SUMMARY BRIEF ON

DR. EMIL JULIUS KLAUS FUCHS

65-58605-1494X
Bulky

(Fuchs)

Part 1 of 2

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CLASSIFIED DECISIONS FINALIZED
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DATE: 7-9-97 5668 SLD/JAC

February 12, 1951 (75-1121 JLG)

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CAA 75-1121 FOIPA 56,361

SUMMARY BRIEF

ON

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EMIL JULIUS KLAUS FUCHS, was.

Espionage - R

(Bureau File 65-58805)

The following pages contain info from appropriate Agency. See Letter dtd 4/22/96, Info has been declassified and marked accordingly: SP6AG/JS 7/5/96 CAA 75-1121 pages 1+3, under Table of contents; pages 1, 4a, 49, 13, 30, 53, 54, 55, 59B, 63, 64, 65, 66, 67, 68, 69, 71, 72, 75a, 75b, 117, 125, 127, 128, 263a, 350, 354, 367, + 374.

page 161, P2 bracketed info. Info declassified. Apply appropriate FOIA exemption per DOE Ltr dtd 7/22/96. SSA5668 SLD / SP6AG/JS (S) U 7/26/96.

HARRY GOLD, was.,

Espionage - R

(Bureau File 65-57449)

6-30-97
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(NOTE: THIS BRIEF CONTAINS INFORMATION FROM (S) [redacted] WHICH IS RECEIVED UNDER AN AGREEMENT THAT IT WILL NOT BE DISSEMINATED. THERE ALSO APPEARS INFORMATION CLASSIFIED TOP SECRET EITHER BY THE ATOMIC ENERGY COMMISSION OR BY THE [BRITISH AUTHORITIES.)] S (U)

FOREIGN GOVT. CONSULTED SSA5668SLD/JAC 7/10/98

Pg. 91b P1 declassified per DOE Ltr 7/22/96. SSA5668SLD / SP6AG/JS 7/31/96

Declass per DOE letter 8/8/89 pgs 71, 5, 64, 6, 19, 19, 91, 64, 65, 87, 91, 99, 100, 102, 106, 107, 107E, 103, 104, 105, 349, 358, 3011, 1077, 375, 381, 388 (5-1121), 371, 374 CAA 75-1121 2/2 JLG/JRA 10/2/93

3042 Part DLC

pages 107, P2 [ ]s, 344, 114 P4; 116, P5; 117, Ps 1, 5+7; 317, P1, [ ]s; 344, P1, [ ]s Info remain classified per another agency's letter dtd 7/25/96. SSA5668SLD / SP6AG/JS 8/7/96. Also pages 355, 357, 358, 364, 366, 369, + 381.

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IX. DISSEMINATION

X. EXHIBITS

A. Exhibit 1.
   1. Page from Israel Halperin's Notebook
B. Exhibit 2
   1. Letter dated December 10, 1943, to Professor J. Chadwick, Washington, D.C., from W. A. Akers, British Ministry of Supply Mission, New York City, and letter dated December 11, 1943, from W. L. Webster, British Supply Council in North America, Washington, D. C., to General L. R. Groves, reflecting that in England Fuchs had undergone a "Special Clearance" for atomic energy work.
C. Exhibit 3
   1. Letter dated October 22, 1947, from L. G. Ralfe to Mr. Carroll L. Wilson, General Manager, U. S. Atomic Energy Commission, requesting clearance of Fuchs to visit Chicago University (Argonne National Laboratory).

D. Exhibit 4
   1. Letter dated November 7, 1947, from Carroll L. Wilson, Atomic Energy Commission, to Mr. L. G. Ralfe, British Commonwealth Scientific Office, Washington, D.C., granting clearance for Fuchs to visit Chicago University.
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F. Exhibit 6
   1. Memorandum from C. A. Bolander, Jr., to Admiral Gingrich (dated January 12, 1949,) with attachment concerning the British Mission that participated in the atomic energy program under the Manhattan Engineer District from 1943 to 1946, and the degree of access had by that Mission.
G. Exhibit 7
   1. List of technical meetings attended by Fuchs while at Los Alamos.
H. Exhibit 8
   1. List of Reports prepared by Fuchs.
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J. Exhibit #10 Declass on DOE Ltr 8/18/89

1. List of some of the reports prepared by Fuchs personally or in collaboration with other scientists while working under the Manhattan Engineer District, on which notes have been placed by Fuchs indicating whether or not the reports were furnished to the Russians. X (w)

K. Exhibit #11

1. Signed statement of Fuchs dated May 26, 1950, (does not include technical data).

L. Exhibit #12

1. Signed statement of Fuchs dated May 26, 1950 (includes technical data).

M. Exhibit #13

1. Signed statement of Gold dated July 10, 1950, concerning activities with Fuchs.

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SCIENTIFIC KNOWLEDGE

V. Fuchs' Scientific Knowledge and Disclosures to Russians.

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B. ACCESS TO SCIENTIFIC INFORMATION AND DISCLOSURES TO THE RUSSIANS

It is impossible to determine exactly how much information of a scientific nature was acquired by Fuchs during his work on atomic energy in England and the United States. It is also impossible to ascertain exactly how much information or knowledge he passed to the Russians and the value of such information to them. An evaluation in this regard can best be arrived at from an examination of Fuchs' statement to Dr. Michael W. Perrin, atomic scientist connected with the British Ministry of Supply, which statement is quoted verbatim below; a summarization of the nature of his work in the United States and his access to scientific information; and an examination of statements of other scientists in a position to estimate Fuchs' knowledge of atomic energy. (U)

At the outset, it should be pointed out that Sir Percy Sillitoe, Head of MI-5, has advised that the technical information which Fuchs admittedly passed to the Russians included the "know-how" of the atomic bomb. (U)

Fuchs' statement to Dr. Michael W. Perrin, referred to above, is quoted as follows:

"First Period. From 1942 to December, 1943." (U)

"Fuchs told me that his first contact was early 1942. By this time he had joined Professor Peierls' team at Birmingham University which was working under a contract from the Directorate of Tube Alloys. Fuchs explained that during this first period, he had been at considerable pains to give the agents only the results of work which he himself had done. He was engaged on a study of the basic theory of and the mathematical treatment of problems connected with the gaseous diffusion process for separating the uranium isotopes, and was also doing some work on the development of mathematical methods for evaluating the critical size and efficiency of an atomic bomb. He was only concerned with the possibility of separating and using pure uranium 235 and told me that at this time he knew practically nothing about the possibilities of the pile reaction other than what had been published in the scientific literature, and he certainly did not appreciate any possibility of using plutonium as an alternative to U-235 in an atomic bomb. He regarded this part of the atomic energy project as, at the best, a long-term possibility for the production of power." (U)

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"In accordance with his intention to give only the results of his own work, his main activity with the Russian agent was to hand him copies of all the reports which he wrote while at Birmingham University. These were in the 'M.S.' Series and he usually handed over a spare carbon copy which he had typed. The agent with whom he was in contact clearly understood none of the technical details but, according to Fuchs, was in no way surprised to hear work directed to the production of an atomic bomb, and on one occasion asked Fuchs what he knew about the electro-magnetic method as an alternative means of separating the uranium isotopes. This very much surprised Fuchs who, at the time, knew nothing of any work on this method and had never considered it. TS(U)

"Apart from the detailed papers of which he was himself the author, Fuchs did tell the agent in general terms that work on the project was being actively prosecuted in the United Kingdom and that a small pilot unit to test out the principal of the diffusion separation process was being put up at the Ministry of Supply factory 'valley' in North Wales. He said that he gave no details of the design or mechanical construction of the equipment in this pilot plant. He also reported that similar work was being done in the United States and that there was collaboration between the two countries. TS(U)

"Apart from the question about the electro-magnetic separation process, Fuchs did not remember much about questions put to him and thought that they were very few and were sometimes so garbled as to be almost meaningless. TS(U)

[<u>"Second Period. New York. December, 1943, to August, 1944.</u>] TS(U)

"Fuchs was a member of the British Diffusion Mission which went to New York in December, 1943, and he stayed on there when the majority came back to the United Kingdom. During this period Fuchs learned a good deal more about the American program and, in particular, that a large production plant for the gaseous diffusion process was being built which would be worked in conjunction with a second large plant using the electro-magnetic process. He knew that both of these plants would be at 'Site X' but he has told me that he did not then TS (U)

"know where this was and could not, therefore, report it to the new Russian agent with whom he was in contact in the U.S.A. He did, however, know the general scale of effort of the American program and the approximate timing, and this information was passed over. By now his original intention to pass on only such information as was the result of his own work had been dropped and he did provide some technical information about the American gaseous diffusion plant. He told me that he had given the agent some general information about the membranes and had told him that these would be made of sintered nickel powder, though he did not know any technical details. His main contribution was to pass over copies of all the reports prepared in the New York Office of British Diffusion Mission. These carried the serial letters 'M.S.N.' and he handed over, usually, the manuscript of each report after it had been typed for duplication. (U)

