

# THE UNIVERSITY OF CHICAGO

CHICAGO 37 ILLINOIS

## THE CENTRAL ADMINISTRATION

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and Dean of Faculties*

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NEIL H. JACOBY *Vice-President*

WILLIAM BENTON *The Assistant to the Chancellor*

September 5, 1945

Dear Mr. Urey:

The recent applications of new scientific developments in military use have revealed unprecedented possibilities of destruction. These scientific achievements raise great questions - questions which in the concluding words of the Smyth report "are not technical questions; they are political and social questions, and the answers given to them may affect all mankind for generations.....In a free country like ours such questions should be debated by the people and decisions must be made by the people through their representatives."

Accordingly, scientists and responsible citizens face the urgent responsibility of discovering and making available to their fellowmen effective means of protection from the destructive use of these new instruments. The University of Chicago, in view of the role it played in the developments involving the use of atomic energy, feels this obligation keenly. The University is, therefore, taking the initiative in arranging for a private conference between a few physical and social scientists, public officials and other citizens to discuss the problem and consider the most feasible practical solutions in discussion which would be completely protected from publicity.

The conference will meet in Chicago from September 19th through noon of September 22nd. Those who are able to stay on will be asked to stay for two additional days. I should like to invite you most cordially to participate in this consultation.

The tentative subjects to be considered at the consultation are:

(1) Analysis of the danger in the light of the facts about the destructive power of these weapons, the sources of supply of the relevant raw materials, the state of research

Mr. Urey

2

September 5, 1945

and related information in so far as it can be revealed under present security regulations as indicated in the Smyth Report.

(2) Proposal and evaluation of possible means of meeting this immediate danger and alternative policies adequate to meet the eventualities of future development in these fields of research and their military application.

(3) Exploration of means for communicating the results of consultation to the people and their representatives with a view to facilitating a wiser choice among alternative proposals and generating the necessary support for public policy.

The closely related problem of the effects upon society of the peaceful use of atomic energy, although of the greatest importance, is not thought of as constituting the center of these discussions.

Due to the urgency of the problem and in order to increase the productivity of the consultation, it is desirable to push the discussion as far as possible even before the group convenes. I am, therefore, sending you a copy of the Smyth report, and as soon as you have found it possible to accept the invitation, I shall send you memoranda which, I hope, will stimulate you to send me your comments, criticisms or memoranda of your own on the subjects listed above or other items which you consider relevant. With your permission I shall have duplicated what you may be pleased to send me and make it available to other participants who in their turn will do the same.

The University will, of course, be pleased to reimburse you for your expenses.

I look forward to your acceptance of this invitation.

Sincerely yours,

*Robert Serber*

Mr. H. C. Urey  
355 Highwood Avenue  
Leonia, New Jersey

XXXXXXXXXXXXXXXXXXXXXXX

September 8, 1945

Mr. Robert M. Hutchins  
Chancellor  
The University of Chicago  
Chicago 37, Illinois

Dear Mr. Hutchins:

I have yours of the 5th inst., and am planning to attend the conference on September 19 to the 22nd.

There is a scientific meeting being held at Chicago on the 20th which may take some of my time, so that I may not be able to attend some of the sessions on that day.

Dr. Rabinowitch has shown me his manuscript in which he has summarized many of the problems involved in connection with the control of atomic power. I hope very much that this can be gotten into final form and mimeographed for distribution to the delegates to this conference. It states my own views better than I can possibly draw them up myself. He evidently has spent a good deal of time on this, and he is an effective writer.

Since the discussion is likely to revolve to some extent around the possibility of world government, would you consider inviting Clarence K. Streit, who proposed Union Now before the war, to this conference? Please understand I am not presuming to nominate him. I am merely calling him to your attention for consideration.

Very sincerely,

Harold C. Urey

FILE COPY

APR 8 1949

1155 East 57th Street  
Chicago 37, Illinois  
April 4, 1949

Dr. J. Robert Oppenheimer  
Director, Institute for Advanced Study  
Princeton, New Jersey

Dear Oppenheimer:

The Emergency Committee had a Trustees Meeting yesterday, which was called because we understood that the Bulletin's financial position was rather desperate. \$1,636.91 was allocated at that time; a rather small sum which, we know of course will not go very far. At that meeting Dr. Urey brought up the following point. The Emergency Committee is going to send out letters to about 20,000 contributors in the near future. In this letter we will advise them that the Emergency Committee has ceased to raise funds, and that the Bulletin will continue, under new sponsorship. Urey wondered whether the Bulletin would not like to make use of this mailing to enclose, with the Emergency Committee's letter, and appeal for funds for the Bulletin, which would be signed by you. If the Bulletin wishes to make use of this opportunity to mail an appeal it will be necessary for you or some other representative of the Bulletin to make the necessary arrangements with Mr. Oram immediately, since the sending out of the Emergency Committee letter cannot be delayed much longer.

I assume that in about a month or so you will know better whether the particular method of financing the Bulletin which has been adopted is going to work out or not. In case you should come to the conclusion that it is not working out, and that it does not constitute a sound basis for maintaining the Bulletin, I should appreciate your dropping me a line.

I have communicated Urey's suggestion to Harrison Davies, who says that he will communicate with you about it. I assume he will keep the Emergency Committee office in Chicago informed about the Bulletin's intentions in this connection.

It was nice seeing you again.

Sincerely yours,

Leo Szilard

PS: Funds have been appropriated for the forthcoming mailing of the Emergency Committee with the proviso that the total expenditure may not exceed \$2000. It is conceivable that this sum would be sufficient to take care of printing the Bulletin's mailing piece, and if so, the Emergency Committee would be glad to finance the entire mailing, including the Bulletin's part of it.

L. S.

cc: Mayer  
Hogness  
Urey ✓  
Davies

Dear Mr. President,

Draft letter

I have learned that an important segment of opinion among some of our military authorities and political leaders holds

that atomic weapons should be used to ~~defend Matsu and Quemoy~~ <sup>attack the Chinese mainland in response</sup> ~~and eventually Formosa. If an attack is made on these islands~~

<sup>Matsu, Quemoy</sup> ~~by the Communists, as indeed seems probable.~~ <sup>to an attack by conventional weapons by the Chinese communists on</sup> The use of these <sup>in these circumstances,</sup> weapons, it seems to me, would be a disastrous mistake.

I believe that atomic weapons should be used only if an enemy uses them first or in other ways starts a large scale

attack, and that our targets should be those of maximum impor- <sup>Eventually these weapons would be used to attack cities on all sides.</sup> tance to the enemy. Such a development would be a catastrophe

of greatest magnitude.

In order to avoid such a catastrophe we should do all that we can to dispense with atomic warfare in all its phases. We should plan to defend the free world by other means no matter how expensive they appear to be. We should always remember that there can be nothing as expensive in effort, material and human suffering as atomic war. Moreover, should we use these weapons in the Koreas, Indo Chinas and Formosas of the present or future we will be condemned by our allies. Our friends and many of our own people will condemn us too, and we will turn Asia solidly against us, if we use atomic weapons.

Thus it would appear necessary to maintain adequate strength in conventional weapons, for otherwise our enemies can put us in the impossible position of having to choose between using the ultimate weapon and being completely impotent. We must face the expense and the tasks of maintaining these lesser weapons so that we may win without fighting a world war.

Personally I believe that stubborn, stoical, patient resistance to our enemy will win, for free democracy is stronger and tougher than Communism. We must keep our faith in our fellow citizens and in the effectiveness of our free institutions and in the righteousness of our cause and purposes.

Of course we cannot do this unless our cause and our methods are just and right. Neither our friends nor our own citizens will retain the essential spiritual qualities if we use these terrible weapons in a military engagement involving a few small islands near to the Chinese Coast.

Mankind has no hopes for the future if atomic bombs are regarded as just additional weapons. We cannot hope to outlaw atomic weapons if we use them in an engagement which is utterly insignificant in the overall defense of the free world.

~~May I urge you not to give an order to use these weapons,~~

Or have I misunderstood? Are there military and political leaders definitely and consciously planning to precipitate a 3rd World War? I am sure that you will not be a party to such a plan.

May I urge you not to give an order to use these weapons, nor even to contemplate their use or to let any other, either friends or foes, think that we may use them under the circumstances that are now developing in the Formosa Straits.

Very sincerely  
Harold C. Urey





Personally, I believe that stubborn, stoical, patient resistance to our enemy will win, for free democracy is stronger and tougher than communism. We must keep a faith in our fellow citizens and in the effectiveness of our free institutions and in the righteousness of our cause ~~and~~ purposes. Of course we cannot do this ~~unless~~ unless our cause and <sup>our</sup> methods are just and right. Neither our friends nor our own citizens will retain these essential spiritual qualities if we use these terrible weapons in a military engagement involving a few small islands near to the Chinese coast.

May I urge you not to give an order to use these weapons, nor even to contemplate their use or to let any others, <sup>either</sup> friends or foes, think that ~~you~~ <sup>we</sup> may contemplate using them under the ~~of~~ circumstances that are ~~to~~ developing in the Formosa Straits. ~~The~~ Mankind has no hopes for the future, if there are regarded as just additional weapons and we cannot avoid the use of ~~the~~ atomic weapons by using them ~~as these completely insignificant~~ in an engagement which is utterly insignificant in the overall defense of the free world.

Am I misunderstood? <sup>Are</sup> ~~to~~ these military and political leaders definitely and consciously planning the third World War? !!! But I am sure that you will not be a party ~~at~~ ~~to~~ such a program and hence will not even ~~discuss~~ ~~it~~ consider this at all.

Very sincerely,

I have learned that an important segment of opinion among some of our military authorities and political leaders hold that atomic weapons should be used to defend Matsu and Quemoy and eventually Formosa, if an attack is made on these islands by the Communists, as indeed seems probable. It seems to me that such use of these weapons would not only be a disastrous mistake but would be truly immoral.

It has seemed to me that atomic weapons should be used only if an enemy uses them first or in other ways starts a large scale attack and that <sup>the</sup> targets should be those of maximum importance to the enemy. Such a development would be a catastrophe of greatest magnitude and should be regarded as such.

Outside of this possibility we should do all we can to avoid atomic warfare in all of its phases and should defend the free world by other means, not matter how expensive they appear to be, for there can be nothing so expensive in effort, material and human lives as atomic war. Also, if we use these weapons in Korea, Indochina and Formosa of the present or future, we will eventually alienate our friends and allies. Hence it is necessary to maintain adequate strength in conventional weapons for otherwise our enemies can put us in the impossible position of using the ultimate weapon or being completely impotent. We must face the expense and tasks of maintaining these lesser weapons and in this way we may win without World War III, which if it comes would be disastrous to all of us.

Personally I believe that stubborn, stoical, patient resistance to our enemy will win, for free democracy is stronger and tougher than Communism. We must keep a faith in our fellow citizen and in the effectiveness of our free institutions and in the righteousness of our cause and purposes.

Of course we cannot do this unless our cause and our methods are just and right. Neither our friends nor our own citizens will retain the essential spiritual qualities if we use these terrible weapons in a military engagement involving a few small islands near to the Chinese Coast.

May I urge you not to give an order to use these weapons, nor even to contemplate their use or to let any other, either friends or foes, think that we may use them under the circumstances that are developing in the Formosa Straits.

Mankind has no hopes for the future, if these are regarded as just additional weapons, and we cannot avoid the use of atomic weapons by using them in an engagement which is utterly insignificant in the overall defense of the free world.

Or have I misunderstood? Are there military and political leaders definitely and consciously planning for a 3rd World War?

But I am sure that you will not be a party to such a program and hence will not even consider this at all.

I have learned that an important segment of opinion among some of our military authorities and political leaders holds that atomic weapons should be used to defend Matsu and Quemoy and eventually Formosa, if an attack is made on these islands by the Communists, as indeed seems probable. It seems to me that such use of these weapons would be a disastrous mistake.

It has seemed to me that atomic weapons should be used only if an enemy uses them first or in other ways starts a large scale attack, and that our targets should be those of maximum importance to the enemy. Such a development would be a catastrophe of greatest magnitude and should be regarded as such.

In order to avoid such a catastrophe we should do all that we can to dispense with atomic warfare in all its phases and should plan to defend the free world by other means no matter how expensive they appear to be, for in the end there can be nothing as expensive in effort, material and human suffering as atomic war. Also, if we use these weapons in the Koreas, Indo Chinas and Formosas of the present or future we will be condemned by our allies, our friends and by many among our own people.

Thus it would appear necessary to maintain adequate strength in conventional weapons, for otherwise our enemies can put us in the position of having to choose between starting an atomic war and being completely impotent. We must face the expense and the tasks of maintaining these lesser weapons so that we may win without precipitating a world war.

