

[Chron. File - March 1940] [Chron. 8/10/45]

[Comm. - Nat. Def.]

Ex 7a

A. Einstein
112 Mercer Road
Princeton, N.J.

March 7, 1940

Dr. A. Sachs
c/o Lehman Corp.
1 South William St.
New York, N. Y.

Dear Dr. Sachs:

In view of our common concern in the bearings of certain experimental work in problems connected with national defense, I wish to draw your attention to the development which has taken place since the conference that was arranged through your good offices in October last year between scientists engaged in this work and governmental representatives.

Last year when I realized that results of national importance might arise out of the research on uranium, I thought it my duty to inform the Administration of this possibility. You will perhaps remember that in the letter which I addressed to the President I also mentioned the fact that C. F. von Weizsaecker, son of the German Secretary of State, von Weizsaecker, was collaborating with a group of chemists working upon uranium at one of the Kaiser Wilhelm institutes, namely, the Institute of Chemistry. Since the outbreak of the war, interest in uranium has intensified in Germany. I have now learned that research there is being carried out in great secrecy and that it has been extended to another of the Kaiser Wilhelm institutes, the Institute of Physics. The latter has been taken over by the Government and a group of physicists, under the leadership of C. F. von Weizsaecker, who is now working there on uranium in collaboration with the Institute of Chemistry. The former director was sent away on a leave of absence apparently for the duration of the war.

Should you think it advisable to relay this information to the President, please consider yourself free to do so. Will you be kind enough to let me know if you are taking any action in this direction.

Dr. Zillard has shown me the manuscript which he is sending to the Physics Review in which he describes in detail a method for setting up a chain reaction in uranium. The papers will appear in print unless they are held up, and the question arises whether something ought to be done to withhold publication. The answer to this question will depend on the general policy which is being adopted by the Administration with respect to uranium.

I have discussed with Professor ^{Wise} ~~Wigner~~ of Princeton University and Dr. Zillard the situation in the light of the information that is available. Dr. Zillard will let you have a memorandum informing you of the progress made since October last year so that you will be able to take such action as you think in the circumstances advisable. You will see that the line he has pursued is different and apparently more promising than the line pursued by Monsieur Joliot in France about whose work you may have seen reports in the papers.

Yours sincerely,

Albert Einstein
(Signed)

Cong - Nat. Def.

U. S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

WASHINGTON

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS

LJB:DEK

June 5, 1940

IN YOUR REPLY
REFER TO FILE

D

Dr. Alexander Sachs,
One South William Street,
New York, N. Y.

Dear Dr. Sachs:

In your capacity as a member of the coordinating committee established here in Washington, I would be greatly obliged if you could find it practicable to secure from the Union Minière of the Belgian Congo answers to the questions outlined below. In presenting this matter you may desire to be accompanied by one or more of our scientific advisors at Columbia University, including Drs. Pegram, Urey, Fermi and Szilard, but I shall leave this to your own good judgment.

Discontinue

The questions in which our Committee is interested are as you know as follows:

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Africa
Tenn*

(1) What is the stock of mined uranium left in the Belgian Congo, and in what form is it? What stocks, if any, were left in Brussels?

(2) What are the possibilities of mining uranium ore in the Belgian Congo and transporting it to this country under present conditions? What would be the out-of-pocket costs of mining "X" amounts, according to scale of profitability of operations from the standpoint of overhead?

(3) Under what conditions would the company on a business basis and at the request of the Belgian Government in response to American mediation, be willing to export its own uranium ore to the United States, the company to retain title to the ore, but committing itself not to re-export it without special permission.

(4) Finally, what would be the practical amounts that could be extracted and transported over, say, three and six months periods, in order to have a basis of comparison with similar maximal amounts that could be secured from, say, Canada in the same periods?

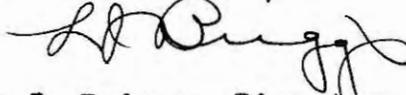
Dr. Sachs

-2-

June 5, 1940

I shall await your findings with much interest.

Sincerely yours,

A handwritten signature in cursive script, appearing to read "L. J. Briggs".

Lyman J. Briggs, Director.

October 17, 1939

Dear Professor Wigner:

In keeping with our conversation on your recent visit to my office and in furtherance of later developments reported to you by Dr. Szilard, I had a conference in Washington on October 11th with a committee appointed by the President, headed by General Watson, his executive secretary and military aide. After that conference I had the honor to present the matter to the President and to leave with him a dossier consisting of Dr. Einstein's letter, Dr. Szilard's memorandum, and my own original letter-memorandum on the subject addressed to him.

On the following day the President appointed a small committee representing the Army, the Navy and the Bureau of Standards, in the persons of Colonel Adamson, Commander Hoover and Dr. Lyman Briggs. Dr. Briggs then, in consultation with me, arranged and formally issued an invitation on the following day for a conference to be held this week at Washington with your goodself and Dr. Szilard, as the scientific complement, and myself as the intermediary, and the informal committee above mentioned. To suit your joint preferences, as conveyed to me by Dr. Szilard, the date was shifted from Wednesday to Saturday morning, October 21st, at 9:30 at the office of the Bureau of Standards in the U. S. Department of Commerce. This afternoon Dr. Briggs warmly approved the suggestion of Dr. Szilard regarding the inclusion of Professor E. Teller of George Washington University and indicated that he would add two scientists conversant with this subject. Such, then, is the diary of the events since our last talk.

Will you be good enough to confirm to me your acceptance and will you also indicate whether you would wish to have a conference prior to our departure, or, alternatively, that we meet Friday night on the 12:50 train from Pennsylvania Station to Washington. In either event, I should like to have you and Dr. Szilard as my guests at breakfast at the Carlton Hotel Saturday morning, and we would thereafter proceed to the Department of Commerce building for our appointment.

Yours sincerely,

Professor E. P. Wigner,
Fine Hall,
Princeton University,
Princeton, N. J.

Covey - Nat. Dep.
Ex. 7a

A. Einstein
112 Mercer Road
Princeton, N.J.

March 7, 1940

Dr. A. Sachs
c/o Lehman Corp.
1 South William St.
New York, N. Y.

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I have discussed with Professor ^{W. C.}Wigner of Princeton University and Dr. Zilgard the situation in the light of the information that is available. Dr. Zilgard will let you have a memorandum informing you of the progress made since October last year so that you will be able to take such action as you think in the circumstances advisable. You will see that the line he has pursued is different and apparently more promising than the line pursued by Monsieur Joliot in France about whose work you may have seen reports in the papers.

Yours sincerely,

Albert Einstein
(Signed)

Com. Nat. Div.

Columbia University
in the City of New York

DEPARTMENT OF PHYSICS

May 14, 1940

Dr. Alexander Sachs,
c/o Lehman Corp.,
1 South William Street,
New York City.

Dear Dr. Sachs:

I wish to let you know that the experiment conducted at Columbia University on four tons of graphite for the purpose of measuring the absorption cross section of carbon for slow neutrons has now been concluded with satisfactory result. The absorption cross section of carbon was found to be encouragingly small, actually somewhat smaller than the tentative figure reported orally at the conference in Washington on April 27, and only about one-third of the upper limit previously reported in the literature.

Sincerely yours,



George B. Pegram

GBP:H

U. S. DEPARTMENT OF COMMERCE
National Bureau of Standards
Washington

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Address Reply to
National Bureau of Standards
LJB:DEK

In your reply
Refer to file
D

June 5, 1940

Dear Dr. Sachs:

In your capacity as a member of the coordinating committee established here in Washington, I would be greatly obliged if you could find it practicable to secure from the Union Miniere of the Belgian Congo answers to the questions outlined below. In presenting this matter you may desire to be accompanied by one or more of our scientific advisors at Columbia University, including Drs. Pegram, Urey, Fermi and Szilard, but I shall leave this to your own good judgment.

The questions in which our Committee is interested are as you know as follows:

- (1) What is the stock of mined uranium left in the Belgian Congo, and in what form is it? What stocks, if any, were left in Brussels?
- (2) What are the possibilities of mining uranium ore in the Belgian Congo and transporting it to this country under present conditions? What would be the out-of-pocket costs of mining "X" amounts, according to scale of profitability of operations from the standpoint of overhead?
- (3) Under what conditions would the company on a business bases and at the request of the Belgian Government in response to American mediation, be willing to export its own uranium ore to the United States, the company to retain title to the ore, but committing itself not to re-export it without special permission.
- (4) Finally, what would be the practical amounts that could be extracted and transported over, say, three and six months periods, in order to have a basis of comparison with similar maximal amounts that could be secured from, say, Canada in the same periods?

I shall await your findings with much interest.

Sincerely yours

Lyman J. Briggs, Director
(Signed)

Copy

420 West 116th Street
New York City
May 10, 1940

Dr. Alexander Sachs
c/o Lehman Corporation
One South William Street
New York City

Dear Dr. Sachs:

Our work concerning systems composed of carbon and uranium has now reached a stage at which it seems necessary to organize a large scale experiment. Only through actually carrying out such an experiment can it be demonstrated beyond doubt that a nuclear chain reaction can in fact be maintained in a system composed of carbon and uranium.

Since it appears necessary and urgent to obtain certainty in this matter we desire to start organizing a large scale experiment. This experiment would require about 100 tons of graphite and perhaps 10 to 20 tons of uranium metal. It would also require elaborate mechanisms designed to stabilize the chain reaction and to safeguard against overheating and the possibility of an explosion. Realizing that this is an enterprise which may require to its conclusion an expenditure of \$200,000. to \$500,000. we propose to carry out this project in successive stages. If the results obtained during the first stage are satisfactory, then the expenditure necessary for the second stage would appear to be justified, and the second stage could be started according to schedule, etc. If this procedure were adopted, then the expenditure would gradually rise parallel to the increase in our assurance of the smooth functioning and final success of the large scale experiment.

In the first stage we would propose to carry out a general survey of all nuclear constants involved with a view to confirming the values previously obtained and to narrowing down the limits of experimental error of the observed values of these constants. A successful conclusion of this survey would strengthen our assurance of the ultimate success of the experiment and would enable us to find the optimum conditions for its performance. Concurrently, with this survey, certain other work would have to be done in order to prepare the ground for the experiment. Such work would include the designing of constructional details, the carrying out of technological tests on samples of materials which have to be used in large quantities in the ultimate experiment, and obtaining bids for the manufacturing of such material in the required quality and quantity. An expenditure of \$50,000. would

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probably be sufficient to bring this first stage in the organization of the large scale experiment to its conclusion, so that we would be in the position of entering into the second stage of the work, provided that the result of the proposed survey of the nuclear constants is favorable. In this second stage the expenditure would gradually rise and might reach a total of \$500,000. by the time when the large scale demonstration experiment will be completed.

If a fund were set up under the direction of a board of trustees who had the confidence of the Government, as set forth in the letter by Dr. Einstein that was written following his conversations with you and read by Dr. Briggs at the meeting of April 27, Dr. Fermi and I would be glad to accept the responsibility for carrying out this work under the direction of such a board, and would be pleased to have our work supervised by a small committee of scientists who might be entrusted with the task of advising the board.

In my personal opinion, it would be advisable that the proposed small committee of scientists be left some latitude in devoting, as was suggested at the last conference, up to 25% of the total expenditure for investigating the possibility of a fast neutron reaction. It is further my personal opinion that, if the study of the separation of the uranium isotope were to be included in the program of work, then Dr. Urey of Columbia and Dr. Beams of the University of Virginia ought to be asked to accept the responsibility for the direction or coordination of this line of work in the same way in which Dr. Fermi and I are prepared to take upon ourselves the responsibility in connection with the work on commercial, unseparated uranium.

Yours sincerely,

signed: Leo Szilard

Please refer to Alexander's file.

*[Chron File
April 1940]*
Exhibit 17

Cong - Nat. Def.

Aide-memoire for conferences with
governmental authorities on current
and prospective needs of Uranium-
National-Defense project.

IMPORT OF WAR DEVELOPMENTS FOR
AND
APPLICATION TO NATIONAL DEFENSE OF URANIUM ATOMIC DISINTEGRATION

by

Alexander Sachs

April 20, 1940

Since the inauguration in the summer of 1939 of discussions with scientists concerned with uranium atomic disintegration, the writer served as the representative and associate of Dr. Einstein in presenting the uranium project to the President of the United States in October 1939 and as a member of the advisory group appointed by the President for determining the utility of the research for national defense and the extent to which the government should promote and support the researches that have thus far been carried on in scattered places and on limited scales in our universities.

1.

As a result of the enlightenment received and the discussions had by the writer with Drs. Einstein, Wigner, Fermi and Szilard, it may be set down as a scientific conclusion that recent experiments have shown (a) the possibility of liberating energy in uranium by means of a chain reaction, and (b) that in the course of such chain reaction it should be possible to utilize the energy liberated for the generation of great power and, what would be of greatest significance, for the promotion of enormously potent explosives.

Dr. Enrico Fermi - the Nobel prize man in physics who occupies a visiting research professorship at Columbia, and who since Italy's military alliance with Nazi Germany has decided to remain in the United States - has played an important part in the extension of the frontiers of the research on atomic disintegration through experiments with uranium. Yet in conversation, whether as a style of expression or of thought, he has remained cautious about the convertability, so to speak, of the indicated potentiality into a demonstrated fact of a maintained chain reaction; and he has a tendency to qualify his statements about the possibilities with the reservation that it might well take years to demonstrate such a chain

reaction in operating with large masses of ordinary uranium similar to the quality of ores used in industrial chemical engineering. Dr. Leo Szilard - who originally worked on the problem at the Kaiser Wilhelm Institut at Berlin and since the advent of Nazism continued his researches at Cambridge University, England,* whence he came to the United States in 1938 - speaks in a more optimistic vein than any of the scientists at work on uranium in the United States, most of whom have been at one time or another brought into the orbit or quoted at the conferences at Washington on the subject that were held under the direction of Lyman J. Briggs, Director of the Bureau of Standards, Department of Commerce. In Dr. Einstein's opinion, Dr. Szilard's work on this subject and in this phase of the uranium research is deemed to be of coeval importance with that of Dr. Fermi; while Dr. Einstein does not regard himself as an experimentalist in this field, he shares Dr. Szilard's optimism with regard to the surmountability of the remaining difficulties. The present writer, as a non-physicist, would not of course venture an opinion alongside those cited. But as an economic historian and as a practical economist versed in the conduct of technological research, he has ventured to convey to the scientists mentioned and to the governmental authorities his hypothesis that the difficulties which loom so large now might well arise from the characteristic physical limitations of the pre-pre-pilot-plant operations that are carried on in the typical university laboratories. If the project is fraught with promise and importance for national defense, then it seems to him worth while to approximate very soon the conditions of industrial-pilot-plant operations. This might entail the building of equipment, machinery, and even the construction of adequately scaled and adequately protected physical plant.

* Incidentally, progress in this research in Britain renders men like Dirac and Chadwick of Cambridge, and F.A.Lindemann of Oxford - a close friend of Churchill's - a most valuable collaborative group.

2.

The higher and more elaborate technology that has been introduced by Nazi Germany in its military weapons and operations - as compared with not only the last war but the current military weapons and operations of the Allies - constitutes a challenge to the democracies that are industrially and technically equipped. It is therefore the writer's conviction - which he has voiced repeatedly - that once we relate the uranium research to national defense, it should be regeared in type and tempo to the most advanced technological research that has been carried out by the American chemical and electrical companies. Indeed, the probability and the hope that the needs of national defense will be taken seriously by the country means that a new norm will presently be evolved for American technical industry in relation to defense research and defense production. As a nation we are just becoming aware of the fact that the superior Nazi technology has been riding roughshod over the totally inadequately prepared Allied victims of Nazi aggression. What has taken place in Poland, Denmark and Norway, and will doubtless go on through other European countries that will be invaded, is that the pacific-minded countries have not brought their national defense up to the quantity and quality required for technological warfare. When the import of the European war is assimilated by the American people and national defense is undertaken as a national enterprise, then we may be confident that we will match in war the progressiveness of our civilian technology and come to surpass it, which means surpassing the German military technology.

Thus reoriented on the interaction between technical research and national defense, it becomes tenable to regard possibilities as probabilities and to assume that what sagacious scientists hold as eventually achievable after a term of years could be telescoped into a much shorter period. Expressed differently,

what the writer calls an adequate organizational framework is itself the precondition for the rapid ascertainment and effectuation of the value of the nuclear research for national defense. In attempting then a mental preview of the import of the current experiments for national defense we should detach ourselves from the dubieties, the cautions and the hesitations that are typical of scientific research rapportage.

3.

Proceeding, then, with admitted mental leaps to the stage beyond the demonstration of chain reaction, let us suppose that such a reaction is demonstrated and maintained in the fission of ordinary commercial uranium. The first meaning is, of course, that we would be anticipating and outwitting the Nazi effort at the Kaiser Wilhelm Institut to produce such power and/or such bombs. The danger that was mentioned by Dr. Einstein in his letter to the President dated August 2, 1939 would be averted. We would also be in a position to decide the use of such bombs against Germany, assuming the continuation of her military march and aggression, entailing as is deemed by him and the writer probably the involvement of the United States in the war. In the pursuit of political and economic research we must take cognizance of the implications inherent in the existence of an Axis consisting of Germany, Italy and Japan and of the probability. The alliance of Japan with Germany means that an enlargement of the war to the scale of the last one would in time carry with it aggression of Japan against the British and Dutch empires already or expected at war with Germany - and later also against the United States. Now in the case of a war between Japan and the United States, the disadvantage under which we labor is the enormous magnitude of the distance between continental United States and our possessions and between our possessions and the Japanese homeland. It is therefore advisable to articulate not only the consequences of the uranium chain reaction for the production of bombs, but also for the development of a new type of power. In the first case, the release of the energy would take the form of the

production of a bomb of hitherto unimagined potency. In the second case, there could be concentrated in a plant of very small compass a driving and propelling power surpassing any of the present elaborate power plants.

It is in connection with this second alternative use that an attempt was made by the writer to evoke from the group members a spelling out of the application. The naval base at Hawaii is some 3500 miles away from Japan. In the discussion the following comparison was made on the basis of assumed data that remain to be checked with technically informed navy people. A capital warship assumed to carry a maximum load of about 4000 tons of oil would be using about 1/2 ton of oil per mile if cruising at a satisfactory speed. If this be valid, then such a warship would have to be refueled at Hawaii destined for operating in the vicinity of the Japanese islands.

An estimate described as conservative was made by Dr. Szilard that we may expect one ton of uranium to supply as much power as about 3000 tons of oil; and that pending the outcome of the still newer experiments there are chances that a ton of uranium would produce as much power as would correspond to from 1/3 to 1 million tons of oil. In the light of that, the question was put whether it would be possible to equip boats stocked with uranium derivative-power equal to the range of the tremendous oil reserves mentioned. This would free naval war weapons from the limitations on cruise range due to the necessity of refueling. The discerned connection between the Navy and the airplane through air carriers would magnify the flexibility and potency of the uranium applications in the dual forms of power and explosive.

The foregoing considerations prompted members of the group to express the hope that the Army and Navy representatives might see their way clear to explore jointly the compounded possibilities thus indicated.

Copy

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420 West 116th Street
New York City

April 14, 1940

Dr. Alexander Sachs
c/o Lehman Corp.
One South William Street
New York City

Dear Dr. Sachs:

If the line of work, which I am pursuing at present, is successful, then one ton of uranium would be capable of supplying as much power as ~~3000~~ tons of oil. The scope of applications would be rather limited, but an important application might be the use of an atomic engine as a reserve driving power for larger naval units. Let me illustrate this by quoting an example:

A 30 000 ton battleship of the fastest type has nowadays a maximum oil load of about 4000 tons and uses somewhat more than $\frac{1}{2}$ ton of oil per mile if cruising at an economical speed. This corresponds to a cruising radius of about 8000 miles. Let us now consider such a battleship equipped with an atomic engine containing 50 tons of uranium as a reserve driving power and assume that the ship would also carry a normal oil load of 1000 tons. The 50 tons of uranium represent the equivalent of an oil reserve of about 150 000 tons of oil and so remove the limitations which arise out of the present finite cruising radius. The equipment which goes with the atomic engine may add about 1000 tons to the weight of the boat, but this would be more than compensated by the saving in weight owing to the reduction of the oil load from 4000 tons to 1000 tons. This saving in weight

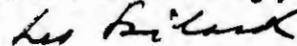
ought to lead to an increase in the top speed of the vessel.

I should imagine that the combination of high speed and a greatly increased cruising radius might be of decisive importance in case of a war with Japan. However, my knowledge of such matters is not sufficient for doing more than raising this question and leaving it to you to find the answer by consulting some expert.

It might be difficult to obtain more than 300 tons of uranium per year for the purposes of the navy. This amount would be sufficient to equip six capital ships annually. These ships would presumably continue to use oil in peace time, except perhaps at manoeuvres, so as to have most of their uranium reserve available at the outbreak of war.

Perhaps I should mention another line of research which might lead to the construction of an atomic engine in which one ton of uranium would supply more power than 300 000 tons of oil. Experiments along this line of work are however not sufficiently advanced to enable us to estimate the chances of ultimate success. This second type of atomic engine would however be of much greater importance to the navy than the one which is the main subject of my letter.

Yours sincerely,



(Leo Szilard)

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EARLY HISTORY ATOMIC PROJECT IN RELATION TO PRESIDENT ROOSEVELT, 1939-40:

**From Inception and Presentation of Idea to the President
by Albert Einstein and Alexander Sachs**

Through the Testing of its Advisability by a Presidential Committee with
Lyman J. Briggs, Director, Bureau of Standards, Department of Commerce, as Chairman
to the Transfer of the Project for Execution to the
National Defense Research Committee Established by the President June 15, 1940.

Documentary Historical Report

By

Alexander Sachs

August 8 - 9, 1945

Note: The majority of the exhibits, in form of letters and notes, are placed immediately following the pages within which they are first mentioned. The others, marked with an asterisk - which in original memorandum form were left with the President for their broader bearing on the unfolding developments or policies - are placed herein as appendices to the Sections within which they are first mentioned.

I. PRELUDE TO PRESENTATION OF PROJECT TO PRESIDENT ROOSEVELT

By Spring 1939, there was completed in the Physics Laboratories at Columbia University an advance upon the uranium researches in Europe of Drs. O. Hahn and L. Strassmann and the supplementary researches of Drs. L. Meitner and R. Frisch, which, in turn, had corresponded to independent work in this country by Prof. Enrico Fermi at Columbia and others (the European work was reported, respectively, in "Naturwiss" No.27,11 (1939) and "Nature" (Feb. 1939)).

The advances made by the collaborative work of Drs. Fermi and Leo Szilard were summarized in a communication entitled, "Instantaneous Emission of Fast Neutrons in the Interaction of Slow Neutrons with Uranium," dated March 16, 1939, from the Pupin Physics Laboratories of Columbia University, which was published in "The Physical Review" of April 15, 1939.

The receipt and study by Dr. Einstein at the Institute for Advanced Study in Princeton of reports of these researches of Drs. Fermi and Szilard led him to confer, first, with Dr. Szilard, and then, directly and indirectly, with the writer, on the implications of atomic disintegration for the world situation in the then and emerging phases. It so happened that the last mentioned, as an economist and political scientist had already been known for his "Cassandra forebodings" on the significance of the European developments dating back to the Great Depression; and just prior to the Nazi seizure of Prague, he had prepared a memorandum entitled, "Notes of Imminence World War in Perspective Accrued Errors and Cultural Crisis of the Inter-War Decades" (included herein as ^{*}Exhibit 1). The concluding note of the memorandum emphasized that "preparedness has and will become more and more urgent for all members of Western

civilization as a result of the past errors committed and in the course of the prospective unfolding aggressions of Nazi Germany." Sharing these views, Dr. Einstein connected the experimental work on uranium carried on throughout the world with certain actions of the German Government since the seizure of Prague on the 15th of March, 1939. For one thing, Germany had stopped the sale of uranium from the Czechoslovakian mines, and for another, there was feverish activity at the Kaiser Wilhelm Institut in Berlin in the direction of repeating and trying to surpass the work on uranium that was proceeding and under our system being published by a number of refugee scientists largely from Germany who had found haven and scope for work in democratic countries.

While among the established physicists in the Western countries doubts were still entertained as to the eventual outcome of the researches, the kinship of outlook and concern Dr. Einstein had with the writer and with refugee colleagues of his led him to project the more optimistically the trend of progress in the establishment of a nuclear chain reaction in a mass of uranium. As that would generate vast amounts of power, he felt that the world configuration required us to consider the consequences flowing from the eventuality of applying the uranium research to the construction of extremely powerful bombs of a new type. As stated by him in the final draft of his letter of August 2, 1939 for eventual submission to the President, "a single bomb of this type carried by boat and exploded in a port might very well destroy the whole port, together with some of the surrounding country." (Exhibit 2a)

Mindful of all this, it was agreed by Dr. Einstein and his colleagues, and the present writer as a new associate, that the implications of the new stage of the uranium research should be brought to the attention of President Roosevelt. While in their capacities as cautious and precise scientists, the experimentalists expressed

themselves as very uncertain whether a fast neutron reaction in the fission of uranium could be made to work, the trio of Drs. Einstein, Szilard and the writer, by reason of their sensitivity to the preparedness implications and military consequences from the next phase in the uranium research believed that a constructive program should be developed and implemented by the Western Powers, the United States, Great Britain and France. Holding, as Dr. Einstein did, that even at that stage the work progressing in America and Allied countries was more significant and promising than that under reported information being carried out by German scientists, he deemed it advisable that the researches in England, France and the United States should be coordinated and the results kept from Nazi Germany. Indeed, a proposal to that effect for the withholding of publication of chain reaction was submitted by a member of the group, and while received with favor in England, the French scientists were unresponsive. Finally, since the largest supply of good ore was in the Belgian Congo and further experimentation would call for larger magnitudes of the material, it was felt that university laboratories with their limited budgets would be inadequate, and that even from an economic standpoint, it would be necessary to enlist the aid of the Government, if only to convey to public-spirited private persons, foundations and corporations that the ensuing research would be invested with a special national importance.

