessing of reactor fuel. Various suggestions for meeting the problems of such an "economy" were discussed, including co-location of other fuel cycle stages at the reprocessing plant and the organization of multi-national fuel centres. The recently adopted recommendations of the IAEA on physical security were noted. It was hoped that they might be used as a starting point for national action by member states; and it was recognized that further exchange of technical information on physical security, perhaps under Agency auspices, is urgently needed. Exports of reprocessing facilities were criticized and some called for a tighter control system for the transfer of nuclear materials and technology to be agreed on by all supplying countries. On the other hand, it was argued that supplier agreements restricting sales of reprocessing plants might violate Article IV of the NPT, which guarantees to non-nuclear-weapons states access to peaceful nuclear technology, and would further undermine the NPT regime.

In any case, it is clear that the safeguards and physical security problems of reprocessing are not very well understood. Some thought that reasonable assurance against diversion or theft could not be achieved without a militaristic or authoritarian system.

The discussion concluded with a review of the prospects for deferring or avoiding altogether this kind of plutonium economy. It was agreed that for the present it is unrealistic as well as undesirable to think in terms of a universal ban on nuclear energy or even a moratorium. But it was also agreed that reliance on fission energy was likely to be only temporary and that it would ultimately be replaced by other energy sources, although when this would occur was a matter of debate. This assessment lends urgency to the arguments for deferral of an irrevocable commitment to reprocessing or breeders.

Estimates of high grade uranium resources and energy demand (based primarily on US data) were presented suggesting that uranium resources would be sufficient without reprocessing or breeding for at least 50 or 60 years, as opposed to the 20-30 years usually assumed. The potential advantages of the thorium breeder were mentioned.

The general conclusion was that the final decision on reprocessing and breeders could probably be delayed for at least 10 years without serious penalty, and there was a significant measure of agreement that governments should be urged to proceed cautiously and to defer for a considerable period the acquisition of reprocessing facilities or a commitment to breeder reactors.

Alternative Energy Sources

An array of possible alternative energy sources were also discussed, including fusion, geothermal, solar and increased use of coal. As in previous Pugwash Conferences, there was general support for sharply increased research and development on all these fronts. In particular, it was strongly suggested that research and development on solar power should be stepped up very steeply. At the present time, funds available for this work are not more than a few percent of the financial support for nuclear energy research. This work should include not only low-temperature applications and photovoltaic generation of electricity, but also photochemical processes like the photolysis of water to produce hydrogen as a basic energy carrier. What is needed is a crash programme involving close collaboration and division of labour among national efforts, with international consultation and information exchange, perhaps through an institution along lines suggested at previous Pugwash meetings. Some thought that an international research institute carrying out and co-ordinating active research will also be needed.

World-wide Nuclear-Weapon-Free Zone

The consideration of nuclear-weapon-free zones produced a major new Pugwash initiative. In response to a suggestion of the Madras Conference, a draft treaty for a "world-wide nuclear-weapon-free zone" was prepared and presented to the Conference.

Past Pugwash Conferences have attached great significance to the concept of regional nuclear-weapon-free zones. It was thought that such zones can serve three purposes: enhanced security for countries situated within the zone, strengthening of the regime of non-proliferation and encouraging nuclear disarmament. But little progress has been made with the traditional approach. By contrast, the new proposal contemplates a treaty open to any country, anywhere in the world, that is willing to undertake not to allow nuclear weapons on its soil. The requirement of substantial unanimity in a particular region is eliminated.

The draft is a preliminary effort,

however, and leaves many questions unanswered so that a detailed study of this unusually promising concept is now warranted.

The Need for Political Will

As in the past, the discussion produced a number of technical suggestions for inhibiting nuclear proliferation and alleviating related problems. But in the last analysis, these problems cannot be solved by a technical fix or institutional gimmick. The essential requirement is political will.

And the necessary political will is increasingly paralysed by the failure of the nuclear weapons states to reduce their weapons stockpiles and their reliance on doctrines involving nuclear weapons as instruments of war. So long as there are no effective steps toward nuclear disarmament and no substantial reduction in nuclear arms, the problems of further nuclear proliferation and diversion of fissile materials will remain with us in acute form. The responsibility for initiating such steps rests squarely on the nuclear powers, and particularly the US and the USSR.

European Security and Cooperation Issues

Further Implementation of the Helsinki Agreement

The meeting of the leaders of 35 states, which ended in Helsinki a year ago with the signature of the final act of the Conference on Security and Cooperation in Europe, was an unprecedented event, which demonstrated that concerted decisions on a series of problems pertaining to European security can be taken. This act laid down a comprehensive set of principles and a programme aimed at the realization of conditions for cooperation and lasting peace in Europe.

There is a need for serious efforts aimed at the successful implementation of the Helsinki Agreement: there are already tangible results in a number of fields; especially in economic, scientific and cultural cooperation.

It was noted that events outside Europe, inadequate progress with the Vienna mutual force reduction (MFR) and SALT II talks and the effect of these on internal domestic politics had combined to diminish enthusiasm in some countries for the Helsinki Final Act. However, there was evidence of a high degree of commitment of other governments and peoples to the realization of its objectives.

It is important to adopt a constructive attitude instead of emphasizing what other parties had not done. There was, nevertheless, general agreement that substantial practical achievements would take time, that the principles were good and that, in any case, there was no alternative to détente if peace was to be consolidated in Europe.

We reviewed the situation in the light of the forthcoming Belgrade Conference. In certain quarters there appeared to be a lack of enthusiasm for the agreement which manifested itself in the mass media and reflected an unnecessary distrust and in some cases, it was felt, governments have shown a cool attitude towards a document they have signed themselves.

While some governments give different weight, importance and priority to each of the four "baskets" of the Final Act, other states regard the four parts of this act as equally important. The Final Act was inevitably a compromise that needs implementation in the spirit of détente and a realistic approach according to the interests of different political and social systems. Steps towards the realization of the provisions of the Final Act relating to military and economic matters as well as free movement of people, information and ideas, are bound to be difficult, because they involve legislative and other changes.

A Perspective for Europe

We felt it useful to attempt to envisage

the kind of Europe which ought eventually to emerge, and the steps to achieve it. Looking ahead 15-20 years, in Europe the military blocs should be dissolved and substantial disarmament and reduction in armed forces attained. It is important to promote further and more effective European economic collaboration, within a framework in which there would be close contacts and mutual cooperation among all European states as well as between the Council for Mutual Economic Assistance (C.M.E.A.) and the European Economic Community (E.E.C.). There should also be broader cultural cooperation, a prerequisite for which would be the substantial reduction of asymmetries in cultural exchange (in translation of books and literature, exchange of films, music, TV programmes, theatrical performances, scientific contacts, mutual projects, etc.).

At present it is considered unrealistic to think in other terms than within a gradually changing pattern of relationships of the two clearly identified political and social systems. This also means the continued recognition of existing sovereign states, whatever degree of economic and political integration might be achieved, on an equal basis and with guarantees of non-intervention in their internal affairs.

Within the foreseeable future a feasible all-European system could be established providing, particularly, procedures for the settlement of disputes. A view was expressed that provision should be made for third party mediation.

A strong possibility exists of developing further international division of labour in fields such as energy and transport, which would reinforce economic development and détente. The necessity was stressed of convening European conferences on energy, on transport and on pollution, and other methods of broadening the field of economic cooperation without discrimination and without barriers.

Considerable concern was expressed that, while economic cooperation and exchange have increased, in recent times expanding economic contacts have not prevented an intensification of the arms race. This suggested that, whatever the progress towards cooperation on many levels, military confrontation would not be lessented without deliberate efforts in that particular direction.

The Talks on Mutual Force Reductions

The Vienna MFR talks have not made real progress, perhaps because the principles on the basis of which the conference was convened have been subject to different interpretations. The spirit of Helsinki needs to be reasserted in this connection. There was general agreement that the technical problems relating to the symmetry and asymmetry of East-West military forces and dispositions in Europe were serious obstacles. Some felt that a fuller exchange of information on the force situation and its development was necessary if objective judgments about reductions were to be made; others claimed that the information problem was not a major obstacle to progress. It was stressed that the success of military negotiations depended upon a clear political determination to find a solution. This was particularly urgent in the light of the development of new weapons and strategic doctrines on the part of both blocs. The nuclear armaments problem in Europe is becoming more critical as mininukes and other new technologies become available.

The first priority is to break the deadlock in Vienna by constructive steps aimed at a substantial measure of force reductions on both sides. The gradual development of the Confidence Building Measures as envisaged in the Helsinki Agreement is one important way of assisting this aim, in that these are directed at the core of the matter - the elimination of distrust. The question of whether the presence of neutral countries, other than those on the periphery of Central

Europe, at the Vienna talks would be useful was a matter of debate.

Nuclear Weapon-Free Zone in Central Europe

The possibility of a relatively narrow nuclear weapon-free zone, not involving the withdrawal of foreign nuclear weapons from European soil but rather the sterilization in this respect of, perhaps, the territory between the Rhine and the Vistula, was canvassed. Doubts were expressed that this might simply prove another optimistic 'first step' which would be overtaken by new technology before it had been implemented and that consequently more radical proposals relating to the whole of Europe, already discussed in Pugwash Conferences, should have priority.

Scientific, Technological, Economic and Cultural Cooperation

Since the Helsinki Agreement there has been a more positive attitude to international cooperation. There was a general optimism that projects were being initiated which would give a new dimension to such cooperation. A possibility existed, for example, that Western Europe might benefit from a supply of natural gas available in the North of the Soviet Union. The interchange of industrial products is of central importance but still presents some financial and technical problems. Because scientific collaboration has proved relatively easy it should be used to trigger technological cooperation. Participants felt, for example, that a determined assault might be made on projects such as the electric car. The manysided collaboration by socialist and capitalist countries in automobile manufacture already showed what could be achieved where interests coincide. Technological cooperation should be raised at least to the level achieved already in a number of scientific fields.

Some Problems Concerning Cooperation

The practicability and desirability of functional collaboration on well defined projects was wholeheartedly endorsed. Some participants, however, suggested a need for caution because beyond a certain point intimate cooperation could not go on without involving changes for which the two social and political systems are not at present prepared. It was stressed that the continuation of effective cooperation depends on the evolution of the interests of the respective countries, groups of countries and systems and that efforts should be made to enlarge the area of mutual interests.

Permanent Machinery for European Security and Cooperation

The creation of a small, and not necessarily fixed, nucleus of officials to coordinate cooperation on an all-European basis is highly desirable. It would not only act as a focus for information, but might help to identify problems that might lead to a renewal of uncertainty before they could take effect.

Europe and the World

Although this discussion has concentrated on specifically European matters, it was strongly felt that every effort should be made to apply the principles agreed upon at Helsinki, in an appropriate form, to problems in other parts of the world - especially in the Mediterranean and the Middle East. The extension of the principles of détente to the point where they are universally applicable is vital for the achievement of world peace. A new system of European relations would assist the establishment of a new system of relationships on a worldwide basis.

Development and Security

The problems of Development and

Security were discussed mainly from the standpoint of the situation in less-developed countries (LDCs).

Development

While economic growth is a fundamental requirement for development, it is not its objective. Among the real objectives of development are the eradication of poverty, access of all to adequate means of existence and work, and the improvement of nutrition, health and education.

All states should also establish the conditions which enable the full development of the individual's potentialities, through education, full access to information, freedom of expression and movement, effective public participation in the political process, and the conditions under which peoples, including minorities, are able to retain and develop their own identities.

Development strategies for the LDCs include broad international cooperation and international division of labour on the basis of equality between countries in different phases of development as well as between LDCs, implications of a New International Economic Order to be elaborated, and self-reliance of the LDCs. Self-reliance implies a national capacity for autonomous decision-making and implementation on all aspects of the development process, including science and technology. The independence of a state is of paramount importance for its development.

Security

There is an inextricable interconnection between the evolution of the development process and the attainment and maintenance of security. In the context of development, security constitutes freedom from political, economic, military and other threats, actual or potential, to independent, self-reliant national development. Security threats particularly relevant to developing countries are: (a) the fact that many developing nations have borders not sanctioned by a long history of national consolidation; (b) political and economic vulnerability arising from acute dependence of at least some of these countries on continued imports of key fundamental needs, e.g. food and energy and the fact that their economies often depend on the export of one or two agricultural or mineral products; (c) dependence of many of these countries on a continuous inflow of equipment and scientific and technical manpower needed for the modernization of their economies.

Military Threats

Cases of military interference in development are exceedingly frequent. In many instances, the military apparatus of a developing country is used internally as a means of oppression and interference with true development. Such a happening has often an outside subversive involvement.

There are other instances of direct outside military intervention in a developing country, as well as in developed ones, when the interests of a larger power are threatened.

National liberation is a prerequisite to development. We note with concern the situation in South Africa, Namibia and Rhodesia. We condemn the repressive measures adopted in these countries, and the support, including trade, that the oppressive regimes are receiving from some countries. The international community should take all possible measures so as to prevent further blood-baths, and enable the peoples of these countries to embark on a path of independent development. In particular, developed countries should stop selling weapons to South Africa and Rhodesia, according to UN resolutions on the subject.

Non-Military Threats to Development

Developing countries also face a number

of non-military threats to their security. For instance, while in the present world food situation some industrialized countries face difficulties on occasion, in the developing world the problem is widespread and severe. In such a situation, the use of the deliberate denial of food as a political weapon is morally unacceptable and to be utterly condemned. In this connection, the concept that food aid be concentrated only on those countries where the problem of food shortage seems to be the most manageable (TRIAGE) was discussed. It was noted that the implications of this view is that the other countries are impossible to "salvage". This utterly repugnant idea is based on the assertion that there is not enough food to go round. We reject this concept. It is our view that, if correctly managed, there exist possibilities of producing more food, of using presently available food stocks more efficiently and humanely, and of avoiding deterioration during storage and transport, so as to meet all urgent requirements.

The vulnerability of developing countries to transnational corporations is another non-military threat to the security of LDCs. This vulnerability arises from several sources: (a) their power and scale of operation; (b) the fact that such corporations are not effectively controlled by national laws and regulations; (c) the monopolistic position that they have acquired in regard to the supply of technology and equipment. Control, including price control, by transnational corporations, over outward flow of raw materials from LDCs and inward flow of finished goods into them, results in exploitation of the LDCs. The counter measures to this situation again reside in the implementation of self-reliance.

International Scientific Cooperation in Developing Countries, and the Social Responsibility of Scientists

It is well recognized that international scientific cooperation has contributed substantially to building up the scientific and technological capability of LDCs and to the solution of specific developmental problems, and that it will continue to do so in future. Nonetheless, there are fears in LDCs, which may or may not be valid, which have to be taken into account in order that international scientific cooperation in this domain may function more effectively. Involved in this are ethical questions relating to the social and professional responsibility of scientists, and also practical questions relating to the credibility of individual scientists, and sometimes even international scientific organizations. There is, therefore, urgent need to formulate a set of guidelines for international scientific cooperation in relation to developing countries. While the precise nature and content of such guidelines will call for careful consideration, there are at least two basic principles which are germane to this issue: (a) development policies and priorities must be defined by the developing countries themselves, and scientific communities everywhere should recognize both the importance and difficulty of the LDCs achieving self-reliant and autonomous development, and (b) cooperation should not be utilized as an umbrella to collect intelligence information or to threaten any aspect of the security of a country. Pugwash will examine these and other issues at an international workshop on Guidelines for International Scientific Cooperation for Development in India in early 1977.

Genetic Engineering

An informal discussion was held on the implications for science and the public interest of the recently developed technique of genetic engineering. This technique consists of the possibility of introducing, into the common bacillus found in the human bowel, genes (the chemical structures governing hereditary traits) from other organisms whether microbial, animal or vegetable. The technique is in an early

stage of development. It has been recognized by the scientific community that, in addition to the great potentialities it has for increasing our fundamental knowledge of life processes and its application to benefit humanity with respect to treatment and control of disease and for agricultural and industrial practices, certain hazards might be connected with the work involved. These consist mainly of the possibility of the escape from the laboratory of new, potentially harmful microorganisms which would multiply and might spread widely.

We noted that the probable benefits to humanity from pursuing this technique are very great and therefore work in this field should be encouraged, a position which has been adopted officially in countries where such investigations are being pursued. Committees have been created for supervising the conditions under which each such experiment is being performed. These Committees, sponsored by respective governments, have formulated guidelines and have defined the safeguards to be applied. We fully endorse these precautions, which should be maintained to the greatest possible degree until more knowledge is achieved with respect to possible hazards, until now only conjectural in nature, involved in such work. All governments in countries where such work is being done or planned should take concrete steps to ensure that proper, internationally agreed precautions are taken for physical and biological containment, and to share fully all experience and information on this subject.

In addition, there is great concern over the possibility of gross abuse of applications of this technique with respect to developing agents for biological warfare purposes.

The prohibition of the use of this technology for weapons clearly falls within the scope of the Biological Weapons Convention of 1972. We therefore particularly welcome the statement to this effect by the USA delegation to the Conference of the Committee on Disarmament (CCD) in Geneva on 17 August, and the subsequent endorsement of this interpretation by some other countries at the CCD. As stated by the USA delegation, such an interpretation of the BW Convention is of great importance and one of which doubt cannot be permitted to exist.

We are confident that all signatory governments share this view, and we urge that this fact be made explicitly and publicly known as soon as possible in order to allay any unjustified fears on this score. In addition, we urge that all governments which have not already done so ratify the 1972 Convention as soon as possible, and meanwhile state officially that they would adhere to all provisions of the Convention, including particularly the ones covering this technology.

We recognize, however, that in the unfortunate continuing atmosphere of international distrust, suspicions and accusations may arise in different quarters concerning the possible abuse of this technique for biological warfare purposes. For this reason, we strongly urge all scientists to refuse, and to make known their refusal, to be associated in any way with work in this field that is directed intentionally or contemplated towards the development of biological warfare agents.

As has often been stated by Pugwash, openness of research in all scientific fields is essential to allay mistrust. This applies with great force to the field of genetic engineering. Knowledge of the results of research and its methodologies, as well as actual agents themselves, should be made freely and widely available for the advance of this technology to all countries under the proper organizational and physical safeguard precautions referred to previously. Coordination of this activity at the global level could be undertaken by the World Health Organization.

