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# MINUTES

## Fortieth Meeting of the General Advisory Committee to the U. S. Atomic Energy Commission

May 27, 28, and 29, 1954
Washington, D. C.

[redacted]

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INDEX

Minutes, Fortieth Meeting, GAC


| | Page |
|---|---|
| Meeting with the Commissioners and General Manager; | 2,29 |
| Research Matters. | 6 |
| Budget. | 6 |
| Successor to Dr. Lillie | 6 |
| Controlled Thermonuclear Program. | 7 |
| Accelerators. | 7,28,34 |
| Computers | 8 |
| Reactor Matters | 10 |
| "L" Category of Information | 3,13,15,29 |
| Aircraft Nuclear Propulsion Program | 5,10,15,29 |
| Fuel Element Fabrication Costs. | 13,15,30 |
| Weapon Matters. | 17 |
| CASTLE Tests. | 17,28,32 |
| Citation for Los Alamos | 4,15,33 |
| Los Alamos Program. | 18,23 |
| [redacted] | 18 |
| Livermore Program | 19 |
| Fall-out Problem. | 21,26,33 |
| [redacted] Test | 21 |
| Mechanism of Fall-out | 22 |
| Bad Weather Shots | 22 |
| Employment of Large Weapons | 23 |
| Intelligence Matters. | 8 |
| Materials Testing Accelerator Program | 3,14,15,29 |
| International Scientific Conference | 9,16,25,30 |
| Nehru Proposal. | 9,16,24,25,30 |
| Pricing Policy for Fissionable Materials. | 4,28,34 |
| Successor to Dr. Beckerley. | 2,26,32 |
| Policy on Aliens. | 2,4 |
| Press Speculations. | 4,9,26 |

[redacted]

INDEX




| | Page |
|---|---|
| Proposed Amendments to the Atomic Energy Act. . . . . | 4 |
| Price of Heavy Water. . . . . | 5 |
| Lithium . . . . . | 6 |
| Defense Measures. . . . . | 28,34 |
| Public Announcements. . . . . | 34 |
| Monthly Reports . . . . . | 34 |
| Agenda. . . . . | 1, Appendix A |
| Minutes, 39th GAC Meeting . . . . . | 1 |
| Dates for next GAC Meeting, and Subcommittee meetings | 1,24,35 |
| Chairman's Report References (Appendix B) | |
| Item 1. . . . . | 29 |
| Item 2. . . . . | 29 |
| Item 3. . . . . | 30 |
| Item 4. . . . . | 30 |
| Item 5. . . . . | 32 |
| Item 6. . . . . | 34 |
| Item 7. . . . . | 34 |
| Item 8. . . . . | 32,33 |
| Item 9. . . . . | 34 |
| Item 10 . . . . . | 29,30 |




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FIRST SESSION
(May 27, 1954)

The Fortieth Meeting of the General Advisory Committee was called order at 9:30 a.m. by the Chairman. The following members were present Dr. Rabi (Chairman), Dr. Buckley, Dr. Fisk, Mr. Murphree, Dr. von Neumann, Dr. Warner, Mr. Whitman, and Dr. Wigner. Dr. Libby was unable to be present at this Meeting. Dr. McDaniel, who served as Acting Secretary in the absence of Dr. Dodson, and Mr. Tomei were also present.

Minutes, 39th Meeting

Since the Minutes of the next previous meeting had been approved by the individual members of the Committee prior to this Meeting, they were not read. (Secretary's Note: The Minutes were distributed to the usual recipients on May 12, 1954.)

Agenda

The Chairman explained the agenda (Appendix A) for the Meeting, and there followed a general discussion of the weapons problems which were brought about by the advent of large weapons. It was agreed that the Committee should thoroughly air the entire weapons field, including the fall-out situation. During these discussions, Dr. Rabi said that the proposed reduction in research funds by the House had been opposed by the Senate and that a conference to resolve the disagreement was scheduled for about June 7; all members expressed the hope that the Senate view would prevail.



Sub-committee Meetings

The members of the Committee then made plans for Subcommittee meetings as follows: Reactor Subcommittee at Argonne on July 7, 8, and 9; Weapons Subcommittee at Sandia and Los Alamos on July 12, 13, and 14, 1954.