Having agreed that the national interest must be articulated and Governmental aid solicited, it was concluded that the importance and the ramifications of the subject called for submission of the idea direct to the President and under conditions that would establish sustained solicitude by the White House and the Army and Navy. This task was entrusted to the economist and political scientist member of the group by reason of his past and current association with the President. Upon

the completion of the letter of Dr. Einstein, dated August 2nd, and the supplementary memorandum of Dr. Szilard, dated August 15, 1939, came the German demands upon Poland which culminated in the invasion of Poland on September 1st. In the wake of this transformation of what to Dr. Einstein and the writer had been the years of the "White War" by Nazi Germany into a totalitarian war, the preoccupation of the President and Congress with the revision of the Neutrality Act served to postpone the arrangement of a meeting and the submission of the material by the writer to the President. Only after the first week of September was it possible to arrange for an interview with the President and a conference with aides that he later delegated for the consideration of the problem and the proposals.

II. CONFERENCE AT THE WHITE HOUSE, October 11, 1939, and Appointment of a Committee headed by Dr. Lyman J. Briggs, Director of the Bureau of Standards, Department of Commerce, to pass upon the Proposal.

1. At the conference with President Roosevelt at the White House on October 11th, the writer presented an oral review and submitted the following collect:

- (a) Letter by Dr. Einstein, dated August 2, 1939 (included herein as Exhibit 2a).
- (b) Memorandum by Dr. Szilard, dated August 15, 1939 (included herein as Exhibit 2b).
- (c) Copies of articles in scientific journals on uranium research (of which only Dr. Szilard's communication to "The Physical Review" dated April 15, 1939, is included herein and marked "Exhibit 2c").
- (d) Memorandum by Alexander Sachs of March 10, 1939 cited above (included herein as "Exhibit 1").*

On behalf of Dr. Einstein and himself, the writer featured the concrete proposals embodied in his covering Memorandum Letter dated October 11, 1939 (included herein as Exhibit 3). The presentation of the communication focused on the following requests:

- (a) Liaison at the White House.
- (b) Compact committee representing the Army and the Navy.

Additionally, the letter of October 11, 1939 to the President pointed to the danger of German invasion of Belgium, and inasmuch as the Belgian Congo as ultimate source and Belgium as warehouse for current inventories would in time be made difficult of access, it was advisable to consider whether steps should be taken through diplomatic channels for the transport of adequate supplies of uranium to the United States. Furthermore, as the financial requirements of the project would be on the upgrade, it was indicated that university funds would need to be supplemented.

2. In the wake of this conference, the President asked his secretary and

* The letter was detached from the collect, read separately, and commended as "concentrated sense which makes the proposal urgent."

military aide, General Edwin M. Watson, to act as liaison for this purpose for the White House. General Watson was further asked by the President to effect an introduction to Dr. Lyman J. Briggs and to constitute in the President's behalf a committee from the Services, under Dr. Briggs' chairmanship, for consideration of the ideas and material that had been submitted to him by Dr. Einstein and the writer. The President further suggested that the writer stay over the following day for a conference with members of such committee.

The conference on October 12th between Dr. Briggs and the writer led to the arrangement of a meeting for the end of the month between the Government group and those concerned with this problem. Dr. Briggs asked the writer to supplement the formal invitation with a fuller explanatory note to Professors Wigner of Princeton and Teller of George Washington University, who were to be added to the non-governmental group (copy of this letter included herein as Exhibit 4). Those later appointed to represent the Services were Lt.Col. Keith F. Adamson for the Army and Commander Gilbert C. Hoover (since then, Admiral Hoover) for the Navy. The two groups met at the Bureau of Standards on Saturday morning, October 21, 1939, at 9:30, under the chairmanship of Dr. Briggs. All who were invited attended, with the exception of Dr. Einstein, whose health and sky disposition interposed obstacles. The participants were as follows:

- (a) For the Government: L. J. Briggs
Lt.Col. Adamson, USA
Commander Hoover, USN
- (b) As Presidential representative: Alexander Sachs

(c) As cooperating scientists

E. P. Wigner, Professor Theoretical Physics, Princeton University
 E. Teller, Professor, George Washington University
 E. E. Fermi, Professor, Columbia University
 L. Szilard, visiting experimental physicist at Columbia and
 Trustee of the Association of Scientific Collaboration

The discussion at this meeting of October 21st developed a strong objection that those interested in the political-military implications were much too previous in converting a mere potential into an actual result of research. Hence, they urged that the Government should leave this project to the universities, which anyhow have evinced active interest. The proponents of this view felt that it would take several years before a favorable answer could be given as to whether it was worth being considered by the Services and the Government generally, from the standpoint of national defense. As this view had quite a number of adherents, it is important to record the leadership taken by Dr. Briggs that the World situation and American national interests must be taken into the cognizance of the equation of probabilities and that it was proper and right of American scientists at this juncture to engage in a mental projection from the normal course of research development to the impact of a mere scientific possibility upon the national defense. Hence, in his judgment, the Government group composed of the Army, Navy and Commerce Department representatives must weigh differently in the new setting the risk coefficients attached to even remote probabilities.

3. This inter-departmental committee — with Dr. Briggs as chairman, and Lt.Col. Adamson for the Army and Commander Hoover for the Navy as the other members — submitted a report to the President, dated November 1, 1939. The report, entitled "Possible Use of Uranium for Submarine Power and High Destructive Bombs," opens with

a reference to the meetings that the committee has had — "with Dr. Sachs and the physicists from Columbia, Princeton and other institutions" — describes the recent uranium work, and notes the possible applications to submarine power and explosives in the event of the establishment of a chain reaction. For its historic interest, this original formulation of November 1, 1939 by a Governmental committee deserves detailed quotation (from Exhibit 5 herein):-

- "(1) Discoveries made within the last year have shown that when a uranium atom is bombarded by neutrons (uncharged elemental particles of matter) from an outside source, the uranium atom may be split in two and this breakdown is accompanied by release of a great amount of atomic energy.
- (2) When the uranium atom is split it likewise sets neutrons free. These neutrons may be able, in turn, to split other uranium atoms and thus continue the process as a chain reaction. This continuous splitting has not so far been accomplished. The proposed research would be directed to finding a way to do it.
- (3) The energy released by the splitting of a mass of uranium atoms would develop a great amount of heat. If the chain reaction could be controlled so as to proceed gradually, it might conceivably be used as a continuous source of power in submarines, thus avoiding the use of large storage batteries for under-water power.
- (4) If the reaction turned out to be explosive in character, it would provide a possible source of bombs with a destructiveness vastly greater than anything now known. "

While underlining that the suggested military and naval applications are only possibilities, it nonetheless contended as follows:

"In view of the fundamental importance of these uranium reactions and their potential military value, we believe that adequate support for a thorough investigation of the subject should be provided."

As a sequel to the major finding and recommendation, the committee proposed that initial support — funds for which it expected to be available from the enactment of the Lea Bill — take the form of:

- (a) supplying for immediate experimental work 4 metric tons of pure-grade graphite, and
- (b) if later justified, supplying 50 tons of uranium oxide

In respect to organization, it concluded with the following recommendations:

"We recommend the enlargement of the committee to provide for the support and coordination of these investigations in different universities. We suggest the following be invited:

President Karl Compton, Massachusetts Institute of Technology,
Cambridge, Mass.

Dr. Alexander Sachs, 1 William Street, New York City

Professor Albert Einstein, Princeton University, Princeton, N.J.

Dean George B. Pegram, Columbia University, New York City" **

** Summary of report of November 1, 1939
to the President included herein as
Exhibit 5

III. COORDINATION PHASE OF UNIVERSITY RESEARCHES with Limited Governmental Aid, and Pressure by Dr. Einstein and the writer for a New Framework and an Accelerated Tempo for the Project.

While a number of the university representatives were encouraged by the Governmental interest, the fundamental tenor and the tempo of the work remained on the whole continuous with the past. The time phase was approximately coincidental with what at the time was called the "phoney war", that is, the period between the fall of Poland and the Nazi invasion of the Lowlands. The President was pressed by and preoccupied with numerous internal and international problems; the liaison for the project, General Watson, while he had orally conveyed the general tenor of Dr. Briggs' report, thought when he transmitted it to the writer on February 8, 1940 that a more pointed conclusion was necessary and stated that he had asked for "a special recommendation from Dr. Briggs."

(1) Meanwhile, some progress was made in the coordination of the university researches by the Coordinating Committee mentioned in the concluding Point 8 of Dr. Briggs' report. The appointment of Dean Pegram served to focalize activities in Columbia on this project and frequent conferences were held with the writer by Drs. Pegram, Fermi and Szilard. In mid-November, this group projected an octet of experimental projects in the hope that the subsidiary questions could be cleared within a period of six months. Based on notes that were made at the time, the nature and scope of these subsidiary problems and the recommended personnel from nearby educational institutions were as follows:

Slow Neutron Reactions

Fermi, Pegram, Szilard (all Columbia), and Wheeler (Princeton)

Fast Neutron Reactions

Fermi, Szilard, Tuve (Carnegie Institute), and Wigner (Princeton)

Ascertainment which of the Uranium Isotopes splits:
 Dunning (Columbia), Fermi, Tuve and Wheeler
 Small-Scale Separation of Isotopes by any Method other than Diffusion:
 Beams (University of Virginia), Fermi and Tuve
 Small-Scale Separation of Isotopes by Diffusions:
 Fermi, Furry (Harvard), and Urey (Columbia)
 Theoretical Possibility and Limitation of Large-Scale Separation
 by Centrifuging:
 Beams, Pegram, Szilard, and Teller (George Washington University)
 Theoretical Possibility and Limitation of Large-Scale Separation
 by Diffusions:
 Fermi, Furry, Onsager (Yale), and Urey
 Possibility of Large-Scale Production of Uranium Metals:
 Pegram, Szilard, and a member of the Chemical Engineering
 Department of either M.I.T. or Columbia

At the same time, the Columbia project became the recipient of Governmental aid in the form of limited funds for the purchase of materials, as is borne out by the reply that Dr. Briggs made to General Watson's note of February 20, 1940 (this exchange of correspondence being marked, respectively, Exhibits 6a and 6b).

(2) On the other hand, the dust that brought the project to the President was dissatisfied with the scope and the pace of the work. The writer conferred with Dr. Einstein at Princeton in February. An inquiry as to the importance of the work carried on at the time in Paris, that had been described in a contemporaneous issue of "Science," evoked the statement from him that the work being done at Columbia was more important, but that conditions should be created for its extension and acceleration. Accordingly, the writer sent on February 15, 1940 to General Watson a plea for larger aid and an intimation that presently Dr. Einstein would give a favorable evaluation of the work being completed at Columbia (copy included herein as Exhibit 6c).

Ensuing conferences with Dr. Einstein prompted a suggestion that he prepare another review of the situation for submission to the President. His review

took the form of a letter to the writer on March 7, 1940 (copy of that letter, the original having been forwarded to the President, submitted herewith as Exhibit 7a). In this letter, he focused attention once more on the intensification of interest in uranium in Germany and noted that the German Government had taken over both the Physical and the Chemical Institutes and had placed the research under the leadership of C. F. von Weizsaecker, son of the Under-Secretary of State for Foreign Affairs. A week later, the writer sent to the President Dr. Einstein's review and asked for an opportunity to confer with him on the latest phases of the experimental work (letter to the President, dated March 15, 1940, marked Exhibit 7b herewith). The reply of General Watson on March 27, 1940 was to the effect that the Governmental Committee was awaiting "a report of the investigations being conducted at Columbia University" and hence, "the matter should rest in abeyance." (Copy herewith, marked Exhibit 7c).

However, the sense of foreboding about Nazi aggression that had been voiced before the outbreak of the war (as disclosed by Exhibit 1) impelled the writer to relate the expectations of new invasions in the wake of Spring to the instant project. At the beginning of April, opportunity was afforded the writer in the course of a visit to the White House to unfold views on the probable course of the German aggression as encompassing in this war, as distinguished from the last war, the elimination of neutrals so as to secure complete control of the Coast from Norway to France. The bearing on the uranium project was suggested to require (a) diplomatic arrangement for the shipment of uranium supplies in Belgium to the United States, instead of shipment on the eve of invasion to France, and their probable capture by the Germans in their military onrush through France. Taking the project as a whole, it was urged that instead of delimited aid in the form of specific

material purchases or reimbursements for expenditures by universities, a fund be made available from Governmental sources or by persuading foundations to allocate a fund in order that research could be planned on an adequate scale and on a long-term basis. The late Spring months were not too early for the planning of the enlargement of the research personnel by diverting academic talent from teaching to public research, as presently the right people will have completed their negotiations with faculties for the next academic year. The tenor of these considerations and recommendations was embodied in an aide-memoire which was prepared at Washington and left at the White House (included herein as Exhibit 7c).

IV. EFFORTS BY THE ORIGINATORS OF THE PROJECT TO GAIN THE ADHERANCE OF THE GOVERNMENTAL AND ADVISORY GROUP TO ORGANIZATIONAL CHANGES needed to attune the research to theurgencies of unfolding world war events.

The representations made to the President at the turn of the month, as just summarized, led him within a few days to revert to and act upon the preceding correspondence that had been pitched in the same key. Accordingly on April 5, 1940, he acknowledged what had been conveyed to him by Dr. Einstein and proposed that a new conference be held in Washington between Dr. Einstein and the writer on the one hand and Dr. Briggs and the special representatives of the Army and Navy on the other hand. (Letter of President to writer, April 5, 1940, marked as Exhibit 8a.) The closing paragraph of that letter implied that the President wanted the research continued - that is, the preliminary question about which a few in the Coordinating Group still retained tints of doubt was in his mind disposed of. While the arrangements for the conference were delegated to General Watson, he wanted to be advised directly of the results of the conference. Under even date General Watson asked the writer for a list of scientists to be invited, inclusive of suggestions by Dr. Einstein. (This letter, included herein as Exhibit 8b). The inquiries made by the writer of Dr. Einstein and other members of the Coordinating Group led to the submission by the writer to General Watson of the requested list. (Letter by writer to General Watson, April 19, 1940, included herein as Exhibit 8c).

Following the receipt on April 15th of the two letters from the White House of April 5th, Dr. Einstein was written to on April 15th. (Letter of A. S. to Dr. Einstein dated April 15, 1940, marked herein Exhibit 10, the preceding number having been reserved for a memorandum letter of Dr. Szilard's). The

letter opened with a statement regarding the transmission to the President of Dr. Einstein's communication of March 7th (Exhibit 7a), and noted a contemporaneous impression that the efforts subsequent to the President's return from the Canal Zone trip had contributed to the decision by the President "to adopt the procedure suggested" in this writer's original communication. Cognizant of the resistances in the group to the proposed enlargement of the organizational framework, the writer urged Dr. Einstein to participate in person in the forthcoming conference. But after a conference that the writer had with Dr. Einstein at Princeton, it became clear that indisposition on account of a cold and the shyness which makes Dr. Einstein recoil from participating in large groups would prevent his attendance. As a substitute it was decided to record the consensus in the form of a written communication to Dr. Briggs. ¶ Dr. Einstein's communication of April 25, 1940 to Dr. Briggs referred to discussions he had had with Dr. Wigner and the writer on the progress of the work of Dr. Fermi and Dr. Szilard (submitted herewith and marked as Exhibit 12a). The purport and purpose of the letter was to impart a new impetus and to suggest an appropriate adjustment of the organizational side of the research to the interlinked necessities of the emergent phase of the research and of the international situation

"I am convinced as to the wisdom and urgency of creating the conditions under which that and related work can be carried out with greater speed and on a larger scale than hitherto.

"I was interested in a suggestion made by Dr. Sachs that the Special Advisory Committee supply names of persons to serve as a board of trustees for a non-profit organization which, with the approval of the Government committee, could secure from governmental or private sources, or both, the necessary funds for carrying out the work . . .

"Given such a framework and the necessary funds, it ((the large scale experiments and exploration of practical applications)) could be carried out much faster than through a loose cooperation of Universities laboratories and Government departments."

Originally the April meeting was scheduled by Dr. Briggs for April 22, and so far as non-governmental people were concerned was to be limited to Dr. Einstein, Dean Pegrum of Columbia and the writer, as appears from a communication marked Exhibit 11a. Then, by telegram of April 20th the meeting was postponed to the 27th, as appears from communication marked Exhibit 11b. On the other hand the writer sought to enlarge the group and requested an invitation be sent to scientists and executives in universities involved in the current uranium research. That request was granted, as appears from the writer's letter to the President of May 11, 1940 (marked herein Exhibit 14a).

The background against which the conference was held was lit up by portentous international events. The second week of the month opened with the German invasion of Norway and Denmark on April 9th, and the third week witnessed counter operations by the British by the landings in Norway on April 16th and 18th. Since the concern for national defense and the survival of civilization motivated the writer's mediation of the project between the scattered scientists and the President, it is understandable that in the flux of erupting international forces the writer should seek to transpose the laboratory questions to the larger theatre of international policy and military operations. Two contemporaneous crystallizations of that preoccupation are available. The first is a memorandum letter prepared at the writer's request by Dr. Szilard under date of April 22, 1940; and the second is a self-addressed aide-memoire dated April 20, 1940 and bearing the title "Import of War Developments for and Application to National Defense of Uranium Atomic Disintegration." ¶ The memorandum letter by Dr. Szilard - marked herein as Exhibit 9 - aimed to describe the next phase of the research and its dual alternatives and their respective

applications to national defense. The first case deals with chain reactions in which the neutrons are slowed down so only a small fraction of uranium can be utilized. In the second case the neutrons are not slowed down and so the bulk of the ordinary uranium can be utilized. It is the latter case which has the greatest significance for national defense and particularly for the production of atomic bombs. The former significance would appear to lie in power production and would also present the complication that personnel handling such built and powered atomic engines would be exposed to the radiations. The second alternative also presented a dual utility for concentrated power and concentrated explosive. As to the second use, the concluding paragraph of that memorandum constitutes a most illuminating formulation:

"A chain reaction of this second type would make it possible to bring about explosions of extraordinary intensity. If, for purposes of aggression, a bomb based on such a chain reaction were set off at sea near the coast, tidal waves brought about by the explosions might lead to the destruction of coastal cities."

The coincident memorandum of the writer was concerned with highlighting the bearing of the war developments on the organizational aspects of the uranium research, and evoking applications for naval warfare with a view to throwing into sharper relief the urgencies of providing more central direction and greater adequacy of scope and speed in the prosecution of the project. This memorandum - included herein under the designation Exhibit #17 - opened with a description of the leading research personalities, their respective international setting and connections, with a sidelight on leading British physicists (viz. Drs. Chadwick, Dirac, and Lindemann) deemed valuable for collaboration with the researchers in America. It then dealt with the tendency to reservations and understatement of the results of research and their implications, the effect

of which on governmental representatives was to recoil from the very suggestions that were being pressed by Dr. Einstein and the writer for providing a larger and more resourceful organizational framework for adequate and faster prosecution of the task. In the effort to overcome the tempo- and scale-dampening that that very attitude entails, the writer submitted the following observations and considerations, - which in a later presentation to the President appeared to be contributive towards a resolution of the organizational difficulties:

"The present writer, as a non-physicist, would not of course venture an opinion alongside those cited. But as an economic historian and as a practical economist versed in the conduct of technological research, he has ventured to convey to the scientists mentioned and to the governmental authorities his hypothesis that the difficulties which loom so large now might well arise from the characteristic physical limitations of the pre-pre-pilot-plant operations that are carried on in the typical university laboratories. If the project is fraught with promise and importance for national defense, then it seems to him worth while to approximate very soon the conditions of industrial-pilot-plant operations. This might entail the building of equipment, machinery, and even the construction of adequately scaled and adequately protected physical plant . . .

"Once we relate the uranium research to national defense, it should be regeared in type and tempo to the most advanced technological research that has been carried out by the American chemical and electrical companies . . .

"What has taken place in Poland, Denmark and Norway, and will doubtless go on through other European countries that will be invaded, is that the pacific-minded countries have not brought their national defense up to the quantity and quality required for technological warfare. When the import of the European war is assimilated by the American people and national defense is undertaken as a national enterprise, then we may be confident that we will match in war the progressiveness of our civilian technology and come to surpass it, which means surpassing the German military technology."

(Exhibit #17, pages 2 and 3)

In the conviction then that "an adequate organizational framework is itself the precondition for the ascertainment and effectuation of the value of nuclear research for national defense," the writer proceeded to sharpen the possible applications of that research for naval operations, on the assumption

that the war would in time become global on the part of the Axis, inclusive of Japan, against the democracies, inclusive of the United States. In that event, the applications in the dual form of telescoped power drive and magnified explosives should aid the United States to overcome "the disadvantage under which we labor due to the enormous distances between continental United States and our possessions, and between our possessions and the Japanese homeland." (pages 4, 5, and 6 of Exhibit #17, April 20, 1940).

Inasmuch as the attempt to relate the applications to strategic and logistic configurations presupposed naval data, Dr. Briggs' good offices with Admiral Bowen and Commander Hoover ^(Do-secure) answers to questions submitted in a letter. (Copy of that letter is unavailable, but it presumably covered the technical questions included in both Exhibit 9 and Exhibit #17).

V. THE CONFERENCE OF APRIL 27TH AND CONTINUING INADEQUACY OF THE ORGANIZATIONAL FRAMEWORK RESULTING IN REPEATED SUBMISSIONS TO THE PRESIDENT FOR A RESOLUTION OF THE DIFFICULTIES.

The conference that was held on April 27, 1940 at the Bureau of Standards under Dr. Briggs' able and amicable chairmanship did serve to dispel doubts that had been entertained by some members. It also marked further progress in evoking a willingness to entertain consideration of large scale expenditures that might run up to six figures. Yet the majority, accustomed to the small scale of physical laboratories at the universities and the corresponding reduced scales of the budgets of governmental scientific laboratories, did not appear ready to design a large scale and comprehensive program, and instead insisted on bit-a-bit procedures with ranked preferences and time deferments.

By the beginning of May the uranium research at Columbia, which was the pathfinding research, had reached the point where expansion was deemed advisable and desirable by the whole quartet of scientists concerned - the direct experimenters, Drs. Fermi and Szilard, and Dean George Pegram, head of the department, and Professor Harold E. Urey, the Nobel prize winner for the discovery of "heavy water." After a number of conferences of the writer with the Columbia group, a sort of minute was drafted as of May 10th embodying the consensus as to the successive stages.

- "1. The first large scale experiment would have as its aim to demonstrate beyond any doubt whatever that a nuclear chain reaction could be maintained in a system composed of carbon and uranium. This would require about 100 tons of graphite and from 10/20 tons of uranium metal. It would also be necessary to design a rather elaborate mechanism to stabilize the chain reaction and to safeguard against overheating as well as the possibility of an explosion.

"2. The next stage is to carry out a general survey of all nuclear constants in order to confirm the values previously obtained and to narrow down the limits of experimental error beyond observed values of these constants. This would strengthen the assurance of the group in the ultimate success of the experiment.

" Then as preparatory ground for that experiment would come the advancing of structural details and the carrying out of technological tests on samples of materials which have to be used in large quantities in the ultimate experiment. This in turn would require getting bids for the manufacturing of the material in needed quality and quantity."

In financial terms, the first stage would require expenditures of \$50,000 to \$50,000, and the second from \$250,000 to upwards of \$500,000. It was the writer's view that in the interest of time speed and even of economy the second could be prepared for while the first was going on, providing that adequate funds were made available to begin with. The proposal which had been submitted for a non-profit organization directed by a mixed board of trustees seemed particularly suited to methodical and economical direction of the work.

The lack of resolution of the organization of difficulties led the writer to submit an analysis of the situation and resultant recommendations in a communication to the President on May 11, 1940, together with a note of transmittal to General Watson of even date. (These communications are marked Exhibits 14a and 14b.)

The point of departure was that according to the advices given to the writer by Dean Pegrum, the graphite experiment, which had been partly financed by the Government, was a success. As the communication was coincident with the German march through Belgium - the invasion having begun on May 10th - the situation adumbrated in the initial presentation of October 11, 1939 had come to pass. A problem of access of uranium supplies that would be needed on larger and larger scales had been thrust forward, and this in turn threw into sharper relief the need for a change of the organizational framework "under

which the work would proceed with the flexibility required for a going enterprise." The President was therefore requested to designate a legal aid to facilitate the establishment of a non-profit body which would secure the resources for carrying on the work under conditions where the tenure of the research posts would be secure and their equipment and material be amply provided for; and along with that provision for the necessary secrecy as distinguished from the normal eagerness and competitiveness in early publication of indicated results.

VI. RESOLUTION OF THE DIFFICULTIES AND RESETTING OF THE URANIUM
RESEARCH PROJECT INTO THE NEW ORGANIZATION ESTABLISHED BY
THE PRESIDENT ON JUNE 15, 1940 FOR THE DIRECTION OF ALL
SCIENTIFIC DEVELOPMENTS RELATED TO NATIONAL DEFENSE.

In keeping with the practice of full confidence and cooperativeness with the Presidential representative from the Government Services to direct the joint committee on the uranium project, the letter to the President of May 11th was given a counterpart in the communication to Dr. Briggs of May 15, 1940 (Exhibit 14c). It drew attention to Dean Pegram's favorable report on the graphite experiment, and inferred that the governmental committee would report favorably to the President on the project. Recognizing that university research is inherently characterized by a "traditional discursive attitude and leisurely tempo", the contemporaneous facts of the invasion of Belgium threw into sharper relief the requirements of national defense. Applied to this project, these requirements were for a resourcefulness of operation and an acceleration of pace and also a secrecy that could not be had in the university projects, generally carried on with limited means and in an atmosphere of mutual interchange.

In furtherance of the foregoing, another letter was written to General Watson on May 15th, the second and revised version of which is included herein as Exhibit 15a. That letter starts out with a reference to a letter from Dean Pegram of Columbia (the text of which is no longer in the writer's possession, as it appears to have been forwarded to the President without the retention of a copy). The substance of Dean Pegram's letter as given to General Watson was as follows:

"The initial experiment has now been concluded with satisfactory result; the absorption cross-section of carbon was found to be encouragingly small, only about one-third of the upper limit previously reported in the literature."