26th Pugwash Conference
List of Participants

Acad. A.T. Balevski (Bulgaria)
Prof. P. Blau (Austria)
Dr. R.A. Bogdanov (USSR)
Prof. G.E. von Bonsdorff (Finland)
Mr. A. Boserup (Denmark)
Acad. K. Bratanov (Bulgaria)
Prof. E. Broda (Austria)
Dr. A. Burzynski (Poland)
Prof. F. Calogero (Italy)
Dr. M.G. Candau (Brazil)
Prof. A. Chayes (USA)
Mr. A. Coroianu (Romania)
Dr. A. Davydov (USSR)
Prof. C. Dominice (Switzerland)
Prof. V.S. Emelyanov (USSR)
Acad. W. Engelhardt (USSR)
Prof. W. Epstein (Canada)
Prof. B.T. Feld (USA)
Dr. J. Franek (Czechoslovakia)
Prof. F.C. Frank (UK)
Prof. D. Frei (Switzerland)
Dr. J.F. Freymond (Switzerland)
Prof. E.E. Galal (Egypt)
Prof. F.A.M. Alting von Geusau (Neth.)
Prof. K. Gottstein (FRG)
Mr. W.F. Gutteridge (UK)
Prof. G. Hahn (GDR)
Dr. F. von Hippel (USA)
Dr. V. Hlavaty (Czechoslovakia)
Prof. Dorothy Hodgkin (UK)
Mr. T. Hughes (USA)
Dr. R. Hunter (USA)
Prof. A. Ionica (Romania)
Dr. M.M. Kaplan (Switzerland)
Dr. H.L. Keenleyside (Canada)
Prof. A. Keynan (Israel)
Dr. G.B. Kistiakowsky (USA)
Dr. C. Kiuranov (Bulgaria)
Prof. K. Korhonen (Finland)
Prof. H. Kröger (GDR)
Prof. J.P. Kuczynski (GDR)
Dr. Betty G. Lall (USA)
Prof. I. Lang (Hungary)
Dr. P.J. Lavakare (India)
Prof. E. Leibnitz (GDR)
Prof. S. Lifson (Israel)
Mr. S. Lodgaard (Norway)
Prof. K.H. Lohs (GDR)
Dr. J. Lundin (Sweden)
Dr. H. Marcovich (France)
Prof. J.K. Miettinen (Finland)
Prof. M. Milstein (USSR)
Acad. G. Nadjakov (Bulgaria)
Prof. M. Nalecz (Poland)
Mr. P. Noel-Baker (UK)
Prof. P.L. Ølgaard (Denmark)
Mr. A. Parthasarathi (India)
Dr. A. Pascolini (Italy)
Prof. D.A.L. Paul (Canada)
Prof. Sir Rudolf Peierls (UK)
Dr. D. Perrin (France)
Prof. F. Perrin (France)
Mr. J.P. Perry Robinson (UK)
Prof. G. Ranki (Hungary)
Acad. O. Reutov (USSR)
Prof. G. Rienäcker (GDR)
Prof. M. Roche (Venezuela)
Prof. J. Rotblat (UK)
Dr. L.S. Semeiko (USSR)
Prof. D. Senghaas (FRG)
Prof. P.B. Smith (Netherlands)
Prof. I.A. Sokolov (USSR)
Prof. J. Steinbruner (USA)
Prof. J.P. Stroot (Belgium)
Mr. K. Subrahmanyam (India)
Mr. W. Swartz (USA)
Dr. Gertrud Szilard (USA)
Prof. T.B. Taylor (USA)
Dr. M. Thee (Norway)
Prof. V. Thurzo (Czechoslovakia)
Prof. T. Toyoda (Japan)
Prof. V.G. Trukhanovsky (USSR)
Prof. K. Tsipis (USA)
Prof. B.M. Udgaonkar (India)
Prof. R. Vukadinovic (Yugoslavia)
Acad. B.M. Vul (USSR)
Prof. Gerda Zellentin (FRG)

Observers

Prof. H. Glubrecht	(IAEA)
Dr. F. Barnaby	(SIPRI)
Mr. T. Nemec	(SIPRI)
Dr. R. Björnerstedt	(UN)
Mr. Y. Novozhilov	(UNESCO)
Prof. L.A. Kaprio	(WHO)

REPORT OF WORKING GROUP 1

PROBLEMS OF LIMITING AND REDUCING STRATEGIC NUCLEAR ARMAMENTS AND OTHER WEAPONS OF MASS DESTRUCTION

The first problem that the Working Group discussed was the status of the SALT talks.

The SALT agreements contain some positive results in limiting ABM systems, in placing ceilings on the number of the most offensive weapons and in agreeing not to interfere with national technical means of verification. However, there were differing views about the significance of these steps.

There was disappointment that SALT has not stopped the qualitative arms race and so far has done nothing to reduce the existing large numbers of strategic offensive weapons. The process of détente and the arms race cannot co-exist indefinitely.

It was agreed that SALT agreements which would halt the quantitative and qualitative arms race should be pursued vigorously. Many noted that the secrecy, complication, and protraction of the SALT negotiations have resulted in a disenchantment and loss of interest of the general public, and that future negotiations should provide more information about the issues discussed, and the position of the two sides on them. Lack of time prevented a detailed discussion of the items that should be on the agenda of SALT III. It was agreed that a substantial and comprehensive reduction of all types of strategic weapons should be achieved. It was proposed by some members that all long-range bombers and all land-based intercontinental ballistic missiles be phased out and that nuclear missile firing submarines be drastically reduced in order to get rid of the massive overkill capacity.

The question of how to make the achievement of early drastic reductions more feasible was also raised; there is here great need for fresh ideas and Pugwash should try and do its best to contribute to their development.

Concern was expressed about the negative effect on SALT and on arms control and disarmament which the large scale deployment of cruise missiles could have. Cruise missiles represent a new and very efficient and precise carrier of nuclear as well as conventional warheads. The strategic long range cruise missile should not be deployed since it could undermine past SALT agreements and would jeopardize prospects for future meaningful strategic arms limitations, and open another channel for an upward spiral of the arms race of action and reaction. All members agreed that the testing and deployment of cruise missiles as a strategic weapon should be banned. It was suggested that the verification of a ban on testing may be possible since non-intrusive technical means of inspection can differentiate long range strategic from short range tactical cruise missiles, provided the latter were built with specific physical attributes such as a type of jet engine, and in the present technological environment, with limited total volume.

It was suggested that such moves as banning the testing and deployment of cruise missiles, and not developing the Backfire bomber into a heavy, long range system, would help the conclusion of a SALT II agreement.

Other nuclear powers should be encouraged to join at some point the process of substantial and comprehensive reduction of all types of strategic weapons.

It was noted that lack of progress in

curbing vertical nuclear proliferation stimulates horizontal nuclear proliferation.

Vertical proliferation has, in part, been promoted by the fears of the major nuclear powers in connection with imbalances in some strategic indicators (such as throw-weight and numbers of nuclear warheads), characterizing their relative strategic postures.

Some regarded the preoccupation with such imbalances unjustified in view of the stability of the overall strategic balance, and particularly regretted that the concern about such imbalances appears to be given priority over the far greater danger represented by the prospect of the spread of nuclear weapons to additional countries.

Many members stressed the ineffectiveness of civil defence programmes designed against the nuclear threat, and the psychological damage they do to efforts at disarmament. Others felt that civil defence as such should not be attacked because it could save lives in some conditions and in some countries in which it could not be a cause of misinterpretation as preparation for nuclear attack. Governments were invited to provide more information about their civil defence measures and the reasons for them, and thereby to eliminate opportunities for misinterpretation.

The Group discussed the present stalemate in the arms control negotiations. It has been stressed that the 15 years exercise in arms control did not prevent an increase in armaments and that the arms race has become more intense. It was felt that a basic departure from arms control is needed in the direction of real disarmament and the aim of general and complete disarmament.

Notwithstanding the continuing threat to civilization posed by the existing stockpiles of armaments, the Group felt that the positive aspects of the developments in the last decades should not be overlooked. A nuclear holocaust has so far been avoided. The factors which have favoured this desirable aspect of an otherwise most dangerous situation should be studied and strengthened. The psychological barriers, which stem in part from ideological roots, hinder further progress. They contribute, on both sides, to the failure to see and understand the points of view and the motivations of the other side, thereby creating tensions, and should be studied, made conscious, and removed as far as possible.

Many members felt that to advance progress for greater arms control and disarmament, the countries involved in negotiations must provide more public information about their weapons programmes and strategies. In this way, those favouring and working toward such progress will be aided immensely as they attempt to influence their governments' position in this matter.

Some proposed as a confidence building measure that a consortium of non-nuclear-weapon states should establish a satellite system for the surveillance of the military activities of all countries and that the information acquired be transmitted to the United Nations to be made available to all. It was recommended that Pugwash should study the proposal.

The Working Group discussed the question of holding a Special Session of the United Nations on disarmament as a step to facilitate the holding of a World Disarmament Conference. Most members felt that both might provide some results in encouraging governments to achieve major progress on disarmament. It was also felt that both a Special Session and a World Conference should be most carefully prepared and that participation should be at the highest level. A few, however, stressed the concern that a World Disarmament Conference would be a mere exercise in propaganda that could damage rather than improve the international climate. Pugwash should help in the prep-

aration of both a Special Session and a World Disarmament Conference.

The Working Group discussed the difficult problem of how to curb military research and development; these were felt to be particularly inflammatory. It was stressed that curbing of military research and development is central to the halting of the arms race. Some of the members noted a new development in the US whereby the US government was being required to prepare for the Congress arms control impact statements for many weapons programmes of the US government. These statements may have the result of postponing the development of new weapons programmes or the refusal of Congress to appropriate funds for them. Some members noted that if other governments producing new weapons systems would undertake to provide similar impact statements of their weapons programmes, this could have a positive result. The tendency, however, will certainly be for governments to claim their weapons programmes as not incompatible with arms control policy and negotiations. Some members stressed the need to have such impact statements evaluated independently.

In the context of military research and development, it was agreed that it was essential to ban the testing of all sorts of new weapons of mass destruction. It was pointed out that such testing can generally be monitored by national technical means of verification. This would impede development and production of such new weapons. It was suggested that unilateral steps of arms limitation and reduction by mutual example would facilitate the process of disarmament.

The Group discussed the possibilities for reducing the numbers of nuclear weapons, tactical as well as strategic. The Group expressed the conviction that the development of small nuclear weapons for use in battlefield situations is most dangerous, because it tends to blur the distinction between nuclear and conventional weapons, thereby making the use, as well as the spread, of nuclear weapons more likely and, furthermore, induce escalation towards general nuclear war. All available means should be attempted to stop it. It would, moreover, be most desirable to drastically reduce the numbers of tactical nuclear weapons stationed in Europe and elsewhere, by agreement or otherwise.

As a means to prevent the development of novel types of nuclear weapons and of nuclear proliferation, all stressed the importance of achieving a comprehensive nuclear test ban treaty. A comprehensive nuclear test ban treaty would also have an important psychological and political impact conducive to disarmament. Many stated their objection to the threshold test ban treaty, because it allows tests to an excessively high level and leaves a major loophole for peaceful nuclear explosions. Therefore, it should be renegotiated by the US and USSR governments, and made into a comprehensive nuclear test ban treaty. Some, however, emphasized that the threshold treaty was a step in the direction of a comprehensive test ban and, therefore, should be accepted as such. They noted that peaceful nuclear explosions could have significant economic benefits.

The validity and utility of the concept of nuclear deterrence was discussed, but the available time was insufficient for exploring the issue thoroughly. It was recommended that this subject be given high priority at the 1977 Pugwash Conference in Munich, taking into account the results of the 1975 Kyoto Symposium.

The Group favoured a ban on chemical weapons. With regard to the verification of such a ban, some members thought some degree of verification by satellite inspection feasible, others thought this very ineffective and open to misinterpretation. Some would encourage investigations into the feasibility of "minimally intrusive" inspections. All expressed the hope that governments might

find it possible to follow the example of the BW Treaty by initiating the process by unilateral action and foregoing on-site inspections, while being aware of the intrinsic differences between bacteriological and chemical weapons. The argument was noted that the acceptance of the principle of non-inspection in this case might set a precedent for other cases in which application of this principle would be undesirable, but this argument was considered as non-overriding. The Group encouraged, however, the continuous activity of the CW Workshop, as indicated in its fourth report to this Conference, to explore further the parameters of on-site inspection - an exercise to be undertaken in 1977 at an organo-phosphorus plant producing pesticides in FRG.

The members believed that major progress towards a complete ban on chemical weapons and their renunciation by states could be achieved if the USA and USSR implemented their intention to submit a joint initiative to the Committee on Disarmament for the prohibition of super-toxic and other lethal agents of chemical warfare. The urgency of a ban on chemical weapons is convincingly illustrated by the development of so-called binary weapons, a new generation of chemical weapons, that could start a new loop in the arms race spiral.

Throughout the discussions in Working Group 1, members repeatedly expressed their conviction that the final goal of this field must be "general and complete disarmament", and that Pugwash should take an active role in stimulating progress towards this end.

REPORT OF WORKING GROUP 2

CONTROLLING THE SPREAD OF NUCLEAR ARMAMENTS

I.

The great majority of the members of the Working Group continue to believe that the acquisition of nuclear weapons by more states would present a serious additional danger to world peace. Unless nuclear proliferation is prevented, the world situation will be increasingly unstable with an increasing danger of "limited" nuclear wars that could escalate into world-wide holocaust.

There was widespread agreement that there are major defects in the present non-proliferation regime, centering on what many call the discriminatory features of the Non-Proliferation Treaty (NPT); these seem to consign the non-nuclear weapons states (the vast majority) to a permanent status of inequality. At the same time, in a certain sense, the Treaty legitimizes the possession of nuclear weapons by the small handful of existing nuclear weapons states. A few of our members questioned the overall value of the NPT. They argued that it has been a "soporific", diverting attention and effort from the real objective - the reduction and eventual elimination of nuclear weapons in the states now possessing them.

The great majority of the Group, although recognizing the validity and seriousness of the criticisms, could not accept these conclusions. This majority believes the NPT makes an important contribution to the effort to prevent the spread of nuclear weapons. A country does not lightly disregard, or even withdraw from, treaty obligations solemnly undertaken. The threat of withdrawal itself could operate as a sort

of sanction. Moreover, the Treaty has become the basis for a major international norm stigmatizing the possession of nuclear weapons. In this sense it is a fulcrum for bringing pressures for nuclear disarmament to bear on the nuclear weapons states themselves. It was asserted by some that this leverage for pressure was available only because certain important states stayed out of the Treaty.

Nevertheless, all the members felt strongly that the efforts of the nuclear weapons states for disarmament have been inadequate. It is fair to say that no decisive progress has yet been made in the limitation of strategic weapons. The recent decision of the UK to embark on a tritium production programme is a glaring example of behaviour that reinforces illusions about the political value of membership in the nuclear club, thereby undermining the non-proliferation effort.

The obligation of Article VI of the NPT, requiring the nuclear weapons states to negotiate in good faith for reduction of nuclear arsenals, is the reciprocal of the obligation of self-denial assumed by the other parties. Continued failure to achieve results will inevitably erode support and adherence to the NPT regime.

Time is growing short.

II.

The connection between nuclear power and nuclear weapons was examined at length from the technical, political and psychological standpoints. There was widespread agreement that the operation of current generation power reactors, of itself, need not present a significant proliferation threat. Acquisition of bomb material from spent fuel is impossible without reprocessing. It was pointed out, however, that in the present circumstances the establishment of a nuclear power industry in any country would contribute to the technological base for a weapons programme, and could generate political and psychological pressures that work in that direction through the acquisition of reprocessing facilities and breeder reactors.

The discussion focussed, therefore, on problems associated with the possible spread of reprocessing facilities, either for recycling fuel for use in current generation reactors or to produce plutonium for future breeder reactors. The plutonium extracted from spent reactor fuel is concededly not the best material for weapons purposes, but it could be used to construct a nuclear explosive, especially if yield and performance requirements are not important. Such a feat would clearly be within the capacity of a country with a modest nuclear capability, such as that implied by the operation of power reactors and small-scale reprocessing facilities.

There was a wider division on the question whether bomb production was within the capacity of criminal or terrorist groups who might gain access to reprocessed plutonium. It was stated that there are formidable difficulties in such an operation, but most thought that a group with the proper composition and resources would have a considerable possibility of success.

This led to a discussion of the potential adequacy of safeguards against diversion and physical security measures in a "plutonium economy" - that is one in which there is extensive reprocessing of reactor fuel. It was said that, on some projections, as much as 5000 tons of plutonium would be produced annually from reactor operations by the end of the century. This is of special concern because of the very long half-life of plutonium and the difficulties of disposing of it. Moreover, the scale economies of reprocessing with presently envisaged technology imply the use of large plants serving 30-50 reactors, spread over a considerable area and requiring large scale transportation of spent and reprocessed fuel.

Various suggestions for meeting these problems were discussed, including co-location of other fuel cycle stages at the reprocessing plant and the organization of multinational fuel centres. The recently adopted recommendations of the IAEA on physical security were noted. It was hoped that they might be used as a starting point for national action by member states; and it was recognized that further exchange of technical information on physical security, perhaps under Agency auspices, is urgently needed. Exports of reprocessing facilities were criticized and some called for a tighter control system for the transfer of nuclear materials and technology to be agreed on by all supplying countries. On the other hand, it was argued that supplier agreements restricting sales of reprocessing plants might violate Article IV of NPT and would further undermine the NPT regime. In any case, it is clear that the safeguards and physical security problems of reprocessing are not very well understood. Some thought that reasonable assurance against diversion or theft could not be achieved without a militaristic or authoritarian system, incompatible with the ordinary conditions of civil society.

The discussion concluded with a long review of the prospects for deferring or avoiding altogether this kind of plutonium economy. It was agreed that for the present it is unrealistic as well as undesirable to think in terms of a universal ban on nuclear energy or even a moratorium. But it was also agreed that reliance on fission energy was likely to be only temporary and that it would ultimately be replaced by other energy sources, although when this would occur was a matter of debate. This assessment lends urgency to the arguments for deferral or an irrevocable commitment to reprocessing or breeders.

Estimates of high grade uranium resources and energy demand (based primarily on US data) were presented suggesting that uranium resources would be sufficient without reprocessing or breeding for at least 50 or 60 years, as opposed to the 20-30 years usually assumed. The potential advantages of the thorium breeder were mentioned.

An array of possible alternative energy sources were also discussed, including fusion, geothermal, solar and increased use of coal. As in previous Pugwash Conferences, there was general support for sharply increased research and development on all these fronts. In particular, it was strongly suggested that R&D on solar power should be stepped up very steeply. At the present time, funds available for this work are not more than a few percent of the financial support for nuclear energy research. The work should include not only low-temperature applications and photo-voltaic generation of electricity, but also photochemical processes like the photolysis of water to produce hydrogen as a basic energy carrier. What is needed is a crash programme involving close collaboration and division of labour among national efforts, with international consultation and information exchange, perhaps through an institution along the lines suggested in the Pugwash Conference at Baden in 1974. Some thought that an international research institute carrying out and co-ordinating active research will also be needed.

The general conclusion was that the final decision on reprocessing and commitment to breeders could probably be delayed for at least 10 years without serious penalty. It was recognized that special problems might exist for some countries with high energy demand and/or little indigenous uranium or other energy resources. And a number of members thought it was necessary to "keep the breeder option open" - though there was disagreement about how intensive an effort would be needed for this purpose. But there was a significant measure of agreement that governments should be urged to proceed cautiously and to defer the acquisition of reprocessing facilities - or a commitment to breeder

reactors - for a considerable period.

III.

The consideration of nuclear-weapon-free zones produced a major new Pugwash initiative. In response to a suggestion of the Madras Conference, Feld prepared and presented a draft treaty for a "world-wide nuclear-weapon-free zone". Past Pugwash Conferences have attached great significance to the concept of nuclear-weapon-free zones. It was thought that such zones can serve three purposes: enhanced security for countries situated within the zone, strengthening of the regime of non-proliferation and encouraging nuclear disarmament. The greatest progress has been made in Latin America, but even there the Treaty is not in force as to major states. Other efforts to establish regional zones seem to have foundered because in every case one or more countries in the region refused to join. The emphasis on security in regional terms prevents realization of a nuclear-weapon-free zone in these circumstances. Our review of the experience with regional zones, including a recent UN study of the subject, confirmed the difficulties with the traditional approach.

By contrast, Feld's proposal contemplates a treaty open to any country, anywhere in the world, that is willing to undertake not to allow nuclear weapons on its soil. The requirement of substantial unanimity in a particular region is eliminated. A copy of the Feld draft is appended.

The Group welcomed the Feld draft and recognized that it was an important contribution to the discussion of nuclear-weapon-free zones, which has been stalled for some time. The draft is a preliminary effort, however, and leaves many questions unanswered. The Working Group could not fully analyse these in the time available, but it identified enough to be confident that a detailed study of the concept is now warranted. The Group recommends that Pugwash should promote a workshop or symposium to begin such a study. Among the topics to be considered are the following:

1. Definition of a nuclear weapon. The definition in Article 4 of the draft, adapted from the Treaty of Tlatelolco is clearly unsatisfactory. The substantive issue is the status of peaceful nuclear explosions under the Treaty.