The value of awards was discussed, and it was agreed that the Committee should inquire further into the status of the proposed Presidential citation for the Los Alamos Scientific Laboratory.

[redacted]

Policy on Aliens

A short discussion on the Committee's recommendation of the last meeting concerning the participation of alien scientists in the researc program of the Commission was held. Dr. Rabi suggested that inquiry b made as to its status.

Meeting with the Commissioners and General Manager

At 11:00 a.m. Commissioners Smyth, Murray, and Zuckert, and Genera Manager Nichols joined the meeting.

Dr. Smyth, in the absence of the Commission Chairman, welcomed the members of the Committee. He asked Mr. Nichols to explain the items or which the Commission would like to have the advice of the General Advisory Committee.

Successor to Dr. Beckerley

Mr. Nichols told the members that Dr. James G. Beckerley had resig as the Director of the Office of Classification, and that Dr. Beckerley would be leaving the Commission in early summer. Dr. Charles D. Luke, Chairman of the Department of Chemical Engineering at Syracuse Universi was mentioned by Mr. Nichols as a possible successor to Dr. Beckerley. Mr. Nichols described Dr. Luke as a man with Manhattan Engineer Distric experience under Dr. Ruhoff, and with some experience with the Standard Oil Company. Mr. Nichols said that Syracuse would give Dr. Luke a one-year leave of absence.

Dr. Rabi asked whether this position did not call for long experience in handling information problems. Both Dr. Smyth and Mr. Nichols agreed, but told of their difficulties in finding the proper man. They said they also were considering Mr. Charles Marshall and Mr. Murray Nas of the Office of Classification for the job.



Mr. Whitman and Mr. Murphree said they knew Dr. Luke, and that he had many of the right qualities for the job.

Mr. Nichols discussed the status of the Materials Testing Accelera

Materials Testing Accelerator Program

Program (MTA). Originally, he said, the MTA was thought of as an alte tive to the ore supply. Now the ore supply is more certain. Dr. Rabi pointed out that MTA also had two other purposes when originally planne namely, the production of polonium substitutes and the production of tritium. It was agreed that the critical requirements for both these materials have changed.

Mr. Nichols explained that the Commission would have a proposal fo the Fiscal Year 1955 Program for MTA before it soon, and that he was seeking guidance as to the appropriate funding level for this activity.

Dr. Smyth restated the question as, should we put the results, as they now stand, on the shelf; or should we spend another 3½ million dollars or so to operate the new machine and then put it on the shelf?

Mr. Murray thought it a mistake to keep putting off the decision a to what to do with the MTA. He said that unless we are going to build production machine we probably ought to stop, but that the GAC could give the Commission advice on this subject.

"L" Category of Information

Dr. Smyth and Mr. Nichols, in response to Dr. Rabi's question, explained the Commission's proposed plan to segregate information of low security significance but of value to industry and friendly foreign countries. Dr. Rabi inquired into the adequacy of Belgian security. D Smyth stated that generally it was pretty good. Dr. Rabi then mentione three items which he thought bore on this information problem: (1) denial to the Russians; (2) prevention of competitor nations obtaining a position adverse to ours; and, (3) securing an advantage to the Unite States by trading.

[redacted]

Dr. Rabi said that the GAC had recommended the same sort of thing previously, and that they would be glad to hear more about it from the Reactor Development Division.

At this time, Dr. Rabi inquired if anything had been done on the question of the participation of alien scientists in the research progr Mr. Nichols replied that he thought the Chairman has gone over the case and that he did not know its present status.

Policy on Aliens

In response to Dr. Rabi's inquiry, Mr. Nichols stated that the Commission was preparing a Presidential citation for Los Alamos, and th copies of the draft would be made available to the GAC for review.

Citation for Los Alamos

Dr. Smyth said that the Commission would appreciate the advice of the GAC on a proposed pricing policy for fissionable materials (AEC 152/49). Mr. Nichols discussed the importance of establishing prices f fissionable materials.