The main communication of the writer (Exhibit 15a) contains the first adumbration of a plan similar to that later developed by the President for the direction of the scientific work related to national defense. The new suggestion was made in the setting of proposals which the writer was evolving for submission to the President with respect to amortization and other incentive-tax devices for national defense plant construction. In connection with the economic aspects of national defense allusion is also made to the original suggestion contributed by the writer at the time of the drafting of the National Recovery Act in 1933 for the inclusion in that Act of a provision authorizing public expenditures for national defense and naval construction.*

In respect to the specific problem of an organizational framework that would carry forward uranium research on a bigger scale and at a faster tempo, the new conclusion and recommendation of the writer was as follows:

"For the instant purpose, the organizational instrumentality proposed is the establishment of a Scientific Council of National Defense, composed of executives, engineers and economists, acting in behalf of the Government, who should be invested with administrative powers for the testing and execution of technical projects of utility for national defense."

(Exhibit 15a)

In acknowledging that letter, General Watson on May 16th (marked Exhibit 15b) added an observation regarding the broader suggestion for a mixed executive and administrative group for scientific phases of national defense:

"As to your suggestion concerning the establishment of a Scientific Council of National Defense, you may be sure that the President will bear that in mind."

* Incidentally, this was described in the late General Hugh Johnson's book called "The Blue Eagle," pp. 197-8. That disclosure of incipient concern for American national defense in the wake of Hitler's accession to power at the turn of 1933 led to an attack by John T. Flynn on this writer—in his review of Johnson's book in the New Republic of April 3, 1935—for having slipped through the provision about naval construction into the NRA bill. What was misinterpreted by Mr. Flynn and inadequately reported by General Johnson was that the original provision had been discussed with and approved by President Roosevelt.

The larger setting now given to the uranium problem was doubtless a contemporaneous reflection of the Nazi headlong marches and victories in Belgium and France and the discernment of the imminent and progressive transformation of the American economy into a defense economy. For between the letter to the President of May 11, 1940 and the letter to his aid, General Watson, on May 15th, had come the invasion of the Lowlands, the advent of Churchill to power in Britain as the head of the Coalition Ministry and the succession of setbacks inclusive of the first phase of the evacuation of Dunkerque.

The next communication to the President's secretary and the liaison for the project, General Watson, was again in two versions, the second of which, along with the telegraphic request for the substitution, are included herein as Exhibits 16a and 16b. The primary request has to do with the assurance of uranium supplies for the experiments. Clearly with Belgium under Nazi domination the huge inventories of raw and processed uranium in that country would accrue to Germany. Attention was drawn to the presence in the country of M. Edgar Sengier, the Managing Director of the company which owns the uranium mines in the Belgian Congo. Another important development was the interest evinced in the project by the Carnegie Institution, headed by Dr. Vannevar Bush. Finally, continuing the writer's occasional advisory role on economic matters, a note was enclosed for the President by the writer on "Reorientation of Defense Concepts." While no conference with the President could be arranged for that week, an opportunity was afforded for re-emphasizing the newer aspects of the uranium problem in the course of a conference on broad defense economics at the White House at the end of May.

At that conference the writer submitted his concrete defense tax suggestions. Furthermore he urged that the then scheduled allocations for defense should be increased. For defense requirements cannot be evaluated as to adequacy but in terms of appropriate ratios to national income, such as reaching what he

called parity with the British Budget ratio to national income immediately after Munich, viz., of the order of one-fifth to one-fourth of the current national income. On that occasion the writer left a copy of the memorandum of April 20th, entitled "Import of War Developments for and Application to National Defense of Uranium Atomic Disintegration" (marked Exhibit #17). Echoes of that conference appear to have reached members of the government group, judging by the sympathetic attitude which ensued towards the initiation of discussions with the officials of the Union Miniere of the Belgian Congo.

After a conference at the turn of the month in Washington with Admiral Bowen and Dr. Briggs the latter on June 5th authorized the writer as a member of the Coordinating Committee to explore the problem of securing uranium supplies from the Belgian Congo and offered an opinion on nearer-by suppliers (marked Exhibit 18). For this purpose the writer, together with Prof. Urey of Columbia, visited the company officials mentioned and secured the necessary information, which was later transmitted to Dr. Briggs.

The culmination of the foregoing phases of the uranium project came on the day following the German army's entry into Paris. On June 15th the President established a new committee for the correlation of the scientific efforts of the country concerned with the problems of national defense, and placed that committee under the chairmanship of Dr. Vannevar Bush, president of the Carnegie Institution of Washington. This committee was to include representatives of the Army and Navy and distinguished scientists, and initially was to be attached to the Council of National Defense. Accordingly, the President advised Dr. Lyman J. Briggs on June 15th that "since the problem on which you are engaged is part of this larger picture" Dr. Bush was requested by him to take over the uranium project and to reconstitute the committee. (A copy of this letter as sent from the White House to the writer is included herein as Exhibit 19).

Thus was found a larger framework concordant with the tenor of the writer's recommendations since mid-April. Dr. Bush's committee after our entry into the war became the Office of Scientific Research and Development; and associated with him and with Dr. James B. Conant of Harvard, as the scientist-executives in charge, was a general Policy Committee that included the then Vice President, Henry A. Wallace, Secretary of War Henry A. Stimson, General George C. Marshall, and Army and Navy representatives.

The uranium project as initially presented by Dr. Einstein and the writer in October 1939 having by the spring of the next year been reported on favorably by the testing and coordinating committee that the President had appointed under Dr. Briggs' chairmanship, was thus launched on a permanent and progressive career in the wake of our decision after the Fall of France to embark on expanding defense. From then on it became invested with the importance, the resources and the secrecy available to the Government of the United States in defense and later in war for the translation of an idea into a reality and into an instrument of national policy in war and peace.

(revised version)

Compt. Nat. Indus.
Chrm 8/10/15

Ex 15a

May 15, 1940

Dear General Watson:

Confirming the intimation that I had the honor to convey in my letter to the President and in my covering note to you, I have just received a letter from Dean Pegrum of the Department of Physics of Columbia University, stating that the initial experiment "has now been concluded with satisfactory result," and that "the absorption cross-section of carbon was found to be encouragingly small . . . only about one-third of the upper limit previously reported in the literature." The detailed meaning of that has been set forth in the letters of Dr. Szilard of May 10 and of April 22, which I forwarded to the President; a copy of the latter was also sent to you. Please advise me before any conference on this is arranged.

In connection with an independent matter having to do with economic and fiscal policies for effectuating national reconstruction and defense, I should appreciate your expressing to the President my readiness to submit certain social-minded economic ideas that had interested him in 1936 and 1934, as to incentive devices for evoking large-scale plant investment for national defense and the training and reconditioning of the requisite skilled labor. To the original proposals drafted in 1932, there was added in early 1933 — when submitted for the National Recovery Act — a provision authorizing public works' expenditures for national defense, in view of the altered international situation. The ideas and proposals in connection with the original F.H.A. plan submitted in 1933 were later expanded in the second F.H.A. plan that, at the President's behest, was worked out for Governor Eccles' advisors. In keeping with the pattern of these earlier plans, the role of Government can be adjusted to specific requirements.

For the instant purpose, the organizational instrumentality proposed is the establishment of a Scientific Council of National Defense, composed of executives, engineers and economists, acting in behalf of the Government, who should be invested with administrative powers for the testing and execution of technical projects of utility for national defense.

Yours sincerely,

General Edwin M. Watson
Secretary to the President
The White House
Washington, D.C.

(EXHIBIT "A")

December 14, 1940

Dr. C. K. Leith, Mineral Consultant
Council of National Defense
Washington, D. C.

Dear Dr. Leith:

At the suggestion of Senator Charles B. Henderson I called to see you in Washington on November 22nd. In your absence I had a meeting with Mr. R. J. Lund. As president of this company, who are the exclusive sales representatives of Eldorado Gold Mines Limited of Canada, I submitted at that time a very brief verbal proposal regarding Radium and Uranium.

This company, the Canadian Radium & Uranium Corporation, is the exclusive world representative for the Eldorado Gold Mines Limited of Canada, the largest producer of radium and uranium. As president of this company and representative of the Canadian Radium and Uranium supply, I want to acquaint you with some current, pertinent facts on available supplies.

The question which I discussed with Mr. R. J. Lund, and which I propose to put before you is regarding radium and uranium and of its importance to you and also the U. S. Health Public Service and the Procurement Division of the Treasury Dept.

The question particularly concerns the present status of the radium and uranium sources in this hemisphere. As you realize, the world sources of radium and uranium are limited to the deposits in the Belgian Congo, Jochymov in Czecho-Slovakia, the Pitchblende deposits in Canada, and the Carnotite deposits in Colorado.

The Belgian Congo ore was treated near Brussels up until the latter part of 1939, and now since the invasion of Brussels by Germany it is impossible for them to treat any further ore from the Congo. The Czecho-Slovakia supply is very limited and whatever production is available is very small and is taken entirely by the German Government. The American domestic production is also a limited source and because of the type of ore, it is very expensive to produce. This leaves the Canadian deposits, which are of very high grade and extensive.

At the present time the Canadian deposits of radium and uranium are not being worked, ostensibly due to a large supply of concentrates and a supply of finished goods on hand, but actually due to a lack of sufficient capital to keep the mine working until some of the present finished supplies and concentrates are disposed of. The stocks of concentrates, partially processed material and finished goods on hand, which is practically all of the available supplies on this hemisphere and in the British Empire, is hardly more than enough to take care of the medical and industrial demands for the next year or possibly two years. If there were suddenly an exceptional demand for radium or uranium for use in industry or in armaments, we would be unable to meet the demand without considerable delay, as we would be unable to produce immediately more than what is available in the stocks on hand.

Dr. C. K. Leith

December 14, 1940

The reason for there being a delay on further supplies is that the concentrates come from the mine near the Arctic Circle and the weather conditions do not permit the commencing of operations at any time of the year other than in the summer. This means that if the mine were opened during the summer of 1941, it would be 18 months before the concentrates reached the refinery in Port Hope and at least another six months before any of the concentrates could be reduced to the finished material and available for sale. If we do not open in the summer of 1941, there will be no further opportunity to commence operation until the summer of 1942, which means a further delay of one year. Such a delay could be disastrous if there were urgent requirements for this material.

With the research work that is being done on uranium, there will undoubtedly be a very large demand for it in connection with further research and defense work. The increased armament and plane production of the United States is also going to require large quantities of radium, and the domestic production in the United States would be insignificant compared with the demand.

The capacity of our refinery at Port Hope is in the neighborhood of $7\frac{1}{2}$ grams of radium per month and 60,000 lbs. of uranium per month. The refinery is not working at capacity at this time, but on a very limited scale. With sufficient demand or assurance of demand, the final output could be increased to capacity, and by opening the mine this coming summer there would be more concentrates available when the present stock on hand is completely treated.

We believe that the situation regarding the supplies of radium and uranium, as far as the Government requirements are concerned, are serious and that situation should be brought to the attention of the U. S. Government. When they are conversant with the situation they will realize the importance and necessity of opening our mine as early as possible.

We believe, providing your Government is interested, that it would be very advantageous to themselves and to the Canadian Government to discuss this question. We have already discussed it with various interested officials at Ottawa, and they were very hopeful of the eventual interest in the situation by the U. S. Government. However, you realize they can do nothing about this matter unless your Government expresses an interest.

Should the U. S. Government be interested in the situation as outlined, our suggestion would be that a credit be established in the United States in U. S. dollars for the Canadian Government to the value of say 100 grams of radium and over 1,000,000 lbs. of uranium. Then immediately we would arrange for the opening of the mine this spring, as soon as the weather permitted.

When the radium and uranium is completely refined, we would turn it over to the proper department in the Canadian Government for use in trade or exchange for goods from United States, which Canada sorely needs for carrying on the war. You need not have any doubt about the Canadian Government's hope that such a transaction would be of interest to you, because of their need for U.S. dollars.

Dr. C. K. Leith

December 14, 1940

In closing, we want to refer to comments by Prof. Pegram of Columbia University, whose interest in radium and uranium must be known to you. Prof. Pegram suggested that Dr. Vannevar Bush, chairman of the National Defense Research Committee, would also be very much interested in the uranium question and that you might refer to him.

This letter will serve to introduce my question to you, and I put myself and this company at your disposal for any details or further plans.

Very truly yours,

CANADIAN RADIUM & URANIUM CORPORATION

BP/bb

Boris Pregel, President.

MIAMI DAILY NEWS

MIAMI, FLA., SUNDAY, JANUARY 12, 1941

Scientists To Decide War



BORIS J. PREGEL

Victory In War May Come To Nation "Solving" U-235

By PHIL LOCKE
(Daily News Staff Writer)

The Battle of Waterloo may have been won on the playing fields of Eton, but the Battle of Britain will be won under the late-burning lights in the laboratories of scientific researchers.

Specifically, upon the outcome of the race to unlock the energy of the much-publicized U-235 will rest victory in the European war, and also the future course of mankind's social and economic development.

This is the judgment of a man, now a guest at Miami Battle Creek sanitarium, who is in the midst of this fascinating struggle.

He is Boris J. Pregel, president of the Canadian Radium and Uranium Corp., with American headquarters in Rockefeller Center, New York.

He is an authority because U-235 is the technical designation for the famous and as yet unconquered isotope of uranium.

"The Axis is working night and day," declares Pregel, "to bring to fruition experiments that will release the unbelievable stores of energy contained in U-235. But so are the scientists of the democracies. The future of the world belongs to the nation which can first accomplish this."

And who will win this race on the part of men of peace to create instruments of war?

There is no doubt in the mind of Pregel.

"We believe that the democracies of the Western Hemisphere will win that race. Free science, like free men, must flee from the Axis, where it is impossible to work except under the club—or the gun.

"All true research is hamstrung by military necessity in Europe. This continent is the hope of science and of a remade society. It is not only the arsenal of democracy, as President Roosevelt has said, but its power mines."

Pregel's corporation owns the El Dorado mines in the Great Bear lake district of sub-arctic Canada that have been revealed to hold the world's richest deposits of pitchblende, or radium-bearing minerals. These deposits exceed in quantity even the famous pitchblende strata of the Belgian Congo.

Production and research now being carried on by M. Pregel's corporation envisage the whole field of man's future scientific progress. The uses of radium, M. Pregel points out, are extremely varied. First of all, he asserts, it is doing indispensable service to defense. There is not a sheet of steel, a vital machine part nor an integral unit in warship construction which is not first checked for flaws by the powerful Gamma rays of radium photography. Luminous compounds glow in the dials of instrument boards of planes, ships and submarines. Radioactive catalyzers are used to "crack" oils for refining; to remove static electricity from the threads of woolsens and silks. Radium is also used in the motor industry. Some of its most important usages are defense secrets.

In the field of medicine, besides the better-known functions of radium therapy, scores of new treatments are being tried out. Radon, a by-product and a short-lived gas, is being found effective in many ills, and so is mild, or micro-radium therapy, both internal and external, used in cases of arthritis, neuritis, sciatica and rheumatism.

Agriculture may in time be completely transformed by the incorporation of radioactive materials in fertilizers. Already they have been found to speed growth, increase size of vegetables as well as of their yield, intensify color and heighten food value. Crop increases of between 25 and 40 per cent are experimentally reported, dwarfing the costs to insignificance. Finally, radium is used to accelerate uranium research, a field skirting the edges of the unknown and miraculous.

The war story is the vital story with uranium at the moment, Pregel asserts, but the industry is also looking forward to the time after Adolf Hitler's Stukas and "flying pencils" and 70-ton tanks will be rendered "as obsolete as Bleriot's flying kite."

"Don't forget," he says, "that after the Hitler menace is beaten back and crushed, the world will have to be reconstructed. We had the ages of steam and electricity. Now we are in the era

of radio-activity, and in a decade or so may come the age of uranium, like an H. G. Wells story of the future.

"If this develops, we can look forward to unlimited cheap power and fuel, an indefinite supply of raw materials, comfort for all with the minimum of labor—those things that should remove the causes of poverty, envy and greed, make wars unthinkable and usher in a golden age for human beings."

"EXHIBIT B"

Astounding Results Predicted For Uranium

Power coming from new uranium stations will be so cheap as to cause an economic revolution if the hopes of scientists are realized, Boris Pregel, president of the Canadian Radium and Uranium Corporation, chief producer of these products in America, said Saturday.

Pregel, who also is an executive committeeman of the International Union Against Cancer, pointed out that scientists have shown that one pound of especially processed uranium has more power than 250,000 gallons of gasoline and that research work promises that with the use of uranium "there will be more progress in the world in one decade than in past centuries.

"Uranium and radium are creative elements and not destructive ones which is fortunate for humanity," he said. "The use of uranium is known to the public as being attached to the war on cancer but it should be known that it is used in large quantities for other purposes.

"It is being used in metalradiography for photographing large and important parts of heavy machinery in order to detect faults. It also is being used in research work going on in agriculture and in luminous compounds necessary for the dials of control boards in airplanes."

World Wide Research

Pregel's corporation is doing constant research work in medicine and in industrial and defense problems involving the use of the elements and their by-products.

"Very important facilities are now in use in the field of study of radio activity," he continued. "It is opening new developments beneficial to humanity, more so in social changes than anything else. The research work is being carried out in laboratories and universities all over the world.

"Fortunately for the present situation the only sources of the elements are in Belgian Congo, now controlled by the British, and in North America where deposits have been found and are being worked in Canada."

He explained that a new union in the fight against cancer has been established with headquarters in New York. It takes the place of the old union which had headquarters in Paris and which had representation from 55 nations. In the four months of the Pan-American Union Against Cancer, he said, delegates have been obtained by governmental appointment from all Western Hemisphere republics. Directors of the union will meet at Buenos Aires late this year or early in 1942 to plan a world-wide campaign for their work



BORIS PREGEL
... sees economic revolution.

Progress At Congress

The last congress of the international union, held in Paris in 1938 and opened by the then French President LeBrun, compiled much important scientific data from the work of Madam Curie, discoverer of radium; Roentgen's compilations on X-Rays and Herz' work in radio short waves.

Pregel said the union against cancer has the active participation and support of "all forces for cancer research and control." It is the "international clearing house for the exchange of results and statistics and for the promotion of research.

"It establishes clinics and local institutions to deal with the problem and has charge of dissemination of cancer education looking toward prevention."

He and Mrs. Pregel, with Edward Ansen, a director of the producing corporation, have been staying at Miami-Battle Creek Sanitarium.

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The New York Times Magazine



"Full employment is the most important subject now before the American people"—Scene at a West Coast shipyard.

TEMPERAMENTALLY I like the idea of reducing Government interference in economic matters to the minimum. Most of our ancestors came to the United States from Europe because they thought there was more freedom here from the heavy hand of Government. It is in our blood and in the air we breathe to hate Government interference. We don't want to be dominated by either a permanent military or a Government bureaucracy. Both tend eventually to become bigoted, thoughtless, or arbitrary.

But to escape from excessive Governmental planning we must find out just what is the smallest amount of planning which will give us the greatest amount of freedom. The answer to this problem will give us the basis for maintaining a democratic, free-enterprise Government. The answer varies every day. War changes the answer. So does the invention of the atomic bomb and so will the development of atomic power. So did the development of great corporations and powerful labor unions. So does the dissipation of fundamental resources, whether they be the health of the people or the supply of uranium, coal, oil, iron, forests and soil fertility.

In 1940 there was no Congressional provision for the acquirement of an adequate

We must plan in moderation, the Secretary says, with full employment as our objective.

By HENRY A. WALLACE

Secretary of Commerce

supply of uranium. That was due to a failure in planning by the executive branch of the Government. The story of how this failure in Government planning was remedied by the foresight of certain individuals who truly loved American freedom and knew its peril will some day be told.

Failure of Government to plan in 1940 for adequate supplies of uranium may seem excusable but it could have been fatal. So also certain Governmental failures to plan for peace after the last war could have been fatal.

BEFORE discussing modern types of Government planning I should like to review briefly those types of Government responsibility which have always been with us and because of that are no longer questioned as legitimate areas of Government influence in our economy.

First, the Government must and does plan with respect to taxes.

Second, it must and does plan with respect to money, interest rates and the floating of loans as they may affect inflation and deflation. Or as the Constitution puts it, Congress has the power to coin money and regulate the value thereof.

Third, the Government must and does plan with respect to tariff policies. A debtor nation with large, unexploited natural resources must without long-time disadvantage to its own consumers give moderate protection for a time to certain infant industries and do everything possible to promote a sufficient excess of exports over imports to service the interest on its loans. A mature creditor nation must plan either to make loans abroad or to receive an excess of imports over exports.

Government policy in these three fields has played a vital role in the vast growth of this nation. At various stages in our history, these policies have been estab-

lished without regard to planning—that is, without taking fully into account the final impact of all of the Government decisions combined. At times these policies, though unplanned, have been fairly uniform in purpose, but set in accord with the short-run gains of special-interest groups.

THE failure of the United States to plan sensibly in these three fields, and especially in the third one, after World War I contributed in large measure to the severity of the depression of the Thirties. This failure also contributed to the economic maladjustments of other countries and thus intensified the world depression. The United States, the ultimate creditor of the world, by its policies refused to receive the necessary volume of goods from the debtor countries of the world. It was this impasse which caused some sensible, decent Germans to say, "All we can do now is to create for ourselves a higher nuisance value."

Planning with regard to taxation and fiscal policy becomes especially important after a great war because the interest charge and therefore the taxes represent a much larger share of the national income. The Government must set interest rates on its huge (Continued on Page 43)

"EXHIBIT D"

("EXHIBIT F")

HTW:KSV

December 15, 1941.

D

Dr. Boris Pregel,
630 Fifth Avenue,
New York, N. Y.

Dear Dr. Pregel:

I have received your letter of December 11 enclosing data on the distribution of radium in Europe. I want to thank you for this information.

I want to assure you of my deep appreciation of your offer to place yourself at the complete disposal of the Government to assist in matters of National Defense. The fact that so many individuals are indicating their willingness to put their immediate problems aside and to sacrifice their own personal interests is very encouraging. It is very likely that you will be able to assist in various ways, and when the proper occasion arises we shall not hesitate to call upon you.

Sincerely yours,

(Signed) L. J. Briggs

Lyman J. Briggs, Director.

(EXHIBIT G)

May 27, 1942.

Dr. Richard C. Tolman, Chairman,
Division A,
National Defense Research Committee,
2101 Constitution Avenue,
Washington, D. C.

Dear Mr. Tolman:

First of all, I wish to express my appreciation of your kind reception. I also wish to confirm our conversation and outline briefly what we propose to do in the field of scientific research.

We have formed a group of outstanding scientists, which was headed by Prof. Jean Perrin, Nobel Prize Laureate. Unfortunately, Prof. Jean Perrin passed away recently, and we have replaced him with his son, Dr. Francis Perrin, who has collaborated with his father for a number of years and is an outstanding physicist himself, now connected with Columbia University. We have also invited Dr. Ladislas Goldstein from the Curie Laboratories, and hope to be able to add a number of other outstanding physicists and chemists, mostly from the Curie Laboratories, and all Free French.

If you add to this our regular staff of physicists and chemists, in New York, as well as the scientific staff at our refinery in Port Hope, this forms quite a group of scientists.

In view of the fact that we have at our disposal the only Radium mine and refinery of importance in the world at this time, we have access not only to large sources of Radium, but can also experiment with various rare radioactive materials, such as Polonium, Actinium, Proactinium, Ionium, Radium D, etc.

We hereby pledge that any and all developments, discoveries, improvements, etc. that we may achieve will be placed at the disposal of the United States Government, absolutely without any remuneration. We feel it is our duty to make this contribution to the war effort.

I wish to state at this time that all expenses in connection with this research will be absorbed by us, and we shall keep you informed of all further developments in this connection.

Very truly yours,

CANADIAN RADIUM & URANIUM CORPORATION

Boris Pregel, President.

EP/bg

*Cong-Nat
Def.*

UNDER
KNOTT MANAGEMENT

TELEPHONE
UNIVERSITY 4-2700

Kings Crown Hotel



420 WEST 116TH STREET
NEW YORK

OPPOSITE COLUMBIA UNIVERSITY

April 24, 1940

Dear Dr. Sachs:

Enclosed I am sending a draft of the letter which Dr. Einstein might want to write to Dr. Briggs. Perhaps you may want to improve upon it.

Yours sincerely,

Leah Land

Ex. 66

U. S. DEPARTMENT OF COMMERCE
National Bureau of Standards
Washington

Copy

February 20, 1940

PERSONAL AND CONFIDENTIAL

Memorandum for General Watson,
Secretary to the President.

Subject: Your memorandum of Feb. 8th.

I wish to report that following my memorandum of November 1, funds have been transferred from the Army and Navy to purchase materials for carrying out a crucial experiment on a satisfactory scale. It is believed that this experiment will show whether or not the undertaking has a practical application. It is hoped that a report on this experiment can be made in a few weeks.

/s/ Lyman J. Briggs,
Director.

IV.

1. By the beginning of May the uranium research carried on at Columbia ~~xxxx~~ had reached a point where the expansion was deemed highly desirable by the two leading experimentators Dr. Fermi and Szilard, and in this they were supported by Dean George Pegram, head of the Physics Department and by Professor Harold B. Urey, Nobel Prize Winner and discoverer of "Heavy Water". After a brief conference with the Columbia group of physicists - in accordance with a practice that was inaugurated at the turn of the year - a sort of "MINUTE" was drafted as of May 10th of the concensus for the ensuing stages of the research as follows:-

1/ The first large scale experiment would have as its aim to demonstrate beyond any doubt whatever that a nuclear chain reaction could be maintained in a system composed of carbon and uranium. This would require about 100 tons of graphite and from 10/20 tons of uranium metal. It would also be necessary to design a rather elaborate mechanism to stabilize the chain reaction and to safeguard against overheating as well as the possibility of an explosion.