2. Definition of a non-nuclear-weapon country. The draft provides that the Treaty is open to any state undertaking not to permit nuclear weapons on its territory. But some argued that a member of a military alliance whose doctrine permits use of nuclear weapons in war cannot be considered a non-nuclear-weapon country, and should not be eligible for membership.

3. Guarantees. The draft includes a protocol under which nuclear powers would agree not to use nuclear weapons against parties to the Treaty, and some thought that such guarantees were essential to the concept. Others thought that reliance on guarantees was inconsistent with the main object of the Treaty, which was to dramatize that nuclear weapons are a negative element in international relations. Some participants argued that the seeking of a guarantee would be a sign of acceptance of the legitimacy of nuclear weapons. Hence the new draft should eschew the guarantee.

4. Verification. Is it necessary, and if so to what extent should the IAEA, or any nuclear-weapon-state, be used to provide it?

5. Transit. Should the Treaty prevent transit of nuclear weapons through the territory, including territorial waters, of the parties? The question poses a trade off between the possibility of wider membership if transit is permitted and a more rigorous conception of "nuclear-free", it it is not.

6. Regional versus world-wide approach. Can they be pursued simultan-

eously or are they mutually exclusive? Which is to be preferred?

7. Withdrawal clause. Is it desirable, and how should it be formulated?

Although many notes of caution were sounded, there was agreement that the Feld proposal was an unusually promising line of approach.

IV.

In the course of their discussion of guarantees in connection with nuclear-free zones, many of the Working Group expressed bitter disappointment at nuclear powers that have continued to refuse to renounce the first use of nuclear weapons. This led to a somewhat broader discussion of recent developments in nuclear weapons doctrines. In the United States, we are now witnessing new formulations of the doctrine of flexible response, including renewed emphasis on possible first use of nuclear weapons. At the strategic level, a retargetting strategy has been proposed, which calls for selective attacks against a limited number of military installations at a certain stage of an armed conflict. At the tactical level "mini nuclear-weapons" are being developed, which tend to obliterate the distinction between nuclear and conventional warfare.

Such concepts are dangerous, and the Working Group condemns them. The casualties from even a limited counter-force strike would be enormous. Moreover, given the current array of strategic forces, and the range of circumstances that might occur in wartime, there is no way to guarantee that limited resort to nuclear weapons - whether in the form of "selective response" or the battlefield use of "mininukes" - can be kept limited. It is much more likely that the conflict would become unlimited and world-wide. Finally, such doctrines are themselves incentives to proliferation.

Nuclear non-proliferation must be complemented by efforts to prevent limited nuclear wars and should eventually lead to the renunciation of force and the prohibition of nuclear weapons.

V.

Everyone supports a comprehensive test ban treaty. But there is a sharp division about what such a treaty should include. There are two chief points of difference:

1. Peaceful nuclear explosions - should they be prohibited or not? One group maintains that they have important economic potential, and at least exploration of this should not be foreclosed. A thermonuclear explosion with drastically reduced radioactivity might be technologically possible. The other argues that PNEs have no real economic significance and the difficulty of ensuring that an ostensibly peaceful explosion is not used to acquire military information is so great as to require prohibition. A solution advocated by some: peaceful explosions would be prohibited unless conducted under international auspices in accordance with arrangements negotiated under Article V of the NPT.

2. Should adherence of all nuclear weapon states be required or not? One group maintains that the comprehensive ban should not go into effect unless all nuclear powers - particularly France and China - are parties. Otherwise complying states will have no assurance that non-signers will not make significant gains. The other group holds that although the unwillingness of nuclear powers to adhere to such a treaty cannot be justified, nevertheless, the great bulk of the testing is carried on by the US and USSR. They have an immense quantitative and qualitative lead in strategic weapons, and less to gain from continued testing. Although it would be desirable for the others to adhere, a test ban for the US and USSR would be valuable in its own right and could be

accepted without risk. A solution advocated by some: a test ban for a limited period, say five years, after which the situation would be re-examined to see whether any problems had arisen because of the non-adherence of nuclear powers. It was also urged that a similar review of the progress made in respect of Article VI of the Non-Proliferation Treaty and threat of withdrawal of states from the Treaty may also have a deterrent effect on the nuclear weapon powers.

A similar division arose with respect to the Threshold Test Ban Treaty. One group maintained that this was a positive development and a step towards a comprehensive ban. The other thought these aspects were outweighed by the height of the threshold (150 kT). Likewise, there was disagreement whether the effect of the Treaty in legitimating PNEs should be considered positive or negative.

Conclusion

As in the past, the Working Group discussion produced a number of technical suggestions for inhibiting nuclear proliferation and alleviating related problems - the risks of diversion of nuclear materials and safeguards against such diversion; the anxieties and concerns surrounding the plutonium economy and peaceful nuclear explosions; the difficulties of achieving nuclear-free zones. But in the last analysis, these problems cannot be solved by a technical fix or institutional gimmick. The essential requirement is political will.

And the necessary political will is increasingly paralysed by the failure of the nuclear weapons states to reduce their weapons stockpiles and their reliance on doctrines involving nuclear weapons as instruments of war. So long as there are no effective steps toward nuclear disarmament and no substantial reduction in nuclear arms, the problems of further nuclear proliferation and diversion of fissile materials will remain with us in acute form. The responsibility for initiating such steps rests squarely on the nuclear powers, and particularly the US and the USSR.

APPENDIX

B.T. Feld *

A NEW LOOK AT NUCLEAR WEAPON-FREE ZONES

1. Generally speaking, the concept of nuclear weapon-free zones is intended to serve three purposes:

a. Reassurance to the inhabitants of the zone that -- in case of outbreak of a conflict involving nations within the zone and even if such conflict should involved nuclear weapon states and the eventual use of nuclear weapons outside the zone -- they will be spared from the threat and danger of nuclear attack. In this sense, it serves as a security supplement to the Nuclear Non-Proliferation Treaty.

b. Reinforcement of internal political and economic barriers, within the nations of the zone, against pressures for the independent acquisition of nuclear weapons. Such pressures can arise from a diversity of causes: from justifiable concerns for the survival of a nation in a hostile international or regional atmosphere to the time-honoured practice (among nations as well as individuals) of "keeping up with the Joneses".

* The author wishes to gratefully acknowledge the facilities provided by SIPRI during the preparation of this paper.

c. Progress towards the ultimate goal of eliminating nuclear weapons from the arsenals of all nations. The larger the fraction of the earth which is covered by nuclear-free zones, the greater will be the pressures and the incentives for extending this area to cover the entire globe. Since the concept of a nuclear-free zone, as it is now understood by most of its serious advocates, includes guarantees to the members of the zone of no-first-use of nuclear weapons by the nuclear weapons powers, such zones do indeed represent a serious stage in the universal acceptance of the non useability of nuclear weapons. The non-first-use concept appears, in turn, to be a prerequisite for the acceptance of an eventual ban on the production, deployment and use of nuclear weapons.

2. The concept of nuclear-free zones has recently been considered in a special study by the U.N. Conference of the Committee on Disarmament (CCD/467, also U.N. document A/10027/add.1). The general consensus (but not universal agreement) of the participants in the study was that a nuclear weapon-free zone agreement should contain the following elements:

(a) Agreement by the zone members

i) Not to develop or to accept possession of nuclear weapons on their territories.

ii) Not to deploy or to permit deployment of nuclear weapons on their territories.

iii) To permit appropriate provisions for control to verify compliance.

(b) Nations outside the zone would agree to respect its nuclear weapon-free character. In particular, the nuclear weapon states would agree formally (as part of the treaty establishing the zone) not to use or threaten to use nuclear weapons against any zone member as long as this member complies with its treaty obligations (v.z., does not acquire nuclear weapons or accept such weapons on its territory).

(c) There are a number of collateral issues on which general agreement is more difficult to achieve: questions of transit and transport of nuclear weapons; so-called peaceful nuclear activities, including peaceful nuclear explosions; treatment of territories or possessions of nuclear powers that lie within the zones; inclusion or not of the high seas and ocean passageways; other security arrangements and alliances of zone members, especially with nuclear weapon states; supplementary security guarantees to zone members. Such issues are very complex and their resolution may differ from zone to zone, making each zonal negotiation a separate problem.

3. For reasons such as those mentioned above, only few nuclear-free zone arrangements have thus far been negotiated; the Antarctic Treaty (1959); the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (1963); the Treaty (of Tlatelolco) for the Prohibition of Nuclear Weapons in Latin America (1967); the Treaty for the Prohibition of the Emplacement of Nuclear Weapons and Other Means of Mass Destruction on the Sea-Bed and the Ocean Floor and in the Subsoil thereof.

Other nuclear-free zones have been proposed -- Central Europe; the Balkans, the Adriatic and the Mediterranean; Africa (south of the Sahara); Northern Europe; the Middle East; South Asia. In each case, special problems, relating to one or more states in the proposed zone, have prevented its successful establishment. Even in the Latin American case, which is the only populated area where a nuclear-free zone

exists, some important states (e.g. Cuba) are not yet parties to the treaty, while others (Argentina, Brazil, Chile) have signed with various reservations, including the right to conduct "peaceful" explosions, thus blocking the Treaty's entering into force in those countries. Among the five admitted nuclear weapon states, only the USSR has not yet formally accepted the zone's nuclear-free status (Protocol II), owing to ambiguities concerning the right of transit of nuclear weapons through nations in the area and the waters surrounding it.

4. In the end, the prospects for equivalent treaties in other areas seem rather remote at this time, in spite of the very strong desires of many nations to enter into such arrangements. For this reason, some participants in the 25th Pugwash Conference in Madras, India last January proposed the following variant of the nuclear-free zone idea. (This is essen tially a revival of some elements of an idea which was current in the early 1960s, to my knowledge first proposed by Sweden in 1961, of a "non-nuclear club" of the non-aligned nations) : those nations which were prepared to do so could, together, form "a World Nuclear-Free Zone to be established by Treaty or other instruments to which all nations of the world would be asked to accede... the areas encompassed by such a zone need not be contiguous and... the zone would be feasible even though only a limited number of countries become parties in the first instance."

In response to the suggestion of the Madras Working Group that Pugwash might develop a formal proposal that "could then be presented to the UN and other world organizations for their consideration and, hopefully, action", I have prepared the following text for a draft World Nuclear-Free Zone Treaty. The wording is based on existing treaties (especially the Treaty of Tlatelolco) and agreements, and is intended to serve primarily as a basis for further discussion and consideration.

A Treaty for a World-wide Zone of the Prohibition of Nuclear Weapons

Preamble: In the names of their peoples, the Governments of the States which sign this Treaty,

Desiring to contribute towards ending the arms race, especially in nuclear weapons,

Recalling that the establishment of nuclear weapon-free zones can be a significant means for achieving universal nuclear disarmament at a later stage,

Desiring to undertake all measures possible to strengthen world peace and security,

Convinced that the incalculable destructive power of nuclear weapons and the inevitable after-effects of a nuclear war could endanger the survival of the human species, and that the proliferation of nuclear weapons would make their eventual elimination enormously difficult and would increase the danger of the outbreak of a nuclear conflagration,

Convinced further that the continuing military denuclearization of regions now free of nuclear weapons will not only be beneficial to the peoples of these zones, but will exert a benign influence on other regions of the earth,

Agree as follows:

Article 1

1. The Contracting Parties hereby undertake not to use for nuclear weapons or other nuclear explosive purposes the nuclear materials and facilities which are under their jurisdiction, and to prohibit and prevent in their respective territories:

(a) the testing, use, manufacture, production or acquisition by any means whatsoever of any nuclear weapons, by the Parties themselves, directly or

indirectly, on behalf of anyone else or in any other way, and

(b) The receipt, storage, installation, deployment and any form of possession of any nuclear weapons, directly or indirectly, by the Parties themselves, by anyone on their behalf or in any other way.

2. The Contracting Parties also undertake to refrain from engaging in, encouraging or authorizing, directly or indirectly, or in any way participating in the testing, use, manufacture, production, possession, or control of any nuclear weapon anywhere.

Article 2.

For the purpose of this Treaty, the Contracting Parties are all those States, irrespective of their locations, for whom the Treaty is in force.

Article 3.

For the purposes of this Treaty, the territory of a party State shall include all the land, sea and air-space over which its sovereignty is recognized by established international law. However, in the case of States that, de jure or de facto, exercise international responsibilities for territories non-contiguous with their main bodies, such territories may, with the agreement of the States party to the Treaty bordering thereon, be separately accepted as contracting Parties to the Treaty.

Article 4.

For the purposes of this Treaty, a nuclear weapon is any device which is capable of releasing nuclear energy in an uncontrolled manner and which has a group of characteristics which may be appropriate for use for warlike purposes.

Article 5.

All the Parties to the Treaty have the right to participate in the exchange of equipment, materials and scientific and technical information for the peaceful uses of nuclear energy, in accordance with this Treaty and under appropriate international supervision and through appropriate international agencies and procedures.

Article 6.

For the purpose of verifying compliance with the obligations entered into by the Contracting Parties in accordance with Article 1, the following controls shall be put into effect:

1. Each Contracting Party shall negotiate appropriate agreements with the International Atomic Energy Agency for the application of safeguards to its nuclear activities; the scope and nature of such safeguards shall be determined by the same provisions as govern signatories to the Treaty on the Non-Proliferation of Nuclear Weapons.

2. The Contracting Parties shall submit to the Atomic Energy Agency such reports and other information as it shall require to verify compliance.

3. The Secretary-General of the United Nations may request any of the Contracting Parties to provide him with complementary or supplementary information regarding any event or circumstance connected with compliance with this Treaty, explaining his reasons. Such Contracting Parties undertake to cooperate promptly and fully with the Secretary-General.

4. The International Atomic Energy Agency has the power to carry out special inspections in the following cases:

(a) In accordance with the agreements referred to in paragraph 1 of this article.

(b) When so requested, the reason for the request being stated, by any Party which suspects that some activity prohibited by this Treaty has been carried out or is about to be carried out, either

in the territory of any other Party or in any other place on such latter Party's behalf.

(c) When requested by any Party which has been suspected of or charged with having violated this Treaty.

5. The International Atomic Energy Agency shall promptly report the findings of its inspections to the Secretary-General of the United Nations, who shall initiate any necessary action required through appropriate procedures provided by the Charter of the United Nations.

6. The costs and expenses of any special inspection carried out under paragraph 4 above shall be borne by the requesting Party or Parties, except where the Secretary-General of the United Nations concludes on the basis of the report on the special inspection that, in view of the circumstances existing in the case, such costs and expenses shall be borne by the IAEA.

7. The Contracting Parties undertake to grant the inspectors carrying out such special inspections full and free access to all places and all information which may be necessary for the performance of their duties and which are directly and intimately connected with the suspicion of violation of this Treaty. If so requested by the authorities of the Contracting Party on whose territory the inspection is carried out, the inspectors designated by the IAEA shall be accompanied by representatives of said authorities, provided that this does not in any way delay or hinder the work of the inspectors.

8. The IAEA shall immediately transmit to all the Parties, through the Secretary-General of the UN, a copy of any report resulting from a special inspection. Similarly, the IAEA shall send through the Secretary-General, for transmission to the United Nations Security Council and General Assembly, and for his information, a copy of any report resulting from any special inspection carried out in accordance with the provisions of this article.

Article 7.

Unless the Parties concerned agree on another mode of peaceful settlement, any question or dispute concerning the interpretation or application of this Treaty which is not settled shall be referred to the International Court of Justice with the prior consent of the Parties to the controversy.

Article 8.

1. This Treaty shall be open indefinitely for signature by all States members of the United Nations, and by the non-contiguous territories of States members, as provided in Article 3.

2. This Treaty shall be subject to ratification by signatory States in accordance with their respective constitutional procedures.

3. This Treaty, of which the Arabic, Chinese, English, French, Hindi, Russian, Spanish and Swahili texts are equally authentic, and the instruments of ratification shall be deposited in the archives of the United Nations.

4. This Treaty shall enter in force as soon as, both

(a) it has been ratified by twenty States members of the United Nations, and

(b) the additional protocol has been ratified by at least three of the permanent members of the United Nations Security Council.

Additional protocol

In the names of their peoples, the Governments of the States which sign this protocol,

Agreeing with the need for the Treaty as set forth in its Preamble,

Desiring to contribute, insofar as it lies within their power, towards the eventual total elimination of nuclear weapons in a world at peace,

Have agreed as follows:

Article 1.

The statute of denuclearization in respect to warlike purposes, as defined, delineated and set forth in the Treaty for a World-wide Zone of the Prohibition of Nuclear Weapons of which this instrument is an annex, shall be fully respected by the Parties to this Protocol in all its expressed aims and provisions.

Article 2.

The Governments represented by the undersigned undertake, therefore, not to contribute in any way to the performance of acts involving a violation of the obligations undertaken by the Contracting Parties.

Article 3.

The Governments represented by the undersigned also undertake not to use or threaten to use nuclear weapons against the Contracting Parties of the Treaty for a World-wide Zone of the Prohibition of Nuclear Weapons, so long as said Parties shall continue to adhere to their obligations under said Treaty and so long as said Treaty shall remain in force.

Article 4.

The duration of this Protocol and the provisions regarding ratification, authentic texts and deposition shall be the same as those of the Treaty for a World-wide Zone of the Prohibition of Nuclear Weapons.

REPORT OF WORKING GROUP 3

EUROPEAN SECURITY AND COOPERATION ISSUES

1. Further Implementation of the Helsinki Agreement

1.1. The meeting of the leaders of 35 states which ended in Helsinki a year ago with the signature of the final act of the Conference on Security and Cooperation in Europe was an unprecedented event, which demonstrated that concerted decisions on a series of problems pertaining to European security can be taken. This act laid down a comprehensive set of principles and a programme aimed at the realization of conditions for cooperation and lasting peace in Europe.

1.2. The Group were agreed on the need for serious efforts aimed at the successful implementation of the Helsinki Agreement: there were already tangible results in a number of fields; especially in economic, scientific and cultural cooperation.

Participants from some countries felt that events outside Europe, inadequate progress with the MFR and SALT II talks and the effect of these on internal domestic politics had combined to diminish enthusiasm for the Helsinki Final Act. Others quoted evidence of the high degree of commitment of their governments and peoples to the realization of its objectives. There was, nevertheless, general agreement that substantial practical achievements would take time, that the principles were good and that, in any case, there was no alternative to détente if peace was to be consolidated in Europe. It was

important to adopt a constructive attitude instead of emphasizing what other parties had not done; Pugwash scientists could play an important role in the formation of such an attitude. At the same time they should encourage self criticism of the response of their own governments to the implementation of the agreement.

1.3. The Working Group examined the situation particularly in light of the forthcoming Belgrade Conference. Some members felt that in certain quarters there was a lack of enthusiasm for the agreement which manifested itself in the mass media and reflected an unnecessary distrust. In some cases, it was felt, governments have shown a cool attitude towards a document they have signed themselves. It was pointed out that, while some governments give different weight, importance and priority to each of the four "baskets" of the Final Act, others regard the four parts of this act as equally important. Steps towards the realization of the provisions of the Final Act relating to military and economic matters as well as free movement of people, information and ideas were bound to be difficult, because they involved legislative and other changes. The importance of understanding the roots of these different attitudes was emphasized, because inertia would be the result from a policy of "wait and see" what happened elsewhere.