"During this period Fuchs said that he still had no real knowledge of the pile process, or of the significance of plutonium. He paid one short visit to Montreal and knew that the teams there were engaged on the design and construction of a small, heavy water pile. He took no great interest in this work and imagined it could only be related to the long term possibility of the development of atomic energy as a source of power. As far as he could remember, he did not pass any of this to the Russian agent as he regarded it as of little interest. He told me that during this period he got the impression from the agent that the Russians had a great general interest in the project and that its importance was fully appreciated, but he did not believe that anything very serious was being done by the Russians themselves. (U)

"Third Period. Los Alamos. August, 1944, to the Summer of 1946. (U)

"When Fuchs went to Los Alamos he realized for the first time the full nature and magnitude of the American atomic energy program and the importance of plutonium as an alternative of U-235 became clear to him. He also learned then that it was intended to build large plutonium-producing pile as an alternative to the U-235 production plant at Oakridge. (U)

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"The first contact with the Russian agent after he went to Los Alamos was in February, 1945, when he met him at Boston, Massachusetts. While there Fuchs wrote a report, which he said would have covered several pages, summarizing the whole problem of making an atomic bomb as he then saw it. This report included a statement of the special difficulties that would have to be overcome in making a plutonium bomb. He reported the highly spontaneous fission rate of plutonium and the deduction that a plutonium bomb would have to be detonated by using the implosion method rather than the relatively simple gun method which could be used with U-235. He also reported that the critical mass for plutonium was less than that for U-235 and that about five to fifteen kilograms would be necessary for a bomb. At this time the issue was not clear as to whether uniform compression of the core could be better obtained with a high explosive lens system, or with multipoint detonation over the surface of a uniform sphere of high explosives. He reported the current ideas as to the need for an initiator, though these, at the time, were very vague, and it was thought that a constant neutron source might be sufficient. Finally, when he wrote his report in February, 1945, he referred only to the hollow plutonium core for the atomic bomb as he did not then know anything about the possibility of a solid core. (U)

"He met the Russian agent again in Santa Fe at the end of June, 1945, and this time handed him a detailed report which he had already written in Los Alamos with access to the relevant files so he could be sure that all figures mentioned were correct. (U)

"This second report fully described the plutonium bomb which had, by this time, been designed and was to be tested at 'Trinity.' He provided a sketch of the bomb and its components and gave all the important dimensions. He reported that the bomb would have a solid plutonium core and described the initiator which, he said, would contain about fifty curies of polonium. Full details were given of the tamper, the aluminum shell, and of the high explosive lens system. He told the agent that the two explosives to be used in the system were 'Baratol' and 'Composition B,' though he himself did not know what this really meant in terms of H. E. Technology. The Russian agent was told that the 'Trinity' test was expected to produce an explosion equivalent to about ten kilo tons of T.N.T. and was given details of the date and an approximate indication of the site. (U)

"Fuchs told me that, at this time, details of production of pile design, construction and operation were still unknown to him and were, therefore, not passed to the Russian agent. He had several further meetings with him in Santa Fe in the autumn of 1945 and spring of 1946, but could not remember precise dates. During these meetings he gave some information on the delta phase of plutonium and 'probably' made some reference to the use of gallium as an alloying constituent, but he was insistent that he gave no other information on the metallurgy of plutonium and that he did not describe the techniques on its preparation or fabrication.

"During this latter period at Los Alamos, or perhaps soon after he returned to the United Kingdom, Fuchs gave the Russian agent some general information about the possibility of developing a 'mixed' bomb. In particular, he emphasized the advantages of this for the United States because they already had both plutonium production pile and isotope separation plant, and could make use of both materials.

"The Russian agent with whom he was in contact during his whole period in the United States (while in New York and Los Alamos) was rather more capable of understanding the information which he was given than had been the case with his contact in the United Kingdom. Fuchs described him as being perhaps an engineer or chemical engineer. He clearly had no detailed knowledge of nuclear physics or of the sort of mathematics with which Fuchs was competent to deal.

"Fourth Period. Harwell. Summer of 1946 to spring of 1949.

"Fuchs explained that during this last period he was having increasing doubts on the wisdom of passing information to the Russians, and he assured me that he did not give them all the information that he could have given and that he did not always answer questions that were put to him. He was, for instance, several times asked for the American rate of production and stockpile of atomic bomb, and about the United Kingdom program. As to the first, he only repeated the information which he had had at the time that he left Los Alamos and said that he knew nothing thereafter. On the United Kingdom program he reported

the arguments which had led to the decision to build air-cooled, rather than water-cooled, piles and gave the design figures for the plutonium output from the two windscale piles that were under construction. Later he told the agent of the plan to build an 'L.S.D.' isotope separation plant in order to economize on raw material. TS (U)

"While at Harwell Fuchs filled in the picture of the plutonium bomb that he had already given from Los Alamos and provided mathematical details such as those relating to the equation of state, the probability of pre-detonation, and the blast calculations of the Hiroshima and Nagasaki bomb. He was asked some questions about the Bikini test and gave the formula for radiation intensity as a function of distance, but he was asked no questions and gave no information about the Eniwetok test. At the end of 1946 or early 1947 he gave the 'net yield from the referenced formula' for the efficiency of an atom bomb explosion. Up to February, 1949, he was several times asked to give the full derivation of this formula, but never provided it. TS (U)

"During 1947 Fuchs was asked on one occasion by the Russian agent for any information he could give about 'the tritium bomb.' He said that he was very surprised to have the question put in these particular terms and it suggested to him (as had the earlier request for information about the electro-magnetic isotopes separation process) that the Russians were getting information from other sources. TS (U)

"In reply to the question Fuchs gave the T-D cross-section value before this was declassified, and he also gave all that he knew from his Los Alamos period on the methods for calculating radiation loss and the ideal ignition temperature. He also described the current ideas in Los Alamos when he left on the design and method of operation of a super bomb, mentioning, in particular, the combination fission bomb, the tritium initiating reaction and the final deuterium one. TS (U)

"Fuchs told me that during 1948 he did not pass to the Russian agent a great deal of information that was then in his possession as a result of his work at Harwell on the design and method of TS (U)

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operation of plutonium production pile. He was surprised that very few questions were put to him on this subject, though, during 1948, he was asked how the uranium metal rods were fabricated. TS (U)

"He did not give this information and was impressed at the time with the peculiarity that this one specific detail had been asked for while there were no questions about the recovery of uranium from its ore, the preparation of pure uranium complements or metals, canning techniques, dimensions of uranium rod or the preparation, purity and dimensions of graphite. He told me that he believed that he 'might have given' the lattice spacing for one particular pile while he was in the United States, but he did not give the lattice formula, nor was he asked for information on how to calculate a pile lattice, and he gave no information on exponential experiments. TS (U)

"He was never asked anything about Wigner expansion, though he did give, at some period which he could not precisely remember, Los Alamos information on the possibility, which was then being considered, of the release of energy from graphite used as moderator in a pile, and may have mentioned the problem of movement in the graphite as affecting the alignment of cooling tubes. TS (U)

"Fuchs told me that he was never asked, and never gave 'fundamental nuclear physics data relating to the fission reaction.' TS (U)

"During this last period Fuchs said that he had given the agent general information on the idea current at Harwell on new types of reactors, including the 'flame trap' design, the 'ball' and 'sandwich' reactors, fast reaction and breeders. TS (U)

"During the latter part of 1948 he was asked on one occasion for a specific Chalk River report, dealing with neutron distribution in the N.R.X. pile, which he had never seen. He was also told that 'there is a report on mixing devices' and was asked whether he could get it. He had not, at the time, seen this report but identified it at Harwell and provided extracts from it. This information refers to a particular design detail that is relevant only to the windscale air-cooled production pile. TS (U)

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"He was also asked about the solvent extraction process. He knew hardly anything of this, but was able to get some very limited information from Harwell reports and passed this over, though he believed that this was of no great significance. (U)

"All these questions confirmed his opinion that the Russians had access to information from another source or sources. (U)

"Finally, I discussed with Fuchs the nature of the 'atomic explosion' that had taken place in Russia in the Autumn of 1949. He told me that he would have expected this to be due to a plutonium bomb in the light of all the information he had passed to the Russians. He, personally, believed that this conclusion was confirmed by the measurements on the airborne fission products that had been collected, though he recognized the doubt in this interpretation due to the lack of chemical evidence for the presence of plutonium in the cloud. He said that he was, however, extremely surprised that the Russian explosion had taken place so soon as he had been convinced that the information he had given could not have been applied so quickly and that the Russians would not have the engineering design and construction facilities that would be needed to build large production plants in such a short time. (U)

"I formed the impression that, throughout the interview, Fuchs was genuinely trying to remember and report all the information that he had given to the Russian agents with whom he had been in contact, and that he was not withholding anything. He seemed, on the contrary, to be trying his best to help me to evaluate the present position of atomic energy works in Russia in the light of the information that he had, and had not, passed to them." (U)

In connection with the second period referred to by Fuchs, relating to his work in New York from December, 1943 to August, 1944, inquiry of the Atomic Energy Commission reflects that in 1943 arrangements were made for a group of British scientists to come to the United States and work with representatives of Kellex, Inc., of New York, prime contractors for the Manhattan Engineer District, and MED representatives on the scientific development of the gaseous diffusion

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project which was also known as K-25. This project related to the gaseous diffusion process for separating the uranium isotopes. Fuchs was one of the members of the British team assigned to work with Kellex. The British scientists had offices in room 2401-E at 43 Exchange Place, New York City. (65-58805-236 Encl. and 253)

The British scientists undertook analysis of the following theoretical problems:

(1) Cascade of cascades flow sheets
(2) Exact calculation of equlibrium time
(3) Loss or separation due to surges
(4) Control of main cascade (e.g., frequency of use of automatic control valves).
(5) Control of purge cascades

Reports of these theoretical studies were summarized in a series of reports, referred to as the MSN Series, which were described as having been helpful in anticipating problems of plant design. The MSN Series were prepared by the scientists belonging to the British Mission. The "N" referred to the New York Office of the Manhattan District. (Ibid, 8 and 156)

It should be noted that Fuchs, in his statement to Perrin, admitted that all of the MSN Series of reports were made available to the Russians.