2. While one or two insisted on the gradualism and the successive stages, it was the view of the writer - as one familiar with the economics of technical research for business purposes - that it would be necessary to plan the mechanical equipment and components on an integral instead of a serial basis. For it was clear that the inventive minds of Drs. Fermi and Szilard were completely free of any hint or tint of doubt that the nuclear chain reaction could be thus maintained. From the standpoint of those who like the writer were mindful of the gravity of the world situation ~~and the magnitude of the damage for unpreparedness that xxxxxx~~ and the rapidity with which claims and bills for unpreparedness were being collected against the European nations at the Bank of History. Serial procedure entailed risks that a great nation should not run.

For those schooled in the administrations of university research projects ~~xxxxxxxxxxxxxxxx~~ geared to small piecemeal budgets could not get themselves out of the old pattern and as indicated their view prevailed at the already described conference in Washington on April 27th.

3. Accordingly those sympathetic to the writer's point of view felt that the most that could be obtained at that stage would be to spell out the ~~xxxxxxxxxx~~ sequences of stages and to get these administrators accustomed to think of the succession and dovetailing of the sequential small scale operations.

~~Most specifically~~ the immediately next stage is to ~~to~~
#2 carry out a general survey of all nuclear constants in order to confirm the values previously obtained and to narrow down the limits of experimental error ~~xxxxxx~~ beyond observed values of these constants. This would strengthen the assurance of the group in the ultimate success of the experiment. ~~Then~~ as preparatory ground for the experiment would come
#3 the advancing of structural details and the carrying out of technological tests on samples of materials which have to be used in large quantities

in the ultimate experiment. This in turn would require getting bids for the manufacturing of the material in needed quality and quantity.

The first stage in the organization of the large scale experiment would provide expenditure of about \$30,000 to 50,000. The second large scale demonstration experiment would entail expenditures of ~~ten to twelve times the~~ ^{the} range given for the first stage.

This very spelling out of the stages and the corresponding budgetary needs seemed then to the writer to reinforce the contention that the preparatory work on the second stage should be provided for financial at once. The writer's proposal of a non-profit trust fund or a corporation directed by a mixed board of men experienced in ~~the~~ research and in ^{to} seemed particularly suited to overcoming the dilemma between ~~two~~ small and delayed on one hand and too large and too fast on the other hand.

4. Another ~~important~~ complication was that up to the time of the notable advances made by the Columbia group, the research was canalized in another direction, such as the separation of the uranium isotopes. By contrast the lines opened up by Drs. Fermi and Szilard in ~~what~~ ^{the} Dr. Einstein was certain was more than a possibility of a sustained fast ~~neutron~~ neutron reaction could go forward with the use of the commercial unseparated uranium.

V.

as thus

The difficulty and dilemma ~~as then~~ described - in the minute-type of memorandum that was drawn up by ~~on~~ May 10th - led to the submission to the president in a letter of May 11, 1940, of an alternative procedure to the one that had emerged from the conference in Washington. (This letter of the writer to the President included herein as Ex. 11a) and accompanied by a note of transmittal to General Watson of even date, marked Exhibit 11b.)

The point of departure was according to the advice given the writer by Dean Pegrum the initial experiment on graphite that was partly financed by the government was completed successfully. The entry of the research upon large scope would call for considerable supplies of uranium. By then the fear voiced in initial letter of the writer to the President dated October 11, 1939, regarding the invasion of Belgium was already a day-old fact. (Germany having invaded the Netherlands, Luxemburg and Belgium on May 10th). This meant that there was a problem of adequate raw material and if time had to be taken by the forelock to insure supplies the project scope of the research should be adjusted to scale. Hence, the plea in the letter for adequacy and comprehensiveness in planning of the experimental work henceforth. The second request or plea was in behalf of the establishment forthwith of an "appropriate organization and framework under which the work could proceed with the flexibility required for a going enterprise. With a view for implementing that suggestion a request was made ~~for~~ that the President designate a legal aid for the forming of the proposed non-profit corporation and the direction of the work through properly selected board of trustees and "assuring that the work by scientists in universities is carried out with due secrecy" as distinguished from the normal eagerness for prompt publication of tenor or results of research.

(EXHIBIT "E")

COLUMBIA UNIVERSITY
IN THE CITY OF NEW YORK

Department of Physics

June 7, 1941

Mr. Boris Pregel, President
Canadian Radium & Uranium Corporation
630 Fifth Avenue
New York, N. Y.

Dear Mr. Pregel:

In accordance with your letter of June 5, 1941, following our conversation of June 3 and further conversation with Dr. Szilard, we are sending you a Columbia University order worded as follows:

"For preparation only of 5 tons (10,000 lbs.) of black uranium oxide at 30 cents a pound for the use of Columbia University until July 15, 1942, and subject to later purchase, all in accord with letter of June 5, 1941, from Canadian Radium and Uranium Corporation, \$3,000."

"Delivery of the uranium oxide to be made within a period of six weeks."

The arrangements which you have explained in your letter seem to us entirely satisfactory, and indeed we are very appreciative of your helpfulness in making such an arrangement in order that we may not run the risk of delay in the progress of our experiments.

Very truly yours,

(Signed) George B. Pegram

George B. Pegram

CLASS OF SERVICE

This is a full AM Cablegram unless its deferred character is indicated by a suitable symbol above or preceding the address.

WESTERN UNION (30)

SYMBOLS

- DL - Day Letter
- NL - Night Letter
- LC - Deferred Cable
- NLT - Cable Night Letter
- Ship Radiogram

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N.Y.

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B. WHITE
PRESIDENT

NEWCOMB CARLTON
CHAIRMAN OF THE BOARD

J. G. WILLEVER
FIRST VICE-PRESIDENT

The filing time shown in the date line on telegrams and day letters is STANDARD TIME at point of origin. Time of receipt is STANDARD TIME at point of destination.

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DR ALEXANDER SACHS=

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BELIEVE IT WISE TO LIMIT ADVISORY COMMITTEE MEETING

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LYMAN J BRIGGS DIRECTOR.

THE COMPANY WILL APPRECIATE SUGGESTIONS FROM ITS PATRONS CONCERNING ITS SERVICE

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Charge to the account of

CLASS OF SERVICE DESIRED	
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TELEGRAM	ORDINARY
DAY LETTER	URGENT
NIGHT LETTER	DEFERRED
SPECIAL	NIGHT LETTER
SPECIAL SERVICE	DAY LETTER
<small> Telegrams and cables transmitted as a telegraph or ordinary message. </small>	

Send the following message, subject to the terms on back hereof, which are hereby agreed to

R. B. WHITE
PRESIDENT

NEWCOMB CARLTON
CHAIRMAN OF THE BOARD

J. C. WILLEVER
FIRST VICE-PRESIDENT

WESTERN UNION

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CHECK
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A BORN LIMITED GATHERING COULD FOLLOW AN EXECUTIVE MEETING STOP RIGHER SZILARD
 FERRI ATTENDING PHYSICAL SOCIETY MEETING AND ASSUME RELACHABLE VARDIAN PART STOP
 PLEASE VITE HE STOP LOOKING FORWARD SEEING YOU TOMORROW.

ALEXANDER SLOWS

Comms - Nat Def

**Aide-memoire for conferences with
governmental authorities on current
and prospective needs of Uranium-
National-Defense project.**

Import of War Developments for

and

Application to National Defense of Uranium Atomic Disintegration

by

Alexander Sachs

April 20, 1940

Aide-memoire
April 20, 1940

Since the inauguration in the summer of 1939 of discussions with scientists concerned with uranium atomic disintegration the writer served as the representative and associate of Dr. Einstein in presenting the uranium project to the President of the United States in October 1939 and as a member of the advisory group appointed by the President for determining the utility of the research for national defense and the extent to which the government should promote and support the researches that have thus far been carried on in scattered places and on limited scales in our universities.

1.

As a result of the enlightenment received and the discussions had by the writer with Drs. Einstein, Wigner, Fermi, and Szilard, it may be set down as a scientific conclusion that recent experiments have shown (a) the possibility of liberating energy in uranium by means of a chain reaction, and (b) that in the course of such chain reaction it should be possible to utilize the energy liberated for the generation of great power and, what would be of greatest significance, for the production of enormously potent explosives.

Dr. Enrico Fermi - the Nobel prize man in physics who occupies a visiting research fellowship at Columbia, and who since Italy's military alliance with Nazi Germany has decided to remain in the United States - has played an important part in the extension of the frontiers of the research on atomic disintegration through experiments with uranium. Yet in conversation, whether as a style of expression or of thought, he has remained cautious about the convertability, so to speak, of the indicated potentiality into a demonstrated

The higher and more elaborate technology that has been introduced by Nazi Germany in its military weapons and operations - as compared with not only the last war but the current military weapons and operations of the Allies - constitutes a challenge to the democracies that are industrially and technically equipped. It is therefore the writer's conviction - which he has voiced repeatedly - that once we relate the uranium research to national defense, it should be regared in type and tempo to the most advanced technological research that has been carried out by the American chemical and electrical companies. Indeed, the probability and the hope that the needs of national defense will be taken seriously by the country means that a new norm will presently be evolved for American technical industry in relation to defense research and defense production. As a nation we are just becoming aware of the fact that the superior Nazi technology has been riding roughshod over the totally inadequately prepared Allied victims of Nazi aggression. What has taken place in Poland, Denmark and Norway, and will doubtless go on through other European countries that will be invaded, is that the pacific-minded countries have not brought their national defense up to the quantity and quality required for technological warfare. When the import of the European war is assimilated by the American people and national defense is undertaken as a national enterprise, then we may be confident that we will match in war the progressiveness of our civilian technology and come to surpass it, which means surpassing the German military technology.

Thus reoriented on the interaction between technical research and national defense, it becomes tenable to regard possibilities as probabilities

and to assume that what sagacious scientists hold as eventually achievable after a term of years could be telescoped into a much shorter period. Expressed differently, what the writer calls an adequate organizational framework is itself the precondition for the rapid ascertainment and effectuation of the value of the nuclear research for national defense. In attempting then a mental preview of the import of the current experiments for national defense we should detach ourselves from the dubieties, the cautions and the hesitations that are typical of scientific research rapportage.

3.

Proceeding then with admitted mental leaps to the stage beyond the demonstration of chain reaction, let us suppose that such a reaction is demonstrated and maintained in the fission of ordinary commercial uranium. The first meaning is of course that we would be anticipating and outwitting the Nazi effort at the Kaiser Wilhelm Institut to produce such power and/or such bombs. The danger that was mentioned by Dr. Einstein in his letter to the President dated August 2, 1939 would be averted. We would also be in a position to decide the use of such bombs against Germany, assuming the continuation of her military march and aggression, entailing as is deemed by him and the writer probably the involvement of the United States in the war. In the pursuit of political and economic research we must take cognizance of the implications inherent in the existence of an Axis consisting of Germany, Italy and Japan and of the probability. The alliance of Japan with Germany means that an enlargement of the war to the scale of the last one, ^{would in time} carrying with it aggression of Japan against the British and Dutch empires ^{already or} ~~expected~~ at war with Germany - and later also against the United States. Now in the case of a war between Japan and the United States, the disadvantage under which we labor is the enormous

magnitude of the distance between continental United States and our possessions and between our possessions and the Japanese homeland. It is therefore advisable to articulate not only the consequences of the uranium chain reaction for the production of bombs but also for the development of a new type of power. In the first case the release of the energy would take the form of the production of a bomb of hitherto unimagined potency. In the second case there could be concentrated in a plant of very small compass a driving and propelling power surpassing any of the present elaborate power plants.

It is in connection with this second alternative use that an attempt was made by the writer to evoke from the group members a spelling out of the application. The naval base at Hawaii is some 3500 miles away from Japan. In the discussion the following comparison was made on the basis of assumed data that remain to be checked with technically informed navy people. A capital warship assumed to carry a maximum load of about 4000 tons of oil would be using about $\frac{1}{2}$ ton of oil per mile if cruising at a satisfactory speed. If this be valid then such a warship would have to be refueled after travelling 8000 miles. This limits the cruising period for a ship refueled at Hawaii destined for operating in the vicinity of the Japanese islands.

An estimate described as conservative was made by Dr. Szilard that we may expect one ton of uranium to supply as much power as about 5000 tons of oil; and that pending the outcome of the still newer experiments there are chances that a ton of uranium would produce as much power as would correspond to from $\frac{1}{3}$ to 1 million tons of oil. In the light of that the question was whether it would be possible to equip boats stocked with ^{derivative power} uranium ~~equal to the~~ range of the tremendous oil reserves mentioned. This would free naval war weapons from the limitations on cruise range due to the necessity of refueling.

The discerned connection between the Navy and the airplanes through air carriers would magnify the flexibility and potency of the uranium applications in the dual forms of power and explosive.

The foregoing considerations prompted members of the group to express the hope that the Army and Navy representatives might see their way clear to explore jointly the compounded possibilities thus indicated.

April 20, 1940

In September last year I was approached by a group of scientists with the request of helping them to enlist the support of the Government for a line of work which might be of great importance for the U.S. Navy. ~~After having studied the matter~~ ^{Thereupon} the attention of the Administration was drawn to this line of research and its potential possibilities by a letter written by Professor Albert Einstein, which was addressed to the President and which I transmitted to him in a personal interview.

According to the scientists who work in this field it will be possible to liberate energy in uranium by means of a chain reaction, and it appears likely that it will be possible to utilize the energy liberated in the chain reaction for power production. It has yet to be demonstrated though that a chain reaction can in fact be maintained in a mass of about 30 tons of ordinary uranium of such purity as can be obtained by applying methods of ordinary chemical engineering. A conservative estimate shows that we may expect one ton of uranium to supply as much power as about 3000 tons of oil, but pending the outcome of certain newer experiments there is a 50:50 chance that one ton of uranium may supply as much power as would correspond to 1 million tons of oil.

If one ton of uranium supplies as much power as 3000 tons of oil then a power plant of this type could be installed on warships of the larger type and serve as a reserve driving power to be used in war time, which would seem to be of part-

icular significance for the United States in case of a war with Japan. This can be seen from the following consideration:

The naval base at Hawaii is at a distance of 3400 miles from Japan. A capital warship which carries a maximum load of about 4000 tons of oil will use about $\frac{1}{4}$ ton of oil per mile if cruising at a satisfactory speed. It has therefore to be refueled after traveling 8000 miles. In the circumstances such a ship, if it is refueled at Hawaii, could cruise only for a very short time in the vicinity of Japan proper. ^{at high speed} Assuming that it may be possible for the Navy to obtain 300 tons of uranium per year it might be possible to equip six boats every year with a plant ^{stocked with} ~~comprising~~ 50 tons of uranium and representing an oil reserve of 150,000 tons. This would enable these boats to have in war time a cruising range which is no longer limited by the necessity of refueling. Moreover, ~~a considerable~~ increase in speed may be achieved by reducing the oil load from 4000 tons to perhaps 1000 tons, resulting in a reduction of weight which is only partially compensated by the weight of the additional equipment of the uranium power plant. []] Assuming that one ton of uranium corresponds to only 3000 tons of oil, it would not seem likely that uranium can replace oil as a driving power for capital ships, but we may expect it rather to play the role of a reserve driving power to be used only in war time and at manoeuvres. Should further experiments, however, show that one ton of uranium can supply as much power as 1 million tons of oil, then capital ships could be equipped with this new source of power exclusively and do away with oil altogether.

In that case the present capital ships may ^{have to} be considered as obsolete.

2. Present Status.

The above-mentioned line of development is pursued by Dr. Fermi and Dr. Szilard in the laboratories of Columbia University. ^{second} ~~Another~~ line of research, which is followed up by Dr. Urey at Columbia University and also at several other places in the United States, represents an entirely different approach and aims at extracting from ordinary uranium a substance called uranium 235. There is no doubt that, if this substance can be extracted on a sufficiently large scale at a reasonable price, it could be used as a source of energy for purposes such as described above. ^I I understand that this second line of research is at present adequately supported both by the Army and Navy, whereas the first line of research, which promises practical results in a much nearer future, is at present not adequately organized. The state of affairs with respect of this first line is at present as follows:

Dr. Fermi and Dr. Szilard are proposing to carry out certain experiments at Columbia University. It is assumed that Dr. Bush's committee will meet the expenses of these experiments. A Special Advisory Committee headed by Dr. Briggs, which comprises representatives of the Army and Navy as well as Professor Pegram, Professor Einstein and myself, has concerned itself with various aspects of the work of Dr. Fermi and Dr. Szilard, including the necessity of its support. A committee of scientists headed by Dr. Urey is supposed to advise the Special Advisory Committee. The relationship of all these committees to

each other and to Dr. Briggs' committee is rather unclear.

3. Shortcomings of the present status concerning the organization of the line of work ^{perused} ~~represented~~ by Dr. Fermi and Dr. Szilard.

The production of a chain reaction in uranium in circumstances which are suitable to be utilized in an engine capable of driving a naval vessel is a task of considerable complexity. This task cannot be carried out by a loose cooperation of various committees and universities. It requires planning, the preparation of experiments six months and occasionally one year ahead, the gathering of a group of physicists prepared to collaborate for a number of years, whose loyalty has to be with this work rather than with the individual teaching institutions with which they happen to be associated. At present we may assume that the work carried out at Columbia University will be supported by Dr. Bush's committee, but it ^{is unlikely that} ~~remains to be seen how much of~~ this complex task can be carried out at a single university where the available space and the necessity of maintaining the routine work carried out by the department will naturally limit the ^A speed at which the work should be carried out. ~~The~~ loose cooperation between various universities can be anticipated and may to some extent remedy the situation, but surely this is no way of obtaining quickly the desired results. The existing committees both by virtue of their composition and by virtue of their structure can hardly be expected to fulfill the function which is required. This is fully borne out by the experience gathered during the ^{last ten months} ~~past year~~. ~~For this reason the history of the past year is summarized in the following:~~

4. ~~History~~. *The past ten months.*

In order to test the possibility of maintaining a chain reaction in ordinary uranium Dr. Szilard proposed last year to carry out an experiment using 100 to 200 tons of graphite and 20 to 30 tons of uranium metal. A successful conclusion of such an experiment may ultimately involve expenses up to half a million dollars, and in October last year I made an appeal to the Government for its moral and material aid in carrying out this project. In response to a letter received from Professor Einstein the President appointed a committee, with Dr. Briggs as chairman, and I submitted the matter to this committee jointly with Dr. Szilard, Dr. Wigner of Princeton University and Dr. E. Teller of George Washington University, Washington, D. C. We emphasized the urgency of deciding the question whether a chain reaction could be made to work with ordinary unseparated uranium, so that in case of a favorable result, steps might be taken to secure an adequate supply of rich uranium ore from the Belgian Congo. It was also pointed out that the matter had been discussed extensively with Professor E. Fermi and Dean G. B. Pegram of Columbia University, that their collaboration could be counted upon, and that certain preliminary experiments were being prepared at Columbia.

The Government representatives expressed their interest and their desire to help at this meeting, and various Government departments represented on the committee promised material aid towards the preliminary experiments (which have since been carried out to their completion at Columbia with ^{an} ~~a~~ definitely encouraging result). A favorable report was sent by Dr. Briggs' committee to the President in October.

5. Suggestions:

In order to insure that the task before us is carried out with the efficiency of a going enterprise it is proposed that it be entrusted to a non-profit organisation which is formed for the purpose. The scientists responsible for devising this project and who are familiar with the various aspects of this complex material ought to be included in the executive and ought to be in direct touch with Dr. Bush and such other government representatives as are interested in the details of the project. Large scale experiments ought to be carried out as a joint enterprise of this organisation and Columbia University and such other universities as may be willing to collaborate and to put up required space and other facilities. It would be the responsibility of this organisation:

1.) to see to it that all necessary experiments be carried out at one place or another and

2.) to see to it that all necessary materials be available for such experiments in the required quantity and quality.

3.) to find out in what form if any collaboration with industrial organisations such as for instance Westinghouse, General Electric and Dupont is desirable and possible, and if desirable to establish such ~~collaboration~~ collaboration.

4.) To maintain contact with the Canadian and U.S. producers of uranium and to stimulate if necessary an expansion of the production.

5.) To ~~advise~~ advise the government in general and the Secretary of the Navy in particular of the developments and ~~gradually~~ to prepare the ground for ~~transferring~~ gradually transferring ~~ex~~ the experience ~~xxx~~ acquired to the Navy ~~xxx~~ at the appropriate time.

It may be mentioned that this form of organisation has been repeatedly discussed at previous meetings and an opinion strongly in favour of it has been expressed by Prof. Einstein in a letter addressed to Dr. Briggs, a copy of which is enclosed.

June 13, 1940

Dear Mr. Sengler:

As a member of a special committee working with eminent scientists and governmental authorities, I have the honor to request an appointment for a conference in regard to uranium. As Mr. Leshien has doubtless informed you a great deal of significant experimental work is being conducted in this country. It has been watched sympathetically and has latterly evoked a fostering interest by important elements in the Government.

In view of the confidential character of the work and the relationships, it is advisable to defer further details until the conference itself. Yet it may not be amiss to state at this point that we are mainly concerned with information on supplies available in or that might be available from the Belgian Congo, and governing facts about production, operation and transportation.

The composition of the committee, as was decided on in conference and correspondence with authorities, is as follows: Dr. George Pegram, Head of Department of Physics and Dean of Graduate School at Columbia University; Dr. Harold Urey of the Department of Chemistry and a Nobel prize man; and Dr. Leo Szilard, who has been a pioneer in experimental work on uranium; and myself, in a strictly personal capacity, acting by appointment of the President as a member of a special advisory and liaison committee, along with Dr. Einstein and Dr. Pegram.

The scientists mentioned are conferring today in Washington and will likely return this evening. In view of the urgencies, it is highly desirable that the foregathering be had as soon as possible, and for this reason I am transmitting this note by hand and should appreciate your telephoning me at Bowling Green 9-3904 shortly after its receipt.

Sincerely yours,

Mr. Edgar Sengler
African Metals Corp.
25 Broadway
New York, N. Y.

July 10, 1940

Dear Mr. Le Chien:

In furtherance of our telephone conversation, in the wake of the enlightening conference that Professor Urey and I had with you on June 21st, I should like to make more precise the two sets of questions on which we should like an answer for submission to colleagues of the Committee and coordinating authorities:

The first set is concerned with uranium oxide as distinguished from the ore, and the quantities are an initial amount of, say, ten tons, with an option on another forty, to be taken up within the fiscal year. I take it that the present commercial price would apply to the total quantity.

The second set of questions is concerned with the importation of uranium ore from the Belgian Congo, on condition that transportation and storage charges are paid, in exchange for an undertaking not to re-export without permission and the right of the potential buyer to take up to the total amount thus imported. This, presumably, will require your setting forth and reaching an understanding as to the conditions and as to the prices for varying amounts of the thus optioned imports and the terms of renewal of the imported ore that may not be taken up within specified initial periods.

In connection with the available 1,000 tons of 65%-pure ore to be thus imported, questions will be put to us on which further light and information from you would be of great help, namely: (1) The arrangements that we understand you are planning to make for smelting in this country as against the former Belgian arrangement, and (2) potential output and product comparisons with Canada. Finally, while remote, a question may also arise as to what further quantities of ore on a monthly or quarterly basis could be mined in the Congo for inclusion in a supplementary arrangement.

With kind regards,

Yours sincerely,

Mr. Gustav Le Chien,
Radium Chemical Company,
570 Lexington Avenue,
New York City.

1st Copy, Bank for Receipt of Bond report for May 30, 1940

May 30, 1940

MEMORANDUM for Dr. Sachs

Please find enclosed memorandum for Dr. Urey of May 30, 1940.

In addition to the items included in the above-mentioned memorandum the following points seem to require attention.

a. It is important that Dr. Urey and the non-governmental members of the Special Advisory Committee be authorized to investigate whether there is a possibility of mining uranium ore in the Belgian Congo and transporting it to this country under the present conditions. If it is considered premature for the Government to buy any uranium ore perhaps some arrangement could be made with Dr. Sengier, the managing director of the Union Miniere who is at present in New York, or through the Belgian Government in exile that uranium ore be brought to the United States with the assistance of the United States Government, the Belgian company retaining the title of this ore but committing itself not to re-export it without special permission. It is impossible to know whether such and other alternative solutions are feasible, unless a preliminary inquiry is made, and it is not advisable to make such an inquiry without proper authorization.

b. It appears necessary that some experimentation be started at once by industrial firms who are willing to supply 10 to 20 tons of uranium metal at about six months notice. It is necessary that the non-governmental members of the Special Advisory Committee and Dr. Urey should be in a position of approaching ^{industrial firms} ~~them~~ on this subject and should feel authorized to do so.

c. It would be desirable that Dr. Urey and the non-governmental members of the Special Advisory Committee should form the nucleus for a board of trustees and work out the ^{statutes} ~~standards~~ for some

PL

for some non-profit organization which would ^{act as a link} ~~as far as the phys-~~
~~cists in the universities are concerned form the link~~ between the
Government and the ^{university} laboratories. If such an organization were
formed the physicists ought to be encouraged to take out patents
for their inventions which would be assigned either to this non-
profit organization or ^{direct} to the Government. In any case the Govern-
ment would thus be safeguarded against having to pay royalties
for the use of such inventions, which otherwise might be patented
by industrial firms whose research employees begin to show in-
creasing interest in this field of development.

In this connection the question has to be raised whether
it is possible to keep such patents secret. In order to do so in
an adequate way it might be advisable to ~~modify~~ ^{if necessary} the present law.
Such a modification of the present law ought of course not to be
made exclusively with a view to inventions concerning chain reac-
tions but also with a view to all inventions which have important
applications in national defense. The ~~se~~ physicists and engineers
ought not to be deprived of the stimulus arising out of the possi-
bility of patenting their inventions and at the same time collabo-
rating with the Government in ^{the} ~~their~~ effort to keep certain of
these inventions secret.

May 30, 1940

MEMORANDUM for Professor Urey

1. Admiral Bowen suggested at a meeting held under the chairmanship of Dr. Briggs at the Bureau of Standards on April 27, 1940, that the scientists working on uranium should form sort of voluntary association and impose upon themselves such limitations concerning the publication of results as appears to be necessary.