1.4. The Final Act was inevitably a compromise that needs implementation in the spirit of détente and a realistic approach according to the interests of different political and social systems.

2. A New Perspective for Europe

The Working Group felt that an attempt to envisage the kind of Europe which ought eventually to emerge would be helpful.

2.1. The view was expressed that, looking ahead 15-20 years, in Europe the military blocs should be dissolved and substantial disarmament and reduction in armed forces attained. To promote further and more effective European economic collaboration, within a framework in which there would be close contacts and mutual cooperation among all European states as well as between the Council for Mutual Economic Assistance (CMEA) and the European Economic Community (EEC), would be the objective. A Europe of the future would also be based on broad cultural cooperation, a prerequisite for which would be the substantial reduction of asymmetries in cultural exchange (in translation of books and literature, exchange of films, music, TV programmes, theatrical performances, scientific contacts and mutual projects etc.).

2.2. At present it was considered unrealistic to think in other terms than within a gradually changing pattern of relationships of the two clearly identified political and social systems. This also meant the continued recognition of existing sovereign states, whatever degree of economic and political integration might be achieved, on an equal basis and with guarantees of non-intervention in their internal affairs.

2.3. The Group believed that within the foreseeable future a feasible all-European system could be established providing particularly procedures for the settlement of disputes. There was also some support for the view that provision should be made for third party mediation.

2.4. A strong possibility existed of developing further international division of labour in fields such as energy and transport which would reinforce economic development and détente. A number of participants stressed the necessity of convening European conferences on energy, on transport and on pollution, and other methods of broadening the field of economic cooperation without discrimination and

without barriers.

2.5. Considerable concern was expressed that, while economic co-operation and exchange have increased in recent times expanding economic contacts have not prevented an intensification of the arms race. This suggested that, whatever the progress towards cooperation on many levels, military confrontation would not be lessened without deliberate efforts in that direction.

3. The Talks on Mutual Force Reductions

The Vienna MFR talks had not made real progress, perhaps because the principles on the basis of which the conference was convened had been subject to different interpretations. The spirit of Helsinki needed to be reasserted in this connection. There was general agreement that the technical problems relating to the symmetry and asymmetry of East-West military forces and dispositions in Europe were serious obstacles. Some members felt that a fuller exchange of information on the force situation and its development was necessary if objective judgments about reductions were to be made; others said that the information problem was not a major obstacle to progress. It was stressed that the success of military negotiations depended upon a clear political determination to find a solution. This was particularly urgent in the light of the development of new weapons and strategic doctrines on the part of both blocs. The nuclear armaments problem in Europe is becoming more critical as mini nukes and other new technologies become available.

The first priority is to break the deadlock in Vienna by constructive steps aimed at a substantial measure of force reductions on both sides. The gradual development of the Confidence Building Measures as envisaged in the Helsinki Agreement is one important way of assisting this aim in that these are directed at the core of the matter - the elimination of distrust. The question of whether the presence of neutral countries, other than those on the periphery of Central Europe, at the Vienna talks would be useful was a matter of debate.

4. Nuclear Weapon-Free Zone in Central Europe

The possibility of a relatively narrow nuclear weapon-free zone not involving the withdrawal of foreign nuclear weapons from European soil but rather the sterilization in this respect of, perhaps, the territory between the Rhine and the Vistula was canvassed. Doubts were expressed that this might simply prove another optimistic 'first step' which would be overtaken by new technology before it had been implemented and that consequently more radical proposals relating to the whole of Europe already discussed in Pugwash Conferences should have priority.

5. Scientific, Technological, Economic and Cultural Cooperation

Since the Helsinki Agreement there had been a more positive attitude to international cooperation not only under the auspices of the regional offices of UN agencies. There was a general optimism that projects were being initiated which would give a new dimension to such cooperation. A possibility existed, for example, that Western Europe might benefit from a supply of natural gas available in the North of the Soviet Union. The interchange of industrial products was of central importance but still presented some financial and technical problems. Because scientific collaboration had proved relatively easy it should be used to trigger technological cooperation. Participants felt, for example, that a determined assault might be made on projects such as the electric car. The manysided collaboration by socialist and capitalist countries in automobile manufacture already showed what could be achieved where interests coincided.

Technological cooperation should be raised at least to the level achieved already in a number of scientific fields.

6. Some Problems Concerning Co-operation

The practicability and desirability of functional collaboration on well defined projects was wholeheartedly endorsed. Some participants, however, suggested a need for caution because beyond a certain point intimate cooperation could not go without involving changes for which the two social and political systems are not at present prepared. It was stressed that the continuation of effective cooperation depends on the evolution of the interests of the respective countries, groups of countries and systems and that efforts should be made to enlarge the area of mutual interests.

7. A Proposed Pugwash Symposium

A Pugwash Symposium suitably composed to consider the possibilities might, if the Council agreed, be convened early in 1977 in good time before the Belgrade review meeting of the ECSE, dealing with Confidence Building Measures. A National Group could be found to sponsor this.

8. Permanent Machinery for European Security and Cooperation

The creation of a small, and not necessarily fixed, nucleus of officials to coordinate cooperation on an all-European basis was highly desirable. It would not only act as a focus for information but might help to identify problems leading to a renewal of uncertainty before they could take effect. Pugwash should do its best to promote such a development.

9. Europe and the World

Though the Working Group has concentrated on specifically European matters, it was strongly felt that every effort should be made to apply the principles agreed at Helsinki, in an appropriate form, to problems in other parts of the world - especially the Mediterranean, the Middle East and the Developing Countries generally. The extension of the principles of détente to the point where they are universally applicable is vital for the achievement of world peace. A new system of European relations would assist the establishment of a new system of relationships on a worldwide basis.

REPORT OF WORKING GROUP 4

DEVELOPMENT AND SECURITY

The problems of Development and Security were mainly discussed by the Group from the standpoint of the situation in the Developing countries. The Group recognized, however, that these problems are also relevant to developed countries; it was recognized that even in the most advanced ones, there are aspects which should be given special attention, such as poverty, malnutrition, poor health and inadequate education for a part of their population.

Development

While economic growth is, at the root level, a necessary condition for development, it is not its objective. Among the genuine objectives of development are the eradication of poverty, access for all to adequate means of existence, work, the improvement of nutrition, health, and education; in short, raising the material, cultural and spiritual level of the deprived people.

All states should establish as well the conditions for the full development of the individual potentialities, through education, full access to information, freedom of expression and movement, the possibility of effective public participation in the political process, and the conditions under which peoples, including minorities, are able to retain and develop their own identity.

The Group acknowledges that there are many roads for development. This question was discussed in depth at the Madras Conference. Development strategies for the LDCs include broad international cooperation and international division of labour on the basis of equality between countries in different phases of development as well as between LDCs, implications of a New International Economic Order to be elaborated, self-reliance of the LDCs which implies a national capacity for autonomous decision-making and implementation on all aspects of the development process, particularly including science and technology.

It attached much importance to the need for much greater assistance from DCs to the LDCs to create a world in which wealth is more evenly distributed.

The Group also recognized that the independence of a State is of paramount importance for its development.

Security

Throughout the discussion, security was considered in all aspects relating to development. In this context, security is constituted by freedom from threat, actual or potential, to national, self-reliant, independent development.

Among the security risks which are particularly relevant to LDCs are:
(a) the fact that many of these states have borders not sanctioned by a long history of national consolidation; (b) vulnerability arising from excessive dependence of some of these countries on the continued maintenance of specific inputs (such as food and energy) and outputs (such as single agricultural or mineral exports); (c) dependence of many of these countries on continuous inflow of technical and scientific manpower and equipment for development.

Military Threats

Military aspects of interference in development are exceedingly frequent. In many instances, the military apparatus of a developing country is used internally as a means of oppression and interference with true development. Such a happening has often an outside subversive involvement, the magnitude of which is variable.

There are other instances where there is a direct outside military intervention in a developing country, as well as in developed ones, when the interests of a larger power are threatened. The Group recognized that national liberation is a prerequisite to development, and took note of the liberation struggles in South Africa, Namibia and Rhodesia. It condemns the repressive measures adopted in these countries, and the support, including trade, that the oppressive regimes are receiving from some countries. Such support is anti-developmental. The Group urges that the international system should take all possible measures so as to prevent further bloodbaths, and enable the peoples of these countries to embark on a path of independent development. In particular, developed countries should stop selling weapons to South Africa and Rhodesia, according to UN resolutions on the subject. In addition, scientists in countries having technical and commercial relations with South Africa should exert their influence on their government and public opinion, insisting that all such relations should be based strictly on the principle of racial equality being followed in South Africa.

Pugwash could play an active role in this explosive situation by arranging an

encounter between scientist members of the majority and minority groups, utilizing its unique expertise and experience in such matters.

Non-Military Threats to Development

In the present world situation of food most countries are more or less in a difficult situation. This is even more so for the LDCs. In such an instance, the use of food denial as a weapon is morally unacceptable and utterly to be condemned.

The concept of TRIAGE has been invoked in relation to food distribution among the starving nations. According to this concept aid is to be concentrated on those countries where the problem seems to be most manageable. By implication, other countries are regarded as impossible to salvage. This utterly repugnant "life-boat ethic" is based on the assertion that there is not enough food to go around. This assertion seems not to be accurate. On the contrary, it appears that, if correctly managed, there exist possibilities of producing more food, of using presently available food and of avoiding deterioration during transport and storage, so as to relieve the most urgent cases.

The Group also noted that an increasing number of LDCs will in the next few years have great difficulties in carrying their present burden of loans. There is a grave risk that in negotiating prolongations with creditors these countries will be forced to adopt economic policies which are not dictated by their genuine development needs.

The Group discussed the vulnerability of LDCs to transnational corporations arising from (a) their power and scale of operation, not effectively controlled by any state laws. (b) The developing countries are vulnerable to the pressures of these corporations in matters related to technology and equipment because of their monopoly. In some instances, because of the little diversity of their resources, the LDCs find themselves tied to some of these corporations.

Control, including price control, by transnational corporations, over outward flow of raw materials from LDCs and inward flow of finished goods into them, results in a real exploitation of the LDCs. The counter measures to this situation again reside in the implementation of self-reliance.

International Scientific Cooperation in Developing Countries, and the Social Responsibility of Scientists

It is well recognized that international scientific cooperation has contributed substantially to the scientific and technological capability building in LDCs and to the solution of specific developmental problems, and that it will continue to do so in future.

Nonetheless there are fears in LDCs, which may or may not be valid, which have to be taken into account in order that international scientific cooperation in this domain may function more effectively.

There are, involved in this, ethical questions relating to the social and professional responsibility of scientists, and also practical questions relating to the credibility of individual scientists, and sometimes even international scientific organizations. The Working Group felt that this is a serious area in which Pugwash action is called for.

Some members of the Group expressed the view that, in the absence of timely international action to remove reasonable doubts and suspicions, there is a possibility that some developing countries may want to detach themselves temporarily from the ongoing international scientific, educational, technological and economic systems.

In this context the Working Group commends the initiative taken by the Indian Pugwash Group to organize an International Pugwash Workshop on Guidelines for International Scientific Cooperation in Relation

to Developing Countries, in the early spring of 1977.

The Working Group had submitted to it a document prepared for the Conference by B.M. Udgaonkar* which contained a list of factors which might impede or misdirect international scientific cooperation in relation to development. Without implying in any way endorsement of the views expressed, the Group wishes to bring the document to the attention of Pugwash for further analysis at that Workshop.

We hope that the recommendations formulated at this Workshop will enable the Quinquennial Pugwash Conference at Munich in 1977 to finalize a set of guidelines, which may then be presented, in particular, to the 1979 World Conference on Science and Technology.

The Group notes there are several other issues of importance to which Pugwash could contribute at the 1979 Conference. It therefore recommends that the Council may set up a machinery, including inputs from National Pugwash Groups, to ensure that Pugwash makes an effective input into it. More specifically, it was suggested that a working background paper should be drafted, in order to be discussed at the 1977 Pugwash Conference. The hope was expressed that the 1977 Pugwash Conference will be able to submit, as one of the Non-government agencies, some concrete recommendations to be considered by the UN Conference on "Science and Technology for Development" in 1979.

The Working Group identified the following two basic principles which should govern international scientific cooperation in relation to developing countries:

(a) development policies and priorities must be defined within the developing countries themselves, and the international scientific community should be aware of the importance of self-reliant and autonomous development of each society, and also the difficulty of achieving self-reliance;

(b) it should be borne in mind that co-operation is not utilized as an umbrella to collect intelligence information or to threaten the security of a country.

The importance of proper understanding of diverse cultures of the world, which is so important for security, was recognized. This is both a problem of adequate teaching of history, and of adequate dissemination of news on contemporary events, both in DCs and LDCs.

History is often taught, from the early school level, in a narrow ethnocentric fashion, without sufficient appreciation of the richness of other cultures. This contributes to lack of communication, to misunderstanding and to suspicion. Therefore the Group suggests that UNESCO should take vigorous steps to tackle this problem. It is indeed a natural function and among the "raisons d'être" of UNESCO.

The mass media are extremely powerful means of communication. They must be utilized for betterment of knowledge and understanding of peoples from diverse socio-political systems and ethnic origins. There has often been inadequate and biased coverage of happenings around the world. In this connection the Group noted the steps that are being taken to set up a News Agency Pool of non-aligned countries.

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* B.M. Udgaonkar : Development, Resources, World Security and New Directions for International Scientific Cooperation : Implications for a Code of Conduct for Scientists.

IN VITRO DNA RECOMBINATION (GENETIC ENGINEERING)

At the 24th Pugwash Conference held in Baden, Austria in 1974, an informal discussion was held to discuss the implications for science and the public of the recently developed technique of genetic engineering through recombination of segments of any DNA, the chemical molecule carrying the information on hereditary traits of all living organisms. At that time the technique was at an early stage of development, but it was recognized by the scientific community that in addition to the great potentialities it had for increasing our fundamental knowledge of life processes and its application to benefit humanity with respect to treatment and control of disease, and for agricultural and industrial practices, certain hazards might be connected with the work involved. Consequently, the Pugwash scientists at their 1974 meeting endorsed the self-imposed moratorium on the part of many of the leading scientific workers in this field with respect to certain types of experiments which were possible, until a fuller understanding of the entire question was achieved.

At the present Conference, developments since 1974 were again reviewed informally by Pugwash scientists, taking into account scientific advances which had occurred, as well as the public debates and governmental and related action which have taken place.

We noted that the probable benefits to humanity from pursuing this technique were very great and therefore work in this field should be encouraged, a position which has been adopted officially in countries where scientific investigations are being pursued. Committees have been created for supervising the conditions under which such experiments are being performed. These Committees, sponsored by respective governments, have defined the safeguards and the guidelines applicable to each class of DNA to be recombined. We fully endorse these precautions which should be maintained to the greatest possible degree until more knowledge is achieved with respect to possible hazards involved in such work, which until now are only conjectural in nature. We urge that all governments in countries where such work is being done or planned take concrete steps to ensure that proper precautions are taken for physical and biological containment through arrangements by appropriate commissions and control procedures following the guidelines which have been set and published in the USA and the UK. In this connection, it would be helpful to work towards some uniformity or degree of standardization with respect to government control of physical containment, a combination of engineering and personal discipline in the laboratory, and to make this information available to all concerned.

In addition, the group noted with great concern the possibility of gross abuse of applications of this technique with respect to developing agents for biological warfare purposes. It should be pointed out that there is no basic difference between in vitro and in vivo recombination, a technique suitable for biological weapons technology. We welcome particularly, therefore, the statement by the USA delegation to the CCD in Geneva on 17 August to the effect that the use of recombinant DNA molecules as a technology for developing weapons clearly falls within the scope of the Biological Weapons Convention of 1972 as prohibited, based upon the explicit language of the Convention as well as its negotiating history, and that such an interpretation is of great importance and one on which doubt cannot be permitted to exist. Subsequently, representatives of other countries endorsed this interpretation of the CCD. We are confident that all signatory governments share this view, and we urge that this fact

be made explicitly and publicly known as soon as possible in order to allay any unjustified fears on this score. In addition, we urge that all governments which have not already done so ratify the 1972 Convention as soon as possible, and meanwhile state officially that they would adhere to all provisions of the Convention including particularly the ones covering DNA recombinants.

We recognize however that in the unfortunate continuing atmosphere of international distrust, suspicions and accusations may arise in different quarters concerning the possible abuse of the DNA recombination technique for biological warfare purposes which is impossible to validate at early stages of such work. For this reason, we strongly urge all scientists to refuse, and to make known their refusal, to be associated in any way with work that is directed intentionally or contemplated towards the development of biological warfare agents.

As has often been stated by Pugwash, openness of research in all scientific fields is essential to allay mistrust. This applies with great force to the field of DNA recombinants. Knowledge of the results of research and its methodologies, as well as actual agents themselves, e.g. modified ("disabled") micro-organisms and vectors, should be made freely and widely available for the advance of this technology to all countries under the proper organizational and physical safeguard precautions referred to previously. Co-ordination of this activity at the global level could be undertaken by the World Health Organization, for example.

The problem of secrecy of industrial processes, patents, etc., has already arisen in this field. We firmly believe that such activities should be closely supervised by responsible governmental authorities and that any resultant profits should be minimized to the greatest extent possible in order not to compromise in any way the benefits which could accrue for humanity in general, and for the economically underdeveloped countries in particular.

Acad. V. Engelhardt
Dr. Martin M. Kaplan
Prof. Alex Keynan
Dr. Herbert Marcovich
Prof. Jorma K. Miettinen
Dr. D. Perrin
Prof. Marcel Roche

PUGWASH NEWS

Meetings of the Pugwash Council and its Executive Committee

The Executive Committee of the Pugwash Council met in London, on April 16-17, 1976 in order to review the status of implementation of the recommendations of Working Groups at the Madras Conference and the plans for the Mühlhausen Conference. The report from the Third CW Workshop was received and plans were approved for the Fourth CW Workshop and for the 26th Symposium, both reported in this Newsletter. The status of the Central Office finances was reviewed; it was noted that the 1976 expenses were expected to exceed by a considerable amount the anticipated contributions from National Groups. A new set of quotas, for National Group contributions to the Central Office expenses, were accordingly agreed upon. These quotas has been approved by the Council

at its meeting in Mühlhausen, and all National Groups are urgently requested to make every possible effort to meet their 1976 quotas of contributions in support of the Pugwash Central Office activities.

In its meetings in Mühlhausen on August 24-25, 1976, the Pugwash Council - besides reviewing activities since its last meeting in Madras, agreeing on the programme of the Mühlhausen Conference and approving a number of Symposia and Workshops for the future (details of which will be given in this and subsequent Newsletters, as they are developed) - devoted the bulk of its time to the consideration of the future directions for the Pugwash Movement. In the course of these discussions, a number of suggestions were made for areas of future study in Symposia and Workshops that deserve serious consideration by National and Regional Pugwash Groups. These include:

- New directions in military technology, new weapons and the means of their control.
- Control over military research and development.
- The dangers of nuclear war in the rest of this century, and means for their avoidance.
- The status of détente and prospects for its growth and spread.
- Implementation of the Helsinki agreements on cooperation and security in Europe.
- The arms trade; its implications and control.
- Mobilization of the scientific community and its resources for development.
- Possible Pugwash inputs into the 1979 United Nations meeting on the applications of science and technology to development.

In the planning for the next Quinquennial Pugwash Conference, in Munich (24-29 August 1977), it was agreed that the Council would prepare a number of documents for submission to the Conference on the future of the Movement. The first stages of the process of preparation have been agreed upon by the Executive Committee, which met during and immediately following the Mühlhausen Conference. The Executive Committee is in process of drafting three such documents: one on the future programme of Pugwash, a second on its future organization, and the third a new Pugwash "manifesto" or "declaration" - an attempt to bring up-to-date the Vienna Declaration of 1958.