Personally I believe that stubborn, stoical, patient resistance to our enemy will win, for free democracy is stronger and tougher than Communism. We must keep our faith in our fellow citizens and in the effectiveness of our free institutions and in the righteousness of our cause and purposes.

Of course we cannot do this unless our cause and our methods are just and right. Neither our friends nor our own citizens will retain the essential spiritual qualities if we use these terrible weapons in a military engagement involving a few small islands near to the Chinese Coast.

May I urge you not to give an order to use these weapons, nor even to contemplate their use or to let any other, either friends or foes, think that we may use them under the circumstances that are now developing in the Formosa Straits.

Mankind has no hopes for the future if atomic bombs are regarded as just additional weapons, and we cannot avoid the use of atomic weapons by using them in an engagement which is utterly insignificant in the overall defense of the free world.

Or have I misunderstood? Are there military and political leaders definitely and consciously planning for a 3rd World War? I am sure that you will not be a party to such a plan.

April 5, 1955

*Dear Urey, I made a few*

Szilard's Version of Urey's Letter

*changes in your  
text and submit them  
herewith for your  
approval.  
L. B.*

I have learned that an important segment of opinion among some of our military authorities and political leaders hold<sup>s</sup> that atomic weapons should be used to defend Matsu and Quemoy and eventually Formosa, if an attack is made on these islands by the Communists, as indeed seems probable.

It seems to me that such use of these weapons would be a disastrous mistake.

It has seemed to me that <sup>*we should use*</sup> atomic weapons (should be used) only if an enemy uses them first or in other ways starts an attack that threatens our very existence as a nation. Once an atomic war starts, that side which has fewer atomic bombs will ultimately be forced to use its bombs on targets that are of greatest importance to its enemy, which are its cities. An atomic war of this sort would be a catastrophe of the greatest magnitude and should be regarded as such.

In order to avoid such a catastrophe we should do all that we can to dispense with atomic warfare in all its phases and should plan to defend the free world by other means no matter how expensive they appear to be, for in the end there can be nothing as expensive in effort, material and human suffering as atomic war. Also, if we use these weapons in the Koreas, Indo Chinas and Formosas of the present or future we will be condemned by our allies, our friends and by many among our own people.

Thus it would appear necessary to maintain adequate strength in conventional weapons, for otherwise our enemies can put us in the position of having to choose between starting an atomic war and being completely impotent.

We must face <sup>*the*</sup> expense and <sup>*the*</sup> task of maintaining these lesser weapons so that we may win without precipitating a world war.

Personally I believe that stubborn, stoical, patient resistance to our enemy will win, for free democracy is stronger and tougher than Communism. We must keep our faith in our fellow citizen and in the effectiveness of our free institutions and in the righteousness of our cause and purposes.

Of course we cannot do this unless our cause and our methods are just and right. Neither our friends nor our own citizens will retain the essential spiritual qualities if we use these terrible weapons in a military engagement involving a few small islands near to the Chinese Coast.

*W*

May I urge you not to give an order to use these weapons, nor even to contemplate their use or to let any other, either friends or foes, think that we may use them under the circumstances that are now developing in the Formosa Straits.

Mankind has no hopes for the future, if atomic bombs are regarded as just additional weapons, and (if) we cannot refrain from the use of atomic weapons in an engagement which is utterly insignificant in the overall defense of the free world.

*see typed copy*

Or have I misunderstood? Are there military and political leaders definitely and consciously planning for a 3rd World War? I am sure that you will not be a party to such a plan.

Dear Urey;  
I made a few changes in your text & submit them  
herewith for your approval. L. S.

Szilard's Version of Urey's Letter

April 5, 1955

J. H.

File  
somewhere

APR 6 1955

I have learned that an important segment of opinion among some of our military authorities and political leaders hold that atomic weapons should be used to defend Matsu and Quemoy and eventually Formosa, if an attack is made on these islands by the Communists, as indeed seems probable. It seems to me that such use of these weapons would be a disastrous mistake.

It has seemed to me that atomic weapons should be used only if an enemy uses them first or in other ways starts an attack that threatens our very existence as a nation. Once an atomic war starts that side which has fewer atomic bombs will ultimately be forced to use its bombs on targets that are of greatest importance to its enemy which are its cities. An atomic war of this sort would be a catastrophe of the greatest magnitude and should be regarded as such.

In order to avoid such a catastrophe we should do all that we can to dispense with atomic warfare in all its phases and should plan to defend the free world by other means no matter how expensive they appear to be, for in the end there can be nothing as expensive in effort, material and human suffering as atomic war. Also, if we use these weapons in the Koreas, Indo Chinas and Formosas of the present or future we will be condemned by our allies, our friends and by many among our own people.

Thus it would appear necessary to maintain adequate strength in conventional weapons for otherwise our enemies can put us in the position of having to choose between starting an atomic war and being completely impotent.

We must face expense and task of maintaining these lesser weapons so that we may win without precipitating a world war.



April 5, 1955

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Or have I misunderstood? Are there military and political leaders definitely and consciously planning for a 3rd World War? I am sure that you will not be a party to such a plan.



Dr. H. C. Urey  
Research Institutes<sup>S</sup>  
*The* University of Chicago  
Chicago,<sup>37</sup> Illinois



Dr. Leo Szilard, Kings Crown Hotel, 420 W. 116th St, New York, N. Y.

**AIR MAIL**

CHICAGO, ILL. PAID  
APR 8  
8 AM  
1955

We, the undersigned, are deeply concerned about press reports that the United States will probably respond to an attack against Quemoy or Matsu by attacking the Chinese mainland with atomic weapons. We each of us have written to the President of the United States expressing our concern. We appeal to all those who share this concern to write to the President and state their views. We urge that those who wish to write do not delay.

*Handwritten signatures and notes:*  
L. J. ...  
...  
...  
...  
...

Louis Halle

Civilization &  
Foreign Policy

their views. We urge that those who wish to write do not delay.  
Those who share this concern to write to the President and state  
the United States expressing our concern. We appeal to all  
atomic weapons. We each of us have written to the President of  
against Choumoy or Kaitan by attacking the Chinese and Japan with  
Louis that the United States will probably respond to an attack  
we, the undersigned, are deeply concerned about these

A matter of considerable urgency and importance is now developing in which you may be interested. At the behest of Professors Urey, Szilard, Einstein,

I, as an interested businessman, am writing this letter to you. I and some of my friends and associates share the concern expressed by these scientists about the irresponsible use of the atomic bomb. Therefore we wish to help in every way we can both financially and otherwise to support an intelligent protest against such use.

Professor Urey is sending an open letter to the President, a copy of which is enclosed. Would you be willing to write a similarly courageous letter to the President giving your own views? A number of us have discussed ways and means of marshalling responsible citizens behind a rather extensive effort to influence our citizens, and through them by democratic processes our government, against the irresponsible use of atomic bombs. We aspire to the following plan of action:

First, we wish to get responsible scientists to agree to mutual concern about the problem. We are enclosing a statement of mutual concern which we hope represents your views and which you therefore can sign.

Once this statement is sufficiently supported, we hope to get adequate publicity through newspaper releases, a series of ads in the New York Times and other responsible newspapers, and a television recounting of this activity on a national hookup.

Since time may be very short we hope that you join with us and that in any event you will reply immediately.

*Use Stationery of Inst.  
2 Copies signed  
and witnessed by  
Mrs Mann  
Mail to Szilard  
Quadrangle Club,* 15 June 1956

To the German Consulate General  
8 South Michigan Avenue  
Chicago, Illinois

Sir,

I am writing to you with reference to the application of Dr. Leo Szilard relating to "Wiedergutmachung" to which this letter will be attached. I understand that in cases of this sort you welcome an expression of opinion on the part of those colleagues who have known the applicant at the time when he was Privatdozent in Germany and, in addition, have had an opportunity to follow his career after he left Germany. Inasmuch as the above mentioned circumstances hold in my case, I believe it is appropriate for me to make the following statement.

I have known Dr. Szilard personally and professionally when Dr. Szilard was a student of physics while I myself was Privatdozent at the University of Berlin. Even at that early time, he impressed me as a man of unusual gifts and abilities. Later on when he was Assistent at the Institute for Theoretical Physics at the University of Berlin, I was in close contact with him and had occasion to observe his academic performance in lectures and seminars. By the time Dr. Szilard became Privatdozent for physics at the University of Berlin, I was convinced--on the basis of his early achievements and general accomplishments--that he could look forward to a brilliant academic career in Germany. From the time on, when he obtained his doctor's degree, Dr. Szilard himself has always regarded the pursuit of an academic career as his main professional aim.

Dr. Szilard went to England in 1933 and I left the University of Goettingen also in 1933. I did not see Dr. Szilard again until 1939. By that time, he was a nuclear physicist of international standing. Dr. Szilard became a leading figure in the United States in the work aimed at setting up a nuclear chain reaction in uranium. His work brought him to Chicago early in 1942 at a time when I was on the staff of the University of Chicago and, from then on, I followed his further progress at close range.

Dr. Szilard's leading role in the development of atomic energy is a matter of historical record and generally known beyond the narrow circle of workers in this field. I can say with great assurance that, if Dr. Szilard's academic career had not been stopped in Germany in 1933 by the National Socialist laws, he would have obtained a full professorship (Ordinariat) at some of the German Universities. To me, it is inconceivable that such a professorship could have been denied to him in the face of his extraordinary achievements.

Very truly yours,

James Franck  
Prof., Phys. Chem., Em.

JF/dh

(Ordinariat)



July 29, 1957

Memorandum based on a meeting held  
on the initiative of Bertrand Russell  
at Pugwash, Nova Scotia in July 1957

by Leo Szilard

The Pugwash meeting was largely occupied with preparing a public statement. Had it not been for this preoccupation, it might have been more useful in other respects. This meeting was very important as a "preliminary experiment," because it may enable us to devise future, somewhat similar, meetings that might serve different, perhaps more important, objectives.

I am proposing in this memorandum the holding of a sequence of meetings of a specific kind and serving a specific purpose. Such meetings could follow each other at six-month intervals, beginning perhaps with the end of this year.

#### The subject of the meetings

The subject of the proposed meetings would be the following general problem: The large-scale liberation of atomic energy accomplished in America during the war and the ensuing development of atomic and hydrogen bombs, has created a situation which has brought unprecedented danger to the world and also unprecedented opportunities for organizing a really stable peace. It is clear that the unprecedented problems posed by these developments can be solved only if the governments are willing to revise their past attitudes, adopt an adequate code of behavior, and to take unprecedented measures. Discussions among scientists, who by tradition try to free their thinking from the shackles of precedent, could, I believe, contribute much to clarification of thinking in this particular area.

Attached to this memorandum is a discourse on the topics that might be discussed at the first post-Pugwash meeting. Out of this discussion could then come a more detailed agenda for subsequent meetings.

The current public discussion of these and other related topics is most unsatisfactory. The voices heard in the public discussion are mostly the voices of statesmen, who of necessity must also be politicians, since it is their job not only to devise policies but also to persuade others to accept these policies. Statesmen frequently believe that they know what needs to be done, and that the only remaining problem is how to persuade others to do what needs to be done. When a statesman says something, what we primarily ask ourselves is not: is it true what he says, but rather for what purpose does he say it? This is probably the main reason why the public discussion of a political problem which is conducted among statesmen contributes so little to the clarification of our thinking.

In contrast to this, a discussion among scientists aimed at discovering the truth is a much simpler affair. If a scientist says something in such a discussion, we need not ask ourselves for what purpose he says it; all we must ask is: is it true what he says.

This is the main reason, I believe, why a discussion among scientists might go a long way towards clarifying an intricate problem. There are among scientists in all countries men who are deeply interested in the problems with which we are here concerned, and who are capable of thinking dispassionately about what may be regarded as a controversial subject. If we can prevail upon them to cooperate, we ought to consider holding a series of meetings, perhaps at about six-month intervals.

There would be present at these meetings perhaps twenty scientists and an undefined number of observers who are not necessarily scientists. We would want to have

present among the participants and observers a broad spectrum of persons. At one extreme end of this spectrum will be those scientists who have no governmental responsibility and no special knowledge of relevant technical information which governments regard as highly secret. These men may examine all aspects of the problem with the same freedom and in the same spirit of experimentation as they are accustomed to examine scientific problems. At the other extreme end of the spectrum will be those of the observers who, because of their governmental connections, do not consider themselves free to say what they think. <sup>P</sup>The main function of those participants, who are free to experiment with ideas and inclined to engage in a freewheeling exchange of views, is to catalyze fresh thinking on the complex topic in which we are interested. The main function of the observers is to transmit, after the meeting is over, their own clarified thoughts to others. Some of the observers may, by writing articles or giving speeches addressed to an informed public, contribute to the formation of an informed public opinion and thereby indirectly facilitate the formation of an adequate political and military strategy on the governmental level. Other observers may have a more direct influence on the formation of governmental policy.