While at the time, this suggestion was made it seemed to be difficult to get the cooperation of the majority of scientists the invasion of Holland and Belgium has brought about a change of attitude so that now we may hope to succeed if we act on the suggestion of Admiral Bowen.

It is proposed that a committee for the coordination of nuclear research be formed under your chairmanship and that this committee formulate from time to time the policy which is to be adopted with regard to publication. If this committee were composed of yourself, Pegram, Wigner, Beams, Tuve, Teller, Fermi, and myself, it would be easy to meet once a month and to deal with all problems which may arise. For this reason no names have been included from the Middle-west or the West coast. Since, however, the Physical Sciences Division of the National Research Council has ~~xxx~~ appointed a committee for the purpose of looking into the question of uranium ~~and~~ ~~xxxxxxxxxxxx~~ which consists of Beams, Breit, and Pegram, you might feel that you want to ask Breit to join the committee so that all members of the group representing the National Research Council should be included in your committee.

Your committee could have a sub-committee for unseparated uranium and a sub-committee for the separation of uranium isotopes. Fermi and I would be glad to act as secretaries to the sub-committee for unseparated uranium and I suppose you and Beams might be willing to act as secretaries for the sub-committee for the separation of uranium isotopes.

The scope of the committee could be enlarged immediately after its formation by including the non-governmental members of the Special Advisory

Committee which has been meeting under the chairmanship of Dr. Briggs. These non-governmental members are Professor Pegram, Dr. Alexander Sachs, and Professor Albert Einstein. They, together with yourself, could then form the link between your committee and the government and could act as a nucleus for a board of trustees. Such a board of trustees will be required if funds are to be obtained or solicited from either governmental or private sources.

Fermi and I
In order to be able to maintain the necessary secrecy and at the same time to preserve the possibility of free discussion among those scientists who wish to cooperate with each other, it is proposed that your committee after its formation, should draw up a list of names and that there should be free discussion among those who are included in this register. At the same time, an uncontrolled diffusion of information would be prevented by pledging all those ~~included~~ to be included in this register to refrain from discussing the subject of uranium with anyone else. New names could be added to the list from time to time in order to include all those who are trustworthy and who may wish actively to collaborate. Separate lists of names may be drawn up for the various branches of uranium research in accordance with the fact that the need for secrecy is greater for some branches than for others.

Requirement For Funds:

Fermi and I would desire to carry out a large scale experiment which would involve the use of about 100 tons of graphite and 10 to 20 tons of metallic uranium. Before actually placing orders for such an experiment which will involve considerable expenditure we propose to go through a preparatory stage involving an expenditure of \$50,000. The successful completion of this preparatory stage would make it possible to carry out the large scale experiment in a comparatively short time

and with an increased assurance of success.

We are looking forward to obtaining from the Government the sum of \$50,000. which is required for this preparatory stage. We feel, however, that a few weeks or months may pass before we will be actually in the position of making financial commitments on the basis of the expected action by the Government. Unless we are able to make such commitments within the next two weeks up to the amount of \$15,000. we shall not be able to efficiently prepare the work which otherwise could be speedily carried out during the summer and during the next academic term. This means that we may lose four to six months of valuable time. If this amount could be obtained without delay from a private source, for instance, from the Carnegie Institute through Dr. Bush, it would represent a very great help at this juncture. It could be either refunded if and when Government facilities become available or it could be handed over to your committee earmarked for work on unseparated uranium and used for such expenditure as will not be provided for by the Government.

Handwritten notes:
I have
not
seen
this
document

Of the required \$15,000. about \$12,000. might be taken up for assuring the collaborators whose help we need adequate salaries for a period of a year. We propose to keep the salaries somewhat higher than usual in order to compensate our collaborators for the damage which in their careers will suffer by their being prevented from publishing any papers.

While undoubtedly a fund of \$25,000. would be preferable inasmuch as it would include an item of \$7000. for buying materials such as uranium oxide and uranium metal in quantities required within the next six months and another item of \$6,000. for building apparatus, we feel that if we could be sure right away that we can go ahead and make commitments on the basis of a budget of \$15,000. this smaller sum would

be sufficient to bridge the gap provided that we receive a pledge by
✓ the Government concerning the budget of \$50,000. by the end of September.

Coverage - Nat. Def.

U. S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

WASHINGTON

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS

LJB:DEK

June 5, 1940

IN YOUR REPLY
REFER TO FILE

D

Dr. Alexander Sachs,
One South William Street,
New York, N. Y.

Dear Dr. Sachs:

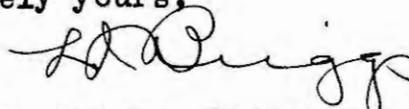
I have prepared a letter along the lines indicated in your letter of June 3rd which was very helpful. Please use your own good judgment as regards the best way to proceed for in such matters you are far more experienced than I am.

The scientific advisory committee is shaping up very nicely. Dr. Bush, the President of the Carnegie Institution of Washington, has assured us that his only desire in calling the conference was to determine in what way the Institution might be most helpful, and the way is now entirely clear to appoint the scientific advisory committee which we discussed last Saturday. I saw Dr. Urey today and we arrived tentatively at the following list:

Dr. Urey, Chairman
Dr. Tuve
Dr. Beams
Dr. Breit
Dean Pegram
Dr. Rabi
Dr. Gunn
Dr. Fermi
Dr. Szilard

It seemed to me advisable to make this strictly a scientific committee which will report its findings and recommendations to us for action. I trust this will meet with your approval. A meeting has been planned in Washington for June 15th.

Sincerely yours,



Lyman J. Briggs, Director.

Comings - Nat. Def.

E-4 156

THE WHITE HOUSE
WASHINGTON

May 16, 1940

Dear Dr. Sachs:

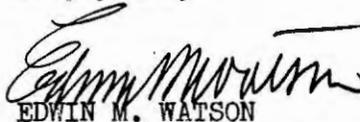
I have referred to Dr. Briggs that part of your letter of May fifteenth concerning the report from Dean Pegrum on the initial experiment on graphite, as Dr. Briggs has been appointed by the President the Chairman of the Special Committee, and I am only the liaison man.

I have asked Dr. Briggs to communicate with you.

As to your suggestion concerning the establishment of a ^{Science} Council of National Defense, you may be assured that the President will bear that in mind.

My best wishes to you.

Very sincerely yours,



EDWIN M. WATSON

Secretary to the President

Dr. Alexander Sachs,
One William Street,
New York, New York.

Conroy Wat. Det.

THE WHITE HOUSE
WASHINGTON

May 23, 1940

My dear Mr. Sachs:

Thank you very much for your telegram of May twenty-third and also for your letter with its interesting enclosure.

The President has asked me to tell you how sorry he is that he cannot see you at this time. As you may well imagine, the President's days are completely filled and it is actually physically impossible to add to his commitments. You know, of course, that any correspondence you may wish to send to him in my care will be brought to his attention immediately.

Sincerely yours,



EDWIN M. WATSON
Secretary to the President

Alexander Sachs, Esq.,
One South William Street,
New York, N. Y.

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Chron 8/10/45

✓ COPY for Dr. Sachs

EX 19

THE WHITE HOUSE
Washington

June 15, 1940

Dr. Lyman J. Briggs,
Director - National Bureau of Standards,
Washington, D. C.

My dear Dr. Briggs:

A short time ago I asked you to serve as chairman of a committee to study into the possible relationship to national defense of certain aspects of atomistics, notably the fission of uranium.

In order more fully to correlate the scientific efforts of the country with problems of national defense I am now creating a new committee under the chairmanship of Dr. Vannever Bush, President of the Carnegie Institution of Washington, to be known as the National Defense Research Committee. This committee will be attached to the Advisory Commission to the Council of National Defense and will include representatives of the Army and Navy, and several distinguished scientists.

Since the problem on which you are engaged is a part of this larger picture I am requesting Dr. Bush to arrange to reconstitute your committee as a subcommittee of the National Defense Research Committee with such rearrangement of membership as may prove desirable. I will appreciate it, therefore, if you will now report directly to this new committee. In your new association you will undoubtedly continue to maintain close and direct contact with those officers of the Army and Navy most directly interested in the field of your efforts.

I appreciate the thought and effort which you are devoting to this baffling and intricate matter.

Very sincerely yours,

(S) Franklin D. Roosevelt

Ex 142

May 11, 1940

Dear General Watson:

Persuant to the letters by the President and yourself of April 5, and the resultant conference with the governmental group held on April 27, I have pleasure in submitting through your good offices a report to the President together with recommendations.

I am advised by Dean Pegram that the experiment conducted at Columbia University with the aid of the governmental committee has been successfully completed this week and that Dr. Briggs and myself will receive a formal statement to this effect.

In view of this and the invasion of Belgium it has become necessary and urgent to confer with the President along the lines and for the reasons set forth in the accompanying letter of mine to him. Will you be kind enough to advise me as to the earliest available date for such a conference?

Yours sincerely,

Comm - Nat. Def.

Chmn 8/10/45

Ex 142

May 13, 1940

Dear Dr. Briggs

Since speaking with you I have learned from Dean Pagan that the experiment conducted on graphite at Columbia University by Drs. Fermi and Szilard has now been concluded, and that we shall shortly be advised of the results.

With the clearing up of this preliminary question and with the new urgency brought about by the invasion of Belgium, your committee is enabled and impelled to advise the President as to the importance of the work of Drs. Fermi and Szilard for problems of national defense. In this connection, it occurs to me that it might serve the convenience of yourself and your colleagues to examine the synoptic statement originally prepared by Dr. Szilard at my suggestion and delivered by him orally at the conference of April 27th in response to your request.

In the event that the governmental committee reports favorably, the problems that are thrown into sharp relief, as already suggested in Dr. Einstein's letter to you, go beyond the appropriate augmentation of the financial support to be accorded by the Government. We are confronted with the pressing need to establish an organizational framework under which the work - conducted as it must be at universities, with their traditional discursive attitude and leisurely tempo - can proceed with the requisite (a) secrecy, (b) acceleration and (c) flexibility required for a going enterprise. The imminence of vacation periods at universities and the attendant dispersal of scientific workers adds another element of immediacy to a situation that, in the present setting so fateful for the survival of the European democracies, is already surcharged with urgency.

Yours sincerely,

Dr. Lyman J. Briggs, Director,
National Bureau of Standards,
Department of Commerce,
Washington, D. C.

Copy to General Watson

Has been reviewed

May 22, 1940

Dear General Watson:

While mindful of the pressure of larger and farther-reaching tasks upon the President and yourself as one of his important aides, the imminence of vacation periods at universities and the attendant dispersal of scientific workers render it of immediate urgency to secure action on the issues that were presented in my letter of May 11th to the President and that of May 15th to yourself. Additionally, the fateful trend of the war and its implications for the Belgian Congo render it urgently advisable that a plan be worked out for the importation of an adequate supply of uranium from the Belgian Congo. There are at present in this country the two leading executives of the Union Miniere du Haut-Katanga, namely Messrs. Sengier and Le Chien. But since their families are in Nazi-dominated Belgium, the extent of pressure that could be exerted by a regime without scruple as to the treatment of hostages is such as to give rise to justifiable concern over their eventual ability to get needed supplies.

In view of the enormous time-lead that Nazism has acquired in amassing and in the resourceful use of instruments of destruction, the potentialities of uranium for our own defense, along the lines sketched in the communications of Dr. Sillard that I have transmitted to the President, have become enhanced, as to value and importance. In a word, it is imperative that we take action betimes not to lose the services of the scientists over the summer for converting into practical use the intellectual lead which the genius of these refugees can make available to our Navy and to our people.

As the governmental group under Dr. Briggs' chairmanship has probably by now decided favorably on the inherent value of the work and the desirability of governmental financing of the experiments - outlined in the letter of April 22nd that I had had prepared in furtherance of Professor Einstein's communications to me - it is all the more necessary to overcome the delays inherent in the device of a dual committee, that was suitable for the inquiry and judgmental stage, but not for the executive stage upon which we are entering. May I therefore request you to arrange the earliest appointment possible - no matter how brief - for me with the President in order to get his consideration and action upon the proposals which Dr. Einstein

and I had worked out, as recorded in Dr. Einstein's letter of April 25th and transmitted to the President.

As an interim organizational agency I would suggest that the President appoint the three names submitted by Dr. Briggs to the President, namely Dr. Einstein, Dean Pogram and myself, to act as an adjunct to the Navy's scientific bureau headed by Admiral Bowen, and that this committee should also serve as a board of trustees of a non-profit corporation to be formed in accordance with the ideas of the President's legal aides for the purpose of arranging the allocation of work and funds to universities in connection with the experiments to be conducted. Such official status needs to be given within the next week or so, in order that the committee members and the secretary they would appoint can line up before the close of the academic year the individual scientists, and also secure, say, from the foundations any supplementary funds that may be required for the administration of the committee's work.

May I ask you to transmit to the President the enclosed memorandum of mine reviewing some cabled comments from a London source on current events and including an interspersed comment of mine on "Reorientation of Defense Concepts," in the thought that both will prove of distinct interest to him.

Yours sincerely,

General Edwin M. Watson,
Secretary to the President,
The White House,
Washington, D. C.

Ex 16a

May 25, 1940

Dear General Watson:

While aware of the magnitude of pressures upon the President and on yourself, as one of his important aides, in connection with national defense, the matter of uranium is now charged with unpostponable urgencies from the international developments, requiring immediate consultation with the President. For, with the Nazi forces in occupation of the greater part of Belgium and hence probably controlling the head office of the company which owns the uranium mines in the Belgian Congo, namely the Union Miniere du Haut-Katanga, - it requires no stretch of the imagination to be fearful of the pressure that the Nazis, who have mobilized their scientists for work on uranium, could exert on the officers and officials of the company through threats upon their families, with a view to the issuance of orders against exports of uranium ore from the Belgian Congo. To assure for the United States an adequate supply requires preliminary diplomatic steps that can be taken only by the President and the State Department and also financing and shipping arrangements, which would involve other Powers.

Fortunately, the managing director of the company, M. Edgar Sengier, is, I understand, still in this country and representations should be made to him and to his associate, M. Le Chien, without the least delay. In view of the enormous time-lead that Nazism has acquired in amassing and in the resourceful use of instruments of destruction, the potentialities of uranium for our own defense, along the lines sketched in the communications of Dr. Szilard that I have transmitted to the President, have become enhanced as to value and importance.

The actual prosecution of the experimental work, as my recent letters have shown, requires immediate arrangements with universities so that we do not lose the services of the scientists over the summer vacation period, which begins next month. I take it that the governmental group under Dr. Briggs's fine chairmanship has by now decided favorably on the value and importance of the work and the desirability of governmental financing of the experiments. By parity of reasoning, if there is danger of great delay of governmental funds, it is imperative that we do not miss the opportunity, again available only in the next fortnight, for securing the funds from the Carnegie

and the Rockefeller Foundations, which, on our best advices, are very much interested in this work.

Overlying all is the pressing necessity for establishing an organisational framework for (a) directing the work outside of governmental institutions, (b) assuring that the scientists carry on their experiments with due secrecy, and (c) that the liaison between the Government and the universities, where the experiments are to be conducted, functions with practical efficiency and flexibility. This means that the device of the dual and informal committee from the Government and the outside that was suitable for the preliminary inquiry stage needs to be supplemented. The proposal referred to in Dr. Einstein's letter, following conversations with me, is that there be set up, in accordance with ideas to be worked out by one of the President's legal aides, a non-profit corporation, like the Foundations or the National Academy, or that there be delegated to a board of trustees the legal powers requisite for conducting arrangements or commitments inherent in the prosecution of any practical task. The officers of this corporation or the board of trustees should, of course, be given an official status in connection with the President's defense organization and committees, and once formed they can co-opt additional numbers from the universities and from other sources, subject, say, to the approval of Dr. Briggs's governmental committee with whom, of course, they would be in continuous touch.

I am enclosing an extra copy of this letter in the thought that you will concur as to the advisability of giving it to Dr. Briggs.

May I ask you to transmit to the President the enclosed memorandum of mine reviewing some cabled comments from a London source on current events and including an interspersed comment of mine on "Reorientation of Defense Concepts," in the thought that both will prove of distinct interest to him.

Yours sincerely,

General Edwin M. Watson,
Secretary to the President,
The White House,
Washington, D. C.

Conroy - Nat. Def.
Evans

May 11, 1940

Dear Mr. President:

In furtherance of your kind letter to me of April 5, the conference suggested by you was arranged and held under Dr. Briggs' chairmanship on April 27 between the governmental and non-governmental groups concerned with the bearing of uranium experiments on national defense. With the conclusion of the first experiment which was conducted at Columbia University by Drs. Szilard and Fermi, with governmental aid, the whole project is now entering upon a new stage. Assuming that the governmental committee will now, upon your inquiry, report in favor of further and larger governmental action, may I, in accordance with your own gracious expression of a desire to be advised of developments, submit the following considerations and suggestions:

1. With the invasion of Belgium by the very Power which has organized the residue of its scientists for uranium work, the danger - alluded to in my original letter to you of October 11, 1939 - that America may be cut off from uranium supplies of the Belgian Congo has increased. In addition, the successful completion of the above-mentioned preliminary experiment renders it practicable and advisable that the action to be taken shall be adequate and comprehensive.

2. Such action inherently involves not only larger financial support to be accorded by the Government, but also the formation of an organizational framework under which the work can proceed with the flexibility required for a going enterprise. Interestingly enough, the latter practical aspect has been emphasized by Dr. Einstein in conversations with myself and was communicated by him in a letter to Dr. Briggs, of which I am enclosing a copy for your kind perusal and attention.

In this connection you might find of interest the enclosed copies of two communications which I have received from Dr. Szilard, the first of which contains a synoptic statement of the implication of the work for National Defense, that was made orally at the above mentioned conference of April 27, and the second an outline of the next tasks to be undertaken.

3. The resultant requirement for forming an organization for directing the work outside of governmental institutions and for assuring that work by scientists in the universities is carried out with due secrecy has to be dovetailed with the designation of persons to serve as trustees of a non-profit organization that is to supervise the allocation of funds and to coordinate the various branches of the work.

4. These interlinked needs suggest to me that it would be desirable to bring one of your legal aides into the circle of discussion, along with General Watson, who is now serving so efficiently as a liaison for the representatives of the Service Departments and the Bureau of Standards.

- 2 -

In view of the urgency of a decision on these points, I should greatly appreciate conferring with you in the course of next week at your convenience.

Yours sincerely,

Congress - Nat.
Def

June 5, 1940

Dear Dr. Briggs:

In furtherance of our conversation last Saturday at Admiral Bowen's office, may I submit to you the facts and considerations bearing on the urgency of initiating discussions with the officials of the Union Miniere of the Belgian Congo resident in New York.

The questions to take up with the managing director, Dr. Sengier, - and perhaps, eventually, with the diplomatic representatives in Washington of the Belgian Government-in-exile, are these:

1. What is the stock of mined uranium left in the Belgian Congo, and in what form is it?
(b) What stocks, if any, were left in Brussels?

2. What are the possibilities of mining uranium ore in the Belgian Congo and transporting it to this country under present conditions? (b) What would be the out-of-pocket costs of mining "X" amounts, according to scale of profitability of operations from the standpoint of overhead?

3. Under what conditions would the company (a) on a business basis and (b) at the request of the Belgian Government in response to American mediation, be willing to export its own uranium ore to the United States, the company to retain title to the ore, but committing itself not to re-export it without special permission.

4. Finally, what would be the practical amounts that could be extracted and transported over, say, three and six months periods, in order to have a basis of comparison with similar maximal amounts that could be secured from, say, Canada in the same periods?

Assuming that the institution of such an inquiry meets with your approval, I would suggest that you authorize

a small committee consisting, in addition to myself, of the present group at Columbia concerned with uranium, namely, Doctors Pegrarn, Urey, Fermi and Szillard. My thought is not to have the whole committee call with me on Dr. Sengier, but only two of its members - one a scientist who is a citizen and the other drawn from the unique experimental team which happens to be non-citizen as yet. But in order to lend authority to the group, it seems to me advisable that you state that these individuals are part of a coordinating committee which has been appointed for keeping the scientific division of the Government advised of the theoretical and the other work. While it might not be necessary to show any credentials to Dr. Sengier, it seems to me important that we have express documentary authorization before calling on him.

Finally, the delegation would, in my opinion, have to agree in advance on the representations to be made. On the negative side, this implies non-disclosure as to focus and methodology of the work and the progress made, and the substitution for that of some general designation with emphasis, perhaps, on the Isotop separation. On the positive side, it requires formulation of alternative probabilities of amounts of the metal - desirable under varying conditions - by experimentors. Tasks of this sort in practice get delegated to Dr. Szillard, for all his modesty, since Dr. Fermi and the others regard him as resourceful in the practical aspects of the work as he is deemed to be original and inventive in ideas and methods. In keeping with the practice I have followed, the formulation by anyone is submitted to the others of the group and generally undergoes some revision. Needless to add as soon as agreed upon I would forward you a copy for your record and, if you desire, also, for your approval; though the above details given in the indent as to scope and method may well suffice.

Sincerely yours,

Dr. Lyman J. Briggs, Director
National Bureau of Standards
Department of Commerce
Washington, U. C.

*Copy Observations as Recommended
for President at Scheduled Conference
Ex. 72
Coring-Nat Dec 1942*

Statements concerning the large scale experiment. *Earl A. Tamm*

The work of Fermi and Szilard has now reached the stage at which it is necessary to start organizing a large scale demonstration experiment. Before making any arrangements for the proposed large scale experiment, it will be necessary to devote some time to remeasure all nuclear constants which enter into the large scale experiment. The exact knowledge of the values of these constants will render it possible to determine the best conditions under which the large scale experiment can be efficiently carried out.

It is suggested that for the work carried out preparatory for the setting up of the large scale experiment a fund of \$ 100,000 be secured. One of the purposes for which such a fund would be used, would be to employ, say, four younger physicists for carrying out a survey. This survey would comprise the following:

1. an improved estimate of the number of fast neutrons emitted by uranium per absorbed thermal neutron ();
2. a study of the resonance absorption of uranium (p);
3. a study of metallurgical problems connected with the large scale manufacturing of uranium metal;
4. cross-sections of uranium for thermal neutrons;
5. slowing down process in carbon;
6. measuring of combinations of nuclear constants in experiments in which a uranium metal sphere is embedded in graphite;
7. constructional details for the large scale experiment.

It is further proposed that the greater part of the fund be used for the preparation of the large scale experiment in a system composed of uranium and graphite. Part of the fund ought

to be spent for another line of research which, if successful, would lead to another type of chain reaction based on fast neutrons instead of slow neutrons.

Part of the fund could also be used for separation research concerning the separation of two uranium isotopes, by means of grants to university laboratories that are currently pursuing this line of research.



SUMMARY ~~(MADE ABOUT [unclear])~~ OF MEMORANDUM OF APRIL 20, 1940
APPLICATION OF URANIUM ATOMIC DISINTEGRATION TO NAVAL OPERATIONS
IN THE LIGHT OF DISCUSSIONS WITH DRS. EINSTEIN, WIGNER, S ZILARD and FERMI

By

Alexander Sachs

Since the inauguration of the discussions in the late summer of 1939 with the scientists who had ~~worked~~ been experimenting with uranium and atomic disintegration, the initial intimation by Dr. Einstein that these researches might have a significance for the United States and Great Britain and the national defense of the United States on the assumption that Germany would resume the bid for world mastery, the writer has not only brought the whole problem to the attention of the President, but played the part of a *Catalyst* to facilitate in respect to the reactions studied and their political-military applications.

to
A According to the scientists just mentioned it will be possible to liberate energy in uranium by means of a chain reaction and furthermore it will be possible to utilize the energy liberated in chain reaction for ~~purpose~~ power production. Dr. Fermi is the most cautious of the group and keeps on stressing that it has not yet been demonstrated and it may take years to demonstrate that a chain reaction can be maintained in operating with large masses of ordinary uranium of the quality used in ordinary chemical engineering.. Dr. Szilard, whose work is regarded by Dr. Einstein in coeval importance with that of Dr. Fermi is more optimistic and regards the reservation being made as due to surmountable difficulties. The present writer as an economist familiar with the executive side of technological research ~~has~~ has conveyed to the scientist mentioned his opinion that the obstacle may well turn out to be the shortcomings in the available plant, equipment and instruments of the university type of facilities as contrasted with the specially designed and controlled physical and instrumental facilities available to the technologists in industrial research.

The higher and more elaborate technology introduced by Nazi Germany in its military weapons as compared ~~on~~ only with the war but with the current defense weapons of the Allies requires a kind of challenge which the industrial democracies can and needs must meet. Hence it is the writer's conviction that once we relate the uranium research to the project of defense and offensive war and higher gearing in quality and tempo of our ~~technological~~ technology should be regarded as advisable and as attainable.

Writer has maintained that from that standpoint we may well be impatient with those who want to transfer the limitations and the leisureliness characteristic of peacetime small scale university research to the necessarily magnified accelerated operations that will become the new norm for American armament of technological industries. What is happening now and will continue to happen is that the superior Nazi technology is riding roughshod over the totally unprepared or most inadequately ~~more~~ prepared military technologies of the coastal area from Norway and eventually through France. The costless victories Germany has had in the White War of 1936 and 1938 is being matched by the relatively defenseless consequences from Poland to Western Europe. When the import of that is assimilated by the American people and we decide to embark upon national defense, then the match that our civilian technology has provided to German technology will be better than ~~not~~ duplicated when we undertake the military technology.

Accordingly we may well adopt as a tenable assumption that what is deemed ~~a~~ by sagacious scientists as capable of achievement over a period of many years could be telescoped into a much shorter period. At any rate, in attempting a mental preview of the import of the current experiments for national defense we should detach ourselves from the dubieties and the hesitations of those reporting experiments with the precisional caution required by the mores of scientific publications.