The Executive Committee also received, and approved in principle for consideration at the next Council meeting, proposals for two international Symposia, to be held in 1977 or 1978:
"Problems of Militarism and Militarization", proposed by the Norwegian Pugwash Group.
"Security Problems in Europe", proposed by the Polish Pugwash Group.

OBITUARY

We regret to announce the death on 10 June 1976 of SIR MICHAEL WRIGHT at the age of 74. Sir Michael was a professional diplomat and occupied a number of ambassadorial and other posts in the British Government. He was very active in the field of disarmament negotiations. He was the head of the UK delegation to the Conference for the Cessation of Nuclear Tests, and his effort undoubtedly helped to produce the Partial Test Ban Treaty. He was also Chairman of the United Nations Association Disarmament Committee in the U.K. He participated in the 22nd Pugwash Conference in Oxford.

CALENDAR OF FORTHCOMING PUGWASH MEETINGS

23-26 November, 1976

27th Pugwash Symposium
"Problems of Militarily-Oriented Technologies in Developing Countries"
Feldafing (near Munich), F.R.G.
(for Agenda, see Pugwash Newsletter, April 1976, Vol.13, No.4, p.183)

February or March, 1977

Proposed Pugwash Workshop
"Code of Behaviour on International Scientific Cooperation for Development"
India

Spring 1977

Proposed Pugwash Symposium
(Tentative title) "Appropriate Technologies and Technological Choice"
U.S.A.

Suggested Agenda

I. Appropriate Technology for the Developed Nations
   - A. Centralized vs. decentralized technologies: centralized technology is marked by hierarchical, integrated organization and economies of scale; decentralized technology implies local organization and self-sufficiency
   - B. Is a small "human-scale" technology, utilizing sophisticated science and technology, a realistic alternative for the developed nations?

II. Appropriate Technology for the Developing Nations
   - A. Implications of choice between centralized and decentralized models
   - B. Comparative ability of centralized vs. decentralized models to increase productivity and improve the quality of life in the developing world
   - C. Opportunities and constraints in technology transfer from developed to developing nations
   - D. Opportunities for indigenous creation of technologies appropriate to the developing world.

III. Societal Implications of Different Scales of Technology and Production
   - A. Political: international, national, regional, local systems of control; independence vs. self-sufficiency
   - B. Economic: industrial efficiency; environmental impact; effect on sources of energy, raw materials,

human labour, and capital

C. Social: impact on individual of complex bureaucracies and highly centralized organizations vs. local, decentralized units - i.e., worker satisfaction, self-reliance vs. dependence and manipulation.

IV. Opportunities for international scientific community to develop a technological model, suitable for global implementation, which would promote balanced growth in both the developed and developing nations and be in keeping with human and environmental needs.

1977

Proposed Pugwash Symposium
"Feeding Africa", Ghana

Agenda

1. Agricultural development on environmentally sound principles
2. Population
3. Uses of different sources of energy
4. Development of means of transportation
5. Education and training
6. Inter-African commercial relations and relations with the outside world
7. Transfer of technology
8. Aid and collaboration
9. The international economy and its relation to food materials

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24-29 August 1977

27th Pugwash Conference
Munich, Federal Republic of Germany

Final Agenda

1. Nuclear Arms Control and Disarmament

a. Dangers to peace and security from the nuclear arms race.
b. Current status and prospects of SALT.
c. Problems of nuclear proliferation and diversion of nuclear materials.
d. Nuclear arms control measures (NPT, CTB, PNE) and security guarantees (nuclear weapon-free zones, no-first-use agreements).
e. Present concepts of 'military balance' and 'deterrence', and alternatives.
f. Systematic steps towards GCD.

2. Arms Control and Disarmament in the Non-Nuclear Realm

   a. Impact of the arms race on peace.
   b. Arms trade.
   c. Military expenditures.
   d. The Vienna negotiations on force reductions in Europe.
   e. Progress in control over armaments: military expenditures, CW, new weapons (e.g. environmental warfare).

3. Co-existence, Détente and Cooperation between Nations and Systems

   a. Reducing distrust and tensions between nations.
   b. Status of implementation of the Treaty for Security and Co-operation in Europe.
   c. Problems of free circulation of people and ideas in areas other than Europe.
   d. Vulnerability of societies to disruption (terrorism, technological imperialism).
   e. Strategies for settlement of conflicts without use of force.
   f. Role of the United Nations in alleviating tensions and preventing violence, with special reference to international security forces.
   g. Psychological and behavioural aspects of mistrust and tension between nations.
   h. Current conflicts.

4. Security of Developing Nations

   a. Impact of nuclear arms race.
   b. The Indian Ocean as a Zone of Peace.
   c. Impact of progress of peaceful nuclear energy.
   d. Problem of transfer of military technology.
   e. Growth of military expenditure.
   f. Non-military threats to security of developing nations.
   g. Role of multi-national corporations.

5. Development Problems of the Economically Poor Nations

   a. Self-reliance and international collaboration.
   b. Priorities for the application of science and technology to development.
   c. Achievement of sufficiency in food, health care, and education.
   d. Optimization of energy requirements for development.
   e. Obstacles to reaching social and economic goals defined by the developing nations.
   f. Contribution of Pugwash to the UN Conference on Science and Technology for Development.
   g. Scientific advances needed for development and their potential impact on society.

6. Energy, World Resources, and Population Trends

   a. Potential alternatives for oil and fission energy.
   b. Non-renewable natural resources.
   c. Distribution of the wealth of the seas.
   d. Population trends.
   e. Prospects for food supplies.
   f. Possibility of defining maxima for consumption.

7. Environmental Hazards of Global Concern

   a. Pollutants and the ecosystem.
   b. Extra-terrestrial modifications.
   c. Disposal of nuclear and other wastes.
   d. International monitoring systems and standards.

8. Science, Scientists and Society

   a. Improving international collaboration in science.
   b. Accountability of science and scientists to the public.
   c. Science and ethics.
   d. Ways of fulfilling the social responsibility of young scientists.
   e. Guidelines for the professional conduct of scientists.

Twenty-Sixth Pugwash Symposium

INTERNATIONAL ARRANGEMENTS FOR NUCLEAR FUEL CYCLE FACILITIES

Wingspread, Wisconsin, USA, 24-27 May, 1976

Participants

C. Allday (UK)
M. Bancora (Argentina)
C. Beets (Belgium)
A. Carnesale (USA)
A. Chayes (USA)
P.J. Dyne (Canada)
W. Epstein (Canada)
F.R. Farmer (UK)
A. Finkelstein (France)
D.A.V. Fischer (Austria)
S. Freier (Israel)
T. Greenwood (USA)
D. Gupta (Germany)
S.R. Hatcher (Canada)
J.S. Hewitt (Canada)
W. Bennett Lewis (Canada)
Patricia J. Lindop (UK)
W. Lowrance (USA)
G. Rathjens (USA)
K. Refaat (Egypt)
L. Scheinman (USA)
M. Sharefkin (USA)
E.B. Skolnikoff (USA)
Constance Smith (USA)
M. Willrich (USA)
Y. Ku Yoon (Korea)
R. Gallucci (USA)

Agenda

I. The impact of fuel reprocessing under international ownership or control on the prospects for proliferation of nuclear weapons.

II. Functional aspects of nuclear fuel reprocessing and the effect upon them of various international arrangements for ownership or control of reprocessing and related facilities:
   a. economic
   b. safeguards
   c. health, safety and environmental protection
   d. security
   e. technical and operational considerations

III. Institutional problems:
   a. general analysis of possible organizational arrangements for international ownership or control of nuclear fuel reprocessing and related facilities
   b. possible roles of the IAEA.

IV. Case studies:
   a. EURODIF and United Reprocessors
   b. The possibilities for regional reprocessing facilities in nuclear-free zones, with special reference to OPANAL.
   c. The FRG-Brazil arrangements
   d. The lessons of INTELSAT
   e. The lessons of private ownership of nuclear fuel reprocessing facilities.

List of Papers Submitted

C. Allday -- Some Experiences in Operation of Multinational Uranium Enrichment and Fuel Reprocessing Organizations.

C. Beets -- Impact of International Safeguards Arrangements Upon Nuclear Fuel Cycle Operation.

P.J. Dyne, R.B. Lyon & D.R. McLean -- Regional Fuel Cycle Centres - Technical and Operational Considerations.

W. Epstein -- The Politics of the Problem.

F.R. Farmer -- Safety of Nuclear Power in a Modern Society.

D. Fischer -- Regional Nuclear Fuel Cycle Centres: Study by IAEA.

S.R. Hatcher & W.W. Morgan -- Technical and Economic Considerations in Fuel Reprocessing.

W. Bennett Lewis -- Storing Radioactive Substances in Cooled Pebbles.

W.W. Lowrance -- Nuclear Futures for Sale: Issues Raised by the West-German-Brazilian Nuclear Agreement.

G.W. Rathjens & A. Carnesale -- Nuclear Fuel Cycle and Nuclear Proliferation.

L. Scheinman -- Functional Aspects of Nuclear Fuel Reprocessing and the Effect on Them of Various International Arrangements for Ownership or Control of Reprocessing Facilities: The Case of Safeguards.

M. Sharefkin -- Notes on the Uncertain Economics of Spent Fuel Reprocessing.

E.B. Skolnikoff -- Relevance of Intelsat Experience for Organizational Structure of Multinational Nuclear Fuel Facilities.

Constance B. Smith & A. Chayes -- Institutional Arrangements for a Multinational Reprocessing Plant.

M. Willrich -- Physical Security in Multinational Nuclear Fuel Cycle Operations.

Report on the Symposium

An International Pugwash Symposium on International Arrangements for the Nuclear Fuel Cycle was held at Wingspread in Racine, Wisconsin, from May 24-27, 1976. Twenty seven experts from ten countries participated. Among them were officials of the IAEA, United Reprocessors and Eurochemic. The Symposium was under the sponsorship of the United States and Canadian Pugwash Groups.

A number of approaches toward the problem of the spread of large-scale reprocessing facilities under national control have been discussed in various national and international forums. One of these is reprocessing facilities under international or multinational control. Under arrangements suitably devised, it was thought that nations might gain the benefits of early experience with reprocessing and yet avoid the dangers

of national control. Exploration of this approach was mandated by the NPT Review Conference of 1975, and the IAEA has undertaken a major long-term study of the concepts. A number of individual governments have expressed interest, including the United States.

In these circumstances, it seemed to the United States and Canadian Pugwash Groups that the discussion might benefit from a systematic and dispassionate analysis of the concept, of the kind that the Pugwash Movement has been able to provide for major arms control and disarmament issues in the past.

It will be seen that the Symposium addressed itself to a rather narrow and technical subject. It was not examining the whole gamut of anti-proliferation policies, or even a generalized programme for containing the spread or reprocessing and enrichment facilities. The analysis was focussed on a single instrument, its advantages and disadvantages and some of the problems that would attend any effort to bring it into being. The hope was that this analysis could feed into and inform the broader international discussions now under way.

The papers presented reflected that orientation of the Symposium. After an opening discussion designed to provide the general background and setting of the problem, the main portion of the Symposium was devoted to questions relating to nuclear fuel reprocessing. There was extensive consideration of a number of technical aspects of reprocessing: economic considerations, safeguards, health and safety, physical security, operational problems and waste management. In each case, the method is to consider the particular issue first in the context of national facilities, and then to ask whether significant differences, favourable or unfavourable, arise in the multinational case.

Thereafter the group explored some of the problems involved in setting up what would be a very complicated international institution to operate a high technology venture. Some of the relevant experience, both inside and out of the nuclear field was examined. And a general analysis of the institutional requirements was attempted.

The Symposium did not reach any agreed conclusions about multinational reprocessing facilities and did not try to. One thing may perhaps be said, however: there is surely no point in encouraging the establishment of any large scale reprocessing facilities - national or multinational - unless it is clear that reprocessing will be necessary or desirable for the nuclear energy economy. And on this question the members of the group were divided. Some saw a present or immediate future need, usually in the context of early development of the breeder reactor. Some saw reprocessing as inevitable, but thought its advent could and should be delayed for 20 or 30 years. Others continued to entertain hopes it might be possible to bypass reprocessing entirely, and with it the so-called "plutonium economy" with all its dangers.

On a number of more concrete issues, there was a considerable measure of consensus:

1. It would be well to start any multinational nuclear fuel cycle enterprise rather modestly, with relatively few participants that have some extrinsic basis of cooperation, and

with limited objectives, for example spent fuel management.

2. In a full blown multinational reprocessing enterprise, the gamut of considerations - economic, health and safety, non-proliferation and security - argue for co-location of related facilities (spent fuel storage, fuel fabrication and waste management operations) at the same site as chemical reprocessing.

3. The call for safeguards assumes the existence of adversaries motivated to depart from normal procedures and calls for co-operation among the operators and participants to defend against irregularities. With skilful management the involvement of nationals from several countries can enhance the possibilities for this cooperation.

4. The success of any multinational effort will be conditioned on the free and voluntary adherence of the parties. Political pressures to force participation are likely to be ineffective and to generate suspicion and resistance.

More generally, all were agreed that there is no single action or programme - certainly no technical or institutional "fix" that can eliminate the dangers of nuclear weapons proliferation. A major element in any such effort must be, as one of our authors has termed it, "psychological denuclearization" - the recognition, by nuclear and non-nuclear powers alike, as well as their political electorates, that, in the words of the UN Secretary-General on the eve of the adoption of the NPT:

> .... since the end of the Second World War no nuclear weapons state has been able to derive any immediate military advantage from the possession of nuclear weapons, let alone use them to gain an easy victory.

Indeed,

> .... the possession of nuclear weapons does not necessarily prevent a decline in political influence.

For the rest, all politically feasible actions operate on the margins of the problem. But it is not impossible that the cumulative effect of marginal actions can decisively influence the course of events. To the extent that the international community has been able to inhibit the spread of nuclear weapons in the first three atomic decades - and the effort has not been wholly unsuccessful - some such process has been at work. It is in this light that the question of international arrangements for the nuclear fuel cycle should be approached.

A.C.

Summaries of Papers

There follow brief summaries of the papers presented at the Wingspread Symposium. The complete texts of these papers are to be included in a monograph now in preparation -- Ed.

C. Allday (UK)

SOME EXPERIENCES IN OPERATION OF MULTINATIONAL URANIUM ENRICHMENT AND FUEL REPROCESSING ORGANIZATIONS

The paper describes the formation and progress of Urenco/Centec and United Reprocessors GmbH, which are tri-national organizations devoted to the development and exploitation of gas centrifuge technology for uranium enrichment and to fuel reprocessing respectively. It is hoped that the information will be of value to those considering Regional Reprocessing Centres. The amalgamation of industrial and political interests on a multilateral basis is not easy, but the success of the organizations demonstrates that industrial cooperation with political control (to ensure proper safeguarding) is possible.

C. Beets (Belgium)

IMPACT OF INTERNATIONAL SAFEGUARDS ARRANGEMENTS UPON NUCLEAR FUEL CYCLE OPERATION

It is recognized that there is an imperative requirement for a system of safeguards against the possible misuse of the applications of nuclear energy by a State or by a clandestine organization. The partition of risks between safeguards systems, based on quantitative accounting, and physical protection systems is discussed, and various approaches to the quantification of risk are examined. The experience of the IAEA and Euratom in implementing safeguards in the European Community is used in illustration.

P.J. Dyne, R.B. Lyon & D.R. McLean (Canada)

REGIONAL FUEL CYCLE CENTRES - TECHNICAL AND OPERATIONAL CONSIDERATIONS

On the basis of studies of the establishment of a reprocessing industry in Canada, the considerations leading to a decision to establish a national fuel cycle programme are examined. The incentives which might exist for a number of countries to organize a regional centre are reviewed, as are some of the many technical, organizational and political matters which would have to be resolved. Consideration is given to general plant specifications, waste management and disposal, safety standards, and choice of host country.

W. Epstein (Canada)

THE POLITICS OF THE PROBLEM

An analysis of the background to the nuclear proliferation problem is followed by an examination of various measures that already exist or have been proposed for its control. These include the International Safeguards systems operated by the IAEA over facilities that a country has agreed to place under such safeguards; the London "Suppliers' Club", and restrictions on exports of nuclear facilities and materials; and regional, multinational or international fuel cycle centres as a means of preventing the diversion of fissionable materials from peaceful to weapons uses. Finally, additional measures for effective safeguards are reviewed, including a comprehensive programme of measures for effective and adequate control of proliferation, as far as is possible in a world of sovereign states.

F.R. Farmer (UK)

SAFETY OF NUCLEAR POWER IN A MODERN SOCIETY

In this paper, a number of propositions which have influenced the development of safety thinking in the field of atomic energy are explored. Attempts to define safety criteria by siting, by containment and by consideration of and protection from maximum credible accident, are analysed. The assumptions on which accident modelling and assessment are based are examined. All this illustrates the difficulty of setting objective and meaningful safety standards in a new industry carrying some risk. It is concluded that nuclear safety problems must be seen in relation to the risks in modern society and not in isolation.

D. Fischer (Austria)

REGIONAL NUCLEAR FUEL CYCLE CENTRES : STUDY BY IAEA

This paper describes the IAEA's Regional Centre project, established to develop the methodology for assessing alternative strategies so as to be able to evaluate the advantages and disadvantages of a regional nuclear fuel cycle centre and of dispersed national or local fuel cycle facilities.

The project will soon be reaching a stage where its findings can be applied empirically. It is hoped that groups of countries may become interested in the possibility of establishing such centres and that these studies could eventually lead to the negotiation of an agreement for the setting up of such a centre.

S.R. Hatcher & W.W. Morgan (Canada)

TECHNICAL AND ECONOMIC CONSIDERATIONS IN FUEL REPROCESSING

Of the many techniques that have been explored for the separation and recovery of plutonium and uranium from fission products, solvent extraction is the only process which has been developed to a commercial scale, and which is being seriously developed for new application.

The various options open within the basic process of solvent extraction are examined and compared. The best known and developed extraction process is the Purex process, which is the basis of all large plants now operating or under construction. This process is described.

The economic analysis of reprocessing will depend largely on the licensing requirements and the financial ground-rules chosen. The relative costs of different reactor types and sizes are shown and factors which will favour the economics of reprocessing plants at regional fuel cycle centres are listed.

W. Bennett Lewis (Canada)

STORING RADIOACTIVE SUBSTANCES IN COOLED PEBBLES

Various phenomena and studies are presented which show that it is possible to store high level radioactive waste in glass blocks or pebbles. A chart is given which provides a rough guideline for the level of atomic mobility that can be expected in various solids. Further study is recommended on schemes for the disposal of such blocks or pebbles.

W.W. Lowrance (USA)

NUCLEAR FUTURES FOR SALE : ISSUES RAISED BY THE WEST-GERMAN-BRAZILIAN NUCLEAR AGREEMENT

This paper reviews the events surrounding the signing of the "Agreement of Cooperation in the Peaceful Use of Nuclear Energy" by West-Germany and Brazil, discusses their unfolding and their present implications, and then draws a more general description of the political territory in which they are long bound to remain prominent landmarks. Through all the issues raised by these events runs the basic quandary: should the supplier nations refuse to export critical and "sensitive" technologies and take other embargoing actions, thereby buying time and prolonging hegemonic control but risking offending the developing nations seriously and inciting indigenous development of the technologies; or should they acquiesce in the foreign import-pull and domestic export-push and go ahead and supply the technologies, but, in exchange, negotiate uncompromisingly for sanctionable promises of restraint on use of the technology?