The inclusion in the meeting of observers whose opinions carry weight is, I believe, essential, and without this the scientists whom we want to have attend such a meeting might be reluctant to take time off from their own work. Even though the problems to be discussed at such a meeting are not without intrinsic interest to scientists, their intrinsic interest is not as great as that of certain scientific problems. Therefore, one cannot very well ask scientists to devote considerable time and attention to these problems unless they have some assurance that the community will benefit from the result of their thinking, at least if they are able to come up with acceptable remedies as well as convincing diagnoses.

It would be my hope that each successful meeting would serve more and more effectively the purposes which I have outlined. Apart from its intrinsic usefulness, each meeting might also be regarded as an experiment that should enable us to make the next meeting more effective. The first meeting ought to be attended by only a few observers. At subsequent meetings, as our discussions become less and less confused and as the real issues emerge more clearly, the circle of observers could be enlarged. I see no reason why men like Walter Lippman, Stewart Alsop, George Kennan, Raymond Aaron, etc. should not be asked to attend one of the early meetings

And if the meetings prove to be very successful, we might in the end consider inviting as observers, perhaps to the fifth such meeting, men like Krushchev and Nixon, together with anyone whom they might choose to bring along.

Clearly I have gone now as far as thought can reach in trying to project the character which such meeting might take on in the future. As far as I can see the only limitation is our own ability to make meetings of this sort really productive.

Concerning the first meeting to be held, my thoughts are as follows:

- 1) The first meeting might take place between December and February and might last from ten days to two weeks;

- 2) The meeting will not devote any attention to the issuance of any public statement, and the nature of the communique to be issued at the end -- since a communique obviously must be issued -- would be agreed upon in advance of the convening of the meeting. The communique could well list the topics that the conference has discussed (though it need not list all of these topics), and thereby disclose what aspects of the situation were considered by the participants to be most important. The communique could further mention points of view that were expressed and thoughts that were put forward. No attempt, however, must be made to issue a public statement representing the consensus of the participants.

Appendix

to memorandum of July 29, 1957.

(Discourse on the relevant topics)

by Leo Szilard

On July 22, 1957, the Secretary of State gave a speech in which he defined America's aspirations concerning international control of atomic bombs. These aspirations appear to be quite limited:

America, it seems, would be satisfied with an arrangement which would leave America, Russia and England in possession of large stockpiles of bombs, presumably large enough for America and Russia to be able to destroy each other to any desired degree. America would like to see all manufacture of bombs stopped after a certain fixed date to be agreed upon, because she hopes thereby to prevent most of the other nations from acquiring large stockpiles of bombs. If this can, in fact, be prevented, the atomic stalemate between Russia and America, towards which we are moving, might be more stable than it would otherwise be. For example, if many nations possessed large quantities of bombs and if one of America's cities or one of Russia's cities were destroyed by bombs in a sudden attack, it might not be possible to identify the nation that caused this destruction, and this would introduce a new kind of instability.

There is some indication that America would like to see the stalemate between Russia and America be based on the atomic striking power of their respective air forces rather than on intercontinental ballistic missiles, and that she would welcome an arrangement that would stop the arms race prior to the full development of <sup>the</sup> intercontinental ballistic missiles system.

America also desires to institute mutual aerial inspection and some additional ground inspection. The reason given for this desire is that such inspection -- as long as it is maintained -- would decrease the danger of a surprise attack and keep down the expenditures of the strategic air forces.

Scientists have learned not to take public statements issued by statesmen at their face value. In this particular case, I am, however, inclined to believe that the objectives stated above are, in fact, objec-

tives in which America is at present seriously interested, even though I do not assert that the particular reasons given are valid reasons in each instance.

The discussions which may take place in our proposed meeting could start out with an examination of the American objectives listed above.

Our discussions must of necessity differ from similar discussions that might be conducted by government officials -- in preparation of inter-governmental negotiations -- either in Washington or in Moscow. Negotiations between two governments in the general area in which we are interested usually serve a double purpose. On the one hand the negotiating governments want to make progress towards a distant goal which they both consider desirable; on the other hand, each one wants to approach this distant goal by steps which give it a temporary advantage. Very often for the sake of such temporary advantage real progress towards the distant goal is sacrificed.

In the discussions at the proposed meeting the emphasis will be different. We will try to discover what are the right goals that the governments ought to pursue, and how can these goals be approached through steps which give neither government any appreciable temporary advantage. We must also try to understand what the real reasons are for the objectives which the governments pursue, and examine whether the reasons they put forward for pursuing these objectives are valid. If they are not valid, we must try to discover whether there might not be other reasons that may be the real reasons that are valid and that lead to the same conclusion.

I may as well illustrate this point by starting out with Mr. Dulles' speech. Mr. Dulles tells those who would like to see the world rid itself of atomic bombs that it is too late for this because by now there are large stockpiles of bombs, and even if America and Russia made an agreement to get rid of these stockpiles, there is no way to make sure that no hidden stockpiles would remain. Thus those who are still pressing for getting rid of the bombs are now told that it is too late; several years ago they were told that it was too early.

We may examine whether the reason given by Mr. Dulles for wishing to retain the stockpiles of bombs is a valid reason. I personally believe that it is not a valid reason, but I am inclined to think that there may be other reasons which are valid and which lead to the same conclusion.

This is a point which ought to be carefully examined at our meeting. Because, if it is indeed true that there are valid reasons for America and Russia to wish to retain their stockpiles of bombs, then the stalemate between the strategic atomic striking forces of Russia and America toward which we are at present moving is likely to be maintained indefinitely or, to be more precise, for the foreseeable future. If this is indeed correct, then our immediate problem is not how to rid the world of the bomb but rather how to live with the bomb.

Should we adopt this thesis as the premise upon which we may base several days of discussions?

While I personally favor our adopting this as a valid premise for some of our discussions, I believe that, before we do so, we must spend one or two days in carefully examining the validity of this crucial premise.

#### Getting rid of the bomb

In the course of examining the validity of this premise, we ought to discuss a number of points mentioned below:

What might be gained if atomic bombs were outlawed, in the sense that each nation involved would agree not to use atomic bombs if there is a resort to force, except if atomic bombs are used against her or one of her allies? Clearly a number of unilateral declarations would have in this respect exactly the same force as an agreement which, by its very nature, must remain unenforceable. In this contest we might have to consider past experience with the convention outlawing gas warfare, and we must try to understand in what respect the situation with respect to atomic bombs is similar and in what respect it is different.

Next, we might consider whether a program aimed at getting rid of the stockpiles of bombs as well as means which are adequate for delivering bombs (assuming that both Russia and America desire to accomplish these objectives) could be carried out without the risk that dangerous secret violations of the agreement might remain undetected.

If we come to the conclusion that such a program would be practicable and the previous attempts to devise inspection schemes were too narrowly conceived, we must then next examine if there are any valid reasons why Russia or America or both may regard such an objective as practicable but undesirable. We might come to the conclusion that there may be valid

reasons for thinking that such an objective may indeed be regarded as undesirable by both America and Russia. In this case we may then want to shift our full attention to the question of "how to live with the bomb" rather than continue to discuss "how to get rid of the bomb."

#### Stabilizing the stalemate.

At present we are moving towards a stalemate between the strategic atomic striking forces of Russia and America. When this stalemate becomes an accomplished fact, America may be able to destroy Russia to any desired extent and Russia may be able to destroy America to any desired extent. Under what conditions can such a stalemate remain in existence for an extended period of time and be stable enough to permit Russia and America to live through this period without getting entangled in an all-out atomic war?

I believe we ought to discuss the stability of the stalemate under the optimistic assumption that no nation except Russia, America and England have at their disposal substantial quantities of bombs and means suitable for their delivery.

At some point in our analysis, we will have to distinguish between the stalemate based on Russia's and America's strategic air forces and the stalemate that might later on develop on the basis of intercontinental ballistic missiles. At that point we must then discuss the merits and disadvantages of current proposals aimed at aborting the development of intercontinental ballistic missiles, for instance by prohibiting the testing of such missiles.

The stalemate between the strategic atomic striking forces of America and Russia would be inherently unstable if either side could knock out in one single sudden blow or several repeated blows the power of the other to retaliate. For the purpose of our discussion, we may assume that efforts will be made both by America and Russia to safeguard themselves against this possibility. But a stalemate that is not inherently unstable may become so if a technological break-through occurs, either in America or in Russia, and this might lead to a dangerous transition period.

There are three factors of very different character which have a bearing on the stability of the stalemate, and we shall discuss these three factors separately. They are as follows:



- 1) The magnitude and kind of disturbances which will occur while the stalemate is maintained;
- 2) The restraints which America and Russia may impose upon themselves in order to keep from being entangled, if there is a resort to force, in an all-out atomic war, and
- 3) Technological break-throughs which may introduce an inherent instability during the period of transition.

These three factors might be discussed at the proposed meeting from the following points of view:

### 1) Disturbances

Today the greatest danger appears to be a conflict between two smaller nations which may lead to a resort to force and military intervention on the part of America and Russia on opposite sides. What measures might be taken to eliminate the danger of disturbances of this sort?

Clearly this danger can be eliminated only if there is a political settlement between the Great Powers which makes it reasonably certain that in case of any of the foreseeable conflicts between two smaller nations the Great Powers will not intervene militarily on opposite sides. Once such a settlement is reached, it might then become possible to take measures aimed at preventing the smaller powers from resorting to force in settling their conflicts.

At the end of the last war, it was generally believed that -- as long as the Great Powers act in concert with each other -- the United Nations Organization may be able to guarantee the security of the smaller nations and may make it impossible, for them to go to war with each other and unnecessary to waste their resources on defense. Attempts to use the United Nations in the past ten years for purposes other than for which it was designed have weakened this organization. Have they damaged it beyond repair? Or should it be possible to restore the United Nations to its original function, once there is a political settlement between the Great Powers that will eliminate the danger that these powers will militarily intervene on opposite sides in a conflict that may arise between two smaller nations.

Assuming, for the sake of argument, that this might be possible, what measures might the United Nations then take to forestall the outbreak

of local conflicts? Should one think in terms of maintaining in the various troubled areas of the world small armed forces equipped with conventional weapons of high-fire power which would be strong enough to enforce maintenance of the territorial status quo? Should such armed forces be under the central control of the United Nations or should they be placed under the control of those few nations, presumably chosen from the smaller neutral nations, who would man these forces, and the role of the United Nations be restricted to financing and equipping these troops?

## 2) Restraints

Another factor relevant for stability in the atomic stalemate depends on the restraints which America and Russia may impose upon themselves concerning the use of atomic bombs in case they do intervene militarily in a conflict on opposite sides. It is generally recognized that, in the absence of such restraints, which must be clearly formulated in advance and understood by all nations involved, what might start out as a local disturbance might end up in an all-out atomic war.

This does not necessarily mean that America and Russia must reach with each other an agreement that lays down a code of behavior for both parties to obey in case of war. Such a code of behavior, which would clearly define the restraints to be exercised, could also be proclaimed by unilateral declarations either by America or by Russia or by both.

We might examine to what extent the code of behavior advocated at present by informed groups both in America and in England is or is not adequate. This particular code of behavior might be phrased as follows: "If war breaks out, either America or Russia may use atomic bombs in combat, within the tactical area and perhaps also in the immediate vicinity of the tactical area. But they must limit the use of atomic weapons to the area of the local conflict and, depending on the circumstances, either America or Russia must be willing to concede defeat when the war has reached a certain point, rather than extend the war and thereby get entangled in an all-out atomic war."

Is it likely that it would be in the interests of both Russia and America to impose just this kind of restraints on themselves? And even assuming that they should both proclaim, in peace time, a rule of conduct based on this kind of restraint, what are the chances that this rule of conduct would in fact be obeyed, if put to the test when there is a resort to force?