Pricing Policy for Fissionable Materials

Dr. Smyth called the attention of the GAC to the redefinition of "atomic energy" in the proposed amendments to the Atomic Energy Act -- "the term 'atomic energy' means all forms of energy released in the course of nuclear fission or nuclear transformation". He wondered if the term "nuclear" included natural radioactive materials, e.g. radium. There was no discussion on this point.

Proposed Amendments to the Atomic Energy Act



Dr. Rabi asked if the Commission considered the William L. Laurenc article on thermonuclear matters as serious. Dr. Smyth said that the timing and manner of expression indicated a leak. He said that an investigation was being made to find out how Time magazine had found ou about [redacted]

Press Speculations

[redacted]

Aircraft Nuclear Propulsion Program

In response to Mr. Whitman's question as to what was the Commissio problem on the ANP program, Mr. Nichols said that the Reactor Subcommit of the Joint Congressional Committee on Atomic Energy had recommended t the ANP program be accelerated. He explained the new cruise concept involving the design of aircraft operating on chemical fuel for takeoff and landing, on nuclear fuel for unlimited cruise, and on both chemical and nuclear fuel for sprints at Mach 2 over targets. The Air Force, he said, tends to look on this as making them independent of overseas base The proposed extra effort during Fiscal Year 1955 amounts to about $6½ million.

Dr. Rabi remarked that such use would require large amounts of fissionable materials, and inquired whether there was a firm military requirement for airplanes of this type. Mr. Nichols said that the Air Force was firming up a requirement, but that the National Security Counc would have the problem. Mr. Zuckert noted that the report of the Boeing Aircraft Company was highly favorable.

Price of Heavy Water

Mr. Whitman noted that heavy water was now priced at [redacted] per pound. He wondered whether the Commission could sell heavy water at a lower pri when production needs had been met, and when industrial reactors came in being. Dr. Smyth pointed out that there would be a continuing need for some deuterium. Mr. Nichols remarked that the Savannah River plant was being amortized over a long time. He told the Committee that the Commis sion was still studying this problem, but that if he were in the industr reactor business he would consider heavy water to be in the [redacted] per pound price range.



[redacted]

Dr. von Neumann inquired into the present policies on lithium-6.

Lithium

Mr. Nichols said that the Commission would build the third plant at Oak Ridge, and that even so the Commission will still fail to meet the military requirements. He said that it would be 1957 before we could [redacted] over to normal lithium, and that even then for [redacted] for a weapon we could [redacted] the yield if we used 40% lithium-6 rather than normal material. He advised the Committee that for the [redacted] configuration, a yield of [redacted] megatons could be obtained with normal lithium and a yield of [redacted] megatons could be obtained for 40% lithium-6.

At 12:40 p.m. this Session was adjourned.

SECOND SESSION
(May 27, 1954)

The afternoon session was called to order at 1:30 p.m. by the Chairman. All Committee members (except Dr. Libby), the Acting Secretary and Mr. Tomei were present. Dr. Smyth and Dr. T. H. Johnson were also present.

Research Matters Budget

Dr. Johnson reported that the Senate had taken action to restore the budget cut of the research program which had been made by the House. This met with the approval of those present.



Successor to Mr. Lillie

Dr. Johnson announced the resignation of Mr. David W. Lillie as the Chief of the Metallurgy Branch of the Division of Research. He mentioned briefly his recruitment plans, and asked for suggestions from the Committee. Dr. Fisk suggested that [redacted] and [redacted] would be good sources of information, and Dr. Wigner suggested that Dr. [redacted] also be asked for recommendations. Dr. Fisk suggested

[redacted]

further that a man be obtained with about the same qualifications as Mr. Lillie had five years ago, when he came to the AEC.

Controlled Thermonuclear Program

Dr. Johnson said that he had little to report on Project Sherwood at this time, but that he would give the GAC a report at its next meeting. In response to a question, Dr. Wigner said that he had not talked with [redacted] at Princeton about his project because he understood that he was not cleared for this subject. It was pointed out to Dr. Wigner by the Chairman and others present that this must be the result of a misunderstanding, for his position on the GAC required that he have access to everything. Dr. Johnson said that he was sure that there was no difficulty in this regard, and that if necessary he would communicate with the project leaders. (Secretary's Note: On June 17th, the Division of Research notified the project leaders in writing.)