Supposing that the general reaction is demonstrated and maintained in the use of ordinary commercial uranium what follows as in case of a war with Japan? For the big disadvantage under which we labor in case of war is the enormity of the distances to our possessions and to the strategic bases of operation. The two applications from harnessing the released energy and (a) production of a bomb of hitherto unimagined potency and (b) the possibility that the power plant of very small compass could be installed on naval vessels to do the work of the present elaborate power plants. In connection with the latter purpose an attempt was made within the groups to translate the contrast between the new and the old power in terms of operations from the Naval base at Hawaii against Japan which is some three and a half thousand miles away. A capital warship which carries a maximum load of about four thousand tons of oil was estimated to use about one half ton of oil per mile, if cruising at a satisfactory speed. If this is valid, then such a warship would have to be refueled after travelling eight thousand miles. Hence, the limitation upon the cruising period for a ship refueled at Hawaii and scheduled to operate in the ~~vicinity~~ vicinity of Japan proper at high speed. Assuming that it would be possible to obtain three hundred tons of uranium per year, it might be possible to equip ~~boats~~ boats every year with a plant stocked with uranium equal to an oil reserve per boat of one hundred and fifty thousand tons. This would enable these boats in wartime to have a cruising range that is no longer limited by the necessity of refueling. Alternatively, the increase in speed could be more readily obtained from reducing the equivalent oil load. There were those in the group who thought that the relationship between uranium and oil was far more favorable, ~~than~~ and that a ton of uranium would be ten to thirty times the above relationship.

The bomb as distinguished from the fuel application would mean that one bomb would be equal to at least several thousand tons of the ordinary explosive bomb.

In The then state of uncertainty led the government, committed to adopt a cautionary attitude as to commitments that on the assumption that the Lea Bill now before Congress would be enacted. It felt that an investigation by them of direct financial support to the extent of the

- (a) procuring of four metric tons of pure-grade graphite, and
- (b) later securing of fifty tons of uranium oxide.

Finally it recommended an enlargement of the Government Committee of three by ⁴five others to constitute a coordinating group. The ^{quintet} quintet recommended to the President was as follows:-

President Karl Compton, Massachusetts Institute of Technology
Cambridge, Massachusetts

Mr. Alexander Sachs - One William Street, New York

Professor Albert Einstein, Princeton University, Princeton, N. J.

Dean George B. Pegram, Columbia University, New York City.

2

II.

The invasion of Poland by Germany at the beginning of September and the ensuing presidential concern with effectuating a revision of the Neutrality Act, - all this contributed to the delay in arranging a meeting (for the writer with the President) for the submission of the foregoing material and the covering letter by the writer.

The initial conference with the President was had by the writer in Washington on October 11, at which ^{letter} material, of Dr. Einstein's (1a) and the letter and memorandum of Dr. Szilard (1b) was submitted along with writer's letter of October 11th ~~(2)~~ to the President (2)

In the wake of this conference the President delegated the problem to General Edwin M. Watson, his secretary, who was to effect an introduction to Dr. Lyman J. Briggs, Director of the National Bureau of Standards of the United States Department of Commerce.

2.1 The President asked writer to stay over the following day for a conference with Dr. Briggs, Colonel Adamson ^{of the Army} and Commander Hoover of the Navy.

In the conference on October 12th Dr. Briggs and myself arranged for a meeting towards the end of month of selected scientists with him and myself. The meeting ~~was~~ finally fixed was for Saturday morning, October 21, 1939, at 9:30 at the office of the Bureau of Standards. The list of participants was as follows:-

- 49.
- (a) For the government - ~~Dr.~~ Briggs
Colonel Adamson
Commander Hoover
 - (b) As Presidential ~~advisor~~ ^{member} Alexander Sachs
 - (c) - As cooperating scientists - Professor Albert Einstein (who was unable to attend on account of health.

E. P. Wigner (Professor Theoretical Physics at Princeton)
E. Teller (Professor, George Washington University)
E. ~~Fein~~ (Professor - Columbia University)
E. L. Szilard (visiting experimental physicist at Columbia and
Trustee of the Association of Scientific Collaboratio

From

(In furtherance of Dr. Briggs' request a supplement to his formal invitation was sent by writer to Professors Wigner and Teller; a copy of the explanatory invitation by writer is included in the collect under the designation of 3a).

III.1

The meeting was held as scheduled on October 21st at Dr. Briggs' office in the Bureau of Standards, and as already indicated those invited from the outside, all by Dr. Einstein attended. Representing the Bureau of Standards there was in addition to Dr. Briggs a staff member who had been at work on the problem. His skepticism led to a long technical discussion and to an eventual agreement that it was worth trying to carry forward the experimental work that had been inaugurated so promisingly at Columbia.

IV. Submission of a formal report to the President on November 1, 1939, by the representative of the Government Scientific Bureau and the Army and Navy. This report ~~report~~ (marked as document 4) was issued to the President on the stationery of the Department of Commerce, National Bureau of Standards. The scope of the report was described as "Possible Use of Uranium for Submarine Power and High Destructive Bombs".

It referred to the meeting held with the writer and the physicists from Columbia, Princeton and other institutions. Because of the historic interest, it is desirable to record the four conclusions of the report.

(1) Discoveries made within the last year have shown that when a uranium atom is bombarded by neutrons (uncharged elemental particles of matter) from an outside source, the uranium atom may be split in two and this breakdown is accompanied by the release of a great amount of atomic energy.

(2) When the uranium atom is split it likewise sets neutrons free. These neutrons may be able to in turn to split other uranium atoms and thus continue the process as a chain reaction. This continuous splitting has not so far been accomplished. The proposed research would be directed to finding a way to do it.

(3) The energy released by the splitting of a mass of uranium atoms would develop a great amount of heat. If the chain reaction could be controlled so as to proceed gradually it might conceivably be used as a continuous source of power in submarines, thus avoiding the use of large storage batteries for under-water power.

(4) If the reaction turned out to be explosive in character it would provide a possible source of bombs with a destructiveness vastly greater than anything now known.

A. Einstein to

File Einstein Ex 1-2a

April 25, 1940

[Chrm. 8/10/45]
Conveg. - Nat. Def.

Dr. Lyman J. Briggs, Director,
National Bureau of Standards,
U. S. Department of Commerce,
Washington, D. C.

Dear Dr. Briggs:

I thank you for your recent communication concerning a meeting of the Special Advisory Committee appointed by President Roosevelt.

As, to my regret, I shall not be able to attend this meeting, I have discussed with Dr. Wigner and Dr. Sachs particularly the questions arising out of the work of Dr. Fermi and Dr. Szilard. I am convinced as to the wisdom and the urgency of creating the conditions under which that and related work can be carried out with greater speed and on a larger scale than hitherto. I was interested in a suggestion made by Dr. Sachs that the Special Advisory Committee submit names of persons to serve as a board of trustees for a non-profit organization which, with the approval of the Government committee, should secure from governmental or private sources, or both, the necessary funds for carrying out the work. It seems to me that such an organization would provide a framework which could give Drs. Fermi and Szilard and co-workers the necessary scope. The preparation of the large scale experiment and the exploration of the various possibilities with regard of practical applications is a task of considerable complexity, and I think that given such a framework and the necessary funds, it could be carried out much faster than through a loose cooperation of University laboratories and Government departments.

Yours sincerely,

Copy to Dr. Sachs

A

Conroy - Nat + Def.

420 West 116th Street
New York City

April 22, 1940

Dr. Alexander Sachs
c/o Lehman Corporation
One South William Street
New York City

Dear Dr. Sachs:

In accordance with the letter written to you by Professor Einstein on March 7, I am submitting to you in the following a memorandum dealing with the present work on nuclear chain reactions. Only one aspect of the subject is discussed in this memorandum, namely its possible bearing on questions of national defense.

Memorandum.

We have to discuss separately two different types of chain reactions, i. e.

a) chain reactions in which the neutrons are slowed down, and in which only a small fraction of the uranium can be utilized, corresponding to the content of uranium 235 in ordinary uranium; (if ordinary uranium is used for the purposes of such a chain reaction, a ton of uranium will be exhausted after having supplied as much energy as corresponds to the burning of about 3000 tons of oil)

b) chain reactions in which the neutrons are not slowed down and in which the bulk of the ordinary uranium could be utilized; (if it were possible to maintain a chain reaction of this type in uranium, one ton of uranium could supply more energy than 300.000 tons of oil.

There is reason to expect that a chain reaction of the type described under a) can be maintained in a system composed of uranium and carbon.

Whether or not a chain reaction of the second type, as discussed under b), can be maintained in uranium is not known and has for the present to be considered an open question which, in view of its far reaching consequences, urgently requires further study.

Part I.

Chain Reactions maintained in Systems composed of Carbon and Uranium.

A chain reaction of this type is capable of applications which may have a bearing on questions of national defense.

1. A system composed of carbon and uranium might be used for purposes of power production. Questions relating to the transformation into power of the energy liberated in the chain reaction as well as questions relating to the regulation of the chain reaction, ^{have been studied,} and methods for solving these problems have been devised.

Personnel has to be protected from being exposed to the radiations emanating from the chain reaction by means of water tanks, and such an atomic engine equipped in this way could be used as a power reserve in larger naval units. The weight of the water tanks rules out the possibility of using an atomic engine for the purpose of driving aeroplanes.

One ton of uranium would be capable of supplying about as much power as 3000 tons of oil. For instance, a 30.000 ton battleship, which would ordinarily have a maximum oil load of 4000 tons could in the future be equipped for the use of both oil fuel and atomic power and would carry perhaps 1000 tons of oil and 50 tons of uranium, the latter representing the equivalent of an oil reserve of about 150.000 tons. Accordingly, such a boat would have a practically unlimited cruising radius.

Since a battleship equipped with an atomic engine need not carry in war-time more than a normal oil load of perhaps 1000 tons, there would result a saving in weight, even if allowance

is made for the weight of the atomic engine. This saving in weight would lead to an increase in the top speed of the vessel.

The limited supply of uranium would make it inadvisable to use up any considerable amounts for naval purposes in peace time, and the atomic engines with which battleships may be equipped must not be used except occasionally in maneuvers and in case of actual warfare. Since a large battleship or battle-cruiser will use more than $\frac{1}{2}$ ton of oil per mile if cruising at an economical speed, it would exhaust its full oil load of about 4000 tons during a cruise covering about 10,000 miles. This means that a fast ship can not operate for any length of time at a distance of about 4-5000 miles from its nearest base. The advantage of a battleship having an equivalent of an oil reserve of 150,000 tons would in these circumstances be decisive, since apart from the increased speed it could stay for a long period near its objective at any distance from its base.

2. A system composed of carbon and uranium may be used as a weapon in the following manner: A chain reaction may be maintained in this system and the neutrons emanating from the chain reaction may be allowed to escape. The intensity of the neutron radiation could be made so high that this radiation would fatally injure by its physiological action human beings who are exposed to it within a radius of one kilometer. By mentioning this fact it is not desired to imply that such a system represents a desirable or particularly efficient military weapon. The reason for emphasizing this point lies rather in the belief that such a system could be used as a weapon by some other country during the present war, possibly in the near future, and that it could be used with considerable effect on a country which is not prepared to meet this new type of attack.

Part II.

Chain Reactions in which the Neutrons Are Not Slowed Down.

It is not known at present whether or not chain reactions of this type can be brought into existence. If, however, this could be done they would have a bearing on questions of national defense, going in their scope of applications far beyond the applications discussed in Part I.

1. In a chain reaction of this second type one ton of uranium used as driving power in a warship could supply more power than 300,000 tons of oil. Consequently, it would probably be possible for the larger types of naval vessels to dispense entirely with the use of oil.

2. A chain reaction of this second type would make it possible to bring about explosions of extraordinary intensity. If for purposes of aggression, a bomb based on such a chain reaction were set off at sea near the coast, the tidal waves brought about by the explosion might lead to the destruction of coastal cities. Such a bomb would not be too heavy to be carried by small boats, but could hardly be carried by existing airplanes.

L. Sziknd

*Dr. Alexander Sachs
c/o Lehman Corporation
New York City*

420 West 116th Street
New York City

April 22, 1940

Dr. Alexander Sachs
c/o Lehman Corporation
New York City

Dear Dr. Sachs:

In accordance with the letter written to you by Professor Einstein on March 7, I am submitting to you the following memorandum dealing with the present work on nuclear chain reactions. Only one aspect of the subject is discussed in this memorandum, namely its possible bearing on questions of national defense.

Memorandum.

We have to discuss separately two different types of chain reactions, i.e.

(a) chain reactions in which the neutrons are slowed down, and in which only a small fraction of the uranium can be utilized, corresponding to the content of uranium 235 in ordinary uranium; (if ordinary uranium is used for the purposes of such a chain reaction, a ton of uranium will be exhausted after having supplied as much energy as corresponds to the burning of about 3000 tons of oil);

(b) chain reactions in which the neutrons are not slowed down and in which the bulk of the ordinary uranium could be utilized; (if it were possible to maintain a chain reaction of this type in uranium, one ton of uranium could supply more energy than 300,000 tons of oil).

There is reason to expect that a chain reaction of the type described under (a) can be maintained in a system composed of uranium and carbon.

Whether or not a chain reaction of the second type, as discussed under (b) can be maintained in uranium is not known and has for the present to be considered an open question which, in view of its far-reaching consequences, urgently requires further study.

Part I: Chain reactions maintained in a system composed of carbon and uranium.

A chain reaction of this type is capable of applications which may have a bearing on questions of national defense.

1. A system composed of carbon and uranium might be used for purposes of power production. Questions relating to the transformation into

power of the energy liberated in the chain reaction, as well as questions relating to the regulation of the chain reaction, have been studied, and methods for solving these problems have been devised.

Personnel has to be protected from being exposed to the radiations emanating from the chain reaction by means of water tanks, and such an atomic engine equipped in this way could be used as a power reserve in larger naval units. The weight of the water tanks rules out the possibility of using an atomic engine for the purpose of driving aeroplanes.

One ton of uranium would be capable of supplying about as much power as 5000 tons of oil. For instance, a 30,000 ton battleship, which would ordinarily have a maximum oil load of 4000 tons could in the future be equipped for the use of both oil fuel and atomic power, and would carry perhaps 1000 tons of oil and 50 tons of uranium, the latter representing the equivalent of an oil reserve of about 150,000 tons. Accordingly, such a boat would have a practically unlimited cruising radius.

Since a battleship equipped with an atomic engine need not carry in war-time more than a normal oil load of perhaps 1000 tons, there would result a saving in weight, even if allowance is made for the weight of the atomic engine. This saving in weight would lead to an increase in the top speed of the vessel.

The limited supply of uranium would make it inadvisable to use up any considerable amounts for naval purposes in peace time, and the atomic engines with which the battleships may be equipped must not be used except occasionally in manoeuvres and in case of actual warfare. Since a large battleship or battle-cruiser will use more than $\frac{1}{2}$ ton of oil per mile if cruising at an economical speed, it would exhaust its full oil load of about 4000 tons during a cruise covering about 10,000 miles. This means that a fast ship cannot operate for any length of time at a distance of about 4-5000 miles from its nearest base. The advantage of a battleship having an equivalent of an oil reserve of 150,000 tons would in these circumstances be decisive, since, apart from the increased speed, it could stay for a long period near its objective at any distance from its base.

2. A system composed of carbon and uranium may be used as a weapon in the following manner: A chain reaction may be maintained in this system, and the neutrons emanating from the chain reaction may be allowed to escape. The intensity of the neutron radiation could be made so high that this radiation would fatally injure by its physiological action human beings who are exposed to it within a radius of one kilometer. By mentioning this fact it is not desired to imply that such a system represents a desirable or particularly efficient military weapon. The reason for emphasizing this point lies rather in the belief that such a system could be used as a weapon by some other country during the present war, possibly in the near future, and that it could be used with considerable effect on a country which is not prepared to meet this new type of attack.

Part II; Chain reactions in which the neutrons are not slowed down.

It is not known at present whether or not chain reactions of this type can be brought into existence. If, however, this could be done, they would have a bearing on questions of national defense, going in their scope of applications far beyond the applications discussed in Part I.

1. In a chain reaction of this second type one ton of uranium used as driving power in a warship could supply more power than 300,000 tons of oil. Consequently, it would probably be possible for the larger types of naval vessels to dispense entirely with the use of oil.

2. A chain reaction of this second type would make it possible to bring about explosions of extraordinary intensity. If, for purposes of aggression, a bomb based on such a chain reaction were set off at sea near the coast, the tidal waves brought about by the explosions might lead to the destruction of coastal cities. Such a bomb would not be too heavy to be carried by small boats, but could hardly be carried by existing airplanes.

signed: Leo Szilard

LJB:DEK

COMMUNICATIONS DEPT NATIONAL BUREAU OF STANDARDS

1300602 Operation and Administration
60845 National Bureau of Standards, 1940

April 20, 1940

APR 20 11 05 AM '40

COMMUNICATIONS DEPT

Dr. Alexander Sachs,
c/o Lehman Bros.,
One William Street,
New York, N. Y.

Meeting of advisory committee has been postponed to two
p. m. Saturday, April twenty-seventh, at National Bureau
of Standards.

THIS MESSAGE WAS TELEPHONED,
AT THE TIME SHOWN ON THE
REVERSE HEREOF, AS CHECKED.

Lyman J. Briggs

Lyman J. Briggs, Director.

- Western Union Postal
- Navy Dept. War Dept.
- Radio Corp. of America

[Chron File
Aug 1939]

Albert Einstein
Old Grove Road
Nassau Point
Peconic, Long Island

August 2nd, 1939

F. D. Roosevelt,
President of the United States,
White House
Washington, D. C.

Sir:

Some recent work by E. Fermi and L. Szilard, which has been communicated to me in manuscript, leads me to expect that the element uranium may be turned into a new and important source of energy in the immediate future. Certain aspects of the situation which has arisen seem to call for watchfulness and, if necessary, quick action on the part of the Administration. I believe therefore that it is my duty to bring to your attention the following facts and recommendation.

In the course of the last four months it has been made probable through the work of Joliot in France as well as Fermi and Szilard in America - that it may become possible to set up a nuclear chain reaction in a large mass of uranium, by which vast amounts of power and large quantities of new radium-like elements would be generated. Now it appears almost certain that this could be achieved in the immediate future.

This new phenomenon would also lead to the construction of bombs, and it is conceivable - though much less certain - that extremely powerful bombs of a new type may thus be constructed. A single bomb of this type, carried by boat and exploded in a port, might very well destroy the whole port together with some of the surrounding territory. However, such bombs might very well prove to be too heavy for transportation by air.

The United States has only very poor ores of uranium in moderate quantities. There is some good ore in Canada and the former Czechoslovakia, while the most important source of uranium is Belgian Congo.

In view of this situation you may think it desirable to have some permanent contact maintained between the Administration and the group of physicists working on chain reactions in America. One possible way of achieving this might be for you to entrust with this task a person who has your confidence and who could perhaps serve in an unofficial capacity. His task might comprise the following:

a) to approach Government Departments, keep them informed of the further development, and put forward recommendations for Government action, giving particular attention to the problem of securing a supply of uranium ore for the United States;

b) to speed up the experimental work, which is at present being carried on within the limits of the budgets of University laboratories, by providing funds, if such funds be required, through his contacts with private persons who are willing to make contributions for this cause, and perhaps also by obtaining the co-operation of industrial laboratories which have the necessary equipment.

I understand that Germany has actually stopped the sale of uranium from the Czechoslovakian mines which she has taken over. That she should have taken such early action might perhaps be understood on the ground that the son of the German Under-Secretary of State, von Weizsacker, is attached to the Kaiser-Wilhelm-Institut in Berlin where some of the American work on uranium is now being repeated.

Yours very truly,

Albert Einstein
(Signed)

Conroy - Nat. Def.

Ex. 6a

THE WHITE HOUSE
WASHINGTON

February 8, 1940

PERSONAL AND CONFIDENTIAL

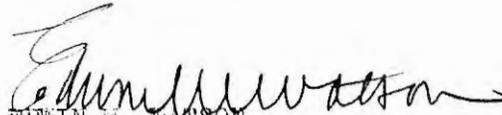
Dear Dr. Sachs:

Here is a copy of a report on Uranium.^x

I have asked for a special recommendation from
Dr. Briggs which I am going to show to the President
when it is received.

With best regards, I am,

Very sincerely yours,



EDWIN M. WATSON

Secretary to the President

Dr. Alexander Sachs,
One William Street,
New York, N. Y.

Enclosure.

Congress - Nat. Def.
Comm 8/10/45

Ex. 6c

February 15, 1940

Dear General Watson:

Thank you very much for your letter of the 8th and the accompanying report of Dr. Briggs, both of which will be treated as confidential. Had the recommendations from the second part of point 5 through points 6 and 8 been placed ahead of the more technical points 1-4, the practical meaning of the letter would have been clearer and more forceful, - namely, that in the opinion of Dr. Briggs and his colleagues it was distinctly worth while to go ahead. Due to too academic a presentation, I feel that that practical point was lost.

As the last issue of Science contained a quotation from "Science Letters" bearing on work in Paris and as since our meeting there has been even more searching and significant work in this country, I shall take the occasion to submit within the next month an up-to-date appraisal of the situation which, according to Dr. Einstein in a recent conversation, holds forth even greater promise than we had thought.

With kind regards and appreciation,

Yours sincerely,

General Edwin M. Watson,
Secretary to the President,
The White House,
Washington, D. C.

March 15, 1940

Dear Mr. President:

As a sequel to the communication which I had the honor to submit to you on October 12, Professor Albert Einstein sent me another regarding the latest developments touching on the significance of research on uranium for problems of national defense. In that letter he suggests that I convey to you the information that has reached me that since the outbreak of the war, research at the Berlin Institute of Physics, which has been taken over by the Government and placed under the leadership of C. F. von Weizsaecker, son of the German Secretary of State.

In the realization that these further views of Dr. Einstein have a definite bearing on the favorable report submitted to you by Dr. Briggs as Chairman of the Committee which conferred with experimental scientists concerned and myself, I am enclosing his communication for your kind perusal. May I also ask whether and when it would be convenient for you to confer on certain practical issues brought to a focus by the very progress of the experimental work, as indicated in the concluding paragraph of Dr. Einstein's letter.

In view of your original designation of General Watson in this matter, I am transmitting it through his good offices.

Yours sincerely,

The President
The White House
Washington, D. C.

March 15, 1940

Dear General Watson:

Bearing further on your communication of February 8 and on a letter received a month later from Professor Albert Einstein regarding additional and significant developments, I would appreciate your transmitting the enclosed letter to the President.

The communication from Dr. Einstein might well lead to some action on the preliminary favorable recommendations contained in Dr. Briggs' report of last November which you were good enough to send me on February 8. It will also be necessary to consider at this time a progress memorandum, referred to in the last paragraph of Dr. Einstein's letter - which memorandum I shall be glad to present at a conference which I trust you will be able to arrange.

Yours sincerely,

Enclosure letter from Dr. Einstein to President of 1/15

General Edwin M. Watson
Secretary to the President,
The White House
Washington, D. C.

Covering - Nat. Dep.

Ex 7c

THE WHITE HOUSE
WASHINGTON

March 27, 1940.

Dear Doctor Sacks:

I have delayed answering your letter until I could speak to Colonel Adamson and Commander Hoover. They came in this afternoon, and we assume that you got the memorandum to me from Doctor Briggs. I am attaching a copy, so as to be sure of that point.

I am told by Colonel Adamson that everything now depends on the report of the investigations being conducted at Columbia University. Under those circumstances, I think the matter should rest in abeyance until we get the official report.

With kind regards, I am,

Very sincerely yours,


EDWIN M. WATSON

Secretary to the President.

Doctor Alexander Sacks,
One South William Street,
New York, New York.

Corrag - Nat. Inf.
Chrm 8/10/45

Ex. 8a

THE WHITE HOUSE
WASHINGTON

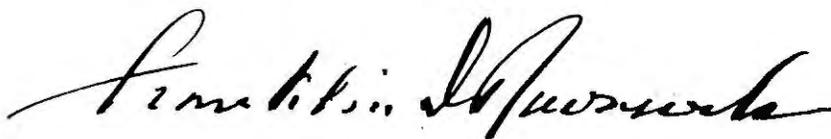
April 5, 1940

My dear Sachs:

I am grateful for your letter of March fifteenth enclosing the information from Dr. Einstein regarding the recent development in Uranium research. I have asked my Secretary, General Watson, to arrange another meeting in Washington at a time convenient for you and Dr. Einstein. I think Dr. Briggs should be included, and special representatives from the Army and Navy.

I am of the opinion that this is the most practical method of continuing this research, and I shall always be interested to hear the results.

Very sincerely yours,



Dr. Alexander Sachs,
One South William Street,
New York, N. Y.

Comm. Nat. Def.
Chmn 8/10/45

Ex 86.

THE WHITE HOUSE
WASHINGTON

April 5, 1940

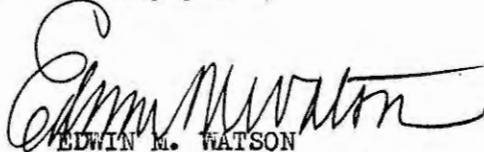
Dear Dr. Sachs:

In order to carry out the suggestions of the President's letter to you today, will you please let me know who you think ought to be at the conference, any professors, and when exactly would be most convenient to all concerned. It strikes me perhaps Dr. Einstein would have some suggestions to offer as to the attendance of the other professors. I believe it would be quite appropriate to hold this meeting at the Bureau of Standards.

If you will give me fully your reactions on all this, I will proceed to get into action.

With best wishes, I am,

Very sincerely yours,



EDWIN M. WATSON
Secretary to the President

Dr. Alexander Sachs,
One William Street,
New York, N. Y.

Conroy - Nat
Dir.

Cham - April 10 1940

U. S. DEPARTMENT OF COMMERCE

Ex 11a

NATIONAL BUREAU OF STANDARDS

WASHINGTON

ADDRESS REPLY TO
NATIONAL BUREAU OF STANDARDS

LJB:DEK

April 13, 1940

IN YOUR REPLY
REFER TO FILE

D

Dr. Alexander Sachs,
Care of Lehman Bros.,
One William St.,
New York, N. Y.

Dear Dr. Sachs:

Confirming our telephone conversation of this morning the meeting of the Advisory Committee will be held at my office at 2 p.m. Monday, April 22nd. I have written to Prof. Einstein and Dean Pegram.

