PUGWASH　STATEMENT

FOR RELEASE AT 4.00 P. M., JULY 11th, 1957

The enclosed statement was unanimously adopted by the scientists whose names are below, who met in the conference convened by Earl Russell at Pugwash, Nova Scotia, Canada, between July 6-10, 1957:

Australia	—	Professor M. L. E. Oliphant
Austria	—	Professor H. Thirring
Canada	—	Dr. G. Brock Chisholm
China	—	Profossor Chou Pei Yuan
France	—	Professor A.M.B. Lacassagne
Great Britain	—	Professor C.F. Powell
	—	Professor J. Rotblat
Japan	—	Professor I. Ogawa
	—	Professor H. Yukawa
	—	Professor S. Tomonaga
Poland	—	Professor M. Danysz
U. S. A.	—	Professor D. F. Cavers
	—	Professor H. J. Muller
	—	Professor P. Doty
	—	Professor E. Rabinowitch
	—	Professor W. Selove
	—	Professor V. Weisskopf
USSR	—	Academician A. M. Kuzin
	—	Academician D. F. Skobeltzyn
	—	Academician A. V. Topchiev

STATEMENT

At the invitation of Lord Russell, and through the generous hospitality of Mr. Cyrus Eaton, a group of scientists drawn from about ten nations and widely representative of different political, economic and other opinions, met in Conference at Pugwash, Nova, Scotia, between July 6 and 11, 1957. Mr. Y. Shimonaka and others also provided valuable assistance.

The meeting originated in the suggestion, contained in the Russell-Einstein appeal, that scientists should meet to assess the perils to humanity which have arisen as a result of the development of weapons of mass destruction. Two years have passed since that statement was issued but the dangers remain. In fact, the stockpiles of nuclear weapons have increased, new nations have joined the ranks of those producing weapons, or trying to produce them, whilst serious misgivings have been expressed as to whether the continued testing of such weapone may not result in damage to the population. The general belief that a full-scale nuclear war would bring universal disaster upon mankind, and the recognition that it is technically possible for both the tow great contending forces to visit any desired degree of destruction upon an enemy, as well as certain political developments, have created an atmosphere in which it was possible for us to meet, and to discuss dispassionately, many important and highly controversial issues.

The international problems which have arisen as a result of the development of atomic energy are of two kinds, technical and political. A gathering of men of science can discuss with special competence only the scientific and technical implication of atomic energy. Such discussion, however, can be fruitful only if it takes into account the political problems which are the background to international negotiations.

The signatories of the Russell-Einstein appeal affirmed their intention to say nothing which might seem to favour one rather than the other of the two great groups of powers into which the world is divided. In attempting to formulate the conclusions which followed from our discussions, we too have tried to avoid any exacerbation of the differences between nations which might follow, for example, from emphasis on technical considerations unwelcome to one or other of the two groups of powers.

Men of science are now well aware that the fruits of their labours are of paramount importance for the future of mankind, and they are thus compelled to consider the political implications of their work. Their opinions on politics are as diverse as those of other men. These facts make it difficult for a conference such as the present to issue an agreed statement on matters which are controversial. The discussion of such issues, however, allowed the points of difference and the areas of agreement to be defined, and led to a measure of mutual understanding of the opinions of one another.

The main work of the meeting was centered round three principal topics : ① The hazards arising from the use of atomic energy in peace and war : ② problems of the control of nuclear weapons ; ③ the social responsibility of scientists. Three committees were established to give detailed consideration to these topics. Their reports to the conference are given in the statements appended to this document, but the principal conclusions bearing on the hazards of atomic energy may be briefly summarized as follows :

Committee I on nuclear hazards, made an independent assessment of the effects of the nuclear tests carried out hitherto. From the details given in the appendix, it may be seen that the hazard, compared with others to which mankind is subject from natural causes, is small.

Nevertheless, because of the world-wide distribution of fission products, and the fact that some areas may be subject to effects much above the average, close attention to the dangers should be maintained, especially if tests of bombs which give large radioactive fall-out continue to be made.

The committee also considered the hazards arising from the peacetime use of industrial atomic power, or the application of radiations in medicine and industry. Although these hazards must be viewed in the light of the great benefits which will flow from such applications, means of greatly reducing the attendant hazards are available and should be widely adopted.

The above mentioned estimates of the hazards which have arisen from test explosions, permitted a closer examination to be made of the probable consequences of an unrestricted nuclear war. This examination led to the unquestioned conclusion that a general war with nuclear weapons would indeed represent a disaster or unprecedented magnitude. The radiological hazards would be thousands of times greater than those due to the fall-out effects of test explosions. In the combatant countries, hundreds of millions of people would be killed outright, by the blast and heat, and by the ionizing radiation produced at the instant of explosion, whether bombs of the so-called "clean" or "dirty" kind were employed. If "dirty" bombs were used, large areas would be made unhabitable for extended periods of time, and additional hundreds millions of people would die from delayed effects of radiation from local fall-out, some in the exposed population from direct radiation inhury, and some in succeeding generations as a result of genetic effects. But even countries not directly hit by bombs would suffer through global fall-out, which, under certain conditions, might be of such intensity as to cause large-scale genetic and other injury.