I believe we ought to devote one or more days to a very careful examination of what might be in fact the crucial question of the atomic stalemate: What are the proper restraints which America and Russia might impose upon themselves, in case of a resort to force, which would satisfy the following conditions:

a) The restraints upon which this rule of conduct is based must not be such as to encourage a resort to force. One of the favorable aspects of the atomic stalemate is that it discourages a resort to force and the proposed rules of conduct must not nullify this effect of the stalemate.

b) The rule of conduct, if it is to survive, when put to a test, must be such that there shall be no appreciable incentive for either side to throw it overboard if a resort to force does in fact occur.

c) The rule of conduct incorporating the proposed restraints should be capable of commanding widespread public support, and in order to deserve public support should be satisfactory from the moral point of view.

d) The rule of conduct proposed need not depend on an agreement between Russia and America, which in any case would be unenforceable, and it should be possible for either of these two nations to put such a rule of conduct into effect by each making known the restraints which she proposes to impose upon herself, in case there is a resort to force, and by declaring that she will abide by these restraints, as long as the adversary shall abide by the same restraints.

### 3) Technological break-through

If there is a stalemate between the strategic air forces of Russia and America which is inherently stable, such a stalemate might be temporarily upset either by a technical break-through (in one of these two countries) or by a race in defensive arms (which is won by one of these two countries).

If, for instance, one of these two countries develops a defense which enables it to shoot down 99% of the jet bombers, there will result an imbalance. For instance, one of these two nations might make a determined effort to defend her cities against jet bombers by an elaborate system of anti-aircraft rockets carrying an atomic warhead. This, incidentally, might start a race in "atomic defense" which might make it impossible ever to fix a date for stopping the manufacture of atomic bombs.

In this respect the stalemate based upon the strategic air forces might be less stable than would be a stalemate based on intercontinental ballistic missiles. ~~To develop a defense for intercontinental ballistic missiles.~~ To develop a defense for intercontinental ballistic missiles is far more difficult, and when a stalemate which is based on such missiles is reached, one might adopt a somewhat Utopian solution for safeguarding it against being upset by a further technical breakthrough. A large-scale research operation on rocket research, jointly carried out by America, Russia and several other nations might be such a solution.

Before we can reconcile ourselves to accepting as inevitable a stalemate based on intercontinental ballistic missiles, we must carefully examine the arguments of those who believe that the development of such missiles ought to be aborted. Their arguments fall into three categories:

a) In the transition from the strategic air force to the intercontinental ballistic missiles, there might be a dangerous period in which either Russia or America is ahead of the other nation.

b) At the time when defense is largely based on intercontinental ballistic missiles, there is likely to be a decentralization of the authority to fire a given missile. It is not clear whether sufficient safeguards can be had in such a situation against a war being started by individuals or groups taking action on their own initiative.

c) We must not give up the hope that sooner or later the world may be ready to rid itself of the bomb. This will be very difficult to accomplish once intercontinental ballistic missiles have been manufactured in quantity and installed in subterranean command centers. Assuming that Russia and America would want at that point to conclude an agreement that would eliminate these weapons, how could they convince each other that no such weapons have been retained in hidden positions, ready to be fired at a moment's notice?

### Miscellaneous

We may hope that, by discussing all problems with which we are confronted as broadly as outlined above, we can establish a framework, and that it will then be possible to discuss intelligently within this framework a number of questions which are currently discussed in an inadequate manner. One of these questions is as follows:

It has been proposed to safeguard America and Russia against a surprise attack from each other by establishing aerial as well as ground inspection. As long as such inspection is maintained, each of these two nations could count on 1-3 days warning before a large-scale attack could occur. This safety margin would enable each of them to reduce considerably the costs of the strategic airforces.

If one takes the point of view that a wanton attack by Russia against America or by America against Russia is far less likely, at least under present-day conditions, than the military intervention of America and Russia in a conflict between two smaller nations, then one is led to the raising of the following question:

Assuming such an intervention, just what are the chances that America and Russia would be able to keep in force throughout such a period the inspection system that has been mutually agreed upon? Would the "safeguard" against a surprise attack not be likely to break down just at the time when the probability for a surprise attack begins to be appreciable?

Assuming that we conclude that such a safeguard against a surprise attack would indeed be very valuable, we would then want to discuss the following question:

Could an adequate aerial and ground inspection be organized without giving the strategic air forces of the potential enemy information concerning the exact location of important targets which he does not now possess? And if this is not possible, is the advantage of the proposed aerial inspection sufficient to overcome the reluctance of Russia to let a potential enemy get possession of such information?

There is one favorable aspect to the proposed aerial inspection which I believe we must not underestimate. The strategic stalemate confronts the world with an unprecedented situation, and it will take unprecedented measures to cope with the problems which it raises. The reciprocal aerial inspection has all the earmarks of a highly unprecedented measure. Those who take the position that it does not make much sense may still favor it for this reason alone. They may say that once we start to cooperate in such an unprecedented manner the ice will be broken, and it might then be easy to establish other unprecedented forms of cooperation that may make more sense from the point of view of all the nations that are involved.

THE UNIVERSITY OF CHICAGO  
CHICAGO 37 • ILLINOIS  
THE ENRICO FERMI INSTITUTE  
FOR NUCLEAR STUDIES

August 15, 1957

From: Leo Szilard  
To: Professor H. C. Levey

Early in July of this year a meeting was held at the invitation of Bertrand Russell in Pugwash, Nova Scotia. The participants were guests of Mr. Cyrus Eaton. There were twenty-two scientists participating, and also Brock Chisholm (now retired from the World Health Organization), and D. F. Cavers (Harvard Law School). The statement issued by the meeting is not very exciting. (I did not sign it because it advocated the stopping of bomb tests in a somewhat misleading, even though very meek, fashion). Yet, this meeting was, I believe, a very important experiment.

I have now discussed with Professor Morton Grodzins, Chairman of the Department of Political Science at this University, the possibility that his Department and the Institute might jointly arrange a meeting, somewhat similar to the Pugwash meeting but different in many respects. The enclosed memorandum and appendix will show you just what kind of meeting I have in mind. A list of those to whom this inquiry is addressed is attached to the memorandum.

If the comments received from you and others to whom this material is being sent are favorable, Mr. Grodzins will explore whether the University of Chicago might want to assume responsibility for arranging for the first of a series of meetings of the kind described. I assume that if the University of Chicago assumes responsibility for such a meeting it would want the first such meeting to be held somewhere in the Western Hemisphere, possibly in Canada or Jamaica, B.W.I.

Only after one meeting of this kind has been held can we really know whether we ought to hold further such meetings, perhaps at intervals of six months.

Could you jot down a few lines and give me, for my own guidance, your personal views on holding one such meeting? And would you also say (provided you are in principle in favor of such a meeting) whether you regard the University of Chicago as an institution that may be suitable for arranging such a meeting?

\* \* \*

June 18, 1958

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Colonel Richard Leghorn  
President, ITEK Corporation  
Commonwealth Avenue 700  
Boston 15, Massachusetts, USA

Copies: Professor L. Szilard  
Professor J. Wiesner

Dear Dr. Leghorn:

I received your letter and a signed copy of the Memorandum. Upon my return to Moscow from Canada I informed my colleagues in the USSR Academy of Sciences about the Second Pugwash meeting of Scientists, which in my opinion was fruitful and also of your proposal to hold a private conference of soviet and american scientists in Moscow in July to discuss the possible ways to eliminate dangers of an atomic war as well as the actions that might be taken in this connection by the scientists of USSR and USA.

My colleauges met this proposal with interest and expressed a hope that such a Conference will contribute towards eliminating the threat to humanity of a devastating atomic war and towards establishment of mutual understanding and trust between our countries.

The problems put forward in your memorandum arouse no objections on our part and can be included into the number of problems to be discussed at this Conference.

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We would appreciate your letting us know before the beginning of the Conference, if your time permits, other considerations and proposals on your part referring to the topic of the discussions.

The Academy of Sciences will invite to this Conference american scientists as its guests in the USSR for 2-3 weeks. The Conference could begin on July 28 if it is convenient for you.

We would like to have particulars on your american colleagues in order to be able to extend invitations and help with getting visas in time. We have no objections against Senator Humphrey's participation in the Conference as observer, if he wishes so.

We convey our friendly greetings to your wife on behalf of myself and Mr. Pavlichenko.

With best regards,

Sincerely yours,

A. V. Topchiev



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JULY 9th, 1958

NIGHT LETTER

A. V. TOPCHIEV  
ACADEMY OF SCIENCES OF THE SOVIET UNION  
LENINSKI PROSPECT  
MOSCOW, USSR

WE ARE VERY GRATIFIED BY YOUR LETTER OF JUNE EIGHTEENTH  
STOP WE PROPOSE THAT THE FULL-SCALE DISCUSSIONS OUTLINED IN  
YOUR LETTER START IN MOSCOW IN THE SECOND HALF OF SEPTEMBER IF  
THAT IS CONVENIENT TO YOU STOP WE PROPOSE FURTHER THAT A  
PREPARATORY DISCUSSION BE HELD IN MOSCOW AT AN EARLY DATE,  
ATTENDED BY WALTER WHITMAN, LEO SZILARD, MYSELF AND, IF  
POSSIBLE, JEROME WIESNER STOP THE PURPOSE OF THIS  
PREPARATORY DISCUSSION IS TO DISCOVER THE MOST PRODUCTIVE  
TOPICS ON WHICH THE FULL-SCALE DISCUSSIONS MAY CONCENTRATE AND  
TO PERMIT A BETTER PREPARATION OF THE FULL-SCALE DISCUSSIONS  
STOP WE PROPOSE THAT THE PREPARATORY DISCUSSION BEGIN ON  
AUGUST EIGHTEENTH IF THIS IS CONVENIENT TO YOU STOP AS AN  
ALTERNATIVE DATE, WE SUGGEST JULY TWENTY-EIGHTH STOP LETTER  
FOLLOWS STOP BEST REGARDS.

LEGHORN

Leo Szilard

July 10, 1958

DESCRIPTION OF A STUDY RELATING TO THE WORLD  
SECURITY PROBLEMS RAISED BY THE BOMB

During the past three months, I have been engaged in a study relating to the world security problems raised by the bomb. This study has proceeded through informal conversations among American scientists and serves primarily the purpose of clarifying the minds of the participants on the issues involved.

Since we had no funds available for the purpose of this study, it was not possible to arrange for special meetings and consultations among the participants and some of the informal discussions were, therefore, conducted incidentally at meetings which were held for purposes other than the conduct of this study,

This study is devoted to a dispassionate analysis of the problems of world security that are raised by the bomb and it could be carried out to a certain point through informal discussions among American scientists and experts without the participation of Russian scientists.

It is not sufficient, however, to determine merely what policies would be desirable from a point of view of world security; it is also necessary to consider whether

particular policies that would appear desirable would also be politically acceptable to Russia as well as to America. Therefore, after a certain degree of clarification of the issues has been accomplished in our own minds, it becomes necessary to widen the circle of the informal discussions to include also Russian scientists, who are in a better position to appraise what may be politically acceptable to Russia than we are.

In April of this year while I attended an international conference of scientists at Lac Beauport, Quebec, Canada, I was led to conclude that the participation of Russian scientists in these informal discussions could be best arranged through the sponsorship of such informal discussions by the Academy of Sciences of the Soviet Union. For the time being such informal conversations between American and Russian scientists could be best carried out in Russia, where American scientists would have access to a fairly wide circle of Russian scientists.

The attached letter written by Academician A. V. Topchiev, General Secretary of the Academy of Sciences of the Soviet Union, to Colonel Richard S. Leghorn--with copies to Professor Jerome Wiesner and myself--affords a unique opportunity to extend the circle of informal discussions to Russian scientists. The events leading up to the

receipt of this letter from Academician Topchiev are described in the attached memorandum of July 2, 1958, addressed by me to Warren C. Johnson.

Since April, when I discussed this topic with Academician Topchiev, my own thinking has moved even further in the direction of stressing the need to keep the discussions between American and Russian scientists as informal as possible. For this reason, we are now exploring whether the meeting that the Academy of Sciences of the Soviet Union is willing to sponsor might not be further loosened up and rendered more diffuse by having first a preparatory discussion of a very few American scientists with Russian scientists, held under the sponsorship of the Academy of Sciences of the Soviet Union. Such a preparatory discussion might examine the possibility of holding informal discussions between Russian and American scientists on a more or less continuous basis. The attached copy of a cable sent on July 9 by Col. Richard S. Leghorn to Academician Topchiev reflects these thoughts.

Formal meetings aimed at proclaiming a consensus of the participants or any other meetings which are not strictly private in character would fall outside the scope of this study.

It is estimated that we shall need for secretarial services, travel expenses of the American participants in this study, long-distance calls, and other similar expenses, a total of perhaps \$35,000 in the next twelve months. Of this, about \$20,000 might be spent on expenses connected with the informal discussions held between American and Russian scientists under the sponsorship of the Academy of Sciences of the Soviet Union, and this sum might have to be spent in the course of the next three months.