In evaluating the importance of this series of reports, it should be noted that Dr. Paul McDaniels, a physicist assigned to the Atomic Energy Commission Building, Washington, D. C., according to reports from the Atomic Energy Commission, has stated that the one report prepared by Dr. Fuchs, entitled "Fluctuations and Efficiency of a Diffusion Plant, Part III, The Effect of Fluctuation in the Flow of N_2," is a skilled, technical, theoretical discussion covering refinement of plant operations. He stated that this document, along with others such as barrier production, operating characteristics, seal development, and pumps, would be helpful in determining over-all plant operating techniques. (Ibid, 156)

It should be noted that the report referred to by McDaniels is MSN-12, referred to by the original informant in this case as having been furnished to the Russians by Fuchs.

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Various meetings were held among members of the British team of scientists, Kellex employees, and MED representatives, which were attended by Fuchs while he was in New York from December, 1943 to August, 1944. Various subjects were discussed at these meetings. Mr. A. L. Baker, Vice-President of Kellex, Inc., stated to Bureau Agents that after the meeting of January 5, 1944, which Fuchs attended, there was no part of the American plan to construct a plant at Oak Ridge for the manufacture of atomic bombs that was not known to the British. (Ibid, 253 and 236 Exhibit)

In commenting on the custody of documents available to the British team of scientists in New York. Christopher Frank Kearton, a member of this British team, when interviewed by the British stated that probably only three officers, Peierls, Fuchs, and himself, would have had unrestricted access to such documents, including the MSN Series. (Ibid, serial 52)

(U)

With respect to the third period of Fuchs' activity at Los Alamos from August, 1944 to June, 1946, Mr. Ralph C. Smith, Assistant Director for Classification and Security of the Los Alamos Scientific Laboratory, stated that Fuchs and his associate, Peierls, were two of the smartest men who were ever at Los Alamos and both contributed heavily to all phases of the weapon development program. Both of them worked in the Theoretical Physics Division of the Laboratory under the direction of Hans Bethe. During the latter part of his stay at Los Alamos, Peierls was the senior collaborator of the British Mission there. Smith stated that both Fuchs and Peierls had almost unlimited access to highly classified information while at Los Alamos. He stated that both of them, as well as Royle Skyrme, another British scientist, had written a great number of reports while at Los Alamos and had contributed heavily to the technical series. Fuchs and Peierls were not only familiar with all phases of the atomic bomb perfected while they were at Los Alamos, but were also familiar with the planned long-range research program. They contributed to all phases of atomic weapon development, including implosion and super. (This refers to the future long-range program of research and the H-bomb research.) Smith stated that they and Robert Christy headed the team which did the hydrodynamics work which made the plutonium implosion method possible. He continued that they did considerable work on the efficiency of the design of the Eniwetok model of the atomic bomb. The members of the British Mission probably, according to Smith, had complete information concerning all phases of atomic energy research in this country up through the latter part of 1946, with the possible exception of the details of the design of the Oak Ridge and Hanford plants. (The information furnished by Smith was classified as secret.) (Ibid, 13--pp. 5,6,10)

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Records of the Atomic Energy Commission reflect that as of January 12, 1949, there was made a compilation of the Canadian Staff, scientific and technical, and United Kingdom Staff, scientific and technical, who participated in the atomic energy program under the former Manhattan Engineering District from 1943 to 1946. This compilation included, in so far as possible, a statement as to the installations visited and degree of access afforded to these groups. It is stated that records available in the security files of the Atomic Energy Commission give a general picture as to the fields of activity in which the British Mission participated, but that the available records do not provide detailed information as to their particular specialties, nor do the records clearly indicate what familiarization the British group may have had with other programs in which they did not actually participate, but undoubtedly became acquainted with by reading technical reports available to them. The following statement appears in the records of the Atomic Energy Commission concerning the British group at Los Alamos: [redacted] (U)

"Inasmuch as it was the policy of the laboratory to make all information available to this group at Los Alamos, and as the British personnel had general access to the Document Room, various local sites, and the organized meetings of the local project, it is believed that the group had substantially complete knowledge of the gun assembly and implosion assembly of fissile material, the actual design of the aerial bombs employing these principles, the possible future developments, including the 'Super' or Thermo Nuclear Reactions, the auxiliary equipment at the various local sites including the Water Boiler. The British Group probably did not obtain detailed information concerning the final chemical work at Los Alamos, however, the general aspects were known to them because they would be discussed in colloquiums or staff meetings. The exact extent of the technical knowledge about sites other than the Los Alamos project by British personnel at Los Alamos cannot readily be determined since work directly relating to Los Alamos activities such as basic physics as well as pile design which members of the Mission would use in their daily work is undoubtedly known to them. Such items as Hanford chemistry would have reached the group by inference only since the laboratory as such did not have detailed access to such information. During their stay at Los Alamos, they also had access to the general physics and chemistry principles involved in the operation of the Chicago and Hanford piles, the physical construction of these piles, but only a minimum of the engineering details. They had, however, complete access to all general theoretical work on pile design. It is assumed that they had rather complete knowledge of the mass spectrometer application used in the Calutron and gaseous diffusion process for separating uranium isotopes."* [redacted] (U)

* See Exhibit # 6 attached declass on DOE letter 8/8/89

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According to the Atomic Energy Commission, the "Super" refers to the hydrogen bomb, and, therefore, Fuchs had knowledge of that development as indicated in the statements above. (Ibid, 236 Encl)

Inquiry of the Atomic Energy Commission at Los Alamos disclosed that Fuchs had attended numerous technical meetings while at Los Alamos. The dates of the meetings and the subject matters discussed and a brief summary of the discussion were furnished to the Bureau and this material is attached as Exhibit # 7 . It should be noted that Fuchs attended several conferences, beginning April 18, 1946, relating to the "Super." Many of the other meetings obviously referred to highly important scientific matters. (Ibid, 183)

In commenting upon the work of the British Mission at Los Alamos, Dr. J. R. Oppenheimer, in a memorandum dated July 15, 1949, prepared for the Atomic Energy Commission, stated that Dr. Fuchs was associated with Professor Peierls in the Theoretical Division at Los Alamos; that Dr. Peierls was head of a group in the Theoretical Division assuming responsibility for the calculation and design of the explosion components of the implosion weapon. He played a large part in the determination to use lenses for the explosive system and in the theoretical guidance of their experimental development. He was fully informed about the metallurgical peculiarities of plutonium and participated in the decision to use the metal in its delta phase. He stated also that the "UK Mission had complete access to all information and reports."

Dr. Morris E. Bradbury advised the Atomic Energy Commission on July 18, 1949, concerning the participation of the British Mission personnel, as follows: "They contributed to the success of the Los Alamos war effort primarily in the field of theoretical and experimental physics and secondarily in the field of high explosive development. It should be noted that the British Mission supplied the major portion of experience in the field of theoretical hydrodynamics which was of fundamental importance to the development of the atomic weapon...." He also stated "All developments underway at the time were known to the British personnel, as well as the probable course of future lines of activity."

Dr. Hans Bethe advised the Atomic Energy Commission on July 18, 1949, with regard to Fuchs, in part as follows: "Contributed directly to the success of Peierls' group, especially in the theory of the jets, which in the early times constituted a major difficulty with implosion practice, and to the theory of the initiator."