It is against the background of the fearful consequences for humanity of a general war with nuclear weapone that the conclusions of Committee II. which considered problems of control, must be viewed. The principal objective of all nations must be the abolition of war and the threat of war hanging over mankind. War must be finally eliminated, not

merely regulated by limiting the weapons which may by used. For this purpose, it is necessary to reduce tension among the nations ; to promote mutual understanding among the peoples ; to strive for the ending of the arms race ; and to provide an adequate control system so as to give substantial protection, and permit the development of mutual confidence.

One of the greatest difficulties in international affairs in recent years has sprung from the fact that in a period of delicate strategic balance, even secondary questions acquire strategic significance ; in such a situation, they are rarely subject to agreed solutions because any particular solution appears to be to the strategic advantage of one rather than another of the powers. We believe that it is unrealistic to depend upon any sudden increase in mutual confidence, and that it is more likely to grow from small beginnings. In this situation, even small agreements covering limited fields could be of great importance.

In the present circumstances, we believe that the greatest peril comes from the possibility that a war might break out between two smaller nations, that Russia and America might intervene militarily on opposite sides, and that such a war might be fought by using atomic bombs in combat. We believe it would be very difficult to limit a local war of this kind—particularly if it is fought with atomic weapons in the tactical area—and that what may start out as a local war may end as a general atomic catastrophe. In order to avert this danger, political settlements aimed specifically at eliminating the risk of the outbreak of a local war between smaller nations are needed.

The conclusions of Committee III on the responsibilities of scientists state our common conviction that we should do all in our power to prevent war and to assist in establishing a permanent and universal peace. This we can do by contributing to the task of public enlightenment concerning the great dilemma of our times ; and by serving, to the full extent of our opportunities, in the formation of national policies. The Committee gives a statement of beliefs and aspirations suitable for scientists in the modern world.

Finally, we should like to give expression to the high degree of unanimity we have found among all the members of the Conference on fundamental aims. We are all convinced that mankind must abolish war or suffer catastrophe ; that the dilemma of opposing power groups and the arms race must be broken ; and that the establishment of lasting peace will mark the opening of a new and triumphant epoch for the whole of mankind. We earnestly hope that our conference may make a modest contribution to these great aims.

STATEMENT OF COMMITTEE ONE
RADIATION HAZARDS

The effects of radiation, from nuclear tests, from peaceful applications, and from the possible wartime use of nuclear weapons, have been the subject of much concern and study. We have felt it desirable at this meeting to consider the available facts bearing on these problems,

With regard to the effects of nuclear testing, we have found that separate calculations carried out independently in Great Britain, Japan, the U. S. A. and the USSR have yielded results in good agreement with one another on the amount of fallout and on its effects.

A principal effect is due to strontium-90. If, as some evidence indicates, the production of leukemia and bone cancer by radiation is proportional to the dose, even down to very small doses, then we estimate that the tests conducted over the past six years will be responsible for an increase of about 1% over the natural incidence of leukemia and bone cancer during the next few decades. Over the next 30 years, this increase would amount to about a hundred thousand additional cases of leukemta and bone cancer. The correct unmbers may be several times larger or smaller. These additional cases could, however, not be identified among the 10,000,000 or so normal cases of the same diseases.

A second principal effect of global fall-out consists of genetic mutations. We estimate that these will cause serious injury to about as many individuals as those in whom leukemia or bone cancer will be produced by the strontium-90. However, the genetic effects from a given amount of fallout, unlike the effects of strontium-90, will be scattered over many generetions,

Peacetime uses of radiation, such as X-rays in medicine, or unclear power production, will also be responsible for the delivery of radiation to large numbers of people. Genetic and long-term somatic effects will result from this radiation, in amounts depending on how much radiation is received by the reproductive cells and by other parts of the body.

It is important, in evaluating the effects from various sources of radiation, to try to put them in proper perspective. For example, the radiation received by the average individual from medical X-rays is, in countries of more highly-developed techniques, considerably greater than the fall-out radiation from tests at the recent rate. This does not mean, however, either that we should stop using X-rays, or that we should not be concerned about fall-out from tests. Great benefits to man are obtained from the use of X-rays, as well as from the industrial use of nuclear energy. The new awareness concerning the deleterious effects of radiation is loading to greatly improved techniques in the use of X-rays, and to more rigorous precautions in the application of nuclear energy. By these means, it will be possible to reduce the doses received from medicál and industrial radiation to levels that are justifiable in the light of the benefits obtained. It is useful to remember that modern industrialized society involves many developments with harmful side effects, as in the case, for example of the fumes from automobiles and industrial establishments. Accurate evaluation of the damage caused in this way has not been made but, even if it should tern out to be considerable, no one would expect to stop using all automobile engines or noxious industrial processes.