Most closely associated with me in this study were so far Col. Richard S. Leghorn and Prof. Jerome Wiesner. Prof. Walter Whitman is about to become associated with it.

As the circle of American scientists participating in this study is getting wider, some of those who initiated this study might have to loosen their connection with it if they get directly involved in negotiations which the Government of the United States may be conducting with the Government of the Soviet Union.

L.Sz.

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July 14, 1958

Dr. Alvin Weinberg, Director  
The Oak Ridge National Laboratory  
Oak Ridge, Tennessee

Dear Al:

Subsequent to our telephone conversation this morning, I had discussed with Jerry Weisner, Dick Leghorn and Walt Whitman your suggestion that Keith Glennan be approached and asked to participate in the study, and they all responded enthusiastically to it. Walt Whitman told me that he had talked over the telephone with Killian about the projected study and that, if Mr. Glennan appears interested, he would be very glad to speak to him over the telephone. His extension at M.I.T. is 561.

According to our present plans, Walter Whitman, Col. Leghorn and I would go to Moscow for the preparatory discussions if Topchiev accepts the dates suggested in the telegram, which is contained in the set of documents enclosed, or if he suggests an alternative date which is acceptable to us.

We had originally intended to include three to four members of the President's Science Advisory Committee among the participants in the first full-scale discussions--which we now propose be started in the second half of September. However, as matters stand now, there seems to be a feeling in Washington that no one who is in a policy-making position with respect to current official negotiations should participate in the Moscow discussions except, perhaps, as an "observer."

2-Dr. Alvin Weinberg

July 14, 1958

Previously, our project had been discussed individually with twelve of the members of the President's Science Advisory Committee, in addition to Dr. Killian.

We have particularly counted on Lloyd Berkner's participation in the preparatory discussions but, because of the recent car accident of his wife, he had to cancel his plans to go to Europe this summer.

In addition to Walter Whitman, those whom were approached by Wiesner, Leghorn or myself with a view of their active participation in the project are: Richard Feynman, Cal Tech; Harrison Brown, Cal Tech; Lee DuBridge, Cal Tech; T. F. Walkowitz, Rockefeller Brothers; Eugene Rabinowitch, Bulletin of the Atomic Scientist; H. C. Urey, University of Chicago, and yourself.

We also decided to approach H. J. Muller, University of Indiana.

We have been discussing the possibility of including either Bernard Feld or Martin Deutsch but have so far not approached either. The same holds for Victor Weiskopff.

We have discussed the possibility of including J. H. Doolittle, Al Hill and Louis Ridenour. The first two of these would, however, probably not be able to participate because of their governmental connections and Ridenour, with whom Leghorn talked several times and who was interested, felt it would not be easy for him to get the wholehearted approval of Lockheed. This might conceivably change if it becomes manifest that we are being encouraged by the U. S. Government and depending on just how strong this encouragement might turn out to be.

3-Dr. Alvin Weinberg

July 14, 1958

Everything looks now just right and my chief worry is that we do not have a sufficient number of participants who are imaginative, knowledgeable and willing to put in the required amount of time and effort.

I personally am inclined to believe that the American participants in this study ought to meet once a month in Washington, say on the first weekend of each month, beginning this Fall. This might make it necessary to include more participants from the East than we have so far planned, for it might be rather difficult for those on the West Coast to come to Washington once a month, or even once in two months.

Enclosed you will find a copy of this letter for your convenience and attached to it a set of the documents which describe the present state of this projected study. Of the funds needed, we have so far pledges for \$15,000 (three donations of \$5,000 each) which I have procured by means of telephone calls.

T. F. Walkowitz can also be counted on to do a little fund-raising and, if necessary, also Dick Leghorn, thus, I am not too worried about obtaining the funds. From what Walter Whitman tells me, it appears likely that the American Academy of Arts and Sciences may agree to handle the funds but, if this should fail us, the University of Chicago or the Massachusetts Institute of Technology are conceivable alternatives.

Sincerely,

Leo Szilard  
c/o Robert B. Livingston  
National Institutes of Health  
Bethesda 14, Maryland

Encs.



CONFIDENTIAL

MEMORANDUM

July 2, 1958

From: Leo Szilard  
To: Warren C. Johnson  
Dean of the Physical Sciences Division  
The University of Chicago  
Re: Study Relating to the World Security Problems  
Raised by the Bomb

An international conference of scientists -- usually referred to as the Second Pugwash Conference -- was held in April of this year at Lac Beauport, Quebec, Canada. This conference was convened by Bertrand Russell and sponsored by Cyrus Eaton. It lasted twelve days and offered the participants an opportunity to clarify their own thinking on security problems raised by the bomb.

While the conference was useful in this respect, and also afforded an opportunity for Russian and American scientists to hold private conversations with each other, it would not seem advisable to attempt to carry forward a study of the security problems raised by the bomb through further conferences of the same character.

At Lac Beauport, Col. Richard S. Leghorn (President of ITEK Corporation, Boston), Professor Jerome Wiesner (Head of the Research Laboratory for Electronics, Massachusetts Institute of Technology, Cambridge, Mass.) and I raised, with Alexander Topchiev, General Secretary of the

Academy of Sciences of the Soviet Union, the issue of just what kind of conferences would be most suitable for carrying further the study of these problems. Subsequently, we made Topchiev concrete proposals on how we might cooperate with the Academy of Sciences of the Soviet Union in regard to clarifying the issues involved in the security problem posed by the bomb. Our proposals were embodied in a memorandum and a signed copy of the memorandum was sent to Topchiev, at his Moscow address, after the Lac Beauport meetings.

The relevant passages of this memorandum run as follows:

"We propose that there shall be held a meeting in Moscow in which ten to fifteen American scientists, of the kind to be described later, would participate, and about an equal number of Russian scientists of approximately the same sort. This meeting might last two weeks and it should take place at the earliest time that will suit those who are to participate and, if possible, not later than July of this year.

"About one third of the American group might be scientists who are familiar with the technology of modern weapons and who, by virtue of their relationship to the United States government, are in a position to communicate their own thinking to the government, but who are not,

themselves, officials of the United States government. About three or four of the Americans may be mathematicians or theoretical physicists or theoretical chemists.

"The topic of the proposed discussions at Moscow might be circumscribed as follows:

"'There exists, in the present state of the atomic arms race, a serious danger than an atomic war might break out which neither America nor the Soviet Union wants. What are the circumstances which might lead to the outbreak of such a war, and how could these circumstances be modified in order to diminish, and later on to eliminate completely, this danger?'

"At the meeting in Moscow we would propose to discuss, as frankly as we have discussed in Quebec, controversial issues, including the difficulties which stand in the way for America to accept certain proposals which have been made by the government of the Soviet Union and for the Soviet Union to accept certain proposals that have been put forward by the American government. Sometimes these difficulties come from apprehensions of one government, of which the other government is not fully aware. The proposed discussion at Moscow should enable both the American participants and the Russian participants to think about ways that may enable us to get around such difficulties.

"After the conclusion of the conference, the participants may be able to explain to their own governments their, perhaps greatly improved, understanding of the difficulties which stand in the way of an agreement between the two governments and which relate to the question of controlled arms reduction, as well as certain other problems which are intimately related to this question. Our reasons for believing that the informal talks between American and Russian scientists, which we propose, might be fruitful are essentially as follows:

"Our talks at Quebec have convinced us that among Russian, as well as among American, scientists there are many who are not only men of good will, but who are also able to explore dispassionately controversial issues. Such men should be able to clarify, in their own minds, what the difficulties are that are impeding the progress towards reaching an understanding between America and Russia even in areas where these two nations have a strong common interest.

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"The American participants in the proposed meeting would want to prepare, in advance of the meeting, memoranda which may be helpful in focusing the discussion on what they believe to be the relevant topics. Some of these American documents will be concerned with problems which they believe to represent valid apprehensions of the

Soviet Union.

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"We suggest that, similarly, our colleagues in the Soviet Union, who are to participate in the proposed meeting, may prepare documents on topics which are concerned with those apprehensions of the American government which they may recognize as valid.

"In addition, both the American and Russian participants might prepare documents which relate to topics that represent apprehensions of both America and the Soviet Union, such as the danger of an accidental outbreak of an atomic war, and the risks involved in the possession of atomic weapons by nations other than America and the Soviet Union and Britain.

"We believe that the invitations to the proposed Moscow meeting should not come from us, but rather that certain Americans be invited individually by the Soviet Academy of Sciences. However, we are prepared to say who, among American scientists, could be particularly useful - in our opinion - at the proposed meeting. We are also prepared to offer our good offices in exploring who, among those whom we regard as desirable participants of the meeting, is likely to be able to attend the meeting. We propose to keep in touch with each other on the subject of the selection of American participants, and one of us

may keep in touch with Academician Topchiev in order to keep him informed on who, among the proposed American participants, may be available at the date set for the meeting."

We have now received the enclosed reply from Topchiev, dated June 18th, advising us that the Academy of Sciences of the Soviet Union has accepted our proposal and suggesting July 28th as the tentative date for the meeting to be held in Moscow.

Should it prove impossible for us to hold the meeting at the date suggested by Topchiev, then according to our present thinking, we might propose to Topchiev that Leghorn, Wiesner and I meet with our Russian counterparts, designated by the Soviet Academy of Sciences, at an early date in Moscow to hold a preparatory conference, lasting perhaps for a week. This preparatory conference could do a considerable amount of intellectual preparation for the forthcoming meeting. At such a preparatory conference we would have an opportunity to explore just what aspects of the problem involved would be the most suitable topics for a discussion at the projected meeting.

I should add that we are not looking at the proposed meeting of Russian and American scientists as a one-shot operation, but rather as a first step in carrying out a

continuous study of the security problem. Therefore, it appears to us more important to open up this new channel of communication, and to keep it open, than to accomplish very much at the first meeting.

L.Sz.

Leo Szilard

Rough Draft

July 16, 1958

Outline of Paper Entitled:

"On the Possibility of a Pax Russo-Americana  
in a Stable Atomic Stalemate"

Introduction.

The bomb poses a problem to the world for which history provides no precedent. In looking towards a solution of this problem, one may adopt either of two approaches to it. Of these I shall mention only in passing the approach on which public attention has been mostly focused in the past twelve years. This approach is based on the thesis that the solution of the problem that the bomb poses to the world lies in ridding the world of the bomb at an early date.

Those who adopt this approach to the problem may be expected to urge the stopping of bomb tests as an important first step toward this goal. One may willingly concede that Russia and America might be able to agree at an early date to stop further bomb tests and, perhaps, they might even take, in the near future, the next step and agree to stop the manufacture of further bombs. But what about the stockpiles of bombs that Russia and America will have built up in the meantime?

Clearly, if one thinks of the solution of the problem of peace in terms of ridding the world of the bomb, then no arrangement which stops short of the step of eliminating the



bomb stockpiles can be regarded as adequate. Would America and Russia want to take this crucial step in the foreseeable future? And assuming that they both did want to take this step, would they be able to take it?

I do not propose to discuss here the difficulties which may stand in the way of solving the problem posed by bomb by getting rid of the bomb in the foreseeable future. Nor do I propose to discuss here the advantages and disadvantages that this approach may have from the point of view of the overriding problem of maintaining peace. Rather, in the present paper, I am discussing chiefly another approach to the problem posed by the bomb. One is quite naturally led to this second approach, if one starts out with the assumption that both Russia and America are going to retain large stockpiles of hydrogen bombs of high power (either of the "dirty" or of the "clean" variety) for the next ten years, and perhaps throughout the entire foreseeable future.

If this is what is going to happen, then, right now, the most urgent problem to which we must devote our attention is how to live with the bomb, rather than how to get rid of it.

Is it possible to try to live with the bomb, say for another generation, and yet to survive? And, furthermore, is it possible to live with the bomb and to live well?

We are not far today from a "stalemate" in which the atomic striking forces of Russia would be capable of destroying

America to any desired degree, and the atomic striking forces of America would be capable of destroying Russia to any desired degree. Accordingly, in a certain sense, both Russia and America are about to become invincible. Today, they might still be drawn into a war and fight on opposite sides, but even today no rational military policy that America or Russia may adopt could be aimed at an all-out victory. In this sense we may speak of a "stalemate" between the strategic striking forces of Russia and America, and I shall speak here of a "stalemate" in this narrow sense of the term only.

At present we are going through a transitional period in which the character of the "stalemate" is still rapidly changing. I am mainly concerned here with exploring the general principles upon which long-term policies might be based in that stage of the stalemate that may be expected to prevail in, say, about five years' time. For the sake of brevity, I shall refer to this stage of the stalemate as the "solid-fuel stage."