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Mr. R. C. Smith, referred to above, advised the Atomic Energy Commission on July 18, 1949, that Fuchs made efficiency estimates on various implosion designs, [redacted] one of them corresponding rather closely to X-ray shot at Eniwetok. He stated that Fuchs and Peierls provided two-thirds of the team which handled the hydrodynamics in "T-Division," which made the implosion development possible. They both contributed heavily to all phases of the weapon development, including implosion and Super. (Ibid, 124)

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Dr. Paul McDaniels, referred to above, advised the Atomic Energy Commission that some of the reports prepared by Fuchs dealt with detonation and assembly of the atomic bomb. He stated that Dr. Fuchs participated considerably in the design and development of the atomic weapon. (Ibid, 156)

Dr. Hans Bethe, under whom Fuchs was employed at Los Alamos and presently attached to the Nuclear Laboratory, Cornell University, advised Bureau Agents on February 14, 1950, that he was in charge of the Theoretical Division at Los Alamos. This Division performed the calculations ahead of time as to how the bomb was to be made and assembled and how it would work. As a result of the Quebec Agreement, England furnished several top scientists to work in this Division. They were about twelve in number and it was Bethe's belief that the bomb would not have been completed as soon as it was without their assistance. Bethe had personally requested that Dr. Rudolph Peierls, of the University of Birmingham, be assigned to the project. Peierls accepted with the stipulation that he bring with him two of his best collaborators, Drs. Fuchs and Skyrme. They, with American scientists, were assigned to the particular task of determining the best way of bringing together parts of materials so that after assembly there would be more than the "critical mass." The work of this group is still restricted information and was about the most highly confidential work done. As a member of this group, Fuchs was in as vital a position as anyone on the entire project and had access at all times to all parts of the Laboratory and all documents, except perhaps some top secret documents. Dr. Bethe pointed out that this did not mean that he could not examine the top secret documents, which were necessary to his work, upon the proper clearance and permission. (Ibid, 326)

Bethe further stated that in June or July 1946, Fuchs visited him at the General Electric Company in Schenectady, New York. Fuchs was on his way back to England. He did not question Dr. Bethe concerning his work and it was Bethe's recollection that Fuchs' sister from Boston came to Schenectady to meet him. Since that meeting, Bethe has seen Fuchs on two occasions. One was in

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England during the Summer of 1948, when Bethe spent a day and a half at Harwell. Fuchs talked with Bethe and "showed him around." He also told him something of the theoretical work being done there. Bethe was under orders from the Atomic Energy Commission not to talk of restricted matters, so the conversation was one-sided. In the Spring of either 1948 or 1949 (this probably actually refers to 1947), Fuchs visited Dr. Bethe at Ithaca, New York. He had come from England to attend Declassification meetings which were held in Washington. His visit was at Bethe's invitation. He stayed one day. Their main topic of conversation was nuclear reactors and declassification. Again, Dr. Bethe was under orders not to speak of restricted information, so the conversation was one-sided. (Ibid, 326)

The Atomic Energy Commission has advised that Roland A. Anderson, Chief of the Patent Branch, advised that the records at Los Alamos indicated that in a memorandum of March 7,1945, it was stated, "Under the present setup the British personnel have been given full access to all documents and data at this Site." (Ibid, 369)

In connection with Fuchs' trip to the United States in 1947 to attend the Declassification Conference, which was held in Washington from November 14 through 16, 1947, the Atomic Energy Commission has advised that the Conference did not involve supplying to the British or Canadians any restricted data which was not already known to them. (Ibid, 285)

It is noted above that while in this country Fuchs made a visit to the Argonne National Laboratory in Chicago on November 28, 1947. Records of the Security Force at the Laboratory indicate that he was there from 2:50 PM to 4:00 PM on that date and at all times was escorted by a member of the Laboratory staff. In accordance with the clearance issued that he was to discuss unclassified and declassified matters, necessary steps were taken to guarantee that he was only concerned with unclassified matters while there. He was shown the crystal spectrometer and the mechanical velocity selector. These instruments, according to the Atomic Energy Commission, were described in Volumes 71 and 72 of the "Physical Review," dated June 1 and October 1, 1947. (Ibid, 369)

Investigation has disclosed that the records of the Inspector of United States Naval Material at the General Electric Company, Schenectady, New York, reflect that on November 17, 1947, Fuchs, as a member of the British Atomic Energy Research Establishment, visited Dr. Herbert C. Pollock, Research

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Laboratory of the General Electric Company, for the purpose of discussing cyclotrons, synchrotrons, and betatrons for a two day period. Pollock was described as Research Associate in the Physics Division of General Electric, assigned to the Synchrotron Project. As noted above, the Atomic Energy Commission has advised that the purpose of Fuchs' trip to the General Electric Company was to see a machine described as "70-MEV Synchrotron." Also, according to the Atomic Energy Commission, the General Electric Company in Schenectady was not doing work for the Atomic Energy Commission at the time of Fuchs' visit. (Ibid, 426 and 578)

On February 8, 1950, Charles W. J. Wende, of 22 Somerton Avenue, Kenmore, New York, who is presently employed by the DuPont Corporation, Buffalo, New York, advised the Buffalo Office of the Bureau that he was formerly in charge of the Technology Division of the atomic energy installation at Hanford, Washington. During the Spring of 1948, while in this position, he and two associates, who are presently associated with the Atomic Energy Commission, made a trip to England for secret technical conferences on atomic energy. He said that Fuchs participated in these conferences. Upon his return to the United States, he and his associates prepared a top secret report on the conferences. He related that the contents of the report are known to about twelve persons in the United States and are of a highly technical nature. Mr. Wende indicated that the discussions in England related to the British "pile program."
(Ibid, 442)

On March 6, 1950, the Bureau Liaison Agent delivered a letter to Commissioner Pike, Acting Chairman, Atomic Energy Commission which reported information obtained from Fuchs by Dr. Perrin. Mr. Pike was requested to furnish to the Bureau any evaluation the Commission might make.

Mr. Pike advised he intended to immediately instruct the scientific personnel of the Commission to make a detailed study and evaluation of this information and he would furnish the Bureau the results.
(Memo Keay to Belmont 3/8/50) (Serial 730)

Attached as Exhibit # 8 is a list of reports prepared by Fuchs as reflected in the records of the Atomic Energy Commission.

Investigation by the Albuquerque Office in February, 1950, reflected that [patent disclosure papers on file in D Division, Los Alamos Scientific Laboratory, Los Alamos, New Mexico, reflected that Fuchs with John Von Neuman as "co-investor," had a disclosure entitled "Method and Apparatus] b (4)

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"for Releasing Nuclear Energy" and the proposed application was described as "One proposed design for Super." This disclosure was made in April, 1946.] (U)

Another disclosure with Rubby Sherr as co-inventor, is entitled "Timed Neutron Source" and its application is given as "Useful in Implosion type bombs." (U) (65-58805-189 p. 11) declassified Let 8-8-89

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paragraph 1 & 2 Remain Classified per CIA letter dtd 7/6/98. SSA5648540/IS 7/14/98 CA# 25-1121

61, 63 per CIA

(Serial 954)

downgraded to Secret per agency letter 8/17/88 CA# 95-1124 10/1/89 275WEWIWA

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The only known access of Fuchs to information concerning the Hydrogen Bomb occurred while he was at Los Alamos, according to Dr. Michael W. Perrin, who has stated that the British did not have any so-called H-Bomb theoretical plan during the time Fuchs was at Harwell. It is to be noted that the terms Hydrogen Bomb, H-Bomb, Tritium Bomb, and Super, mentioned herein, are synonymous. (65-58805-642)(U)

Former Atomic Energy Commissioner Strauss advised on February 16, 1950, that Mr. Bennett Boskey, Deputy Chief Counsel for the Commission, had just returned from a declassification conference in London. British atomic energy scientists told Boskey that Fuchs had revealed every secret involving atomic energy, and that Fuchs knew as much about the Hydrogen Bomb as any American scientist. (65-58806-347)

On May 19, 1950, British authorities made available to Assistant Director H. H. Clegg and Special Agent R. J. Lamphere a copy of a record of an interview with Fuchs on March 22, 1950, by Michael W. Perrin. This interview was conducted in accordance with questionnaires prepared by the Joint Atomic Energy Intelligence Committee, which were prepared to elicit more information from Fuchs concerning what atomic information was furnished to the Russians by him. This record of interview is classified top secret and is quoted as follows: DE(U)

"I had an interview with Dr. Fuchs at Wormwood Scrubs on 22nd March, 1950 lasting for about an hour. As in the case of my earlier interview on 30th January, 1950, Mr. Skardon of M.I.5 was present. DE(U)

"This second interview was arranged with Dr. Fuchs' consent, and its object was to try to get more information from him as to what he had passed over to the Russian agents with whom he had been in contact here and in the U.S.A. DE(U)

"The questions which I put to Dr. Fuchs were based on discussions of the record of my earlier interview with Sir John Cockcroft and Commander Welsh, and were designed to get answers, if possible, to a list of 24 questions arising from consideration of the record of the first interview which had been forwarded to us from the Nuclear Energy Division of the C.I.A. These questions were the result of consideration by the American Joint Atomic Energy Intelligence Committee which includes representatives of the Intelligence Section of the U.S.A.E.C. DE(U)

"I would first emphasise two general points arising from my interview with Fuchs. DE(U)

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"While he showed every sign of willingness to help in any way that he could, he strongly maintained his inability to remember in detail much of the information that he had passed over to the Russians. This seems surprising but may perhaps be due to his having, subconsciously, forced himself to forget his disloyalty. TS (U)