G.W. Rathjens & A. Carnesale (USA)

THE NUCLEAR FUEL CYCLE AND NUCLEAR PROLIFERATION

The paper opens with an identification of the paths to, and the incentives for, a nuclear weapons capability. On the assumption that the inducement of nations to forego the acquisition of independent "sensitive" facilities is a worthwhile contribution to the non-proliferation effort, mechanisms for bringing about such forebearance are examined. However, such measures are likely to be largely irrelevant to the control of proliferation unless there is also success in dealing with the incentives to acquire weapons.

L. Scheinman (USA)

FUNCTIONAL ASPECTS OF NUCLEAR FUEL REPROCESSING AND THE EFFECT ON THEM OF VARIOUS INTERNATIONAL ARRANGEMENTS FOR OWNERSHIP OR CONTROL OF REPROCESSING FACILITIES : THE CASE OF SAFEGUARDS

The economic, political and technological incentives for States to acquire a nuclear fuel reprocessing capability, and the means whereby they may do so, are examined. The potential problems that the development of such activities may create for realization of non-proliferation objectives are discussed and, in view of these, the importance of defining and applying adequate and effective safeguards becomes clear. Some of the problems associated with national and international safeguards systems are identified and the question is raised whether or not multinational ownership or control of reprocessing facilities serves non-proliferation objectives to such a degree that the effort to structure such centres is worth the political and other costs entailed.

M. Sharefkin (USA)

NOTES ON THE UNCERTAIN ECONOMICS OF SPENT FUEL REPROCESSING

This paper aims to provide a tolerably unambiguous statement of the prospective economics of spent fuel reprocessing and mixed oxide fuel fabrication. Cost estimates are given which make it clear that the essential problems are not narrowly economic. Nonetheless, an economic analysis is presented which attempts to pick an efficient pattern of industry development supportive of other, broader objectives, and informs a selection of a mix of public and private participation in the "back end" of the nuclear fuel cycle.

E.B. Skolnikoff (USA)

RELEVANCE OF INTELSAT EXPERIENCE FOR ORGANIZATIONAL STRUCTURE OF MULTINATIONAL NUCLEAR FUEL FACILITIES

Lessons are drawn from the experience of the International Telecommunications Satellite Organization for the design of international institutional structures in other high technology areas, specifically of a multinational nuclear fuel facility (MNF).

A brief history of Intelsat is given. Important requirements for a successful MNF are laid out and, in the light of these general requirements, parallels are drawn with Intelsat, some to be followed, some to be avoided.

Constance B. Smith & A. J. Chayes (USA)

INSTITUTIONAL ARRANGEMENTS FOR A MULTINATIONAL REPROCESSING PLANT

The building of national reprocessing plants increases the chances of further nuclear proliferation by giving the nations possessing such plants the means to produce plutonium that could be used in nuclear weapons. It has been suggested that a multinational reprocessing plant (MRP) could provide a viable alternative by providing reprocessing and other needed services for its participants. An evaluation of this proposal must consider the organizational and institutional problems involved, for the structure and organization of such a centre will not only influence its acceptability and feasibility but will also affect its actual non-proliferation benefits. The paper examines a range of institutional arrangements and identifies some of the principal organizational decisions that would have to be faced in the establishment of multinational fuel cycle facilities.

M. Willrich (USA)

PHYSICAL SECURITY IN MULTINATIONAL NUCLEAR FUEL CYCLE OPERATIONS

The paper explores the question of physical security in civilian nuclear fuel cycle operations under various forms of multinational control. The primary focus is on the "back end" of the fuel cycle -- reprocessing, plutonium-bearing fuel fabrication, and associated irradiated fuel and plutonium storage and transportation. First, the security threats are outlined and the basic features of a physical security system are discussed. Next, physical security principles and requirements are assessed in the context of various forms of multinational control.

INTERNATIONAL SCHOOL ON DISARMAMENT AND RESEARCH ON CONFLICTS (ISODARCO) - 1976

The sixth ISODARCO course was held in Nemi, Italy (30 km south of Rome), from 22 June to 7 July 1976. These courses, held on alternate years, have been sponsored by the Italian Pugwash Group who have arranged for the publication in book form of the papers presented and the discussions held. The publication of the 1974 course is entitled "International Terrorism and World Security", edited by David Carlton and Carlo Schaerf (Croom Helm Ltd., London, 1975). The Italian Pugwash Group has kindly assigned the royalties from that publication to the Pugwash Central Office.

The main themes of the sixth course were new military technologies and the perception of nuclear deterrence, strategical arms limitation, the changing world economic structure and the transfer of conventional arms and nuclear technologies, and the consequences of nuclear weapons proliferation and military and political instabilities. There were some 70 participants from 23 countries, with many Pugwashite lecturers including Calogero (Italy), Milstein (USSR), Kende (Hungary), Epstein (Canada), Röling (Netherlands), Robinson (UK), Miettinen (Finland), York (USA), Mary Kaldor (UK), Tsipis (USA), Carlton (UK), Eide (Norway), Lapter (Sweden), Ooms (Netherlands), Schaerf (Italy), Scoville (USA) and Kaplan (Switzerland).

The sessions were held in the beautiful surroundings of the Missione Verbiti, and most of the participants were lodged there. The course consisted of a series of lectures lasting about 45 minutes, followed by discussions from the floor. Round-table panels of experts were used for selected topics. Natural and social scientists from seven developing countries and six socialist countries ensured a wide spectrum of political and social viewpoints to balance the preponderance of participants from western Europe and the USA. A summary of the discussions is presented below, and the proceedings will be published in book form in 1977.

The ISODARCO courses are fine examples of a Pugwash national effort, and the Italian Pugwash Group are to be congratulated on carrying out this very worthwhile undertaking.

M.M.K.

Herbert Levine *

SUMMARY OF ISODARCO SIXTH COURSE

The Sixth Course of the International School of Disarmament and Research on Conflicts (ISODARCO) was conducted in Nemi, Italy, from June 22 to July 7, 1976. The topic was the arms race - particularly in nuclear weapons but also in conventional weapons.

Four subjects were dealt with:

1) the problem of weapons and the arms race;
2) the consequences of the arms race to the world;
3) the control of the arms race;
4) the causes of the arms race.

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* Ed. note: the original report has been slightly edited and shortened. The conveners plan to publish a monograph which will give a complete account of the course.

1. The Problem of Weapons and the Arms Race

The basic problem of the arms race, according to several lecturers, was that the accelerating rate of development of weapons and delivery systems technology threatens the survival of civilization itself.

The present technology was described. The most powerful weapons belong to the US and the USSR with strategic arsenals composed of nuclear explosives and delivery systems (bombers, inter-continental ballistic missiles (ICBMs), and submarine launched ballistic missiles (SLBMs) poised for instant use on command. Defence systems exist but are regarded as ineffective against an all-out war.

New military weapons for use in both nuclear and conventional wars were described, including precision guided munitions (PGMs), cruise missiles, remotely piloted vehicles, electronic warfare and anti-submarine warfare devices, advanced ballistic missiles, and point anti-ballistic missiles. These systems improve weapon accuracy and threaten to make existing systems obsolete. A few lecturers devoted attention to the cruise missile, a device capable of carrying nuclear warheads across strategic distances. In conventional warfare, accuracy and intelligence gatherings have improved.

2. The Consequences of the Arms Race to the World

a) Strategic. Some lecturers contended that for the superpowers, the main purpose of the arms race is to keep parity so as to prevent any one side from possessing first strike capability. Strategic policy has emphasized deterrence rather than defence.

New weapons are viewed as stabilizing or destabilizing, depending on the degree to which they increase the prospects of a first strike capability. The conference was particularly concerned that the cruise missile may be viewed as destroying parity. The cruise missile is being developed for sea, air, and land platforms. It is small - about the size of a torpedo. It has a range of up to 2,000 nautical miles and can be launched from outside Soviet air defence forces. It can fly at low altitudes and, consequently, avoid radar. It is difficult, and sometimes impossible, to detect a cruise missile by national means of verification.

Two important points were made about this new weapon. First, the development and production of strategic cruise missiles may negate the SALT accords, which were based on national technical means of verification. Second, it is possible for Third World countries to develop strategic capabilities since the cruise missile is relatively cheap.

b) Tactical. The major issue of tactics, according to some participants, pertains to the deployment and possible use of tactical nuclear weapons in Europe. Both NATO and Warsaw Pact countries have thousands of these weapons in place.

Several arguments for keeping these weapons in Europe were presented:

1) They contribute to deterrence since the USSR will be able to concentrate its forces in a land attack if it believes that NATO does not have or is not willing to use these weapons in response to a Soviet conventional or nuclear attack.

2) To reduce or eliminate tactical nuclear weapons would lead each NATO country to make whatever deal it could with the Warsaw Pact, resulting in Finlandization.

3) Western Germany would object to removal of these weapons, the result may lead it to become neutral or possibly to acquire nuclear weapons of its own.

4) Removal or tactical nuclear weapons would give Warsaw Pact countries a military advantage.

Several arguments for removing these weapons from Europe were presented:

1) There is no distinction between tactical and strategic nuclear weapons. The tactical nuclear weapons currently deployed in Europe have explosive power more devastating than those detonated at Hiroshima and Nagasaki.

2) The new technology in conventional weapons can serve as a suitable substitute for tactical nuclear weapons.

3) There is no way of preventing total nuclear war once tactical nuclear weapons are used.

4) Tactical nuclear weapons in forward based positions may be captured in case of a surprise attack. They should at least be moved several hundred miles back from the possible initial battlefield.

5) The destruction of Europe would be assured by use of these weapons.

6) A balance of military power exists in Europe even without these weapons.

Mention was also made of the use of reconnaissance satellites for tactical purposes. Their original purpose was for intelligence, and they have been used as a basis for national technical verification of strategic forces involved in SALT. It was argued that these satellites had a "benign purpose" in controlling the arms race. There has been a tendency, however, for these satellites to be used in battlefield situations, e.g., the Bangladesh crisis and the Yom Kippur War.

c. Economic. The consequences of the arms race to the economies of the superpowers and other countries were examined in several lectures. It was argued that defence expenditures distort economic development. Military industries are inefficient and do not contribute to the productive forces of a society. The economies of the Soviet Union and the United States, for example, have suffered because of large defence expenditures. Third World economies have also been hurt. Money spent on defence is needed for civil purposes. To the extent that the big powers encourage Third World states to increase their military expenditure, they contribute to the economic decay of these countries.

In reply, it was argued that the US has one of the strongest economies in the world. Defence expenditures on hardware represent less than 2% of the US gross national product, hardly a share which can have such devastating consequences.

d. Diplomatic. The international diplomatic consequences of the arms race were also considered. The superpower rivalry, it was argued, is not limited to the two countries and their power blocs. Since the effects of nuclear war between the superpowers would produce radioactive fallout and possibly nuclear attack on neutrals, there have been numerous international attempts to control the arms race. Small powers have played a role in the Test Ban Treaty and the Non Proliferation Treaty (NPT), and have advocated nuclear-free zones and general disarmament conferences.

Another consequence of the arms race is that small powers must consider adopting nuclear weapons of their own.

The arms race has also encouraged the development of nuclear energy, with the attendant risks of proliferation.

As a result of the superpower arms race, small powers have tended to become distrustful of the big powers. Some Third World countries look upon US-USSR arms control arrangements as devices to control the world.

e. Political. The arms race produces internal political effects. Several commentators mentioned how arms control issues

can be injected into a political campaign. In the US, for example, Ronald Reagan has criticized President Ford for the SALT accords, and this criticism may have had an impact on the pace of negotiations.

A few lecturers also emphasized the importance of political leadership at the executive level in promoting arms control. For example, Nixon and Kissinger dominated the US position in SALT talks, sometimes working without the approval of the SALT negotiating team. When Nixon's position was weakened because of Watergate, so, too, was his ability to enter into arms control agreements with the USSR.

In a few lectures, the impact of nuclear weapons on sub-state actors in the international arena was discussed. Because international controls of nuclear materials and weapons could not be perfect, there was some discussion as to what role the terrorists could play. The experience of the IRA, guerrilla groups in Angola and guerrilla groups in Israel around the time of independence illustrate a lack of expertise in the use of sophisticated weapons. It was argued that unless there is support from a foreign nation which can provide the necessary scientific and military skills, it is doubtful that terrorist groups represent a nuclear danger.

The consequences to democracy of big power arms transfers to Third World countries was discussed. The role of the United States in furnishing vast amounts of military aid to Pakistan, it was argued, supported the professional military at the expense of Pakistani political leaders and contributed to the military coup in 1958.

3. The Control of the Arms Race

Participants offered numerous proposals for control of the arms race. More time was spent on discussing the strengths and weaknesses of these plans than on any other aspect of the arms race. (The classification used in this report was not the actual structure of the lectures).

a. Multilateral, bilateral and unilateral

The multilateral approach offers opportunities for all nations to contribute their ideas in arms control. One lecturer described how the small powers contributed to the Test Ban Treaty and the Non-Proliferation Treaty. Multilateral discussions, moreover, attract the attention of public opinion which, it was argued, is necessary to put pressure on governments to enter into arms control agreements. However, it was noted that technological innovation is proceeding more rapidly than are the multilateral institutions capable of dealing with it.

The bilateral approach involving the US and the USSR offers the advantage of limiting discussion to the nations with the most power and responsibility for the use of nuclear weapons. It was argued again, however, that agreements are often superseded by rapid technological change. Even when agreements are concluded, the superpowers find ways to carry on the nuclear struggle in other ways. (For example, underground nuclear tests actually increased in number after the Partial Nuclear Test Ban Treaty was ratified. Also, the quantitative limits on strategic weapons agreed upon at SALT resulted in a qualitative struggle, particularly in MIRVs). The bilateral approach also leads to a search for "bargaining chips" (i.e., cruise missiles and backfire bombers) which the military leaders in each country are not willing to give up. In effect, the bilateral approach may serve to speed up the arms race.

The major advantages of the unilateral approach are speed, flexibility and low cost. One lecturer advocated a programme of Reciprocal Unilateral Restraint (RUR). Under this plan each side cuts back on any

military component it chooses without waiting for an international agreement. The adversary would take similar steps since it would view the initial move as a sign of genuine willingness to bring effective arms control. The plan is flexible in that it could be reversed if no response came from the other side. Examples of this approach which led to satisfactory treaties were the unilateral test ban by Kennedy and the ban on biological weapons by Nixon.

Arguments were presented against the plan. For example, if the US removed its Pershing tactical nuclear weapons from Europe, would the USSR see this as a sign of arms control or as an attempt by the US to get rid of an outmoded weapons system? The US has already reduced 3,500 tactical nuclear weapons from Europe without a reciprocal response from the USSR. It was also argued that RUR might play into the hands of the hawks since it will create expectations which - if not realized - may lead to a stepping up of the arms race.

Another unilateral approach recommended that the US eliminate its ICBMs and long-range bombers, and rely on the sea-based deterrent. The advantage of this move, it was argued, was that the continental US would be a less desirable target for a nuclear attack. The feasibility of this move was questioned. Such a step, moreover, might be destabilizing to the nuclear balance since the advantages of bombers and ICBMs would be lost.

Another unilateral programme was suggested, whereby a military force would be capable of defending a country rather than conquering other nations, as illustrated by Switzerland and Sweden. It was argued that no superpower would accept such a policy, and also that there are no objective criteria for determining what is defensive and what is offensive.

Some lecturers contended that multilateral, bilateral, and unilateral approaches each have weaknesses, but that each approach should be tried so long as it moves towards effective control of armaments.

b. Comprehensive and incremental.

One point of discussion was the relative merits of the comprehensive versus the incremental, or step-by-step, approach to disarmament. A comprehensive package included an underground test ban, a cessation of the production of fissionable material for weapons purposes, the reduction and phasing out of all land-based ICBMs and strategic bombers, reduction of SLBMs, the ban on the testing, manufacture, and deployment of new strategic weapons and mininukes, superpower acceptance of all regional treaties creating nuclear-free zones or peace zones, new draft treaties for general and complete disarmament, a freeze and then reduction of conventional armaments, and reduction of sales and transfers of arms to Third World countries.

It was argued that the incremental approach has been tried and has not worked. Even if a comprehensive programme does not work, it is at least good peace propaganda in that it calls the problem to the attention of world public opinion. In reply, it was argued that the programme is too unrealistic. However, it was pointed out that the test ban treaty seemed unrealistic until it was tried.

The incremental approach, it was argued, represented a good way to bring about arms control. Nations will not accept grandiose schemes for bringing about disarmament. There was much attention given to what specific steps could be taken to improve SALT, test bans and nuclear-free zones.

c. Horizontal and vertical.

One approach to controlling the arms race was to look at the relationship between vertical proliferation (US and USSR) and horizontal proliferation (nuclear weapons

for the rest of the world). One plan called for a reduction in nuclear arms by the big powers since this would have an impact on horizontal proliferation. The superpowers, it was argued, could not prevent nuclear proliferation but they could minimize it. They should adopt a modified low defence posture in which the nuclear weapons states give positive security guarantees to certain non-nuclear weapons states subject to actual or threatened nuclear attack by either a hostile superpower or a minor nuclear weapons state when all other options have failed. The superpowers would retain nuclear weapons but would enter into arrangements to reduce the arms race. In the discussion the question of the credibility of such guarantees was raised.

Another plan focused on manipulating the use of nuclear fuels. The use of nuclear fuels for peaceful purposes is inevitable, it was argued. However, they could be used for weapons purposes. Nuclear energy may be viewed as a form of prestige, and pressures to export new hardware to small states may become intense. There was a suggestion that arms control advocates should work against nuclear power because of its proliferation consequences. It was argued, in reply, however, that as nations seek self-sufficiency in energy, nuclear power remains a necessary alternative for many states. It would be foolish to launch an anti-nuclear campaign and hope for success. Other discussion centered on new sources of energy which would be substituted for nuclear power. How close these new sources are to being harnessed in time to prevent nuclear proliferation became the subject of vigorous debate.

Another recommendation was to make the Middle East a nuclear-free zone. The superpowers have poured enormous amounts of weapons into the Middle East. The pace of military build-up in the Middle East is faster than between NATO and Warsaw Pact members. The spread of nuclear weapons to the countries of the Middle East is likely unless there is some form of disarmament or arms control in this area. There was considerable discussion as to what kinds of policies would work in the Middle East and whether or not a disarmament treaty was possible.

d. Legal

One approach to arms control was through international law. International law, it was argued, allows for disarmament by providing a world structure of institutions, rules of conduct among states, solutions of conflict and, finally, sanctions. It was argued that states are relying more and more on international law, and there is no reason to believe that international law cannot help provided that states have the political will to do so. A discussion arose as to whether international law is really Western law and, consequently, discriminates against Third World countries. It was argued, however, that in the West the view is often presented that the United Nations is using international law to the advantage of Third World countries rather than Western countries.

e. Substantive and procedural

There was considerable discussion about substantive and procedural approaches to controlling the arms race.

SALT dealt with substantive matters, i.e., how many anti-ballistic missiles (ABMs), bombers, SLBMs, ICBMs each nation could have and what means of verification were permissible. A lecturer described the factors which propelled the US and the USSR to enter into agreements. The US wished to limit the growth of Soviet systems and ultimately to improve US-Soviet relationships. The Soviet Union, it was asserted, wanted to limit US systems, to have the US accept the principle of parity, to obtain US managerial and technical skills to develop the USSR., and to weaken the US-People's Republic of China link.

There was considerable discussion about

the usefulness of SALT. Some argued that it was important not only because it put a ceiling on the arms race, but also because it symbolized a move towards détente. Others argued that it left too much out and just carried on the arms struggle in other forms.