Five, or at most ten, years from now there should be a stalemate between the strategic atomic striking forces of Russia and America, based on solid-fueled-long-range rockets carrying "clean" hydrogen bombs of high power. Moreover, these long-range rockets would be launched from bases dispersed inside the territories of America and Russia proper. These bases could, and presumably would, be made invulnerable

to attack by bombs. In this stage of the stalemate, Russia and America would be capable of destroying each other to any desired degree, but neither of these two countries would need to fear that a sudden atomic attack, by the other, might appreciably diminish its own power to strike a counterblow. This fear is one of the elements responsible for the inherent instability which characterizes the present, transitional phase of the "stalemate." With this fear eliminated, the current American emphasis on the need to be prepared for an instant counterblow would disappear also.

"What kind of an understanding between Russia and America would it take to make it possible for them to refrain from embracing such 'undesirable' policies?"

Whether an all-out atomic war, that neither America nor Russia wants, would erupt in the "solid-fuel stage" of the stalemate would depend essentially on the answer to two questions:

A. What kind of political and military disturbances may be expected to occur?

Clearly, political and military disturbances that may be expected to occur would depend on whether or not there is a political settlement between America and Russia and on the nature of the settlement.

B. What policies would America and Russia adopt concerning the possible use of the bomb in any of the hypothetical contingencies that might conceivably arise?

In the "solid-fuel stage" of the atomic stalemate, the main danger would not lie in the possibility of a wanton attack of the atomic striking forces of America against the cities of Russia or vice versa. An all-out atomic war which neither Russia nor America wants, might come however either as the result of an accident, arising perhaps from a mistake in judgment, or--more likely--come as the result of a conflict between two other nations which may lead them to go to war with each other. In such a case, America and Russia may then militarily intervene on opposite sides. If that happens, the war might then be fought with atomic weapons, used within the area of conflict, against supply and air bases, as well as against troops in combat. Such a war might not remain limited to the initial area of conflict and it might end in an all-out atomic catastrophe, unless Russia and America impose upon themselves certain far-reaching restraints and unless these restraints are proclaimed in advance and fully understood by both nations.

The need for a political settlement.

The danger of this kind of disturbance could be greatly diminished through a political settlement between America and Russia, particularly if the settlement had the concurrence of the other great powers affected.

I am using the words "political settlement" here in a narrow sense of the term only, having primarily in mind an understanding that would enable Russia and America to act in concert with each other and thereby to prevent other nations from resorting to war. A political settlement in order to be adequate would have to insure also that, if Russia and America were not able to prevent a war between two other nations, at least they would not intervene militarily on opposite sides. An adequate political settlement could eliminate the kind of disturbances which could be most dangerous, from the point of view of the stability of the stalemate.

What are the chances that Russia and America may be able to arrive at a political settlement of this nature?

The possibility of a political settlement.

It is my contention that an adequate political settlement may become possible in the setting of the stalemate which is based on the possession of long-range, solid-fuel rockets by America as well as Russia because in such a setting the political forces which had led to the cold war in the post-war years would cease to operate. In the post-war years, preceding the advent of the atomic stalemate, each additional ally represented a potential asset to America; in the setting of such a stalemate, however, each additional ally would represent a potential liability to her. The same

considerations hold, of course, for Russia also. The controversial issues that have arisen in the post-war years between Russia and America should become negotiable in the setting of the stalemate. And when Russia, America and the other great powers may act in concert for the purpose of stabilizing the stalemate, then it should become possible to set up machinery under the United Nations organization that may effectively prevent other nations from going to war with each other.

In the setting of the "solid-fuel stage" of the stalemate, America's and Russia's overriding national interests will substantially coincide. Also, America and Russia are not rivals in trade, nor do they compete for essential raw materials. Therefore, in that setting, it should become possible for America and Russia to reach a political settlement with the concurrence of the other great powers involved. Rendering the stalemate metastable--The general principle of limited commitments.

It is hardly possible to say at this time that the political settlement, <sup>which</sup> would be obtainable in the foreseeable future, would be reasonably satisfactory to all the major aspirations of all the major powers. If no such settlement is, in fact, obtained, then the status of the world could not be regarded as truly stable, i.e., changes might still

be brought about by force or by the threat of force against the wishes of either America or Russia.

It is, however, within the power of Russia or America to render the atomic stalemate at least "metastable" in the sense that the political and military disturbances that could occur would not trigger a chain of events involving progressively increasing destruction that could end up in an all-out atomic catastrophe. To this end it is not even necessary for America and Russia to conclude an agreement with each other. In case of a conflict between America and Russia, either Russia or America could render the stalemate metastable by unilaterally adopting and proclaiming an adequate policy with respect to the bomb.

If, say, America were to adopt a policy deliverately aimed at rendering the stalemate metastable, then she would have to impose certain far-reaching restrictions on her own actions with respect to the use of the bomb. These restrictions would limit not only what America may do, but also what she may threaten to do in any of the hypothetical eventualities that might conceivably arise.

In the post-war years, America did not hesitate to make unlimited commitments for the protection of certain areas of the world. As long as she was in sole possession of the bomb, she was in a position to make such unlimited commitments because she was able to threaten massive

retaliation against Russia, and thus to protect these areas against any real (or imaginary) threat, attributed to Russia. But clearly, in the "stalemate," when America and Russia could destroy each other to any desired degree, the threat of massive retaliation against Russia would be tantamount to a threat of "murder and suicide." A threat of this sort, if it were made by a nation like America, would not be sufficiently believable to be effective. If there is strong provocation for Russia to take armed action against a nation, which America is committed to protect, Russia may choose to disregard such a threat and America would then either have to admit to bluffing, or to proceed to destroy Russia and be herself destroyed in the process.

If America wants to render the stalemate metastable, as she must, then any commitment which she may make for the protection of other nations must remain a strictly limited commitment on her part. Such a limited commitment, if it is believable, may then afford a measure of protection to third nations, because America could make it reasonably costly for Russia to engage in armed action against an ally of America which is under America's protection. But America may not aim, in any contingency in which she might be called upon to fulfill such a limited commitment, at exacting a greater sacrifice from Russia than she herself is willing to make, or else she may provoke an all-out atomic war.



All this holds, of course, in the reverse for Russia also.

While the stalemate could be made metastable by either Russia or America through the unilateral adoption and proclamation of an adequate policy with respect to the bomb, the stalemate would not--in this manner--be necessarily rendered truly stable.

If America wanted to bring about a change--against the wishes of Russia--by using force or by threatening the use of force, and if she were willing to pay a higher price for the sake of obtaining this change, than Russia were willing to pay for the sake of preventing it, then--in principle at least--America would be in a position to have her way.

The same holds true, of course, in the reverse for Russia also.

At this point it becomes necessary to examine, in a more concrete fashion, just what kind of a threat the bomb may represent in a stalemate, what kind of sacrifice may America threaten to extract, and what kind of prices may she be called upon to pay if the stalemate is to be kept metastable.

Rendering the stalemate metastable--What use of the bomb may be threatened and what use may not.

We have been very slow in comprehending to what kinds of "use" the bomb might conceivably be put. Thus, in the first few years immediately following Hiroshima, the extensive private (as well as the public) discussions of the issue of the

bomb wholly failed to take into account the possibility that atomic bombs might be used in war against troops in combat by America or that America might at least threaten to use them in such a manner. It was therefore generally believed, in those early post-war years, that as soon as Russia as well as America will be in possession of the bomb, then these two nations would be willing to give up the bomb, since neither could then use the bomb against the other and survive.

It took years before people in America began to see that atomic bombs could be used against troops in combat also. Today there is a strong and increasing emphasis on the need for America to be militarily prepared to fight local wars with small atomic weapons. Today, many people believe that America ought to state clearly that she intends to confine herself, in case of war, to the use of small atomic bombs and would drop these only within the area of conflict. They assert that if America's intentions in this respect were clearly understood, America's possession of the bomb would represent a "deterrent" that would be effective because the threat implied would be believable.

These people argue that hydrogen bombs of great power may be retained in the stockpiles by America and Russia, for a long time to come, but that the possession of these bombs would not affect the course of any war in which America and Russia may fight on opposite sides. For neither side could

use such bombs for the destruction of any of the cities of the other without precipitating an all-out war, which neither Russia nor America wants.

This, I believe, is a wholly fallacious argument. It is my contention that only if Russia and America both chose to resolve a contest by fighting an atomic war with small bombs, locally, in and around the contested area, would the conflict, in fact, be resolved by such means. Either America or Russia might, unilaterally decide to threaten to demolish a limited number of cities within the territory of the other, after giving those cities adequate warning to permit their orderly evacuation. But, if/Russia made such a threat,/<sup>for instance</sup> she could not <sup>then</sup> aim at causing greater property damage to America than she would be willing to suffer herself, for if she were to pursue such a goal, she would bring about a chain of events leading step-by-step to ever-increasing destruction. If Russia were to impose upon herself, however, such far-reaching restrictions as she must--in order to preserve the stability of the stalemate--and if she were to proclaim these restrictions in advance, then her threat to demolish a limited number of evacuated cities would not be a threat of "murder and suicide;" it would be a believable threat that might well be effective.

Faced with such a threat, America would have no choice but to threaten a limited counterblow of the same kind. If America were not willing to pay the price set by Russia in such terms, then America would not be in a position to "fight" even though she might have military superiority in the contested area were she to use small atomic bombs against troops in combat.

But, even if America and Russia both wished to lean primarily on their capabilities of fighting limited atomic wars against each other, they could extend real protection to other nations by these means only as long as the threat to fight a local atomic war would prevent the outbreak of the war. If it failed to do this, then invoking the protection offered would presumably mean the almost total destruction of the protected nation. Thus, the protection afforded by such a "security system" might perhaps be invoked once, in the course of future events but, thereafter, nations would probably be reluctant to accept such "protection."

At a certain point on the road along which we are now moving, either Russia or America might decide to base their security on their capability of demolishing a limited number of evacuated cities by clean hydrogen bombs of high power, and to renounce atomic war as an instrument of her national policy. Thus, she could retain the bomb as an instrument of policy that would permit her to threaten the use of force

(or, if necessary, actually to use force) without threatening any longer the killing, by means of atomic bombs, of soldiers or civilians. If either Russia or America were to adopt such a policy, in the "solid-fuel stage" of the stalemate, she would then be able to reduce her arms expenditure to a small fraction of her current arms expenditure.

It is likely that the stockpiling of "clean" hydrogen bombs of high power would more or less automatically lead the Russian and American Governments to base their defense policy on the threat to demolish, if need be, a limited number of cities which have been given adequate warning to enable the orderly evacuation of the population.

In contrast to this, the stockpiling of "dirty" hydrogen bombs of high power is likely to lead governments to think in terms of threatening "murder and suicide," and no attempt to stabilize the stalemate on this basis could have an appreciable chance of succeeding.

It is my contention that in the "solid-fuel" stage of the stalemate, Russia and America would be in the position to maintain a stalemate based on long-range-solid-fuel rockets, capable of carrying clean hydrogen bombs of high power that may be launched from invulnerable bases inside American and Russian territory. The atomic stalemate could, under such conditions, be metastable even in the absence of an adequate political settlement. The stability of this system need not necessarily be destroyed by a third, fourth or fifth power stockpiling clean hydrogen bombs of high power.



of the killing of civilians, as well as soldiers, emotions be aroused which would make it difficult for these two governments to follow a rational course of action?

And, one may also ask: Would the situation in this respect be worse, or better, if Russia or America renounced atomic war and threatened, instead, to demolish evacuated cities that have been given warning adequate to permit their orderly evacuation?

One might, perhaps, argue that the loss of property would arouse emotions just as strong as <sup>would be</sup> loss of human life, and this argument must be met.

Certain nations, if they acquire substantial atomic capabilities, might make the threat of "murder and suicide" an integral part of their national policy, either for the purpose of protecting what they possess or for the purpose of acquiring what they covet. It might appear to be a perfectly rational course of action to threaten "murder and suicide," but to carry out the threat, if the bluff were called, would not be a rational course of action. It is my contention that, because it is always doubtful whether a threat of "murder and suicide" would be carried out, such threats would introduce a dangerous element of instability in the stalemate.

Breakdown of the stability--for other reasons.