"The second general point is that Fuchs made it clear that, from his first contact in 1942 until his last in the early part of 1949, he only had about a dozen meetings with Russian agents here and in the U.S.A. At any one of these meetings he might have been asked two or three questions, and these were generally of a very vague nature. It is therefore extremely difficult to assess, from the nature of the questions put to Fuchs, the real interest of the Russians. TS (U)

"As an example of this (cf. C.I.A. question No. 10), Fuchs said that, so far as he could remember, the question about the E. M. process put to him in the U.K. in 1943 was read out from a piece of paper, and the words were something like: 'What do you know of the electro-magnetic method for separating isotopes?' TS (U)

"Fuchs told me that he was never asked any questions on heavy water, and none about uranium production until 1948 when he was asked how the uranium metal rods for a pile were fabricated. TS (U)

"Fuchs confirmed his earlier statement that the information given to the Russians on the gaseous diffusion process while he was in the U.K. during 1942 and 1943, and in New York during the first part of 1944, was fairly complete as far as the theory was concerned. He did not have much practical knowledge or engineering 'know-how' and did not pass this over, nor did he give the Russians information on construction materials in a gaseous diffusion plant. TS (U)

"Fuchs was asked no supplementary questions on this subject other than a general question about the barriers. As he told me at the first interview, he did say, during the time when he was in New York, that these were made of sintered nickel powder. (cf. C.I.A. questions No. 3 & 4.) TS (U)

"Fuchs told me, in amplification of what he had said at the first interview, that he was fairly sure that, either at the end of the Los Alamos period or early in the final Harwell period, he had told the Russian agent something about the relationship between the spontaneous fission rate of Pu 240 and the exposure time of uranium in a pile. He believed that he had quoted 2% Pu 240 as being the permissible upper limit due to difficulty that would be encountered from spontaneous fission neutrons from this isotope in the detonation of a bomb. (cf. C.I.A. question No. 5.) TS (U)

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"Fuchs was very clear in his recollection that he had never given, or been asked for, information about the fusing and firing techniques in any kind of atomic bomb. The detailed information about the Trinity Test bomb which he had written out and passed over in June 1945 stopped short of the H. E. lens system. TS (U)

"Few, if any, technical production details or 'know-how' were given in the Santa Fe meetings about weapon components, but Fuchs did describe in detail the design of the initiator and 'possibly' the nickel carbonyl process for plating. He did not, however, give any information on the manufacture of beryllium metal. TS (U)

"He did not remember giving any details about delta phase plutonium or phase diagrams, but only referred in rather general terms to its existence. (cf. C.I.A. questions No. 12, 13 & 22.) TS (U)

"The calculations of blast etc. that Fuchs passed over were based on reports which he had written for Dr. Penney. This information was mostly passed in the form of short summaries, but 'some of the actual reports may have been passed over.' (cf. C.I.A. questions 8,20, & 21.) TS (U)

"As far as the 'mixed' bomb is concerned, Fuchs repeated that he had only given the agent some general information about its possibilities. He thought that he had 'probably' referred to a 2-to-1 mixture as a particular case, and had mentioned the critical mass that would be involved. No sketches were given. TS (U)

"In my first interview with Fuchs he had told me that he believed that he 'might have given' the lattice spacing for one particular pile while he was in the U.S.A. On thinking this over, however, he felt more certain during the second interview that the lattice which he had passed over was that designed for the Windscale piles, and that this information had been given early in 1947. (cf. C.I.A. question No. 16.) At that time he gave, as he had said at the first interview, the design figures for the plutonium output from the Windscale piles. TS (U)

"During the Harwell period he was also asked about the U.S. rate of production and stock pile of atomic bombs. The information he gave was based on the knowledge that he had when he left Los Alamos, and his recollection is that he would have reported a U. S. production rate of something not more than 100 kilos per month of U 235 and about 1 kilo per day of plutonium. This information would probably have been passed over early in 1947. (cf. C.I.A. question No. 11.) TS (U)

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"Fuchs told me that only general statements were given about possible advanced types of reactor such as the flame trap, ball and sandwich designs. The question he was asked about the report on 'mixing devices' towards the end of 1948 refers to a particular design detail relevant to the Windscale air-cooled pile. TS (U)

"Fuchs knew hardly anything about the solvent extraction process and cannot remember the details of any information that he may have passed about solvents, resins, etc. used in connection with it. He seemed sure, however, that this would have amounted to very little. (cf. C.I.A. questions No. 17, 18 & 19) TS (U)

"As regards information about the hydrogen bomb, Fuchs provided, in response to the question put to him during 1947, a note which was based on a summary of the lectures which Fermi had given on this subject during the time when Fuchs had been at Los Alamos. He explained that the initiating fission bomb would be most likely to use U 235 and the 'gun' technique. Fuchs did not go into any great detail and, as far as he can remember, wrote his note against the general background that a hydrogen bomb would be a very difficult weapon to make but that it was 'perhaps possible'. TS (U)

"Fuchs was asked no further questions other than a rather general one about 'what is the problem of tritium production.' He did not provide any answer to this, nor had any information been passed earlier on light element or thermo-nuclear reactions. (cf. C.I.A. questions No. 6 & 24.) TS (U)

"It is most unlikely that Fuchs had knowledge of any significance about long-range detection techniques, or of any programme that was being followed. I therefore avoided this subject in my interview, but feel fairly confident that, if any questions had been asked or information had been given, he would have referred to it at the first interview when I did discuss with him the nature of the 'atomic explosion' that had taken place in Russia in the autumn of 1949. (cf. C.I.A. question No. 23.) TS (U)

[/s/ M. W. Perrin"] TS U)

(Letter from H. H. Clegg in London dated May 22, 1950)

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As indicated above, on March 6, 1950, the Acting Chairman of the Atomic Energy Commission was furnished with information obtained from Fuchs by Dr. Michael W. Perrin, and he was requested to furnish to the Bureau any evaluation which the Commission might make. S (U)

By letter dated May 19, 1950, Mr. Francis Hammack, Acting Director, Division of Security of the Atomic Energy Commission, forwarded to the Bureau portions of a report prepared by a committee of Senior Responsible Reviewers who had considered the effect of Fuchs disclosures on the AEC declassification policy. S (U)

This report indicates that it was concluded that the information turned over by Fuchs concerning the diffusion plant was largely theoretical and that probably the bulk of it has since been declassified. The information disclosed by Fuchs concerning barriers also appeared to have dealt essentially with theoretical aspects and did not contain significant information concerning fabrication and performance of barriers. It was indicated that only one document of the MSN series (reports of the British Mission - New York) namely MSN-18, contained production figures for the K-25 plant (Oak Ridge). It was further indicated that there is some uncertainty, however, as to whether MSN-18 was included in the documents passed to the Russians by Fuchs. S (U)

In evaluating the Los Alamos aspects, the report indicates that Fuchs turned over to the Russians very important information concerning weapons. With respect to the Trinity (plutonium implosion) type weapon, it was stated that it was clear that the essentials of the bomb, in adequate detail, were turned over either while Fuchs was at Los Alamos or later. It also appeared apparent that considerable information was turned over regarding gun-type weapons. S (U)

The report discussed participation of Fuchs in the work on thermonuclear weapons at Los Alamos and a list of the meetings on this subject which were attended by Fuchs was set forth. It is believed that this refers to the hydrogen bomb. S (U)

It was indicated also that officially, Fuchs had little information concerning other phases of the United States project; for example, the Hanford project, and it appears that the information in this category which he turned over was relatively "minor." It was further indicated that Fuchs did not pass a great deal of information to the Russians concerning "pile technology" including the British work on this point. S (U)

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It was also noted that Fuchs did not admit the transmission of information relative to the "fission process" itself, except for specific information such as the spontaneous fission problem. It was stated that this might possibly be interpreted to mean that fundamental nuclear data were not needed by the Russians because of their own efforts in this field or because the information was being furnished to them from other sources.

A copy of this report furnished by the Atomic Energy Commission is attached as an exhibit. (See exhibit #9)

(Letter from Francis Hammack, Acting Director, Division of Security, AEC, dated May 19, 1950)

During the interview of Fuchs in London, in the period May 20 through June 2, 1950, by representatives of the Bureau, Fuchs furnished a summary of the information which was furnished by him to the Russians. He stated that generally information of a technical type was given to "Raymond" in writing and that "Raymond" would have been unable to understand technical information furnished orally. He did give some information to "Raymond" orally dealing with personalities, the identities of scientists, plans for the test explosion at Alamogordo and other things that were within the scope of comprehension by "Raymond." He advised that "Raymond" never took notes at any meeting.

He stated that his best estimate is that the information furnished by him speeded up the production of an A-Bomb by Russia by several years because it permitted them to start on the development of the explosion and have this ready by the time the fissionable material was ready. He concluded that the Russian scientists are as good as scientists in England and the United States but there are fewer good scientists in Russia that the other two countries. He stated that he gave the Russians nothing that would speed up the production of plutonium and estimated that if he had given the same data which he gave the Russians to the United States as of the date of his arrival in the United States, he would have speeded the U.S. production of the A-Bomb only slightly. He did pass on to his Russian espionage contact what he learned concerning the production of plutonium during the final period of his work at Los Alamos. He stated that the information furnished by him alone could have speeded up the production of an A-Bomb by Russia by one year at least. He indicated that if the Russians had information on the plutonium process from any other source, the data furnished by him could have been of material assistance on this plutonium phase.