One lecturer suggested that SALT negotiations should move away from dealing directly with substantive matters. Instead SALT negotiators should set up a system - a procedure - based on a plan of mutual reductions of 5 per cent annually over a ten year period. Such a programme would be more flexible and avoid the internal issues which are more serious than the external differences. In the discussion, the feasibility of achieving such a plan was questioned. It was also suggested that the internal debate would continue to include procedures. Was not the key a lack of political will rather than the absence of procedures?

f. Test bans

Dissatisfaction was expressed with the limited test ban treaty of 1963. New agreements to expand these agreements have resulted in the Threshold Test Ban and an agreement to control peaceful nuclear explosions. The new agreements were criticized by one speaker as setting the ceiling at such a high level - 150 kilotons - as to be meaningless. There was some discussion as to the significance of allowing inspectors to look at the tests of the other side. The prospects and difficulties of reaching a comprehensive test ban treaty were considered.

4. The Causes of the Arms Race

The causes of the arms race were explained in terms of the following factors: diplomatic, military, economic, bureaucratic and political, and evolutionary. From the diplomatic point of view, the state system produces insecurity which leads to a search for armaments. There was considerable discussion about whether there was a basis in reality for the mutual perceptions of a threat to security between the US and the Soviet Union.

A number of speakers pointed to the military establishments in the US and the USSR. The military leaders are charged with the primary security responsibility of their countries and constantly fear the military capabilities and intentions of their major adversaries.

The argument was also put forward that the military claim is self-serving. Military leaders seek to expand their influence through demands on budgets and, if left uncontrolled, they would never be satisfied.

Various economic views were presented. It was argued that a military-industrial complex exists in the US. The question arose as to whether a similar structure existed in the USSR. The subject of whether or not a decline in the capitalist economy structure was responsible for stimulating the arms race was also discussed.

Bureaucratic and political factors were analysed. It may take years of internal debate before the different agencies of a government agree on a negotiating position. Unless there is strong leadership at the top to move the bureaucracy, it was argued, technological changes may inhibit negotiation and even encourage the arms race.

Finally, the arms race was explained in terms of the evolution of humanity. The industrial age which saw the growth of nation states and wars is being replaced by a communicative age based on electronics, and characterized by international institutions and cooperation. The arms race is but a reflection of cultural lag and will end when the world evolves to a new stage. This view was challenged on factual grounds. Are the new international institutions bearers of peace or war? Do not the advanced societies still show strong signs of nationalism?

Can war be explained this way?

....

Although the participants shared the view that proliferation of weapons - particularly nuclear weapons - was a great danger facing the world, they expressed different views about the consequences, control and causes of the arms race. Several lecturers commented, however, that the study of the arms race contributes to a feeling of hope of finding solutions to a major problem of our time.

THE FOURTH PUGWASH CHEMICAL WARFARE WORKSHOP

Mühlhausen, GDR, 22-23 August 1976

Participants

Prof. Z. Binenfeld (Yugoslavia)
Dr. J. Franek (Czechoslovakia)
Prof. E. Jacchia (Italy)
Dr. M.M. Kaplan (Switzerland)
Prof. K.H. Lohs (GDR)
Dr. J. Lundin (Sweden)
Prof. J.K. Miettinen (Finland)
Mr. J.P. Perry Robinson (UK)
Dr. K.J. Schmidt (FRG)
Prof. V. Vojvodic (Yugoslavia)

Agenda

1. Developments at the CCD since the Third Workshop
2. Medical preventive measures for protection against nerve gases
3. New ideas on verification procedures.
4. Preparations for visit to an organophosphorus production plant in the FRG, and consequent workshop around the time of the 1977 Pugwash Conference in Munich.

List of Papers Submitted

Z. Binenfeld & V. Vojvodic -- Medical Protection against Nerve Gas Poisoning: Present Situation and Future Possibilities

K.H. Lohs -- Dioxin - A New Warfare Agent

K.H. Lohs -- Regular Medical Check-ups serving as a Means of Determining the State of Health of all those who are employed in Making and Using Organophosphorus Compounds

J. Lundin -- On Arms Control Negotiations and On the Ban on Chemical Weapons

J.K. Miettinen -- Recent International Developments in the Field of Chemical Disarmament.

Report from the Workshop

At its Fourth Workshop, the Pugwash CW Study Group reviewed developments at the 1976 sessions of the Conference of the Committee on Disarmament (CCD), and the present international situation in the field of chemical disarmament, as an additional contribution to that of the Third Workshop held in London in April of this year. The purpose of the meeting, as at previous Workshops, was to focus on salient issues in which Pugwash efforts would contribute constructively to the attainment of a comprehensive ban on the development, production and use of CW agents, along with destruction of existing stockpiles. The main agenda item concerned preparations for an exercise involving an "on-site" visit to a large industrial plant manufacturing organophosphorus pesticides. The exercise would be designed to clarify the parameters of such on-site visits as part of the verification provisions in a comprehensive CW treaty.

Certain encouraging developments during the past few months were noted. These were:

(1) A revival of interest on the part of the USA in proceeding towards resolution of substantive issues. For example, the USA has put forward suggestions within the CCD on minimally intrusive measures of verification, and has announced a willingness to have observers witness the destruction of part of its stockpiles.

(2) The informal CCD meeting in July at which technical experts from several countries presented interesting working papers on scope, verification procedures, CW protection, and destruction of stockpiles.

(3) The tabling in August of a new draft CW treaty by the UK.

These developments, while encouraging in a certain sense, are still insufficient. All of them are based on the premise that the achievement of a comprehensive chemical-weapons ban will require many years at best, with at least ten years being needed for the destruction of present stockpiles. The graduated mechanisms now being envisaged for implementing such a ban are all very involved, with many potential pitfalls unless each step is undertaken with a degree of mutual trust which clearly does not yet exist. For this reason, and in view also of the real danger of proliferation of CW weapons to countries not already possessing them, the Group considers it most regettable that more urgent action at a high political level is not being taken to achieve the desired total ban within the near future, analogous to that achieved with respect to BW weapons. It is to be hoped that the long drawn-out process envisaged will be considerably shortened so that the world will be rid as soon as possible of this particular class of weapons of mass destruction.

Medical protective measures against organophosphorus (OP) CW agents

The Group reviewed developments in the field of medical protection only insofar as they related to mass-casualty situations from the employment of highly toxic phosphorus-containing CW agents. The present background situation is as follows:

Medical measures for preventive purposes in all situations relevant to OP agents are very subsidiary to the first line of defence which comprises physical protection (masks and protective clothing) and decontamination of affected areas. The main problems that would be encountered in treating OP poisoning in mass-casualty situations are that with existing possibilities of treatment:

(1) there is a very low limit to the dose of OP compounds that can be treated successfully; and

(2) even with available chemotherapeutic compounds (atropine, oximes) - and against poisoning by some OP agents such as soman there is no effective chemotherapy at all - their effective application requires prompt use and skilled follow-up. This, plus the impossibility of administering artificial respiration in the field to a large number of people, negates almost all possibility of dealing effectively with mass casualties.

In the past year or two there have been some interesting scientific developments, though not as yet applied practically, with respect to improved antidotes. There is now, for example, a definite possibility of developing potent oximes of low toxicity that are capable of penetrating the blood-brain barrier considerably better than existing oximes. Other theoretical but far-distant possibilities are the development of substances capable of inactivating OP compounds in the body prior to inhibition of acetylcholinesterase; and the development of immunization procedures against OP poisoning, using OP compounds as haptenic antigens. It must be stressed, however, that success in such endeavours that would result in practical measures would appear to lie in the relatively distant future.

Nevertheless, in view of the very small number of scientific workers engaged in such work, and their relative isolation from each other, Pugwash in the past has encouraged informal meetings of such workers from different countries in order to encourage exchange of information andexperience, e.g. the meetings in Herzeg-Novi in 1974 and Helsinki in 1975.* The Group considers that such meetings should be continued, and that efforts should be stimulated to improve the dissemination of information relating to OP poisoning and therapy, and also with respect to protective equipment.

Non-organophosphorus CW agents, and the question of scope

The CCD negotiations have shown that one consequence of adopting a stepwise approach towards CW disarmament is that the definition of scope becomes a most sensitive matter. The Group reiterates its firm belief that the ultimate objective must be a fully comprehensive CW treaty, and notes that the latest draft treaty, tabled at the CCD by Britain, seems to fall short of this objective. Thus, in contrast to the 1972 BW Convention, the British CW draft does not appear to cover antiplant or antianimal agents; and there is also an obscurity of language regarding incapacitating antipersonnel agents (psychochemicals, irritants, etc.).

In the reports from earlier Workshops, the Group has noted the existence of an increasing number of highly toxic lethal and incapacitating chemical substances other than OP compounds which could be considered as potential candidate CW agents. Even if not at present suitable for use as CW agents, their existence points to the need for prohibiting their possible development as such. This is a matter which requires continual surveillance and which underscores the need for a CW treaty that is fully comprehensive in scope.

The recent tragic accident in Seveso, Italy, involving dioxin (2,3,7,8-tetrachlorodibenzo-p-dioxin) demonstrates on a very small scale the consequences of what would happen should highly toxic CW agents be used in a future conflict. Dioxin is comparable to the V agents in terms of its acute toxicity, and it is in addition one of

* As reported in Pugwash Newsletter 13(3): 177-180, 1976. The proceedings of the Herzeg-Novi meeting have just been published by SIPRI: Medical Defence against Chemical-Warfare Agents (Stockholm, 1976)

the most dangerous synthetic poisons known with regard to its delayed toxic manifestations. Dioxin is cheap, easy to produce, persistent, and difficult to decontaminate; and there is no effective medical treatment for its effects.

Verification and confidence building

In considering the problem of verification, the Group built upon the results of its earlier meetings, as summarized in the Final Reports from the three previous Workshops. These had emphasized the importance of incorporating in a CW treaty provisions for verifying stockpile destruction and CW-agent non-production; and the report from the London Workshop had envisaged procedures for both these purposes in which national and international verification organs worked in concert with one another, using a range of techniques not excluding on-site inspection visits.

It was recognized that mutual trust would be an essential component of a CW disarmament regime, for no verification procedures, however intrusive or elaborate, could ever provide complete assurance that a CW treaty was being fully observed. The conclusion reached at this Workshop was therefore that one purpose of verification should be to enhance mutual trust in the treaty. To this end, verification procedures may be seen as a complement to other confidence-building measures.

The Group noted the attention given to confidence building in the British draft, realizing, however, the inherent difficulty in the specific measure envisaged - the requirement that States declare their stockpiles upon signing the treaty but before its entry into force . It was recognized that declarations of stock would do a great deal to build confidence, and that for this reason governments should be urged to make such declarations on a unilateral basis, even before the signing of a treaty. The Group noted other areas where mistrust existed and for which remedies were possible. In particular, the Group recommends that governments should agree, in the spirit of the Helsinki Declaration, to give one another prior notification of CW defence exercises during military manoeuvres, and to invite foreign observers to witness the exercises in order to verify their non-offensive nature.

Another possible measure would be the exchange of information on the health care of people working with highly toxic OP compounds, who, of necessity, must receive regular medical examinations. People involved in the destruction or detoxification of OP CW agents, an essential part of CW disarmament, would come within this category. A procedure for such exchanges could provide a confidence-creating measure as part of a programme of national and international verification.

The Group noted again that its own meetings served as a measure of mutual confidence building.* For instance, the proposal made at an earlier Workshop concerning exchange visits to chemical-destruction facilities was now before the CCD, at the instigation of the US delegation. It was felt that this function of the Group could profitably be expanded. Accordingly, further attention was given to the possibility of mutual exchange visits to chemical facilities for the purpose of gaining understanding of on-site inspection techniques. The Group noted with appreciation the willingness of a major Federal German organophosphorus producer to receive such a visit at one of its plants, and a sub-group was set up to do the necessary planning. A draft questionnaire has been prepared (somewhat along the lines of the questionnaire developed during the Pugwash BW exercise); this will serve as a basis for refinement before and after the visit.

Finally, the Group considered that the Pugwash Movement as a whole could contribute further to the advancement of CW

* It is regrettable that the participants invited from the USA and the USSR were unable to attend this Workshop.

disarmament. National Pugwash Groups should be encouraged to advertise more widely the dangers which chemical weapons present to the world, particularly at a time when sophisticated armaments are proliferating so widely and so rapidly.

J.P.R.

Summaries of Papers

Z. Binenfeld & V. Vojvodic (Yugoslavia)

MEDICAL PROTECTION AGAINST NERVE GAS POISONING : PRESENT SITUATION AND FUTURE POSSIBILITIES

There is today an enormous discrepancy between the efficiency of "nerve gases" and the efficiency of available defensive counter-measures. This paper aims to present some data concerning problems of medical protection. Existing methods of treatment of nerve gas poisoning (therapy by specific and non-specific antidotes, and general measures) and their drawbacks are described, and the future development of antidotes examined. An analysis of current research on organophosphorus poisoning and therapy indicates that, if it continues, reasonably effective medical protection may become feasible in the not too distant future. It is suggested that international coordination of such research would be useful.

K.H. Lohs (GDR)

DIOXIN - A NEW WARFARE AGENT

Among the new weapons of mass-destruction, chemical weapons are of constant importance. We should not consider exclusively the absolutely lethal poisons such as the organophosphates, especially V-agents and others. Tetrachlorodibenzo-p-dioxin, called dioxin for short, is comparable to the "VX-gases" in terms of its acute toxicity and is one of the most dangerous synthetic poisons, even with regard to its side-effects and delayed lesions. Some weeks ago, everybody got a new impression of this terrible compound when a great area in Seveso, in North Italy, was contaminated with dioxin.

From the technical point of view, it would be possible to contaminate a large town by means of few tons of dioxin, so that this town would become uninhabitable. This would be a new method of chemical warfare; making human dwellings useless without actually destroying them. Nothing can be done against such contamination with the existing methods of detoxication.

All available results obtained from scientific studies and observations of poisonings in man have conclusively shown that dioxin constitutes a new generation of chemical weapons.

K.H. Lohs (GDR)

REGULAR MEDICAL CHECK-UPS SERVING AS A MEANS OF DETERMINING THE STATE OF HEALTH OF ALL THOSE WHO ARE EMPLOYED IN MAKING AND USING ORGANOPHOSPHORUS COMPOUNDS

(A confidence-creating measure forming part of a programme of inspection of military and non-military production)

Organophosphorus compounds of high toxicity are of extreme military importance as chemical weapons of mass destruction. There is a risk to the health of those employed in producing and storing these toxic materials.

The World Health Organization could recommend a bill of health to be issued to all of those who are working in plants where such highly toxic materials are produced, stored, and used. This bill of health, which should be submitted from time to time to a national inspection authority, should have regularly entered in it the results of clinical and chemical laboratory tests to which the respective individual has been subjected, of which the validity could perhaps be confirmed by national labour union representatives. Cases of acute poisoning, invalidism, and death occurring among such people should also be reportable to an inspection authority. Using code designations and numbers for the compounds that are subject to inspection, it would be possible to prevent detailed data on important areas of production from being misused for purposes of industrial espionage.

J.K. Miettinen (Finland)

RECENT INTERNATIONAL DEVELOPMENTS IN THE FIELD OF CHEMICAL DISARMAMENT

Chemical disarmament has recently achieved a greater momemtum at the Conference of the Committee on Disarmament (CCD). The interest of the superpowers seems to have revived and many states have participated actively in its meetings of experts.

The USA took a major step in 1975 by ratifying the 1925 Geneva Protocol. The US defence budget for FY 1977 contained no further funds for the binary programme, and there was important information recently that the USA will unilaterally destroy its stockpiles of the incapacitating agent BZ. The USA has also presented several interesting working papers to the CCD, expressed its willingness to invite observers from other countries to its chemical agent destruction plants and suggested at the CCD minimally intrusive measures for verification. The USSR, although it has not recently presented any new concrete proposals, has confirmed its continuing interest in achieving complete chemical disarmament.

More than ten working papers were delivered at the CCD in the recent meeting of experts, providing new ideas on confidence building measures and describing progress in the field of monitoring chemical warfare activities. The draft convention presented by the United Kingdom on 6 August at the CCD combines in a useful way features of the earlier drafts, although it may need

modification in important aspects, particularly its scope. Hopefully, the long promised joint initiative of the USA and the USSR will be presented soon after the elections are over in the USA.

J. Lundin (Sweden)

ON ARMS CONTROL NEGOTIATIONS AND ON THE BAN ON CHEMICAL WEAPONS

General and complete disarmament may be a goal to strive for, but it seems more remote than ever. Thus, it will in the future be increasingly more important to establish clear, realistic aims and hopes for pursuing certain arms limitations negotiations, e.g. the one now going on to obtain a treaty prohibiting possession of chemical weapons.

The political trustworthiness of such negotiations would increase if the gap between the officially declared aim for disarmament and the limited aims that actually are involved in the negotiations could be diminished and a more straightforward public discussion on the subject be initiated. Public understanding of the long time span for these negotiations and of their dynamic changes is important.

The verification problems are among the most serious obstacles for reaching arms control agreements. The public needs more information about these problems. It is conceivable to have arms control treaties both with and without verification measures, depending on the actual need. A treaty without verification measures cannot be characterized as an arms control measure. Its value as a disarmament treaty therefore is uncertain even if one aim of the treaty would be to provide for destruction of some weapons. A treaty without verification may still serve as a means of obstructing - or restraining - an open weapons development. Its value accordingly is dependent on how difficult it may be to keep such a development secret. In the case that the prohibited weapons are without military importance non-verified treaties may constitute a sufficiently effective measure, if it provides for renegotiating opportunities like review conferences.

Treaties which provide for some, but not sufficient, verification serve, although some arms control effects can be claimed, the same main purpose of obstructing armaments. The present work on a ban on chemical weapons may result in some such partial arms obstructing treaty.

Even if effective verification measures for these kinds of treaties presently are few, an increased reliance on national technical means of verification and increased international cooperation, may increase the value of arms obstructing treaties. It is particularly important for the arms obstructing treaties that they must provide for continuing opportunities to renegotiate scope and verification.

This situation requires a realization on behalf of political negotiators and their experts that arms obstructing treaties can only form a part of a continuous negotiation process. No agreement on an arms obstructing treaty should be hailed as more than an intermediate step in this process.

Pugwash at London International Youth Science Fortnight (LIYSF)

This year's meeting, lasting two weeks, was attended by some 500 students from 35 countries. The attendees were in their late teens, at the beginning of their scientific studies, and provided a receptive audience for the entire afternoon of 29 July which was devoted to Pugwash. The annual participation of Pugwash was inaugurated several years ago through the initiative of Professor Rotblat who served as President of LIYSF for several years. A distinguished group of sponsoring organizations and individuals were involved in the organization of the sessions. Sir Hermann Bondi, who has attended Pugwash Conferences, is currently President of LIYSF. He took time off his duties as Chief Scientific Adviser to the Ministry of Defence to address the opening session.

Six Pugwash performers were on stage and introduced their respective topics for discussion. Professor Rotblat reviewed briefly the background and nature of Pugwash. Philip Noel-Baker outlined the history of disarmament negotiations, including the tragic failure of the League of Nations' efforts in the early 30s, and graphically described the effects of Hiroshima and Nagasaki bombins. Professor F.C. Frank covered the problems of nuclear energy and the environment. Mr. N.W. Pirie presented various ways of improving the protein supply badly needed in developing countries. Dr. Kaplan dwelt on the social responsibility of scientists, and especially the need for enlisting the active participation of young scientists in problems being covered by Pugwash.