Sincerely yours,



Lyman J. Briggs, Director.

Chronological
File
April 1940
and 8/10/45

April 15, 1940

Dear Dr. Einstein:

In connection with your important communication of March 7th in regard to the research in uranium and its bearing on national defense, I wrote to the President on March 15th, as per enclosed copy, and have at first received an acknowledgment from his secretary, General Watson. It would appear that upon his return to Washington after his trip to the Canal Zone, he decided to adopt the procedure suggested in my original communication. Accordingly, I received on Saturday, April 13th, a letter of his dated April 5th which was post-marked from Washington on April 12th, 5:30 P.M., - a delay which is understandable in view of the tragic international occurrence of the intervening week. In the wake of that letter I also received on the 13th a note from General Watson dated the 5th, and, in furtherance of a telephone call on Saturday, Dr. Briggs's letter of the 13th.

Naturally, having been brought into the orbit of this problem by Dr. Sillard, I have been in continuous touch with him at every stage of the developments and over this weekend and particularly today we have discussed aspects of the appropriate procedure for the forthcoming conference which the President has instructed General Watson and Dr. Briggs to arrange in conformity with the ideas implicit in your original letter. May I add that in the interest of assuring an adequate scale for the experimentation and a right tempo for the work it will be most helpful if you could see your way to attending, along with Drs. Wigner and Szilard, as I am sure that the President would feel all the more confident and would be delighted to know that any program that is worked out will have had your sagacious cooperation and your approval.

I am looking forward to seeing you and conferring with you before the meeting which, owing to the exigencies of conference and the development of a coordinate policy, might require postponement.

Yours sincerely,

Dr. Albert Einstein,
112 Mercer Road,
Princeton, N. J.

J. A. S.

April 15, 1940

Dear Dr. Einstein:

In connection with your important communication of March 7th in regard to the research in uranium and its bearing on national defense, I wrote to the President on March 15th, as per enclosed copy, and have at first received an acknowledgment from his secretary, General Watson. It would appear that upon his return to Washington after his trip to the Canal Zone, he decided to adopt the procedure suggested in my original communication. Accordingly, I received on Saturday, April 15th, a letter of his dated April 5th which was post-marked from Washington on April 12th, 5:50 P.M., - a delay which is understandable in view of the tragic international occurrence of the intervening week. In the wake of that letter I also received on the 15th a note from General Watson dated the 5th, and, in furtherance of a telephone call on Saturday, Dr. Briggs's letter of the 15th.

Naturally, having been brought into the orbit of this problem by Dr. Szilard, I have been in continuous touch with him at every stage of the developments and over this weekend and particularly today we have discussed aspects of the appropriate procedure for the forthcoming conference which the President has instructed General Watson and Dr. Briggs to arrange in conformity with the ideas implicit in your original letter. May I add that in the interest of assuring an adequate scale for the experimentation and a right tempo for the work it will be most helpful if you could see your way to attending, along with Drs. Wigner and Szilard, as I am sure that the President would feel all the more confident and would be delighted to know that any program that is worked out will have had your sagacious cooperation and your approval.

I am looking forward to seeing you and conferring with you before the meeting which, owing to the exigencies of conference and the development of a coordinate policy, might require postponement.

Yours sincerely,

Dr. Albert Einstein,
112 Mercer Road,
Princeton, N. J.

Ex. 8c

April 19, 1940

Dear General Watson:

I wish to acknowledge your kind letter of the 8th, which arrived last Saturday coincidentally with Dr. Briggs's telephone inquiry in regard to a convenient date for the suggested conference.

In keeping with your letter, I have reflected upon the problem that you set, and at my suggestion Dr. Sillard of Columbia University and Dr. Wigner of Princeton saw Dr. Einstein yesterday. After due discussion with those in New York who attended the original meeting, I would suggest the addition of Professor E. Fermi of Columbia. This would make the membership, apart from those in Washington representing the Government, as follows:

Dr. Einstein
Professor Fermi
Dean Pegram
Dr. Sachs
Dr. Sillard
Professor Wigner

I gather from Dr. Briggs that the Special Advisory Committee - listed in the report of Dr. Briggs dated November 1st, a copy of which you sent to me with your letter of February 8th - is considered as having been appointed by the President. I trust that it will not be amiss to suggest that Dr. Einstein and the other members of the committee be formally notified of their appointment.

Finally, as regards the date for the conference, the date that appears best for those with whom I have been able to communicate is Saturday, April 27th.

Yours sincerely,

General Edwin M. Watson,
Secretary to the President,
The White House,
Washington, D. C.

(DRAFT)

VI (cont.)

This was followed up by a letter of May 13th to Dr. Briggs (marked exhibit 14c). It drew attention to Dean Pegram's advice that the experiment at Columbia on graphite was successful. Assuming then that the governmental committee would report favorably to the President on the project, the pressing action was the establishment of an organizational framework that would permit a departure from the "traditional discursive attitude and leisurely tempo" of university research. The reminder of the import of the invasion of Belgium threw into proper relief the contrast intended, since national defense clearly required a resourcefulness of operation and an acceleration of pace and also a secrecy that could not be had in the university projects that are carried on with limited means and in an atmosphere of mutual interchange.

In furtherance of the foregoing, another letter was written to General Watson on May 15th, the second and revised version of which is included herein as exhibit 15a. It starts out with a reference to a letter from Dean Pegram of Columbia (the text of which is no longer in the writer's possession, as it appears to have been forwarded to the President without the retention of a copy), the substance of which was given to Gen. Watson as follows:

The initial experiment has now been concluded with satisfactory result; the absorption cross-section of carbon was found to be encouragingly small, only about one-third of the upper limit previously reported in the literature.

The letter contains the first adumbration of the plan that was later adopted by the President for the direction of scientific experimental work related to national defense. The letter also refers to certain proposals which the writer was evolving for submission to the President with respect to amortization and

other incentive tax devices for national defense plant facilities construction. In connection with the economic aspects of national defense allusion is also made to the original suggestion contributed by the writer at the time of the drafting of the National Recovery Act in 1933 for the inclusion in that Act of a provision authorizing public expenditures for national defense and naval construction (described in detail in the late Gen. Hugh Johnson's book on the NRA, 1934). In respect to the specific problem of an organizational framework that would carry forward uranium research on a bigger scale and at a faster tempo, the conclusion then reached and recommended by the writer was as follows:

For the instant purpose, the organizational instrumentality proposed is the establishment of a Scientific Council of National Defense, composed of executives, engineers and economists, acting in behalf of the Government, who should be invested with administrative powers for the testing and execution of technical projects of utility for national defense.

In acknowledging that letter, Gen. Watson on May 16th (marked exhibit 15b) added an observation regarding the broader suggestion for a mixed executive and administrative group for scientific phases of national defense:

As to your suggestion concerning the establishment of a Scientific Council of National Defense, you may be sure that the President will bear that in mind.

VII. The larger setting now given to the uranium problem was doubtless a contemporaneous reflection of the Nazi headlong marches and victories in Belgium and France and the discernment of the imminent and progressive transformation of the American economy into a defense economy. For between the letter to the President of May 11 and the letter to his aid, General Watson, on May 15th, had come the invasion of the Lowlands, the advent of Churchill to power in Britain as the head of the Coalition Ministry and the succession of setbacks inclusive of the first phase of the evacuation of Dunkerque. The next communication to the President's secretary and the liaison for the project, General Watson, was

again in two versions, the second of which, along with the graphic request for the substitution, are included herein as exhibits 16a and 16b. The primary request has to do with the assurance of uranium supplies for the experiments. Clearly with Belgium under Nazi domination the huge inventories of raw and processed uranium in that country would accrue to Germany. Attention was drawn to the presence in the country of M. Edgar Sengier, the Managing Director of the company which owns the uranium mines in the Belgian Congo. Another important development was the interest evinced in the project by the Carnegie Institution, headed by Dr. Vannevar Bush. Finally, continuing the writer's occasional advisory role on economic matters, a note was enclosed for the President by the writer on "Reorientation of Defense Concepts." While no conference with the President could be arranged for that week, an opportunity was afforded for re-emphasizing the newer aspects of the uranium problem in the course of a conference on broad defense economics at the White House at the end of May. At this conference the writer submitted his views on defense plant amortization and urged that the then scheduled proportions for defense should not be measured in terms of percentage gains on the old base but in terms of reaching what he called parity with the British ratio to national income after Munich, namely allocation for defense purposes of the order of one-fourth of the current national income. On that occasion the writer left a copy of the memorandum of April 20th, entitled "Import of War Developments for and Application to National Defense of Uranium Atomic Disintegration" (marked exhibit 17). Echoes of that conference appear to have reached members of the government group, judging by the sympathetic attitude which ensued towards the initiation of discussions with the officials of the Union Miniere of the Belgian Congo.

After a conference at the turn of the month in Washington with Admiral Bowen and Dr. Briggs the latter on June 5th authorized the writer as a member of the Coordinating Committee to explore the problem of the securing of uranium

supplies from the Belgian Congo (marked exhibit 18). For this purpose the writer, together with Prof. Urey of Columbia, visited the company officials mentioned and secured the necessary information, which was later transmitted to Dr. Briggs.

The culmination of the foregoing phases of the uranium project came on the day following the German army's entry into Paris. On June 15th the President established a new committee for the correlation of the scientific efforts of the country concerned with the problems of national defense, and placed that committee under the chairmanship of Dr. Vannevar Bush, president of the Carnegie Institution of Washington. This committee was to include representatives of the Army and Navy and distinguished scientists, and initially was to be attached to the Council of National Defense. Accordingly, the President advised Dr. Lyman J. Briggs on June 15th that "since the problem on which you are engaged is part of this larger picture" Dr. Bush was requested by him to take over the uranium project and to reconstitute the committee. (A copy of this letter as sent from the White House to the writer is included herein as exhibit 19).

Thus was found a larger framework, concordant at any rate with the spirit of the writer's recommendations since mid-April. Dr. Bush's committee later became the Office of Scientific Research and Development; an associate with him and with Dr. James E. Conant of Harvard as the scientist-executive was a general policy committee that included the then Vice President, Henry A. Wallace, Secretary of War Henry A. Stimson, General George C. Marshall, and Navy representatives. The project as initially presented by Dr. Einstein and the writer in October having by the spring of the year been reported on favorably by the Testing and Coordinating Committee that the President had appointed under Dr. Briggs' chairmanship, thus was launched on a permanent basis in the ensuing quarter in the early summer; from then on it naturally became invested with the

secrecy, the importance, and the resources available to the government for the translation of the idea into a reality and instrument of national defense and national policy.

*Dr. Sachs' pd. - this is done
was added.*

BORIS PREGEL
630 FIFTH AVENUE
NEW YORK

[Conroy-Pregel]

August 13, 1941

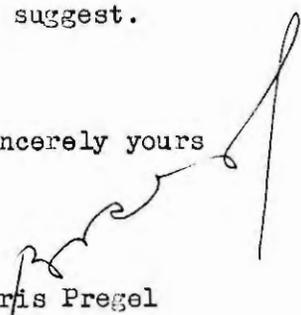
Dr. Leo Szilard
c/o King's Crown Hotel
420 West 116 Street
New York, New York

Dear Dr. Szilard:

Replying to your letter of the 12th inst., I shall be pleased to have luncheon with you and Dr. Alexander Sachs on Monday, August 18th, at 12.45 P. M. and will meet you at Dr. Sachs' office, Lehman Corporation, 1 South William Street, as you suggest.

With kind regards, I remain

Sincerely yours



Boris Pregel

BP/bb

✓
BORIS PREGEL
~~630 FIFTH AVENUE~~
NEW YORK

[Cover - Pregel]

~~CONFIDENTIAL~~

August 19, 1941

Dr. Alexander Sachs
Lehman Corporation
1 South William St.
New York, New York

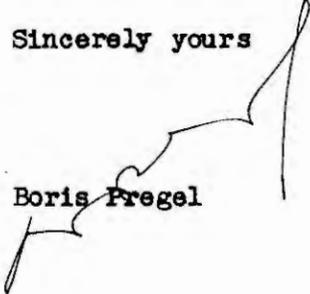
Dear Dr. Sachs:

I take this opportunity to thank you for our pleasant interview yesterday at luncheon.

I am returning to you herewith the interesting memorandum you gave me. I fully agree with your conclusions and feel that if the policy is not changed, we shall face dangerous surprises in the future.

As I told you, I am leaving New York for about two weeks and will be at your disposal on my return which will be a few days after Labor Day.

Sincerely yours


Boris Pregel

BP/bb
enc.

1155 East 57th Street
Chicago, Illinois
January 13, 1944

Dr. Alexander Sachs
1 South William Street
New York, New York

Dear Dr. Sachs:

I dropped in Monday of this week at your office and asked Miss Hess to have photocopies made of certain letters which were exchanged in 1939 and the first half of 1940 in connection with the matter in which at that time both you and I were interested. I am now writing to you to ask whether you would be good enough to look over these photocopies on your return and inform Miss Hess whether I may have photocopies of all those selected documents. I would then pick them up at your office together with the bill some time when I am in New York again.

Sincerely yours,



Leo Szilard

cc: Miss Hess

P. S. The documents for which I have asked would serve to complete a collection of documents which I compiled about a year ago and which covers the period of 1939 and the first half of 1940. Incidentally I submitted such a collection of documents, together with a detailed statement concerning the persons involved and my connection with them, to those authorities who might be interested in such questions, *about one year ago. -*

Comm - Nat.
Def.

Columbia University
in the City of New York
DEPARTMENT OF CHEMISTRY

July 18, 1941

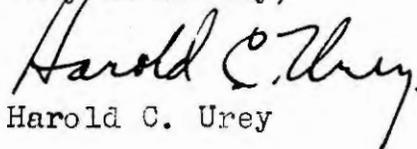
Dr. Alexander Sachs
The Lehman Corporation
1 & 3 South William Street
New York, N.Y.

Dear Dr. Sachs:

After talking to you I went on a little vacation and concluded that the best thing to do is not to take the matter of the uranium work up at the present time through the Secretary of War and the Secretary of the Navy. Dr. Szillard mentioned this to me and I think he and I agree as to the action that should be taken.

I am returning with this letter the correspondence which you so kindly loaned me, and am very glad to be informed in regard to the origin of the whole matter.

Very sincerely,


Harold C. Urey

Registered Mail

Comm. Nat. Def.



TELEPHONE
UNIVERSITY 4-2700

KING'S CROWN HOTEL

OPPOSITE
COLUMBIA UNIVERSITY

UNDER KNOTT MANAGEMENT
420 WEST 116TH STREET, NEW YORK N.Y.

August 28, 1940.

Dr. Alexander Sachs

Dear Dr. Sachs:

Enclosed you will find a rough draft which I am certain you will want to change in many places.

I am sending it to you in advance of my visit which is scheduled for 5 p.m. , so that you may be able to redictate it, if you wish to do so, before we discuss it orally.

Yours very sincerely,

(Leo Szilard)

Dear Dr. Briggs:

I understand that the experiment conducted on graphite at Columbia University by Drs. Fermi and Szilard has now been concluded and that Dean Pegrum will advise you shortly of the results. This means that the governmental committee under your chairmanship will be able to reach a decision and advise the President upon inquiry as to whether governmental action is to be taken along the lines discussed at our last joint conference on April 27.

In view of the increased urgency of action brought about by the invasion of Belgium, it might well be desirable for your committee to form a definite opinion on the importance of the work of Drs. Fermi and Szilard for problems connected with national defense. Accordingly, I am submitting for the convenience of yourself and your colleagues a synoptic statement in the form of a memorandum by Dr. Szilard of the views that he expressed orally at the last conference on the bearings of the experimental work on questions of national defense.

Yours sincerely,

Conroy - Nat. Def.

UNDER
KNOTT MANAGEMENT

TELEPHONE
UNIVERSITY 4-2700

Kings Crown Hotel



420 WEST 116TH STREET
NEW YORK

OPPOSITE COLUMBIA UNIVERSITY

May 14, 1940

Dr. Alexander Sachs
c/o Lehman Corporation
1 William Street
New York City

Dear Dr. Sachs:

Enclosed I am sending you copies of
those letters which accompanied your letter
addressed to the President and dated May 11.

Yours sincerely,

A handwritten signature in cursive script, appearing to read "Leo Szilard".

(Leo Szilard)

LS/JC
ENCLOSURE

(Revised)

May 15, 1940

Dear General Watson:

Confirming the intimation that I had the honor to convey in my letter to the President and in my covering note to you, I have just received a letter from Dean Pegrum of the Department of Physics of Columbia University, stating that the initial experiment "has now been concluded with satisfactory result," and that "the absorption cross section of carbon was found to be encouragingly small...only about one-third of the upper limit previously reported in the literature." The detailed meaning of that has been set forth in the letters of Dr. Szilard of May 10 and of April 22, which I forwarded to the President - a copy of the latter was also sent to you. Please advise me before any conference on this is arranged.

In connection with an independent matter having to do with economic and fiscal policies for effectuating national reconstruction and defense, I should appreciate your expressing to the President my readiness to submit certain social-minded economic ideas that had interested him in 1936 and in 1934, as to incentive devices for evoking large scale plant investment for national defense and the training and reconditioning of the requisite skilled labor. *a* Having ~~to~~ the original ~~proposal of social planning~~ ~~for~~ recovery, submitted in 1932, included national defense along with the original plan for the F.H.A. as expensive channels for publicly fostered investment. *a* These ideas and proposals have had the advantage of maturing over time and of adjustment to criticism, in the same manner as was articulated in my second F.H.A. plan, that, at the President's behest, was worked out for Governor Eccles's advisors. In keeping with the pattern of my earlier plans, the government role can most effectively be as fosterer and insurer of the enormously available dis-employed capital. As to organizational instrumentality, I would suggest the re-establishment of a ~~Department~~ *a* Council of National Defense of ~~Scientists, Engineers and Economists~~ *a* engineers and economists, invested with administrative powers.

a ~~or without Secretary~~
Yours sincerely,

General Edwin M. Watson
Secretary to the President
The White House
Washington, D. C.

Conroy - Nat. 184.

420 West 116th Street
New York City
May 10, 1940

Dr. Alexander Sachs
c/o Lehman Corporation
One South William Street
New York City

Dear Dr. Sachs:

Our work concerning systems composed of carbon and uranium has now reached a stage at which it seems necessary to organize a large scale experiment. Only through actually carrying out such an experiment can it be demonstrated beyond doubt that a nuclear chain reaction can in fact be maintained in a system composed of carbon and uranium.

Since it appears necessary and urgent to obtain certainty in this matter we desire to start organizing a large scale experiment. This experiment would require about 100 tons of graphite and perhaps 10 to 20 tons of uranium metal. It would also require elaborate mechanisms designed to stabilize the chain reaction and to safeguard against over-heating and the possibility of an explosion. Realizing that this is an enterprise which may require to its conclusion an expenditure of \$200,000 to \$500,000, we propose to carry out this project in successive stages. If the results obtained during the first stage are satisfactory, then the expenditure necessary for the second stage would appear to be justified, and the second stage could be started according to schedule, etc. If this procedure were adopted, then the expenditure would gradually rise parallel to the increase in our assurance of the smooth functioning and the final success of the large scale experiment.

In the first stage we would propose to carry out a general survey of all nuclear constants involved with a view to confirming the values previously obtained and to narrowing down the limits of experimental error of the observed values of these constants. A successful conclusion of this survey would strengthen our assurance of the ultimate success of the experiment and would enable us to find the optimum condition for its performance. Concurrently, with this survey, certain other work would have to be done in order to prepare the ground for the experiment. Such work would include the designing of constructional details, the carrying out of technological tests on samples of materials which have to be used in large quantities in the ultimate experiment, and obtaining bids for the manufacturing of such material in the required quality and quantity. An expenditure of \$50,000 would probably be sufficient to bring this first stage in the organization of the large scale experiment to its conclusion, so that we would be in the position of entering into the second stage of the work, provided that the result of the proposed survey of the nuclear constants is favorable. In this second stage the expenditure would gradually rise and might reach a total of \$500,000 by the time the large scale demonstration experiment will be completed.

If a fund were set up under the direction of a board of trustees who had the confidence of the Government, as set forth in the letter by Dr. Einstein that was written following his conversations with you and read by Dr. Briggs at the meeting of April 27, Dr. Fermi and I would be glad to accept the responsibility of carrying out this work under the direction of such a board, and would be pleased to have our work supervised by a small committee of scientists who might be entrusted with the task of advising the board.

In my personal opinion, it would be advisable that the proposed small committee of scientists be left some latitude in devoting, as was suggested at the last conference, up to 25% of the total expenditure for investigating the possibility of a fast neutron reaction. It is further my personal opinion that, if the study of the separation of the uranium isotope were to be included in the program of the work, then Dr. Urey of Columbia and Dr. Beams of the University of Virginia ought to be asked to accept the responsibility for the direction or coordination of this line of work in the same way in which Dr. Fermi and I are prepared to take upon ourselves the responsibility in connection with the work on commercial, unseparated uranium.

Yours sincerely,

Leo Szilard
(Signed)

Ex. 11a.

From ACS.

May 11, 1940

Dear Mr. President:

In furtherance of your kind letter to me of April 5, the conference suggested by you was arranged and held under Dr. Briggs' chairmanship on April 27 between the governmental and non-governmental groups concerned with the bearing of uranium experiments on national defense. With the conclusion of the first experiment which was conducted at Columbia University by Drs. Szilard and Fermi, with governmental aid, the whole project is now entering upon a new stage. Assuming that the governmental committee will now, upon your inquiry, report in favor of further and larger governmental action, may I, in accordance with your own gracious expression of a desire to be advised of developments, submit the following considerations and suggestions:

1. With the invasion of Belgium by the very Power which has organized the residue of its scientists for uranium work, the danger - alluded to in my original letter to you of October 11, 1939 - that America may be cut off from uranium supplies of the Belgian Congo has increased. In addition, the successful completion of the above-mentioned preliminary experiment renders it practicable and advisable that the action to be taken shall be adequate and comprehensive.
2. Such action inherently involves not only larger financial support to be accorded by the Government, but also the formation of an organizational framework under which the work can proceed with the flexibility required for a going enterprise. Interestingly enough, the latter practical aspect has been emphasized by Dr. Einstein in conversations with myself and was communicated by him in a letter to Dr. Briggs, of which I am enclosing a copy for your

kind perusal and attention.

In this connection you might find of interest the enclosed copies of two communications which I have received from Dr. Szilard, the first of which contains a synoptic statement of the implication of the work for National Defense, that was made orally at the above-mentioned conference of April 27, and the second an outline of the next task to be undertaken.

3. The resultant requirement for forming an organization for directing the work outside of governmental institutions and for assuring that work by scientists in the universities is carried out with due secrecy has to be dovetailed with the designation of persons to serve as trustees of a non-profit organization that is to supervise the allocation of funds and to coordinate the various branches of the work.

4. These interlinked needs suggest to me that it would be desirable to bring one of your legal aides into the circle of discussion, along with General Watson, who is now serving so efficiently as a liaison for the representatives of the Service Departments and the Bureau of Standards.

In view of the urgency of a decision on these points, I should greatly appreciate conferring with you in the course of next week at your convenience.

Yours sincerely,

May 13, 1940

Dear General Watson:

Supplementing my letter of Saturday, I am enclosing copy of a letter that I have just sent to Dr. Briggs, together with the enclosure. I trust these copies will serve to place the problems in proper perspective and also in the close-up of the practical and larger-scale international urgencies that I have alluded to.

Yours sincerely,

General Edwin M. Watson,
Secretary to the President,
The White House,
Washington, D. C.

File *Boydland* ^{Com. - Nat}
^{Det.}

I am taking the liberty of requesting your advice and comment on an inquiry that has arisen in connection with certain scientific work being conducted at Columbia University by eminent physicists, with a bearing on problems of national defense. On account of its far-reaching importance and its inherent confidential character, I may say that I have brought the whole subject to the attention of governmental authorities and preliminary conferences have been held between those scientists and a small conference group has been organized by General Watson with the aid of Mr. Driggs, Directors of the Bureau of Standards. While fully aware of the requirements for working through the regular channels, a technical question has arisen. The problem, as you will note from the enclosed letter, is stated in the form of a hypothesis and requires merely the supplying of what appears to be elementary naval facts, which these scientists do not happen to possess. Nevertheless, I do not feel that it is appropriate for me to approach members of the Naval or War Academy faculties. Because of your eminence in the service, I feel that there would be no objection to my submitting to you this very limited inquiry, ~~with the exception of~~ touching on the naval background, without in any way infringing upon the province of activities of the conference group. I should ^{greatly} appreciate hearing from you and if you deem it advisable I would be glad to stop over to see you about it.

*Draft of letter to Admiral
Stanley - not sent*

Sept - Oct 44 Szilard
Commiss - Nat. Sec.

In September of last year I was advised by Professor E. P. Wigner and Professor Albert Einstein of Princeton that Dr. Szilard had devised a method for maintaining a chain reaction in a system composed of uranium and carbon, and that the energy liberated in such a system could be effectively used for producing power. A conservative estimate shows that one can expect one ton of uranium to supply as much power as 3,000 tons of oil and, in the circumstances, uranium might be used as a fuel reserve in warships of the larger types. I understand that there is at present a 50-50 chance that this chain reaction could also be maintained under conditions in which one ton of uranium might supply as much power as would correspond to the burning of one million tons of oil. If this favorable alternative can be realized, then the larger naval units built according to the present naval program would have to be considered obsolete in the near future.

In order to test the method proposed by Dr. Szilard, an experiment using 100-200 tons of graphite and 10-30 tons of uranium metal would have to be carried out. Such an experiment may involve expenses which ultimately may aggregate half a million dollars, and in October of last year I made an appeal to the Government for its moral or material aid in carrying out this project. In response to a letter received from Professor Einstein the President appointed a committee, with Dr. Briggs as chairman, and I submitted the matter to this committee jointly with Dr. Szilard, ^{Dr} Professor ~~E. P.~~ Wigner of Princeton University and Dr. E. Teller of George Washington University, Washington, D. C. We emphasized the urgency of deciding the question whether a chain reaction could be made to work with ordinary unseparated uranium, so that in case of a

Ph

favorable result, steps might be taken to secure an adequate supply of rich uranium ore from the Belgian Congo. It was also pointed out that Dr. Szilard had discussed the matter extensively with Professor E. Fermi and Dean G. B. Pegram of Columbia University, that their collaboration could be counted upon, and that certain preliminary experiments were being prepared at Columbia.