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Fuchs claimed not to have furnished information to the Russians concerning the H-Bomb while he was in the United States. He did some research work during the late period of his stay at Los Alamos relating to the H-Bomb including hydrodynamics as involved in the United States work. He did subsequently pass on to his espionage contact in England what he had learned in the United States but considered the paper which he prepared in this regard as a "confused picture."

There is set out below a summary of the information furnished to the Russians by Fuchs as stated by him during the interview:

Information Delivered by Fuchs to Gold in New York City, December 1943 to August 1944

Written Information Furnished:

1. His longhand drafts of the 13 MSN papers prepared by him, and all of the information contained in those papers at the time he delivered them was classified.
2. He furnished what he knew, and that was quite much, concerning gaseous diffusion, which was later applied in the production process at Oak Ridge, but he knew hardly anything about the electro-magnetic process, although he furnished what he did know.
3. He furnished general information concerning membranes and the composition of sintered nickel powder. Although he did not know much about the technical details, he furnished the information as to the principle.
4. He furnished information concerning the general scale of the effect of the American program, with the approximate timing of this program.
5. He furnished information from time to time, as received by him, concerning the over-all and general effect and activities in connection with his own work relative to the production of fissionable material and its potential use as an explosive in the war effort.

Oral Information Furnished:

1. Information as to the address of his sister, Kristel Heineman in Cambridge, Massachusetts, for contact purposes.
2. At each meeting in New York he and Gold agreed orally as to the details of time and place for the next planned meeting.
3. He furnished information concerning the identity of officers and the identity of leading research personnel at The Kellex Company and The Manhattan Engineering District in New York. He also furnished information concerning personalities and the general personnel situation at these establishments.

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4. He furnished information that a plant was to be established for the production of fissionable material, to employ both the gaseous diffusion and the electro-magnetic processes in the development of fissionable material, such materials to be used in the development of an A-Bomb, and the plant was to be built somewhere in the southeastern part of the United States (later at Oak Ridge).

Information Furnished at Cambridge, Massachusetts, February 1945

Fuchs stated that he passed no written information to Gold at Cambridge, Massachusetts, during a meeting at the home of Fuchs' sister, Kristel Heineman. He did furnish the following oral information:

1. Oral plans for a meeting soon afterwards in the City of Boston.
2. Oral plans for a meeting to be held in June, 1945, at Santa Fe, New Mexico, and in making these plans a detailed street map was examined. He agreed to prepare for delivery to Gold at Boston a paper containing additional confidential, classified information. He agreed that the information contained therein would bring the information which he possessed up to date as far as passing such information to his contact was concerned.
3. He received an oral offer of money from Gold; he does not recall the specific amount, but he turned down this offer and stated he would not do such a thing.

Information Delivered at Boston, Massachusetts, February 1945

Fuchs claims that he furnished no classified oral information at the Boston meeting, held within a few days after the meeting at his sister's home, but that he did prepare a written paper which, he believes, was prepared by him in his sister's home and which he delivered at the heretofore described meeting in Boston. This information was all in writing and consisted of:

1. Details of the principle of A-Bomb construction.
2. The principle of the method of detonation.
3. The decisions made up to that time as to the type of core - he knew nothing then concerning a solid core.
4. The principle of the lens system, although it had not yet been definitely adopted.

5. The outer dimensions of the high explosive and the lens system.
6. The possibility of making a plutonium bomb.
7. Most of what was then known concerning implosion - this was the main point covered by this paper.
8. That high explosive was the type of material for compression being considered, although it had not been entirely decided upon.
9. The difficulties of multiple-point detonation, on which Fuchs was then working.
10. The sequence of timed explosion.
11. The agreed-upon, as well as the prospective, plans for the construction and the production of an A-Bomb, as was then known to him.
12. The high spontaneous fission rate of Plutonium 240. (Although he did not know the material as Plutonium 240 at that time, he knew it was a type of plutonium.)
13. The critical mass of plutonium as compared with Uranium 235.
14. The approximate amount of plutonium necessary for such a bomb.
15. The current ideas as to the need for an initiator.

He does not believe that he disclosed at that time the amount of U-235 that was required in the production of an A-Bomb. Likewise, he did not know whether mention was made at this meeting of the sintered nickel powder.

Information Delivered at Santa Fe, New Mexico, June 1945

Written Information Furnished:

1. A description of the plutonium bomb.
2. A sketch of the bomb and its components, with important dimensions indicated.
3. As much up-to-date information concerning the bomb as he then knew.
4. Additional information concerning implosion.
5. Additional information concerning ignition - although this research was not yet finished.
6. The principle of IBM calculations.
7. The method of efficiency calculations.
8. The results of efficiency calculations, his estimates being from a small percentage to fifty percent.
9. The size of the bomb.

10. The intention to use the bomb against Japan.
11. The type of core.
12. A description of the initiator.
13. Details as to the tamper.

Oral Information Furnished:

1. The names of the types of explosives to be used in the bomb.
2. The fact that the Trinity test explosion of the A-Bomb was soon to be made, and the approximate site of the test.
3. That the explosive effect of the A-Bomb would be vastly greater than TNT, and a comparative statement as to the amount of TNT was actually furnished. He knew at this time that work on the gun was going on, but he knew very little about it

Information Delivered at Santa Fe, New Mexico, September 1945

Written Information Furnished:

1. That the production rate of U-235 was about 100 kg. per month.
2. That the production of plutonium was about 20 kg. per month.
3. Information developed by him in connection with his work, concerned with figuring out where things might go wrong.
4. Information concerning blast waves, especially the tail end of the blast waves, as he was doing work on this.
5. Results of the Trinity tests and whether the English were keeping up with the U.S.A. in developments.
6. His work on the initiator.
7. The rate of production.
8. He may have furnished something concerning the pre-assembled core and compass, and the chances are he did, he advised.
9. The critical size, which would have been important only if someone wanted to know how many bombs were being made, based upon the rate of the production of materials.
10. He believes he passed information that the barriers were to be of "sintered nickel."
11. The special technical phase of plutonium, and the uses of a special alloying constituent.

Fuchs stated that, as of the time of the September, 1945, meeting, the uranium bomb at Los Alamos was an appendix and not too much interest was shown there in this type of bomb, and he knew of no one at Los Alamos concerned with the gun. He advised that he knew of no stock pile of A-Bombs in 1946 since there were only a very few available, and that the diversion of the isotopes material into medical and industrial research was very little. He was about twenty miles from the A-Bomb fission trial at Alamogordo, New Mexico, and observed what could be seen from that distance. He advised that only so far as it entered into the interpretations of experimental results would he know of the effect of an atomic explosion on human life. He knew nothing at this time as to the change of design concerned with gaseous diffusion or electro-magnetic forces, although he knew a small amount about making a compact machine for gas.

Information Delivered in England after Return from U.S.A., between June 1946, and February, 1949

1. Data on the probability of predetonation, and he relied on his memory in furnishing this information.
2. Working on the calculations involved in the tests in connection with the Japanese explosions, although the information possessed by him and furnished by him was not the accepted figure, he believes.

For added pertinent information, he made the following comments concerning the delivery or nondelivery of information to his Russian espionage contacts in the United States or in England, and it would appear that perhaps most of this information which was delivered would have been in England since he claims to have had no contacts for delivering espionage information in the United States after September, 1945:

1. As to the document referred to as MSN-18, entitled "Adaptation of K-25 Plant for Partial Operation on the Cascade of Cascades Principle - - - Flow Sheets, VIII, a, b, c," he advised that he does not remember this report. He recalls that the problem was discussed, but he did not know a paper had been issued concerning the subject. He had heard nothing concerning K-25 at Los Alamos, and if he passed any information at all concerning K-25, it would have been prior to his going to Los Alamos. The Cascade of Cascades principle was considered in England previous to his coming to the United States and was transmitted to his Russian

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espionage contacts in England prior to his arrival in the U.S.A. He furnished no information dealing with the work at Hanford, Washington.

2. He did give more than an indication as to the composite bomb and its economic features, this information having been given at the last meeting in Santa Fe in September, 1945, and the first meeting in England thereafterwards. The information was transmitted in writing. He furnished no information concerning the problem of achieving a non-equilibrium reaction and he does believe that he furnished information concerning the inverse Compton radiation cooling effect.
3. Concerning thermo-nuclear weapons, he advises that he furnished, roughly, the information which was in the Fermi lectures as distinguished from the information set forth in the "Super" Handbook. He furnished some information relative to reactions in England as well as a certain limited amount of information concerning barriers, but no information concerning conditioning in the diffusion plant problems.
4. Concerning the first "Super" conference in Mr. Bradbury's office, which was addressed by Mr. Teller, he furnished no information which was discussed there. He furnished no information concerning the second "Super" meeting, presided over by Mr. Teller, and information discussed by Mr. H. Hurwitz. Fuchs claimed to have been the one who suggested the ignition of the "Super" bomb by the implosion process. He furnished no information concerning the suggestion of the cylindrical rather than the spherical implosion gadget. He furnished no information which was discussed at the third and fourth "Super" meetings. He cannot recall the subject matter at the fifth "Super" meeting. He did furnish the identity but not the details concerning the development of slow explosives as discussed by Mr. Stout in Fuchs' presence. He could not identify the subject matter of Mr. Milo Sampson's talk at a meeting held on June 3, 1946.