With regard to fall-out effects from tests, it should be recognized that the effects are global, and exerted upon citizens of all countries, regardless of whether they or their governments have approved the holding of tests. In these circumstances, the usual criteria as to whether a given hazard is justifiable cannot be applied. According to the figures given above, many individuals will be affected, although the numbers represent only a small percentage increase over normally occurring effects, and it will not be possible to say, for example, which specific case of leukemia is due to fall-out and which is a natural case. It should also be realized that appreciable areas of the world will experience higher than average effects from fall-out.

We now come to the consideration of the effects of a nuclear war. It cannot be disputed that a full-scale nuclear war would be an utter catastrophe. Its effects would be thousands of times greater than the fall-out effects from nuclear tests. In the combatant countries, hundreds of millions of people would be killed outright, by the blast and heat, and by the ionizing radiation produced at the instant of explosion. If so-called "dirty" bombs were used, large areas would be made uninhabitable for extended periods of time, and additional hundreds of millions of people would probably die from delayed effects of local fallout radiation : some in the exposed population from direct radiation injury, and some in succeeding generations as a result of genetic effects. Even countries not directly hit by bombs would suffer through global fall-out, which under certain conditions might be of such intensity as to cause large-scale genetic and other injury.

REPORT OF SECOED COMMITTEE

In this age of atomic weapons, the objective of all nations must be the abolition of war and even the threat of war from the life of mankind. War must be eliminated, not merely regulated by limiting the weapons to be used. The advancement of this objective calls for :

1. The lossening of tensions among nations and the promotion of mutual understanding among their peoples.

2. The ending of the arms race.

3. The provision of reasonable safeguards in the arms control system to give substantial protection and build up mutual confidence. The development of atomic armaments has now gone so far that a completely effective and reliable control system appears to be no longer possible.

4. The initiation of a step-by-step process to develop as satisfactory a set of controls and safeguards as practicable. The prompt suspension of nuclear bomb tests could be a good first step for this purpose.

REPORT OF COMMITTEE III

It is our conviction that the paramount responsibility of scientists outside their professional work is to do all in their power to prevent war and to help establish a permanent and universal peace. This they can do by contributing to the full measure of their capabilities to public enlightenment on the destructive and constructive potentialities of science and by contributing to the full extent of their opportunities in the formation of national policies.

To this aim, scientists of all countries without regard to political and economic systems can dedicate themselves because they share certain common beliefs. Following are some of them :

1. With the penetration of science into the world of atomic nuclei, humanity has entered a new epoch.
2. The developments of science and technology have paramount importance for the future of all mankind. This imposes upon scientists the obligation to be more actively concerned with matters of public policy, and upon political leaders, the duty to take fully into account the scientific and technological facts.
3. As consequence of man's mastery of nuclear forces, a war can now cause immeasurable damage to mankind.
4. If the achievements of science are rationally employed, they now could enormously increase the well being of all men.
5. Scientific and technical progress is irreversible. With humanity basing much of its technological progress on the manipulation of nuclear forces, it is of paramount importance that war be made permanently and universally impossible.
6. In the past, nations have often resorted to force in the quest for natural resources and fruits of labor. These methods must now be replaced by a common effort to create wealth for all.
7. The security of mankind demands that no section of it shall have the capacity to destroy any other.

   The developments of science and technology tend to breakdown barriers between nations and, in effect, to unify mankind.
8. The need of all parts of mankind to cooperate in the growth of the total sum of human knowledge and wealth, despite ideological and other differences which may divide them, is permanent and not a matter of temporary "coexistence" of different political or economic systems.

9. Tradition tends to place the emphasis in the education of youth on separate ideals of single nations, including the glorification of wars. The atomic age urgently requires a modification of these traditions. Without abandoning loyalty to national heritage or fundamental principles of the different societies, education must emphasize the fundamental and permanent community of the interests of mankind, in peace and cooperation, irrespective of national boundaries and differences in economic or political systems.
10. Science has a well proven tradition of international cooperation. We hope that this cooperation can be strengthened and extended into other fields of human endeavor.
11. Science develops most effectively when it is free from interference by any dogma imposed from the outside, and permitted to question all postulates, including her own. Without this freedom of scientific thought, and the freedom to exchange information and ideas, full utilization of the constructive possibilities of science will not be possible.