Following the presentations a spirited discussion was held from the floor. The students questioned closely, and at times disputed, several of the viewpoints advanced by the speakers. Several students who spoke voiced a conservative and almost unquestioning acceptance of conventional wisdom, and none took a radical position which was the norm in previous meetings. Few had heard of Pugwash before and urged a wider dissemination of Pugwash ideas, with the conviction that students could provide considerable support to the Movement.

It is hard to say who learned more from the meeting, the students or the Pugwash panelists, but there is little doubt that such occasions provide exceptional opportunities for reaching those who will exert much influence in the future - the next generation of scientists.

M.M.K.

News Item

On May 24th, the Japanese Parliament ratified the Nuclear Non-Proliferation Treaty, thereby making Japan the 96th nation to adhere to the treaty. The Japanese ratification comes at an especially critical time, when the impetus towards universal acceptance on the non-proliferation concept appears to be flagging. It is to be hoped that the action of Japan, the nation which alone has experienced the ravages of nuclear war, in foreswearing any future acquisition or possession of nuclear weapons, will signal a turn-about in the recent tendency towards acceptance of nuclear weapons as an inescapable fact of modern life. Only by the universal renunciation of nuclear weapons can there be hope of future peace and progress for the human race.

E.E. Galal (Egypt)

The Future of Pugwash and World Affairs

There seem to be two issues which are consistently skirted in our debate on future Pugwash activities.

One is related to the political dimension of the possible Pugwash contribution. Understandably some Pugwashites, because of the connotations of partisanship and horse-trading implied to many by politics, and perhaps because of limited knowledge or experience, tend defensively, contemptuously and nervously, to shirk the word. Politics, of course, is an established science perhaps with more far-reaching immediate effects on world affairs than most other branches of science. If world affairs is to remain the concern of Pugwash, peace and disarmament being world affairs, such an attitude can be termed, at least, untenable.

It may help to define what type of politics Pugwash never engaged in but cannot, in the future, avoid. It is political, scientific assessment and analysis utilizing the same tools of objectivity and rationality as are used in other sciences. Without such exercise, it is unimaginable how to relate our scientific expertise and human concerns to world affairs.

Is it presumptuous to recall that the Russell-Einstein Manifesto did just that?

Next comes the need to determine what exactly people mean by Pugwash retaining its consistency with its past.

Is it consistency with our members' attitudes and inclinations or consistency with our established role in world affairs? It is understandable that pure scientists, dealing with universal external constants, may fail to notice or comprehend the confusing, swirling dynamism of world affairs; yet this can only be permitted at the price of being out of touch and without influence on the affairs justifying our very existence.

I think it is part of our common scientific experience that the wrong questions rarely yield the right answers. The question is not whether we would like to change or not. The real question is: can we, or any other organization or system, fail to accommodate major shifts in its environment without jeopardizing its capacity to achieve its constant and ultimate goals? Of course, some systems and organizations attempted to do just that; a famous example is the Dinasaur.

I know of no Pugwashite who does not subscribe to the proposition that our ultimate goals are arms control, disarmament and world peace.

The crisis to me is that some Pugwashites, under the guise of "consistency with our past", want to enforce a radical change in the Pugwash role and goal, probably unintentionally. Pugwash was never an ivory tower, insulated from world affairs and conflicts and engaged in an abstract exercise of purely scientific interest.

The significance of Pugwash has always derived from its down to earth concern with imminent developments of world affairs and the eminent contributions it could make in the face of these developments - and not the eminent "titles" held by its scientists. Maybe we should go back to the Vienna Declaration of 1958 and read it for a consistent orientation.

To avoid a confusion of issues, let me categorically state that I am against Pugwash dealing with problems of developed or developing countries as such, with their complex socio-economic-political and cultural ramifications. What is at issue is the drastic implications and repercussions that some of these problems of developed and developing countries have on the arms race and conflicts

and, as such, on prospects for world peace. Can we, with any degree of objectivity or honesty, stop our ears to the basic issues of détente (political, economic and social) dealt with in Helsinki? Can we, with any degree of objectivity or honesty, close our eyes to the causes and origins of one hundred and twenty wars since World War II, in developing countries with their over ten million victims or the equivalent number of victims of starvation and famines in these countries? If we do, do we expect our contribution to disarmament and peace to have any relevance, meaning or impact, outside our closed, rarified circle? How eminent will be our contribution, even if we happen to be the most eminent collection of scientists in our own narrow specialities?

It appears, thus, that the Pugwash controversy in its current form does not focus on the real issues involved. And, thus, I suspect that it is unreal and irrelevant, whatever my share is of the responsibility for its promotion.

I am sure that we all agree with what one of our prominent Pugwash members said: "We must safeguard the very existence of the human race so that we can have the opportunity to solve its problems". Personally, I feel that the real issue for Pugwash is to decide in what way it can make a positive contribution twards safeguarding the very existence of the human race.

Since the dawn of history, the existence of the human race or, to be more accurate, of substantial sections of the human race, has been threatened by wars, famines or diseases. At its climax, any particular threat has naturally taken precedence over all others. But it naturally never abolished the others; in fact, it frequently accentuated them.

In the era of the second World War, one issue stood, and still stands, as an imminent and predominant threat to human existence. This threat was not the discovery of atomic warfare but its availability to potentially antagonistic and incompatible political systems.

Scientists, as impotent observers of this antagonism, or (at worst) as passive supporters of it, but more aware of the new catastrophic dimensions built into it, gave logical urgent priority to neutralizing these new dimensions.

The outcome of these efforts is a sad commentary on contemporary world affairs and, as such, on Pugwash achievements in this field: intensive development and proliferation of the very means of mass destruction, a growth which, however tragic, appears to be highly responsible for the breathing space for which we are all grateful.

In this light, the contribution of scientists, and of Pugwash, in their alleged specialty of arms control does not, by any objective measure, appear to be very positive or significant. But it is in another sphere that the positive contribution of Pugwash really lies. By establishing contact and dialogue where none existed, Pugwash indirectly made a very positive and a very political contribution. It ameliorated the suspicions and fears that fed antagonism, and by establishing dialogue, however limited or tenuous, proved that incompatibility is not inevitable.

It thus appears that, contrary to the view of some Pugwashites, the real and positive contribution of Pugwash was not in the field of arms control but in the field of control of the drives and motivations or arms use -- of conflict. The arms control exercise, however limited its achievements, was only a tool for and means towards a more positively successful political target, and probably a more significant one in the long run.

The real issue before us is not whether we need to reverse our role or shuffle our priorities, but how to regain the relevancy and significance of our established role in the context of the changing situation.

My feelings on this issue are affected

by several considerations:

(a) We are still sitting on monstrous and rapidly mushrooming powder kegs.

(b) Breathing spaces, however welcome, cannot be entrusted with the whole issue of human existence.

(c) The established rapport (détente?) may have proved that the two political systems are not inherently incompatible, as Stalin and Foster Dulles once believed. But conflicting global interests and commitments could override this new consideration if allowed to play havoc with delicate balances, as was illustrated in Korea, Cuba, Vietnam, the Middle East and Angola. We can be said to be passing from the dangers of the era of central frictions, i.e. West versus East direct confrontations, to the era of peripheral frictions, i.e. West-East involvement in North-South antagonisms.

(d) The hegemony of the two superpowers over a divided world is rapidly fading and independent motivations and actions are mounting both in their camps and outside, with the inevitable risk of antagonism, not necessarily subject to their cold, controlled calculations.

(e) "Existence" is rapidly coming to have a universal meaning to all peoples of the earth, with diminishing possibilities of acceptance of enormous unbridgeable gaps in the mode and meaning of existence, in spite of variations of capabilities and facilities.

(f) With the stabilization of the risk of imminent mutual annihilation, the mounting urgency of other threats to human existence (again, to be more correct, that of a substantial section of humanity) can no longer be relegated to the back benches. The hundred and twenty wars since 1945, the death by starvation of millions, the galloping illiteracy of billions, the carcases riddled by endemic and epidemic diseases, the real dwindling of incomes already below subsistance level for the majority of the third world population, racial discrimination and subjugation etc. - all these look real enough and urgent enough to their victims. It may be unfortunate, but most of these victims cannot afford the comfortable detachment of atomic scientists, the realization that even these tragedies cannot take precedence over mutual annihilation. They have acted and will continue to act on the assumption that any form of annihilation that is directed against oneself is the most urgent and decisive. It may also be unfortunate, but I think it is true, that their actions are as likely to affect issues of arms races and proliferation, as well as military conflicts and threats to world peace, as those of any other group of nations.

It is an illusion and futile for Pugwash to try to recapture the unrepeatable raptures of being a unique and solitary line of communication in this era of endless and limitless contacts.

The milieu for these raptures (cold wars, iron curtains, containment) has, like all things, radically and, to be hoped, irreversibly, shifted in parallel with the role of all international lines of communication. Pugwash is very unlikely to be the only exception.

The initial priority in our approach to the problems of world peace had its justification in the over-shadowing presence of the imminent risks of mutual annihilation and the resulting superpower hegemony. As an emergency measure, it served its purpose.

The complex realities of our contemporary world, however, necessitate a more comprehensive approach if ever we hope to get through the stopgap phase in our dealings with problems of mounting urgency. Helsinki was needed to give détente its socio-political and economic foundation, if détente between West and East is to survive.

The contribution of Pugwash to arms control is even more urgent than it ever was, with the increasing proliferation of arms and the chances of their use. All the more reason why the role of Pugwash should be continuously reviewed to ensure its rationality and relevancy.

Because of these considerations, I think that the controversy of arms control versus development is not only erroneous but dangerously misleading. I do not believe we are facing choices of reorientation. What we are really facing is the need for taking cognizance of the realities of our role and past achievements and of developing them to their logical conclusions.

There is no disagreement that our basic concern, together with many other international, regional and national bodies, is with the technicalities and means of control of the tools and the risks of mass destruction.

The basic question is whether this can ever be achieved, at this juncture of world history, outside the general framework of a strategy for peace, an encompassing strategy for stablizing conflicts, for an international Helsinki that will give cohesion and direction to the myriads of fragmentary efforts touching on isolated aspects of the problem.

Like co-existence at the height of the cold war, the need for such a strategy is the subject of an international conspiracy of silence. The mounting disarray in the opposing camps, the rising North-South confrontations and the disenchantment with détente are natural products of this arrested development of the logistics of peace.

Pugwash, under its original inspired leadership of Einstein and Russell, broke the first conspiracy of silence and by diligent, objective and scientific clarification made its historical contribution by speaking and preaching the inspeakable, co-existence and détente.

Pugwash has only two choices at this stage: to bask lethargically in its past glories and close its eyes to the realities of the fundamental shifts that have been and are taking place, or to bring its laborious journey to its logical conclusion, with an upgraded effort to deal with the technicalities and means of control of tools and risks of destruction within the framework of a comprehensive strategy of peace, with real international and global significance. To me these are the only choices.

The arguments about cost, time and organizational problems are, to be frank and decisive, irrelevant in the context of my proposition.

If the operation is fatal without anaesthesia, it is futile to enumerate the cost and complications of anaesthesia, except perhaps to a surgeon who is only interested in the operation and not the patient.

The argument about the special nature of Pugwash and its available experience sounds very much like putting the cart in front of the horse. One was always under the impression that chariot makers are hardly justified in attempting to reverse new developments in transport -- that they have either to acquire the additional needed specialities and experience, or be satisfied to produce museum-pieces.

After all, it is self-evident that the means of arms control and disarmament have not been, and cannot be, the function of military-technology development alone.

The irrationality of politicians, in apparently ignoring the radical qualitative changes introduced by the new tools of mass destruction, does not simply reflect their ignorance and inferior intellectual capacities compared to those of the basic scientists. In addition, it reflects the complex political nature of the issues involved and their unfathomed and apparently unresolved socio-economic implications.

F.A. Long (USA)

The Future of Pugwash : Some Thoughts for the 1977 Pugwash Meeting of Reaffirmation

The Pugwash Movement has few compelling traditions. But there is one to which it holds firmly: to review every five years its status, plans and organization and formally ask its (informal) membership for a mandate to proceed along agreed lines for the next five years. The 1977 Pugwash Meeting in Munich will be the time of the next review. Hence it is not too soon to start thinking.

What are the principal objectives which guide the Pugwash efforts? Three seem to me to be of critical importance, and I should like to list them briefly and then discuss each.

1. To address problems of major significance which at the same time are handleable by Pugwash procedures.
2. To maintain a world, or universalist, view of its problems, striving to go beyond the particular point of view of single nations or regions.
3. To influence governments and the public.

As to the first of these, there is a double reason why Pugwash must give considerable thought and care to the problems which it addresses. First, because Pugwash is a comparatively small organization having only part-time participation from its members, it has only the time and opportunity to address a modest number of problems with any intensity and with any expectation of developing analyses and positions which the world will listen to. Second, because Pugwash participants are almost entirely scientists (both natural and social), it is essential to select areas of study where scientific input is important and where, in turn, the analyses of scientists will be listened to.

Implicitly or explicitly Pugwash has historically followed these precepts. The initial Pugwash efforts dealt with atomic weapons and the danger of nuclear war where scientific and technical understanding was almost essential. In these early days, Pugwash also emphasized increased dialogue between East and West, and here again the international character of science was helpful in the development of meaningful discussions. The problem of social responsibilities of scientists is closely coupled with the dangers of nuclear war, and hence was early seen as an appropriate topic for discussion. However, in the twenty years since Pugwash was started, the world has greatly increased in complexity, and the critical problems have broadened considerably. Atomic devastation remains a central concern, but the threats from conventional military arms and arms trade in sophisticated weapons have become increasingly worrisome. A broad set of problems has arisen in the area sometimes called the "North-South confrontation". These include such diverse items as: increased cooperation and commitment by the richer nations to accelerated development of the poorer; control of wars and of military spending among the smaller nations with particular anxiety about big power intervention; increased worry about limited natural resources of the world, along with a concern that these be harvested and distributed in a responsible and above all, equitable fashion. Most of these are problems to which scientists can make inputs and on which discussions from a universal point of view are strongly to be desired. They do, however, call for new areas of expertise among Pugwash participants and greatly complicate the question of ensuring that Pugwash restricts itself to only the

modest number of topics it can hope to cover well.

The second of the objectives, maintenance of a world view by Pugwash, links closely to the broader spectrum of problems which the world now faces and which Pugwash must give consideration to. In its earliest days, when high priority was given to questions of atomic war and East-West understanding, it was satisfactory that Pugwash consist almost exclusively of participants from the developed nations. However, as world priorities and concerns have changed, and as Pugwash has responded to these, it has become essential that Pugwash represent a substantially broader view, and in particular that Pugwash have participants from the less developed nations of the world. This need has been addressed, but it is doubtful whether many Pugwash participants believe that the current situation is fully satisfactory. Communication difficulties have arisen as Pugwash has broadened its participants; there are troubles in identifying people from the smaller nations and in maintaining in them viable Pugwash organizations. If Pugwash is to maintain an adequate world view of its principal problem areas, there is much work still to be done.

The third objective, exercising influence, has always been a Pugwash goal starting with the original Russell-Einstein Manifesto, which led to its formation. The explicit hope has always been that Pugwash, by publicizing its findings and communicating them to decision-makers, could influence public opinion and governments throughout the world. As only one example, Pugwash was never content simply to analyse the technical and socio-political aspects of a ban on nuclear weapons testing; it worked actively from the earliest days to persuade people and governments that a treaty to provide a complete test ban should be instituted world-wide. Pugwash can point with pride to places where there is good evidence that Pugwash recommendations were strongly influential. One suspects, however, that at no time was Pugwash as influential as its membership hoped it would be. Furthermore, the complexity of issues and the consequent variety of topics which Pugwash is likely to discuss these days makes it all the more difficult to maintain a position of influence.

A complication which impacts on all these objectives is that some of the Pugwash desires almost inescapably conflict with others. For example, the desire to influence governments and the public suggests that Pugwash should solicit participation from well-known "senior scientists". However, the idea of giving priority to elderly and established participants directly conflicts with another Pugwash desire, which is to maintain a commitment to the future. This latter strongly implies that Pugwash should be giving great attention to the opinions and priorities of the younger people which implies an explicit search for new and young participants.

The three listed Pugwash objectives lead directly to a set of propositions about specific items which will be of concern to the 1977 Pugwash meeting. The following is a partial list.

(a) <u>Pugwash will continue to need a vigorous international organization with an effective Council and almost full-time Secretary-General</u>

All three of the problem areas discussed virtually require an effective international organization for Pugwash. If Pugwash is to set priorities for its study groups, workshops, symposia and annual meetings, it will require broad analyses from the Council. If Pugwash is to work increasingly towards influencing the public and decision-makers, it will need more follow-on effort bringing important results of meetings, workshops and symposia more directly to the attention of influential people. Finally, the problems of maintaining Pugwash as a world organization with a universalist view will continue to require very active efforts on the part of the central organization. We all desire

that China rejoin Pugwash, but it will probably take active and continuing solicitation to bring this about. We would like to see larger and more effective organizations for Pugwash in South East Asia and Latin America. Again, this will only occur if there is active planning. Finally, the question of financing the Pugwash programmes remains a troublesome issue, and only the central Council can address it with adequate generality and balance.

(b) Strong and effective local Pugwash organizations must be maintained in individual countries or areas

Even though Pugwash is and should be a broadly international movement, the role of the local Pugwash groups is crucial. It is they who can identify effective participants and transmit topics of importance for analysis. It is they who generate support and manage symposia and workshops. And since most of the effort to influence decision-makers and governments must be done from within the countries and regions, the participation of local Pugwash groups is almost essential in attempting to exercise influence.

The record of Pugwash in developing strong and viable local groups has been uneven. There now do exist, throughout the world, around a score of national Pugwash groups which meet regularly, concern themselves with membership and participation in annual meetings and symposia, and take responsibility for generating ideas for annual meeting topics, symposia and workshops. The number of such groups should and surely can be increased.

Pugwash has not done so well in some of the areas of the world which are comparatively distant from Moscow, London or Washington. One of the continuing problems has been that many of the smaller African and Latin American nations do not have enough interested scholars to make forming a national Pugwash group easy. A thoroughly interesting response has been developed in Africa by the formation of the Pan-African Pugwash group, with headquarters in Cairo. This group is expected to take increasing responsibility for generating names of new African participants, for developing symposia, and for contributing topics to Pugwash annual meetings. It may well be that the formation of similar regional groups will be the answer to increased participation from Latin America, South East Asia, and the Middle East. This is a problem of some importance for the Council.

(c) Pugwash must continue to exercise considerable thought and planning in the development of its programmes both to ensure that the topics are important and accessible to its membership and to ensure that the topics are ones on which Pugwash may hope to have significant influence

This question of programme planning is one which must necessarily devolve upon the international organization and separately on the national Pugwash organizations. Pugwash very clearly needs more thoughtul analysis of programmes and opportunities at both levels. However, effective planning and priority-setting will not be easy. Individual Pugwash groups will surely disagree strongly among themselves as to the most important topics for consideration. At any given time, the international Council may have views which differ still. The problem of reconciliation of differing views and of adjusting these views and recommendations to the availability of funds and effort, will continue to be a perplexing one. However, this only re-emphasizes the need for an effective international organization and active national and regional organizations.

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CENTRAL OFFICE

9, Great Russell Mansions
60, Great Russell Street
London, WC1B 3BE, England
Telephone : (01) 405 6661
Telegraph : PUGWASH LONDON

EXECUTIVE OFFICE

Pugwash Conferences on Science and World Affairs
11A, Avenue de la Paix
1202 Geneva, Switzerland
Telephone : (022) 33 11 80
Telex : PEACE 28 167 CH
Telegraph : PUGWASH GENEVA

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