There is attached an exhibit which is a signed statement obtained from Fuchs by the Bureau representatives, including information concerning scientific data which he passed to the Russians. In addition, there is attached as an exhibit, a signed form listing a number of reports prepared by Fuchs during his work on atomic energy with notations thereon placed there by Fuchs as to whether or not the particular report was passed to the Russians by him.
(Memo to the Director from Messrs. Clegg and Lamphere dated 6-6-50)

February 12, 1951

TOP SECRET

SUMMARY BRIEF

ON

EMIL JULIUS KLAUS FUCHS, was.

Espionage - R

(Bureau File 65-58805)

HARRY GOLD, was.,

Espionage - R

(Bureau File 65-57449)

(NOTE: (S) THIS BRIEF CONTAINS INFORMATION FROM [redacted] WHICH IS RECEIVED UNDER AN AGREEMENT THAT IT WILL NOT BE DISSEMINATED. THERE ALSO APPEARS INFORMATION CLASSIFIED TOP SECRET EITHER BY THE ATOMIC ENERGY COMMISSION OR BY THE [redacted] S

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IX. DISSEMINATION

X. EXHIBITS

A. Exhibit 1
1. [redacted] b7D

B. Exhibit 2
1. [redacted] b1 S

C. Exhibit 3
1. Letter dated October 22, 1947, from L. G. Ralfe to Mr. Carroll L. Wilson, General Manager, U. S. Atomic Energy Commission, requesting clearance of Fuchs to visit Chicago University (Argonne National Laboratory).

D. Exhibit 4
1. Letter dated November 7, 1947, from Carroll L. Wilson, Atomic Energy Commission, to Mr. L. G. Ralfe, British Commonwealth Scientific Office, Washington, D.C., granting clearance for Fuchs to visit Chicago University.

E. Exhibit 5
1. Memorandum dated August 6, 1947, from D. Dean to T. O. Jones, approving clearance for Fuchs to attend Declassification Conference at Washington, D. C. U

F. Exhibit 6
1. Memorandum from C. A. Bolander, Jr., to Admiral Gingrich (dated January 12, 1949,) with attachment concerning the British Mission that participated in the atomic energy program under the Manhattan Engineer District from 1943 to 1946, and the degree of access had by that Mission. U

G. Exhibit 7
1. List of technical meetings attended by Fuchs while at Los Alamos. U

H. Exhibit 8
1. List of Reports prepared by Fuchs. U

I. Exhibit 9
1. Letter from Francis Hammack, Atomic Energy Commission, dated May 19, 1950, transmitting portions of a report evaluating information passed to the Russians by Fuchs. U

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J. Exhibit #10

1. List of some of the reports prepared by Fuchs personally or in collaboration with other scientists while working under the Manhattan Engineer District, on which notes have been placed by Fuchs indicating whether or not the reports were furnished to the Russians.

K. Exhibit #11

1. Signed statement of Fuchs dated May 26, 1950, (does not include technical data).

L. Exhibit #12

1. Signed statement of Fuchs dated May 26, 1950 (includes technical data).

M. Exhibit #13

1. Signed statement of Gold dated July 10, 1950, concerning activities with Fuchs.

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In connection with the [redacted] referred to by Fuchs, relating to his work in [redacted] inquiry of the Atomic Energy Commission reflects that in 1943 arrangements were made for a group of British scientists to come to the United States and work with representatives of Kellex, Inc., of New York, prime contractors for the Manhattan Engineer District, and MED representatives on the scientific development of the gaseous diffusion

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project which was also known as K-25. This project related to the gaseous diffusion process for separating the uranium isotopes. Fuchs was one of the members of the British team assigned to work with Kellex. The British scientists had offices in room 2401-E at 43 Exchange Place, New York City. (65-58805-236 Encl. and 253)

The British scientists undertook analysis of the following theoretical problems:

(1) Cascade of cascades flow sheets
(2) Exact calculation of equilibrium time
(3) Loss or separation due to surges
(4) Control of main cascade (e.g., frequency of use of automatic control valves).
(5) Control of purge cascades

Reports of these theoretical studies were summarized in a series of reports, referred to as the MSN Series, which were described as having been helpful in anticipating problems of plant design. The MSN Series were prepared by the scientists belonging to the British Mission. The "N" referred to the New York Office of the Manhattan District. (Ibid, 8 and 156)

[redacted]

In evaluating the importance of this series of reports, it should be noted that Dr. Paul McDaniels, a physicist assigned to the Atomic Energy Commission Building, Washington, D. C., according to reports from the Atomic Energy Commission, has stated that the one report prepared by Dr. Fuchs, entitled "Fluctuations and Efficiency of a Diffusion Plant, Part III, The Effect of Fluctuation in the Flow of N_2," is a skilled, technical, theoretical discussion covering refinement of plant operations. He stated that this document, along with others such as barrier production, operating characteristics, seal development, and pumps, would be helpful in determining over-all plant operating techniques. (Ibid, 156)

It should be noted that the report referred to by McDaniels is MSN-12, referred to by the original informant in this case as having been furnished to the Russians by Fuchs.

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Records of the Atomic Energy Commission reflect that as of January 12, 1949, there was made a compilation of the Canadian Staff, scientific and technical, and United Kingdom Staff, scientific and technical, who participated in the atomic energy program under the former Manhattan Engineering District from 1943 to 1946. This compilation included, in so far as possible, a statement as to the installations visited and degree of access afforded to these groups. It is stated that records available in the security files of the Atomic Energy Commission give a general picture as to the fields of activity in which the British Mission participated, but that the available records do not provide detailed information as to their particular specialties, nor do the records clearly indicate what familiarization the British group may have had with other programs in which they did not actually participate, but undoubtedly became acquainted with by reading technical reports available to them. The following statement appears in the records of the Atomic Energy Commission concerning the British group at Los Alamos: 1(a)

"Inasmuch as it was the policy of the laboratory to make all information available to this group at Los Alamos, and as the British personnel had general access to the Document Room, various local sites, and the organized meetings of the local project, it is believed that the group had substantially complete knowledge of the gun assembly and implosion assembly of fissile material, the actual design of the aerial bombs employing these principles, the possible future developments, including the 'Super' or Thermo Nuclear Reactions, the auxiliary equipment at the various local sites including the Water Boiler. The British Group probably did not obtain detailed information concerning the final chemical work at Los Alamos, however, the general aspects were known to them because they would be discussed in colloquiums or staff meetings. The exact extent of the technical knowledge about sites other than the Los Alamos project by British personnel at Los Alamos cannot readily be determined since work directly relating to Los Alamos activities such as basic physics as well as pile design which members of the Mission would use in their daily work is undoubtedly known to them. Such items as Hanford chemistry would have reached the group by inference only since the laboratory as such did not have detailed access to such information. During their stay at Los Alamos, they also had access to the general physics and chemistry principles involved in the operation of the Chicago and Hanford piles, the physical construction of these piles, but only a minimum of the engineering details. They had, however, complete access to all general theoretical work on pile design. It is assumed that they had rather complete knowledge of the mass spectrometer application used in the Calutron and gaseous diffusion process for separating uranium isotopes."* 1(a)

* See Exhibit # 6 attached

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According to the Atomic Energy Commission, the "Super" refers to the hydrogen bomb, and, therefore, Fuchs had knowledge of that development as indicated in the statements above. (Ibid, 236 Encl)

Inquiry of the Atomic Energy Commission at Los Alamos disclosed that Fuchs had attended numerous technical meetings while at Los Alamos. The dates of the meetings and the subject matters discussed and a brief summary of the discussion were furnished to the Bureau and this material is attached as Exhibit # 7 . It should be noted that Fuchs attended several conferences, beginning April 18, 1946, relating to the "Super." Many of the other meetings obviously referred to highly important scientific matters. (Ibid, 183)

In commenting upon the work of the British Mission at Los Alamos, Dr. J. R. Oppenheimer, in a memorandum dated July 15, 1949, prepared for the Atomic Energy Commission, stated that Dr. Fuchs was associated with Professor Peierls in the Theoretical Division at Los Alamos; that Dr. Peierls was head of a group in the Theoretical Division assuming responsibility for the calculation and design of the explosion components of the implosion weapon. He played a large part in the determination to use lenses for the explosive system and in the theoretical guidance of their experimental development. He was fully informed about the metallurgical peculiarities of plutonium and participated in the decision to use the metal in its delta phase. He stated also that the "UK Mission had complete access to all information and reports."