The Government representatives expressed their interest and their desire to help at this meeting, and various Government departments represented on the committee promised material aid towards the preliminary experiments (which have since been carried out to their completion at Columbia with a definitely encouraging result. A favorable report was sent to the President in October.

A number of meetings, with constantly varying membership, have taken place between October of last year and July this year, at which the Government representatives showed a steadily increasing desire that the proposed project be carried out with Government funds rather than private funds. The representatives of Columbia University - Dr. Fermi, Dean Pegram and Professor H. C. Urey - played an increasingly prominent part in these conferences, as well as Admiral Bowen of the Naval Research Laboratory. The opinions of scientists from other universities, such as Dr. Breit of the University of Wisconsin and Dr. Wigner, were heard and were favorable. A consensus of opinion developed to the effect that a fund of \$140,000, if it could be spent freely with no strings or red tape attached, might be sufficient to bring the project to a stage at which the ultimate success of the whole enterprise could be considered as established as beyond doubt.

In spite of the favorable opinion and manifest desire to help

of all those concerned, the project has failed to make any headway since its introduction last October. It has become known during this period that work on uranium is proceeding in Germany in great secrecy and on a very large scale in two of the Kaiser Wilhelm Institutes under the auspices of the German Government. The increasing degree of interest shown by the Government representatives in this country has so far only resulted in dissuading Dr. Fermi and Dr. Szilard from seeking assistance from private sources and in establishing a constantly changing system of committees, none of which seems to possess any clearly defined authority.

The present state of affairs in this respect is as follows: Drs. Fermi, Szilard, Wigner and Teller are now supposed to act as unofficial advisors to six other scientists who form an official scientific advisory committee to the special advisory committee headed by Dr. Briggs. This latter committee is supposed to be a sub-committee of Dr. Bush's advisory committee. I understand that Dr. Bush's committee has now decided to appropriate \$40,000 for the proposed project, if and when it will have funds at its disposal, and is also recommending that \$100,000 worth of material be purchased through some purchasing agency of the Government for the requirements of the project. I understand that Dr. Bush's committee has no funds at present at its disposal. Its decision to provide the material required through a Government purchasing agency was made without having heard either Dr. Fermi or Dr. Szilard, and does not solve the problem, since the bulk of the material required cannot be bought but has to be procured by methods other than straight purchase.

Handwritten:
2-1-43
L. S. Brown

The task of establishing a chain reaction in unseparated uranium under conditions in which the energy liberated can be efficiently used for power production is of considerable complexity. It cannot successfully be carried out unless those who are familiar with all its aspects and who are supposed to carry out the work are given the authority necessary to effectuate the task. It is therefore proposed that (1) a fund of \$140,000 should be entrusted without restriction to a board of trustees comprising Dr. Briggs, Dean Pegrum, Professor Urey and Mr. Sachs; (2) that the seat of the board be in New York City; (3) that Drs. Pegrum, Sachs, Fermi and Szilard should act as executives; (4) that a board of scientists, - namely Drs. Pegrum, Urey, Wigner, Tuve, Teller, Breit, Fermi and Szilard - supervise the work and coordinate the work conducted at universities outside of New York. An estimate of the cost for the measurement of nuclear values which will have to be carried out is enclosed. This will leave \$90,000 of the total of \$140,000 to be used for buying materials required for an experiment with large quantities of material for the purpose of deciding the issue. The largest item, as far as materials are concerned, is an amount of 5-10 tons of uranium metal. It is not possible at present to buy uranium metal in the required quality and quantity. It is therefore proposed to approach two or three firms with a fixed offer to buy one ton of uranium metal of a specified quality at a price of about \$5 per pound, and thereby to induce these firms to carry out such experiments as they find necessary in order to be able to accept such an order or to be able to make a bid of their own. If the firms find that they have to charge a higher price, we would then be free to place an order for a quantity of 5-10 tons with the firm which makes the lowest bid.

be used - if available in large quantities - as a fuel for driving boats or airplanes. It should be pointed out however that the physiological action of the radiations emitted by these new radioactive elements makes it necessary to protect those who have to stay close to a large quantity of such an element, for instance the driver of the airplane. It may therefore be necessary to carry large quantities of lead, and this necessity might impede a development along this line, or at least limit the field of application.

Large quantities of energy would be liberated in a chain reaction which might be utilized for purposes of power production in the form of a stationary power plant.

In view of this development it may be a question of national importance to secure an adequate supply of uranium. The United States has only very poor ores of uranium in moderate quantities; there is a good ore of uranium in Canada where the total deposit is estimated to be about 5000 tons; there may be about 1500 tons of uranium in Czechoslovakia, which is now controlled by Germany; there is an unknown amount of uranium in Russia, but the most important source of uranium, consisting of an unknown, but probably very large amount of good ore, is Belgian Congo.

It is suggested therefore to explore the possibility of bringing over from Belgium or Belgian Congo a large stock of pitchblend, which is the ore of both radium and uranium, and to keep this stock here for possible future use. Perhaps a large quantity of this ore might be obtained as a token reparation payment from the Belgian Government. In

taking action along this line it would not be necessary officially to disclose that the uranium content of the ore is the point of interest; action might be taken on the ground that it is of value to secure a stock of the ore an account of its radium content for possible future extraction of the radium for medical purposes.

Since it is unlikely that an earnest attempt to secure a supply of uranium will be made before the possibility of a chain reaction has been visibly demonstrated, it appears necessary to do this as quickly as possible by performing a large-scale experiment. The previous experiments have prepared the ground to the extent that it is now possible clearly to define the conditions under which such a large-scale experiment would have to be carried out. Still two or three different setups may have to be tried out, or alternatively preliminary experiments have to be carried out with several tons of material if we want to decide in advance in favor of one set-up or another. These experiments cannot be carried out within the limited budget which was provided for laboratory experiments in the past, and it has now become necessary either to strengthen - financially or otherwise - the organizations which concerned themselves with this work up to now, or to create some new organization for the purpose. Public-spirited private persons who are likely to be interested in supporting this enterprise should be approached without delay, or alternatively the collaboration of the chemical or the electrical industry should be sought.

The investigations were hitherto limited to chain reactions based on the action of slow neutrons. The neutrons emitted from the splitting uranium are fast, but they are slowed down in a mixture of uranium

and a light element. Fast neutrons lose their energy in colliding with atoms of a light element in much the same way as a billiard ball loses velocity in a collision with another ball. At present it is an open question whether such a chain reaction can also be made to work with fast neutrons which are not slowed down.

There is reason to believe that, if fast neutrons could be used, it would be easy to construct extremely dangerous bombs. The destructive power of these bombs can only be roughly estimated, but there is no doubt that it would go far beyond all military conceptions. It appears likely that such bombs would be too heavy to be transported by airplane, but still they could be transported by boat and exploded in port with disastrous results,

Although at present it is uncertain whether a fast neutron reaction can be made to work, from now on this possibility will have to be constantly kept in mind in view of its far-reaching military consequences. Experiments have been devised for settling this important point, and it is solely a question of organization to ensure that such experiments should be actually carried out.

Should the experiments show that a chain reaction will work with fast neutrons, it would then be highly advisable to arrange among scientists for withholding publications on this subject. An attempt to arrange for withholding publications on chain reactions has already been made early in March, but was abandoned in spite of favorable response in this country and in England on account of the negative attitude of certain French laboratories. The experience gained in March would make it possible to revive this attempt whenever it should be necessary.

Leo Szilard
(Signed)

File

f

April 23, 1940

Dear Dr. Briggs:

May I ask your good offices to transmit to *Admiral Bown* Commander Hoover the enclosed letter, which states in the form of a hypothesis the possible bearing on naval operations of the experimental work being conducted at Columbia University by Dr. Szilard and Professor Fermi.

While the questions raised in that letter appear to require rather elementary naval facts - such as one might get from any graduate of the naval colleges - the confidential character of the tasks entrusted to our committee seem to me to render it advisable to exercise the utmost caution in confining discussion of even the peripheries of the subject to those within the group.

You have doubtless received a copy of my letter to General Watson, and I take it that you have already advised Drs. Szilard, Fermi and Wigner, as well as Dr. Einstein and Dean Pogram to join with you and the three representatives from the Services in the conference on Saturday. I should appreciate a confirmatory word by telegraph or telephone from you.

Yours sincerely,

Dr. Lyman J. Briggs, Director,
National Bureau of Standards,
Department of Commerce,
Washington, D. C.

Ex. 9

Copy

420 West 116th Street
New York City

April 22, 1940

Dr. Alexander Sachs
c/o Lehman Corporation
New York City

Dear Dr. Sachs:

In accordance with the letter written to you by Professor Einstein on March 7, I am submitting to you the following memorandum dealing with the present work on nuclear chain reactions. Only one aspect of the subject is discussed in this memorandum, namely its possible bearing on questions of national defense.

Memorandum.

We have to discuss separately two different types of chain reactions, i.e.

- a) chain reactions in which the neutrons are slowed down, and in which only a small fraction of the uranium can be utilized, corresponding to the content of uranium 235 in ordinary uranium; (if ordinary uranium is used for the purposes of such a chain reaction, a ton of uranium will be exhausted after having supplied as much energy as corresponds to the burning of about 3000 tons of oil);
- b) chain reactions in which the neutrons are not slowed down and in which the bulk of the ordinary uranium could be utilized; (if it were possible to maintain a chain reaction of this type in uranium, one ton of uranium could supply more energy than 300,000 tons of oil).

There is reason to expect that a chain reaction of the type described under a) can be maintained in a system composed of uranium and carbon.

Whether or not a chain reaction of the second type, as discussed under b) can be maintained in uranium is not known and has for the present to be considered an open question which, in view of its far-reaching consequences, urgently requires further study.

Part I : Chain reactions maintained in a system composed of carbon and uranium.

A chain reaction of this type is capable of applications which may have a bearing on questions of national defense.

1. A system composed of carbon and uranium might be used for purposes of power production. Questions relating to the transformation into power of the energy liberated in the chain reaction, as well as questions relating to the regulation of the chain reaction, have been studied, and methods for solving these problems have been devised.

Personnel has to be protected from being exposed to the radiations emanating from the chain reaction by means of water tanks, and such an atomic engine equipped in this way could be used as a power reserve in larger naval units. The weight of the water tanks rules out the possibility of using an atomic engine for the purpose of driving aeroplanes.

One ton of uranium would be capable of supplying about as much power as 3000 tons of oil. For instance, a 30,000 ton battleship, which would ordinarily have a maximum oil load of 4000 tons, could in the future be equipped for the use of both oil fuel and atomic power, and would carry perhaps 1000 tons of oil and 50 tons of uranium, the latter representing the equivalent of an oil reserve of about 150,000 tons. Accordingly, such a boat would have a practically unlimited cruising radius.

Since a battleship equipped with an atomic engine need not carry in war-time more than a normal oil load of perhaps 1000 tons, there would result a saving in weight, even if allowance is made for the weight of the atomic engine. This saving in weight would lead to an increase in the top speed of the vessel.

The limited supply of uranium would make it inadvisable to use up any considerable amounts for naval purposes in peace time, and the atomic engines with which the battleships may be equipped must not be used except occasionally in manœuvres and in case of actual warfare. Since a large battleship or battle-cruiser will use more than $\frac{1}{2}$ ton of oil per mile if cruising at an economical speed, it would exhaust its full oil load of about 4000 tons during a cruise covering about 10,000 miles. This means that a fast ship cannot operate for any length of time at a distance of about 4-5000 miles from its nearest base. The advantage of a battleship having an equivalent of an oil reserve of 150,000 tons would in these circumstances be decisive, since, apart from the increased speed, it could stay for a long period near its objective at any distance from its base.

2. A system composed of carbon and uranium may be used as a weapon in the following manner: A chain reaction may be maintained in this system, and the neutrons emanating from the chain reaction may be allowed to escape. The intensity of the neutron radiation could be made so high that this radiation would fatally injure by its physiological action human beings who are exposed to it within a radius of one kilometer. By mentioning this fact it is not desired to imply that such a system represents a desirable or particularly efficient military weapon. The reason for emphasizing this point lies rather in the belief that such a system could be used as a weapon by some other country during the present war, possibly in the near future, and that it could be used with considerable effect on a country which is not prepared to meet this new type of attack.

Part II : Chain reactions in which the neutrons are not slowed down.

It is not known at present whether or not chain reactions of this type can be brought into existence. If, however, this could be done, they would have a bearing on questions of national defense, going in their scope of applications far beyond the applications discussed in Part I.

1. In a chain reaction of this second type one ton of uranium used as driving power in a warship could supply more power than 300,000 tons of oil. Consequently, it would probably be possible for the larger types of naval vessels to dispense entirely with use of oil.

2. A chain reaction of this second type would make it possible to bring about explosions of extraordinary intensity. If, for purposes of aggression, a bomb based on such a chain reaction were set off at sea near the coast, the tidal waves brought about by the explosions might lead to the destruction of coastal cities. Such a bomb would not be too heavy to be carried by small boats, but could hardly be carried by existing airplanes.

signed: Leo Szilard

Emerg - Nat. Def.
Chrm 8-10-45

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DR ALEXANDER SACHS

CASE LEMMAN DROB 1 WELLMAN ST

MEETING OF ADVISORY COMMITTEE HAS BEEN POSTPONED TO TWO PM
 SATURDAY APRIL TWENTY SEVENTH AT NATIONAL BUREAU OF STANDARDS

LEMMAN J BRIGGS DIRECTOR.

April 18, 1940

My dear Dr. Briggs

In accordance with Mr. Sachs' instructions, I am enclosing herewith copy of a letter which he wrote today to General Watson.

Yours very truly,

Secretary to Mr. Sachs

Dr. Lyman J. Briggs, Director,
National Bureau of Standards,
U. S. Department of Commerce,
Washington, D. C.

File

April 15, 1940

Dear Dr. Sillard:

In connection with your recent discussions with Mr. Sachs, I am enclosing herewith three copies each of letters received from the President, General Watson, and Dr. Briggs.

Yours very truly,

Secretary to Mr. Sachs

Dr. Leo Sillard,
King's Crown Hotel,
420 West 116th Street,
New York City.

Conroy - Nat. Dep.

THE WHITE HOUSE
WASHINGTON

February 19, 1940

Dear Dr. Sacks:

General Watson is away on a trip with the President and I am, therefore, acknowledging the receipt of your letter of February fifteenth. I shall bring it to his attention immediately upon his return.

Very sincerely yours,



Lillian Dennison
Secretary to General Watson

Dr. Alexander Sacks,
One South William Street,
New York, N. Y.

STANDARD FORM NO. 14
APPROVED BY THE PRESIDENT
MARCH 10, 1926

CONFIRMATION COPY
LIB:DEK

Ev 11d 620

TELEGRAM

OFFICIAL BUSINESS—GOVERNMENT RATES

FROM _____

BUREAU NATIONAL BUREAU OF STANDARDS

CHG. APPROPRIATION Operation and Administration

1300603
60845 National Bureau of Standards, 1940

U. S. GOVERNMENT PRINTING OFFICE 10-1723

April 26, 1940

Dr. Alexander Sachs,
Lehman Brothers,
One William St.,
New York, N. Y.

Believe it wise to limit advisory committee meeting
Saturday to Einstein, Sachs, Pegram and four Washington
Government officials.

THIS MESSAGE WAS TELETYPE
AT THE TIME SHOWN ON THE
REVERSE HEREOF, AS CHECKED.

Lyman J. Briggs, Director.

-✓. Western Union Postal
- Navy Dept. War Dept.
- Radio Corp. of America

Chm 8/10/45

Ex. 11c

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LEHMAN CORPORATION

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R. B. WHITE
PRESIDENT

NEWCOMB CARLTON
CHAIRMAN OF THE BOARD

J. C. WILLEVER
FIRST VICE-PRESIDENT

CHECK
ACCOUNTING INFORMATION
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Send the following message, subject to the terms on back hereof, which are hereby agreed to

APRIL 26, 1940

DR. LYMAN J. BRIGGS
 BUREAU OF STANDARDS
 U. S. DEPARTMENT OF COMMERCE
 WASHINGTON, D. C.

SINCE YOUR TELEGRAM YOU DOUBTLESS RECEIVED EINSTEINS LETTER FOLLOWING MY VISIT WITH HIM ADVISING YOU HIS INABILITY ATTEND AND HIS HAVING DISCUSSED WITH OTHERS I HAVE MENTIONED PROPOSALS FOR CARRYING FORWARD WORK WITH GREATER SPEED AND MORE ADEQUATE SCALE THAN HITHERTO STOP ADDITIONALLY YOU WILL RECALL GENERAL WATSONS LETTER SYNCHRONIZING WITH PRESIDENT'S APRIL FIFTH ASKING SUGGESTIONS IN BEHALF EINSTEIN AND MYSELF REGARDING ATTENDANCE STOP BESIDES FERMI READY GIVE PRELIMINARY REPORT ON GRAPHITE EXPERIMENT AND AS THIS TIME PIVOTAL IN ACADEMIC ~~XX~~ CALENDAR FOR ASSURING CARRYING ON WORK THROUGH SUMMER BY OTHER SCIENTISTS NEED COMPREHENSIVE DISCUSSION ACCORDINGLY ~~XX~~ URGE ADHERENCE ORIGINAL PLAN ~~XXXXXXXXXXXX~~ STOP YOUR OWN IDEA OF

Chrom 8

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SERIAL	DEFERRED
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R. B. WHITE
PRESIDENT

NEWCOMB CARLTON
CHAIRMAN OF THE BOARD

J. C. WILLEVER
FIRST VICE-PRESIDENT

Send the following message, subject to the terms on back hereof, which are hereby agreed to

- 2 -

A MORE LIMITED GATH RING COULD FOLLOW AS EXECUTIVE MEETING STOP WIGNER SZILARD
 FERMI ATTENDING PHYSICAL SOCIETY MEETING AND ASSUME REACHABLE WARDMAN PARK STOP
 PLEASE WIRE ME STOP LOOKING FORWARD SEEING YOU TOMORROW.

ALEXANDER SACHS

Charge to the account of ALEXANDER SACHS

\$

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R. B. WHITE
PRESIDENTNEWCOMB CARLTON
CHAIRMAN OF THE BOARDJ. C. WILLEVER
FIRST VICE-PRESIDENT

CHECK
ACCT'G INFMN.
TIME FILED

Send the following message, subject to the terms on back hereof, which are hereby agreed to

PROFESSOR HAROLD UREY
CARE OF PROFESSOR J. W. BEAMS
UNIVERSITY VIRGINIA
CHARLOTTESVILLE VIRGINIA

National Defense

ADMIRAL BOWEN WILL GLADLY CONFER WITH US TOMORROW AT TEN O'CLOCK
AT HIS OFFICE IN NAVY BUILDING. PLEASE WIRE ME COLLECT ONE
WILLIAM STREET WHETHER YOU CAN ATTEND.

ALEXANDER SACHS

WESTERN UNION MESSENGERS ARE AVAILABLE FOR THE DELIVERY OF NOTES AND PACKAGES.

LEHMAN CORPORATION

Charge to the account of

CLASS OF SERVICE DESIRED	
DOMESTIC	CABLE
TELEGRAM	DAY
LETTER	URGENT
SERIAL	DEFERRED
NIGHT LETTER	NIGHT LETTER
SPECIAL SERVICE	PHOTOGRAM
Special instructions to be indicated in the message or on the accompanying card.	

WESTERN UNION

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1200-B

R. S. WHITE, PRESIDENT
NEWCOMB CARLTON, CHAIRMAN OF THE BOARD
J. C. WILLEVER, FIRST VICE-PRESIDENT

JULY 9, 1940

Send the following message, subject to the terms on back hereof, which are hereby agreed to

D. L.

DR. LYMAN J. BRIGGS
BUREAU OF STANDARDS
DEPARTMENT OF COMMERCE
WASHINGTON, D. C.

HAVE NOT YET RECEIVED COPY PRESIDENT'S LETTER REGARDING REINTEGRATION OUR COMMITTEE WITH DR. BUSH'S. STOP PLEASE TRANSMIT AIR MAIL SPECIAL DELIVERY DUPLICATE OR COPY REGARDS

ALEXANDER SACHS

Vering. 100. 074.

Cover - Nat. Def.

Charge to the account of

CLASS OF SERVICE DESIRED		CLASS	
DOMESTIC	TELEGRAM	ORDINARY	
	DAY LETTER	URGENT	
	SPRINT	POSTPAID	
	NIGHT LETTER	REGISTERED	
	SPECIAL SERVICE	RADIOGRAM	

LEHIGH CORPORATION

WESTERN UNION

1900-B

R. B. WHITE
PRESIDENT
NEWCOMB CARLTON
CHAIRMAN OF THE BOARD
J. G. WILLEVER
FIRST VICE-PRESIDENT

CHIEF
ACCOUNTING INFORMATION
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Send the following message, subject to the terms on back hereof, which are hereby agreed to

GENERAL EDWIN S. WATSON
SECRETARY TO THE PRESIDENT
THE WHITE HOUSE
WASHINGTON, D. C.

MAY 25, 1940

TRANSMITTING IMPROVED VERSION BY LETTER AND PLAN WHICH PLEASE SUBSTITUTE FOR
FIRST DRAFT SENT LAST NIGHT STOP IN VIEW URGENCIES FROM IMMINENCE VACATION
PERIOD AT UNIVERSITIES AND MORE PRESSING NEED FOR ARRANGING IMPORTATION OF
ONE SUPPLY FROM BELGIAN RUBBER COMPANY WHOSE LEADING OFFICER FORTUNATELY
REACHABLE WOULD APPRECIATE BRIEF APPOINTMENT WITH PRESIDENT ON SATURDAY STOP
XXXXXXXXXX PLEASE WIRE ME SO I CAN ARRANGE SUPPLEMENTARY APPOINTMENT WITH
DR. BRIGGS AND ADMIRAL BOWEN

REGARDS

ALEXANDER SACHS

Conroy - Nat. Def.

Charge to the account of

CLASS OF SERVICE DESIRED	
DOMESTIC	CABLE
TELEGRAM	DNDAILY
DAY LETTER	URGENT RATE
NIGHT LETTER	DEFERRED
SPECIAL SERVICE	NIGHT LETTER
SHIP ADDRESSES	SHIP ADDRESSES

R. E. WHITE
PRESIDENT

NEWCOMB CARLTON
CHAIRMAN OF THE BOARD

J. C. WILLEVER
FIRST VICE-PRESIDENT

WESTERN UNION

LEHMAN CORPORATION

1206-B

Ex 11c

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Send the following message, subject to the terms on back hereof, which are hereby agreed to

DR. LYMAN J. BRIGGS
BUREAU OF STANDARDS
U. S. DEPARTMENT OF COMMERCE
WASHINGTON, D. C.

APRIL 26, 1940

SINCE YOUR TELEGRAM YOU DOUBTLESS RECEIVED EINSTEIN'S LETTER FOLLOWING MY VISIT WITH HIM ADVISING YOU HIS INABILITY ATTEND AND HIS HAVING DISCUSSED WITH OTHERS I HAVE MENTIONED PROPOSALS FOR CARRYING FORWARD WORK WITH GREATER SPEED AND MORE ADEQUATE SCALE THAN HITHERTO STOP ADDITIONALLY YOU WILL RECALL GENERAL WATSON'S LETTER SYNCHRONIZING WITH PRESIDENT'S APRIL FIFTH ASKING SUGGESTIONS IN BEHALF EINSTEIN AND MYSELF REGARDING ATTENDANCE STOP BESIDES FERRI READY GIVE PRELIMINARY REPORT ON GRAPHITE EXPERIMENT AND AS THIS TIME PIVOTAL IN ACADEMIC CALENDAR FOR ASSURING CARRYING ON WORK THROUGH SUMMER BY OTHER SCIENTISTS'S NEED COMPREHENSIVE DISCUSSION ACCORDINGLY I URGE ADEQUATE ORIGINAL PLAN IMPLEMENTATION STOP YOUR OWN IDEA OF

Conroy - Nat. Def.
Clunk's File, Lehman
Corp - Conroy.

December 7, 1943

To: Mr. Robert Lehman

From: Alexander Sachs

I have known Dr. Leo Szilard since the beginning of 1939, through a common friend and Dr. Albert Einstein. He is a research physicist who had worked in Berlin Physics Institute and in Oxford and Cambridge on the problems of uranium before the outbreak of the war.

The implications of uranium as a source of energy creation and its implications for national defense were brought to the attention of our Government by Dr. Einstein and myself, with a view to the facilitation under governmental auspices of the experimental work which could be done by a number of refugee scientists including Dr. Szilard and Professor Fermi at Columbia, a Nobel prize physicist who was not agreeable to the Fascist government.

By the summer of 1940 our Government did become interested, and the President appointed a committee representing the Army, the Navy and the head of the Bureau of Standards and an outside liaison group consisting of Dr. Einstein, Dean Pegrum of Columbia University and myself. Then, as our defense program increased, the Navy devoted funds for the acceleration of the researches of Dr. Fermi and Dr. Szillard. In the summer of 1941, the President established a committee of scientists to supervise and unify researches that would be of benefit for national defense, and placed in charge Dr. Vannever Bush, President of the Carnegie Institution, and as Vice-Chairman, President Conant of Harvard. This scientific research committee then coordinated all the researches in uranium and nuclear physics going on in various universities, and allocated funds for expansion and placed it under special secrecy.

Dr. Compton, a professor of Physics at the University of Chicago, was put in charge of a special unit and it is with that unit that Dr. Szilard has been working. While I do not have Dr. Szilard's residence address in Chicago, I would assume I could secure it from Dr. Einstein or Professor Wigner of Princeton who has been within the circle of this problem.