The stalemate would be rendered instable also if several nations were in a position to launch from submarines intermediate or long-range rockets carrying hydrogen bombs. The reason for this is as follows: Solid-fuel long-range rockets which are launched from bases located on solid ground can be picked up in flight by radar and traced back to the launching site. Thus, it is possible to identify the nation that is responsible for the launching of a given rocket. Any nation launching a rocket under these circumstances, for the purpose of inflicting damage on another nation would have to be willing to suffer damage commensurate to that which it inflicts on another nation that is capable of striking a counterblow. But if Russia, America, and several other nations are in a position to launch rockets from submarines, then if a city in Russia or America or elsewhere were destroyed by a hydrogen bomb, it would not be possible to know what nation is responsible for the destruction wrought.

The stability of the stalemate might be endangered also if a technological break-through occurs either in Russia or in America that would enable one of these two countries to destroy incoming long-range rockets in flight.

Such a defense system is not in sight at present. What is likely to happen in this regard is, rather, the



following: Both America and Russia might develop a defense system which would enable them to destroy a small--but perhaps gradually increasing<sup>--</sup> fraction of incoming long-range rockets in flight. As progress is made in this direction, say in America, Russia would respond by building more long-range rockets and more hydrogen bombs to be carried by such rockets in order to compensate for the rockets which might be destroyed in flight. Such a process could lead to a perfectly senseless and very expensive arms race.

It would take an agreement between Russia and America to stop this kind of a senseless arms race. In the absence of such an agreement, the American and Russian stockpiles might increase beyond bounds and it would probably not be possible to keep them within such limits, as could still be regarded as safe from the point of view of the world as a whole.

Undesirable short-term policies which might lead to instability of the stalemate.

There is a considerable danger that, during the present transitional stage of the stalemate, either Russia or America may yield to the temptation of adopting short-term policies which will make it impossible for them, later on, to render the "solid-fuel" stage of the stalemate metastable.

In the present transitional stage of the stalemate, America is dependent for her defense on bases outside of her own territory because she does not as yet possess solid-fuel-long-range rockets that could be launched from invulnerable bases within her own territory. Thus, America has, for the time being, an incentive to maintain the system of alliances that she had built up after the second world war.

A number of her allies are, however, not satisfied with the limited commitment that America is able to make for their protection. The possession by Russia of long-range rockets carrying hydrogen bombs of great power carries with it the implied threat that, in case of a conflict, Russia might demolish a number of their cities. Were Russia in case of a concrete conflict explicitly to threaten to do this, then America might well counter with a threat of demolishing Russian cities. This counter threat could, <sup>however</sup> be effective only, if Russia were to believe that America would be willing to lose cities of her own, for the sake of protecting cities of her allies.

Whether Russia would or would not believe such an American counter-threat is, at the moment, beside the point. What matters is that, clearly, today the governments of America's allies, themselves, do not believe that America would be willing to sacrifice cities of her own--if the

chips were down--for the sake of protecting theirs. Nothing that the American Government might say could possibly convince her allies in this regard.

In these circumstances, one after the other of America's major allies is going to demand to have atomic striking forces of its own. They will argue that, if they had such forces, they would then be able to respond to the possible Russian threat with a believable counter-threat of their own.

Clearly, before long, America will, <sup>thus</sup> be faced with the choice of either relinquishing an ally or putting that ally in the position of striking an atomic blow against Russia, or anyone else, independently of any decision that the American Government might take, in any given contingency.

If more and more nations acquire bombs, as well as an adequate delivery system, and if one of these nations adopts the threat of "murder and suicide" as an integral part of its national policy, then the stalemate may become instable and there might occur an all-out atomic catastrophe.

During the present transitional phase of the stalemate, there may come a period of time when--ahead of America--  
a substantial number of  
Russia may be in the possession of solid-fuel long-range rockets capable of carrying hydrogen bombs of high power and capable of being launched from invulnerable bases inside of Russian territory. America, lagging behind in development,

would then have to safeguard herself against a surprise attack that could destroy her ability to strike a counterblow, by keeping a considerable fraction of her jet bombers in the air. This is a costly operation and, in order to avoid it, America might build submarines equipped to launch intermediate-range rockets carrying hydrogen bombs of high power. Submarines, because they can shift their position, may be regarded as invulnerable bases.

The same consideration may lead other nations, such as England, France and Germany and, in the not too distant future still others, to base their defense on the submarine, the intermediate-range rocket and the hydrogen bomb. Rockets launched from submarines and picked up by radar in flight can be traced back to the point where the submarine was, when it launched its rocket, but this does not permit identifying the nation responsible for the attack. Thus, atomic striking forces based on submarines will render the system inherently instable and may lead to an all-out atomic catastrophe which neither Russia nor America wants.

#### Conclusions.

The atomic stalemate in the solid-fuel stage could be rendered metastable if the great powers adopted an adequate long-term policy with respect to the bomb. But in addition they would have to act in concert with each other in order to

prevent nations, that might make the threat of "murder and suicide" an integral part of their national policy, from acquiring a substantial atomic capability. The great powers would have to act in concert also to eliminate the danger of instability inherent in a defense system based on the launching of rockets from naval vessels.

Clearly, the interdependence of the world is such that the Great Powers, if they act in concert, are in a position to prevent all other nations from upsetting the stability of the stalemate by stockpiling bombs or by maintaining a system suitable for the delivery of such bombs. But, would the Great Powers assume this responsibility and, having assumed it, persevere in such an endeavor?

The chances that this would happen would be obviously enhanced if they were in a position to act in this matter in conformity with international legality and morality. It is conceivable, but by no means sure, that the machinery set up in the United Nations might enable the Great Powers to do so.

At the end of the last war, it was generally believed that--as long as the great powers act in concert with each--the United Nations organization may be able to guarantee the security of all other nations and may make it unnecessary, as well as impossible, for these other nations to go to war with each other or otherwise endanger world peace. Attempts made in the past ten years to use the United Nations for purposes other than those for which it was designed, have

greatly  
/weakened this organization. But

if it were possible to restore the United Nations to its original function and base its actions on decisions of the Security Council, arrived at with the concurring vote of the five permanent members, <sup>then</sup> the Great Powers acting in concert with each other, would be legally as well as morally justified in imposing <sup>on all other nations such</sup> arms limitation and such other measures as the stability of the atomic stalemate may require.

of course,  
Such measures could, include the maintenance of armed forces operating under the United Nations' auspices in a few selected regions of the world.

Before the United Nations could effectively fulfill the functions that it was meant originally to fulfill, it might be necessary, however, to recognize China as one of the five permanent members of the Security Council. The original choice of the five permanent members might not have been a judicious choice, but once the choice has been made, and until such time as the Charter might be modified, it will not be possible for the Security Council to supply the moral and legal justification for the steps that might be taken in order to keep the atomic stalemate from becoming instable.

What is urgently needed at this time is not so much an agreement between America and Russia aimed at stopping bomb tests, but rather a meeting of the minds between America and Russia on the long-range policies that Russia and America will have to pursue in order to render an atomic stalemate stable.

Russia and America need to reach a meeting of the minds on the means that need to be employed in order to render the stalemate stable and on the kind of political settlement that they must reach in order that they shall be able to employ these means.

Appendix.

And, now, what about bomb tests?

The American Government has stated that America now knows how to make hydrogen bombs of high power which are 96% "clean." If a bomb is 96% "clean," it is clean enough and one might think that there should be no real need to develop such bombs further, in order to make them still cleaner.

But are these hydrogen bombs of great power which are 96% "clean," as light and as compact as the "dirty" hydrogen bombs of equal power which America now knows how to make? Would these "clean" hydrogen bombs be light enough and compact enough to be carried by the kind of rockets which America now knows how to make?

If the answer to these questions is in the negative, as it well might be, and further, if the rockets which America now knows how to make are capable of carrying hydrogen bombs of the "dirty" variety (but not of the "clean" variety), then America will be tempted to continue to stockpile "dirty" hydrogen bombs instead of going over to the stockpiling "clean" hydrogen bombs.

The same might be true for Russia, though to a lesser degree. For Russia may be at present further advanced along the road of developing solid-fuel-long-range rockets that are

capable of carrying heavy "payloads." Thus, if Russia also knows how to make the kind of "clean" hydrogen bombs of great power which America has learned how to make, she could more easily afford to stockpile them in place of the "dirty" hydrogen bombs than could America.


In these circumstances, I am led to conclude that America and Russia may well need to reach an agreement on bomb tests, but what they need to agree upon might not be a cessation of all bomb tests. Perhaps they ought to agree to continue such tests as they need to perform in order to learn--either through their own separate efforts or through a joint effort--how to make bombs of great power which are compact and light enough. Such test would then permit them to dispense with the "dirty" hydrogen bombs.

Unless this is done the cessation of bomb tests might turn out, in retrospect, to have been a step not in the direction of disarmament but rather in the direction of misarmament.



THE UNIVERSITY OF CHICAGO  
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THE ENRICO FERMI INSTITUTE  
FOR NUCLEAR STUDIES

July 18, 1958

To : Richard Feynman  
Harrison Brown  
Lee DuBridge  
Eugene Rabinowitch  
H. C. Urey   
H. J. Muller  
Louis Ridenour

From: Leo Szilard

Enclosed is a collection of documents which, I believe, will interest you. I should appreciate getting such comments from you as you care to make at this time.

This is an informal and unofficial query that I am making personally. Any more official approach to you would come to you through Col. Leghorn who functions as our "official" line of communication with the Academy of Sciences of the Soviet Union.



C  
O  
P  
Y

July 17, 1958

Dr. Alvin Weinberg  
Director  
The Oak Ridge National Laboratory  
Oak Ridge, Tennessee

Dear Al:

Since I wrote you on July 14th, the American Academy of Arts and Sciences in Boston has set up a Committee which will assume responsibility for the Study Relating to the World Security Problems Raised by the Bomb, about which I have written to you. The Committee is to be called, "A Special Committee on World Security Problems Raised by Nuclear Weapons."

There will be both a general supervisory committee and an operating subcommittee to carry out the study. The General Supervisory Committee will be under the Chairmanship of John T. Edsall of Harvard, and its other members are supposed to be: Saville R. Davis, Leo Szilard, Walter Whitman and Jerome Wiesner. The membership of the Operating Subcommittee is supposed to be: Leo Szilard (Chairman), Richard Leghorn, Walter Whitman and Jerome Wiesner.

I am enclosing an extra copy of the letter which you might want to pass on to Mr. Keith Glennan as information, additional to the material that you had sent him.

With kind regards.

Sincerely,

Leo Szilard

AMERICAN ACADEMY OF ARTS AND SCIENCES

280 NEWTON STREET · BROOKLINE STATION · BOSTON 46, MASSACHUSETTS · JAMAICA 4-0303

15 August 1958

Dear Professor Urey:

The members of the Academy's Operating Committee on the Study of World Security Problems Raised by Nuclear Weapons invite your participation in this study.

I understand that you have already received verbally some particulars on the project from Mr. Richard S. Leghorn who is a member of the Committee. The enclosed material will serve to further acquaint you with the details and the Committee's immediate plans.

We wish to have as soon as possible your indication of interest in this study and your availability for participation in the meetings which are scheduled on 6 September 1958 in Washington, D. C., and on 24 September 1958 in Moscow. Your completion of the attached sheet, therefore, is requested and prompt mailing of it in the envelope which has been provided for your convenience will be appreciated.

Sincerely yours

*Ralph W. Burhoe*

Ralph W. Burhoe  
Executive Officer

L/s

Enclosures

*Write impossible Sept 8, saying it was*

A STUDY OF  
WORLD SECURITY PROBLEMS RAISED BY NUCLEAR WEAPONS

Summary of Program

This study, recently organized under the auspices of the American Academy of Arts and Sciences, will explore world security problems raised by nuclear weapons. A suggested approach is set forth in the adjoining communication by Leo Szilard.

It is anticipated that participating American scientists (some engaged in theoretical activities, and others with backgrounds in weapons technology and military affairs) will meet periodically in the United States for discussion of papers and ideas, and that occasional meetings will be arranged with Russian scientists through the cooperation of the USSR Academy of Sciences.

The first meeting in the United States of American scientists is scheduled for Saturday and, possibly, Sunday a.m., September 6 and 7, 1958, at the Hotel Shoreham in Washington, D. C.; and the first meeting in Moscow with Russian scientists for two weeks is to begin on September 24, 1958. Those traveling to Moscow will convene at the Hotel Regina in Vienna on September 21 for an all-day meeting on September 22, prior to traveling to Moscow on September 23.

Purpose of Activity

Broadly, the study has two purposes: (1) to explore technically and politically feasible security arrangements which might be effected in the world during the 1960's to avoid wars which nobody wants; and (2) to develop a communication channel with the Russians for dispassionate and objective consideration of these longer range, mutual security goals. The formation or influence of public opinion is not a direct objective of this study.