Dr. Morris E. Bradbury advised the Atomic Energy Commission on July 18, 1949, concerning the participation of the British Mission personnel, as follows: "They contributed to the success of the Los Alamos war effort primarily in the field of theoretical and experimental physics and secondarily in the field of high explosive development. It should be noted that the British Mission supplied the major portion of experience in the field of theoretical hydrodynamics which was of fundamental importance to the development of the atomic weapon...." He also stated "All developments underway at the time were known to the British personnel, as well as the probable course of future lines of activity."

Dr. Hans Bethe advised the Atomic Energy Commission on July 18, 1949, with regard to Fuchs, in part as follows: "Contributed directly to the success of Peierls' group, especially in the theory of the jets, which in the early times constituted a major difficulty with implosion practice, and to the theory of the initiator."

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Mr. R. C. Smith, referred to above, advised the Atomic Energy Commission on July 18, 1949, that Fuchs made efficiency estimates on various implosion designs, [redacted]-one of them corresponding rather closely to X-ray shot at Eniwetok. He stated that Fuchs and Peierls provided two-thirds of the team which handled the hydrodynamics in "T-Division," which made the implosion development possible. They both contributed heavily to all phases of the weapon development, including implosion and Super. (Ibid, 124)

Dr. Paul McDaniels, referred to above, advised the Atomic Energy Commission that some of the reports prepared by Fuchs dealt with detonation and assembly of the atomic bomb. He stated that Dr. Fuchs participated considerably in the design and development of the atomic weapon. (Ibid, 156)

Dr. Hans Bethe, under whom Fuchs was employed at Los Alamos and presently attached to the Nuclear Laboratory, Cornell University, advised Bureau Agents on February 14, 1950, that he was in charge of the Theoretical Division at Los Alamos. This Division performed the calculations ahead of time as to how the bomb was to be made and assembled and how it would work. As a result of the Quebec Agreement, England furnished several top scientists to work in this Division. They were about twelve in number and it was Bethe's belief that the bomb would not have been completed as soon as it was without their assistance. Bethe had personally requested that Dr. Rudolph Peierls, of the University of Birmingham, be assigned to the project. Peierls accepted with the stipulation that he bring with him two of his best collaborators, Drs. Fuchs and Skyrme. They, with American scientists, were assigned to the particular task of determining the best way of bringing together parts of materials so that after assembly there would be more than the "critical mass." The work of this group is still restricted information and was about the most highly confidential work done. As a member of this group, Fuchs was in as vital a position as anyone on the entire project and had access at all times to all parts of the Laboratory and all documents, except perhaps some top secret documents. Dr. Bethe pointed out that this did not mean that he could not examine the top secret documents, which were necessary to his work, upon the proper clearance and permission. (Ibid, 326)

Bethe further stated that in June or July 1946, Fuchs visited him at the General Electric Company in Schenectady, New York. Fuchs was on his way back to England. He did not question Dr. Bethe concerning his work and it was Bethe's recollection that Fuchs' sister from Boston came to Schenectady to meet him. Since that meeting, Bethe has seen Fuchs on two occasions. One was in

England during the Summer of 1948, when Bethe spent a day and a half at Harwell. Fuchs talked with Bethe and "showed him around." He also told him something of the theoretical work being done there. Bethe was under orders from the Atomic Energy Commission not to talk of restricted matters, so the conversation was one-sided. In the Spring of either 1948 or 1949 (this probably actually refers to 1947), Fuchs visited Dr. Bethe at Ithaca, New York. He had come from England to attend Declassification meetings which were held in Washington. His visit was at Bethe's invitation. He stayed one day. Their main topic of conversation was nuclear reactors and declassification. Again, Dr. Bethe was under orders not to speak of restricted information, so the conversation was one-sided. (Ibid, 326)

The Atomic Energy Commission has advised that Roland A. Anderson, Chief of the Patent Branch, advised that the records at Los Alamos indicated that in a memorandum of March 7,1945, it was stated, "Under the present setup the British personnel have been given full access to all documents and data at this Site." (Ibid, 369)

In connection with Fuchs' trip to the United States in 1947 to attend the Declassification Conference, which was held in Washington from November 14 through 16, 1947, the Atomic Energy Commission has advised that the Conference did not involve supplying to the British or Canadians any restricted data which was not already known to them. (Ibid, 285)

It is noted above that while in this country Fuchs made a visit to the Argonne National Laboratory in Chicago on November 28, 1947. Records of the Security Force at the Laboratory indicate that he was there from 2:50 PM to 4:00 PM on that date and at all times was escorted by a member of the Laboratory staff. In accordance with the clearance issued that he was to discuss unclassified and declassified matters, necessary steps were taken to guarantee that he was only concerned with unclassified matters while there. He was shown the crystal spectrometer and the mechanical velocity selector. These instruments, according to the Atomic Energy Commission, were described in Volumes 71 and 72 of the "Physical Review," dated June 1 and October 1, 1947. (Ibid, 369)

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Investigation has disclosed that the records of the Inspector of United States Naval Material at the General Electric Company, Schenectady, New York, reflect that on November 17, 1947, Fuchs, as a member of the British Atomic Energy Research Establishment, visited Dr. Herbert C. Pollock, Research

Laboratory of the General Electric Company, for the purpose of discussing cyclotrons, synchrotrons, and betatrons for a two day period. Pollock was described as Research Associate in the Physics Division of General Electric, assigned to the Synchrotron Project. As noted above, the Atomic Energy Commission has advised that the purpose of Fuchs' trip to the General Electric Company was to see a machine described as "70-MEV Synchrotron." Also, according to the Atomic Energy Commission, the General Electric Company in Schenectady was not doing work for the Atomic Energy Commission at the time of Fuchs' visit. (Ibid, 426 and 578)

On February 8, 1950, [redacted], who is presently employed by the [redacted] advised the Buffalo Office of the Bureau that he was formerly in charge of the [redacted] Division of the [redacted] During the Spring of 1948, while in this connection, he and two associates, who are presently associated with the [redacted], made a trip to England for [redacted] He said that Fuchs participated in these conferences. Upon his return to the United States, he and his associates prepared a top secret report on the conferences. He related that the contents of the report are known to about twelve persons in the United States and are of a highly technical nature [redacted] indicated that the discussions in England related to the British "pile program."
(Ibid, 442)

On March 6, 1950, the Bureau Liaison Agent delivered a letter to Commissioner Pike, Acting Chairman, Atomic Energy Commission which reported information obtained from Fuchs by Dr. Perrin. Mr. Pike was requested to furnish to the Bureau any evaluation the Commission might make.

Mr. Pike advised he intended to immediately instruct the scientific personnel of the Commission to make a detailed study and evaluation of this information and he would furnish the Bureau the results.
(Memo Keay to Belmont 3/8/50) (Serial 730)

Attached as Exhibit # 8 is a list of reports prepared by Fuchs as reflected in the records of the Atomic Energy Commission.

Investigation by the Albuquerque Office in February, 1950, reflected that [patent disclosure papers on file in D Division, Los Alamos Scientific Laboratory, Los Alamos, New Mexico, reflected that Fuchs with John Von Neuman as "co-investor," had a disclosure entitled "Method and Apparatus] (4)

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"for Releasing Nuclear Energy" and the proposed application was described as "One proposed design for Super." This disclosure was made in April, 1946.

Another disclosure with Bubby Sherr as co-inventor, is entitled "Timed Neutron Source" and its application is given as "Useful in Implosion type bombs." (65-58805-183 p. 11)

It is to be noted at this point that by letter from the

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By letter dated May 19, 1950, Mr. Francis Hammack, Acting Director, Division of Security of the Atomic Energy Commission, forwarded to the Bureau portions of a report prepared by a committee of Senior Responsible Reviewers who had considered the effect of Fuchs disclosures on the AEC declassification policy. X(U)

This report indicates that it was concluded that the information turned over by Fuchs concerning the diffusion plant was largely theoretical and that probably the bulk of it has since been declassified. The information disclosed by Fuchs concerning barriers also appeared to have dealt essentially with theoretical aspects and did not contain significant information concerning fabrication and performance of barriers. It was indicated that only one document of the MSN series (reports of the British Mission - New York) namely MSN-18, contained production figures for the K-25 plant (Oak Ridge). It was further indicated that there is some uncertainty, however, as to whether MSN-18 was included in the documents passed to the Russians by Fuchs. X(U)

In evaluating the Los Alamos aspects, the report indicates that Fuchs turned over to the Russians very important information concerning weapons. With respect to the Trinity (plutonium implosion) type weapon, it was stated that it was clear that the essentials of the bomb, in adequate detail, were turned over either while Fuchs was at Los Alamos or later. It also appeared apparent that considerable information was turned over regarding gun-type weapons. X(U)

The report discussed participation of Fuchs in the work on thermonuclear weapons at Los Alamos and a list of the meetings on this subject which were attended by Fuchs was set forth. It is believed that this refers to the hydrogen bomb. X(U)

It was indicated also that officially, Fuchs had little information concerning other phases of the United States project; for example, the Hanford project, and it appears that the information in this category which he turned over was relatively "minor." It was further indicated that Fuchs did not pass a great deal of information to the Russians concerning "pile technology" including the British work on this point. X(U)

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