## A Study of World Security Problems Raised by Nuclear Weapons

The techniques of scientific study--individual papers, seminars, and the like--will be employed. Any formal meeting aimed at proclaiming a consensus of the participants will be strictly omitted from the program. While seeking to avoid any impression of secrecy, every attempt will be made to keep meetings fully quiet and private in character. No public communication of results is currently planned, but it is foreseen that individual participants may wish to communicate their thoughts and impressions privately to officials and to leaders of organizations concerned with public opinion formation in this problem area. Individual papers presented and discussed as part of the study may be published separately in a normal manner.

### Origin of Activity

At the Quebec Conference of international scientists in April, 1958, Richard S. Leghorn, Leo Szilard, and Jerome B. Wiesner discussed the possibilities of informal meetings of Russian and American scientists with Professor Topchiev, then General Secretary and now, additionally, Deputy Chairman of the USSR Academy of Sciences. A memorandum was prepared, and key excerpts follow:

April 6, 1958.

FROM: Richard Leghorn, Leo Szilard and Jerome Wiesner

TO: Academician Topchiev.

We propose that there shall be held a meeting in Moscow in which ten to fifteen American scientists, of the kind to be described later, would participate, and about an equal number of Russian scientists of approximately the same sort. This meeting might last two weeks and it should take place at the earliest time that will suit those who are to participate and, if possible, not later than July of this year.

About one third of the American group might be scientists

## A Study of World Security Problems Raised by Nuclear Weapons

who are familiar with the technology of modern weapons and who, by virtue of their relationship to the United States government, are in a position to communicate their own thinking to the government, but who are not, themselves, officials of the United States Government. About three or four of the Americans may be mathematicians or theoretical physicists or theoretical chemists.

The topic of the proposed discussions at Moscow might be circumscribed as follows:

"There exists, in the present state of the atomic arms race, a serious danger that an atomic war might break out which neither America nor the Soviet Union wants. What are the circumstances which might lead to the outbreak of such a war, and how could these circumstances be modified in order to diminish, and later on to eliminate completely, this danger?"

At the meeting in Moscow we would propose to discuss, as frankly as we have discussed in Quebec, controversial issues, including the difficulties which stand in the way for America to accept certain proposals which have been made by the government of the Soviet Union and for the Soviet Union to accept certain proposals that have been put forward by the American government. Sometimes these difficulties come from apprehensions of one government, of which the other government is not fully aware. The proposed discussion at Moscow should enable both the American participants and the Russian participants to think about ways that may enable us to get around such difficulties.

After the conclusion of the conference, the participants may be able to explain to their own governments their, perhaps greatly improved, understanding of the difficulties which stand in the way of an agreement between the two governments and which relate to the question of controlled arms reduction, as well as certain other problems which are intimately related to this question. Our reasons for believing that the informal talks between American and Russian scientists, which we propose, might be fruitful are essentially as follows:

Our talks at Quebec have convinced us that among Russian, as well as among American, scientists there are many who are not only men of good will, but who are also able to explore dispassionately controversial issues. Such men should be able to clarify, in their own minds, what the difficulties are that are impeding progress towards reaching an understanding between America and Russia even in areas where these two nations have a strong common interest.

\* \* \*

A Study of World Security Problems Raised by Nuclear Weapons

The American participants in the proposed meeting would want to prepare, in advance of the meeting, memoranda which may be helpful in focussing the discussion on what they believe to be the relevant topics. Some of these American documents will be concerned with problems which they believe to represent valid apprehensions of the Soviet Union.

\* \* \*

We suggest that, similarly, our colleagues in the Soviet Union, who are to participate in the proposed meeting, may prepare documents on topics which are concerned with those apprehensions of the American government which they may recognize as valid.

In addition, both the American and Russian participants might prepare documents which relate to topics that represent apprehensions of both America and the Soviet Union, such as the danger of an accidental outbreak of an atomic war, and the risks involved in the possession of atomic weapons by nations other than America and the Soviet Union and Britain.

We believe that the invitations to the proposed Moscow meeting should not come from us, but rather that certain Americans be invited individually by the Soviet Academy of Sciences. However, we are prepared to say who, among American scientists, could be particularly useful - in our opinion - at the proposed meeting. We are also prepared to offer our good offices in exploring who, among those whom we regard as desirable participants of the meeting, is likely to be able to attend the meeting. We propose to keep in touch with each other on the subject of the selection of American participants, and one of us may keep in touch with Academician Topchiev in order to keep him informed on who, among the proposed American participants, may be available at the date set for the meeting.

After his return to Russia, Professor Topchiev replied on June 18 in a letter to Richard Leghorn:

I received your letter and a signed copy of the Memorandum. Upon my return to Moscow from Canada I informed my colleagues in the USSR Academy of Sciences about the Second Pugwash meeting of Scientists, which in my opinion was fruitful and also of your proposal to hold a private conference of soviet and american scientists in Moscow in July to discuss the possible ways to eliminate dangers of an atomic war as well as the actions that might be taken in this connection by the scientists of USSR and USA.

## A Study of World Security Problems Raised by Nuclear Weapons

My colleagues met this proposal with interest and expressed a hope that such a Conference will contribute towards eliminating the threat to humanity of a devastating atomic war and towards establishment of mutual understanding and trust between our countries.

The problems put forward in your memorandum arouse no objections on our part and can be included into the number of problems to be discussed at this Conference. We would appreciate your letting us know before the beginning of the Conference, if your time permits, other considerations and proposals on your part referring to the topic of the discussions.

The Academy of Sciences will invite to this Conference american scientists as its guests in the USSR for 2-3 weeks. The Conference could begin on July 28 if it is convenient for you.

We would like to have particulars on your american colleagues in order to be able to extend invitations and help with getting visas in time.

\* \* \*

Both because the Russian invitation did not reach us until late in June, which made arrangements difficult for a July 28 meeting in Moscow, and because Washington officials were apprehensive of even a private meeting at that particular time, the Moscow meeting has been postponed, in agreement with Professor Topchiev, until September 24.

### Attitude of United States Government

A considerable number of discussions have taken place between members of the Operating Committee and key government officials in the White House, State Department, and other interested agencies. The official government attitude as expressed in a letter from the State Department, copy attached, is essentially one of "no objection" to such informal, private talks with the Russians.

### Financial Support

For the first year's operation, a budget of \$50,000 is envisioned;



A Study of World Security Problems Raised by Nuclear Weapons

\$20,000 of this amount is to cover transportation expenses in connection with the Moscow meeting.

Fifteen thousand dollars has already been received or pledged-- \$5,000 from the William C. Whitney Foundation, \$5,000 from the Christopher Reynolds Foundation, and \$5,000 from Mrs. Ralph Pomerance. Gifts in support of this study can be made directly to the American Academy of Arts and Sciences which qualifies as a non-profit organization for tax purposes, or to the University of Chicago which qualifies as an educational institution for tax purposes; each has also consented to act as a disbursing agent for the study.

Participants

The Operating Committee for the study is presently constituted as follows:

Leo Szilard, Chairman  
Harrison S. Brown  
Richard S. Leghorn  
Walter G. Whitman  
Jerome B. Wiesner

Richard S. Leghorn

August 15, 1958

Attachment

C O P Y

DEPARTMENT OF STATE

Washington

August 5, 1958

Dear Colonel Leghorn:

I refer to your letter of June 20, 1958 to Mr. Smith and to Mr. Davis' telephone call to you of July 8, 1958 concerning the possibility of organizing informal exploratory talks between Soviet and American scientists to discuss the arms control problem in relation to the security needs of the two countries. You asked Mr. Davis if the Department could send a follow-up letter setting forth the substance of the points made in Mr. Davis' call and I am glad to do so.

The Department is not in a position, of course, to give official sanction to the meeting you propose. You will appreciate, moreover, that the Soviets might well exploit any such meeting to embarrass both the American participants and the United States Government. I am confident you will also understand that American participants should not include any one with policy advisory responsibilities toward the United States Government.

However, the Department does not wish to discourage your proposed visit to Moscow, which we understand is unofficial, informal and exploratory. We also understand that your group desires to avoid publicity. In this connection, we believe that any formal meeting, which would inevitably be publicized, would be undesirable.

As you know, our exchange program envisages exchanges of scientists. We also hope that meetings between American and Soviet scientists at international scientific conferences will become more and more numerous. We believe that your objectives can best be pursued in the context of informal and unpublicized contacts.

Sincerely yours,

(Signed) Foy D. Kohler

Foy D. Kohler  
Deputy Assistant Secretary  
for European Affairs

Colonel Richard S. Leghorn,  
Itek Corporation,  
1605 Trapelo Road,  
Waltham, Massachusetts.

## WORLD SECURITY PROBLEMS RAISED BY NUCLEAR WEAPONS

### Proposed Scope of Study

It is proposed to carry out a study of world security problems raised by nuclear weapons through informal discussions among a group of American scientists, and also through informal discussions between American and Russian scientists to be held under the auspices of the USSR Academy of Sciences.

A committee appointed by the American Academy of Arts and Sciences will have over-all responsibility for this study. The initial meeting among American scientists will be held on September 6, 1958, in Washington, D. C. Informal discussions between American and Russian scientists will be held in Moscow, starting on or about September 23, 1958, and lasting about two weeks.

I propose that American scientists who participate in this study, including those who may attend the Moscow discussions, meet informally perhaps six to ten times a year for an exchange of views, and that further meetings with Russian scientists be arranged through the USSR Academy of Sciences as the need may arise. I further propose that for the next year we narrow down somewhat the subjects of our discussions and deal with issues which appear to have the greatest urgency.

I, personally, am inclined to assume that both Russia and America are going to retain large stockpiles of hydrogen bombs of high power (either of the dirty or of the clean variety, or both) for the next ten years, and perhaps throughout the entire foreseeable future. As far as I can see, we find ourselves at present in a transitional phase of a stalemate between the atomic striking forces of Russia and of America; and the character of the stalemate is still rapidly changing. We appear to be moving towards a more advanced, and possibly much steadier, stage of the stalemate, which may be based on solid-fuel, long-range rockets capable of carrying hydrogen bombs of high power. Such rockets could be launched from bases scattered inside of America and of Russia, which could, and presumably would, be made invulnerable against an aerial attack.

If these assumptions are correct, then I believe that the most important first step would be for America and Russia to reach a meeting of the minds on the measures which would be needed in order to render the atomic stalemate stable so that there may not break out an all-out atomic war that neither America nor Russia wants. Such an all-out atomic war might come about as a result of an accident or an error in judgment. Even more likely, it might come about as a result of America and Russia intervening militarily in a conflict that might arise between two other nations; in such a case, what might start out as a local war could end up as an all-out atomic catastrophe.

World Security Problems Raised by Nuclear Weapons (Proposed Scope of Study)

Therefore, we ought to examine, first of all, from a long-term point of view, what kind of policies, that America and Russia might pursue, would be adequate to stabilize the atomic stalemate. Subsequently, we could then examine, from the long-term point of view, the policies that Russia and America may be driven to adopt in the present transitional phase of the stalemate. Some short-term policies, were they once adopted and implemented, might make it very difficult for Russia and America later on to adopt the measures which are desirable from the long-term point of view; i.e., from the point of view of rendering the atomic stalemate stable. For this reason, we ought to try to find out as soon as possible what kind of an understanding America and Russia would need to reach at an early date in order to make it possible for them to refrain from adopting, in the present transitional phase of the stalemate, policies that would be detrimental from the long-term point of view.

Should the other participants of the study agree with this general approach to the security problem, then this approach could perhaps serve as the basis of the first informal discussion that our group will have in the fall.

The background leading up to this study is described in an enclosed communication which has been prepared by Richard S. Leghorn.

Leo Szilard

August 6, 1958

From the desk of  
HAROLD C. UREY

New York Hos.

Cornell Med. School  
69th St.

Re 4-9609

Maria Schrecker

Templeton

2-8794.

4 2654

December 23, 1959

Dr. Leo Szilard  
New York Hospital  
Cornell Medical School  
69th Street  
New York, New York

Dear Leo:

Reports out here say that you are in the New York Hospital suffering from an incurable case of cancer. Needless to say, I and all of your friends here are most shocked and awfully sorry. We hope very much that the reports are not true. If possible, we would be glad to hear from you, even a note telling us what the facts are.

I do hope that you keep cheerful and also keep up your courage.

I am scheduled to arrive in New York on my way to Nice at 4:45 p.m. on January 9, leaving there at 8 p.m. If my plane is on time, I could slip into the city to see you.

With best regards,

Sincerely yours,

Harold C. Urey