Accelerators

Dr. Johnson next discussed the plans of the Division of Research to recommend that the Argonne National Laboratory be authorized to make a study leading toward the construction of a high energy accelerator in the Midwest. Dr. Zinn plans to divert about five people from their present assignments and to employ about five others from the participati universities of the Midwest for this study. Dr. Wigner inquired whether there were any plans for an accelerator at Oak Ridge. He was told that they are considering the subject, but have not progressed as far in thei plans as have the Argonne people. He agreed that there was an urgent reason for allowing ANL to go ahead with their plan, but expressed the hope that something could be done for ORNL later.



Dr. Johnson reported that there were no problems on the pricing of radioactive and stable isotopes which needed Committee attention.

After a short discussion on computers, the Chairman suggested tha

Computers it was the consensus of the Committee that the Research Division shoul give sympathetic consideration to proposals from universities involvin the procurement of computers for work on Atomic Energy Commission problems.

At 2:05 p.m. this session was terminated, and Dr. Charles H. Reichardt, who had entered a few minutes earlier, began his presentatic on intelligence matters.

Intel-ligence Matters

Dr. Reichardt explained the general nature of the articles which appeared in the Red Star, an official Red Army publication. He remarke that although the Red Star is generally available to the Russian public these articles were prepared by military people. Those present remarke on the naivety of the Red Star's sketch of the H-bomb.

Dr. Reichardt mentioned that an intelligence report had been received to the effect that

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DOE ARCHIVES

Dr. Reichardt announced that the Bethe panel would be convened in July or August to go over the USSR tests. In answer to a question, he stated that no further USSR tests had been detected.

At 2:25 p.m. Dr. Reichardt left, and Mr. Strauss, Dr. John Bugher, Mr. Kenneth Davis, Mr. Nichols, and Mr. A. Tammaro joined the meeting. Dr. Johnson and Dr. Smyth remained.

[redacted]

Mr. Strauss reviewed the status of the President's proposal for an international scientific conference on the peaceful uses of atomic energy, and furnished the Committee with copies of the State Department proposal to the Russians on the pool of fissionable materials (AEC 226/ He mentioned that he had asked Dr. Rabi to function as the chief preliminary organizer for the international conference, and that he hoped the GAC could make suggestions as to place of meeting, timing, procedur steps, and anything else which would help make the conference successfu

International Scientific Conference

Mr. Strauss discussed the Nehru proposal to cease testing atomic and hydrogen weapons. He asked the GAC to consider what the advantages and disadvantages would be to a favorable or unfavorable decision on this subject.

Nehru Proposal

Dr. Rabi wondered whether it would ever be possible to negotiate with the USSR, and expressed his opinion that weapons tests are importa Mr. Nichols remarked that it would become difficult for the AEC to get funds from the Congress for weapons tests if there were any indication that the Nehru proposal is to be accepted. He stated as an example tha he was worried about the proposed 3,000 pound thermonuclear warhead and believed that it should be tested at the appropriate time.

Dr. Rabi agreed that the Committee would advise the Commission on this subject.



Dr. Beckerley entered the meeting at 3:20 p.m. for his talk on Classification Matters. Mr. Tammaro and Mr. Davis remained.

Press Speculations

Dr. Beckerley presented the GAC with copies of the various articles which had appeared in the press since certain deletions had been made

from the Alsop H-bomb article submitted September 18, 1953. It was hi belief that most of the speculations grew from the deletions in the Al article.

He concluded by saying that his resignation was for personal reas and did not follow from internal AEC strife as some press stories had reported.

Dr. Beckerley left the meeting at 3:35 p.m. At this time, Gen. D. J. Keirn, Col. N. L. Krisberg, Col. R. L. Wassell, Col. Melvin Neilsen, Mr. J. C. Robinson, and Mr. E. N. Bower entered. Mr. Tammaro and Mr. Davis were also present.

Reactor Matters

Gen. Keirn pointed up the importance which the Air Force puts on the achievement of the ability to reach every point on the earth from continental bases. He said that it now appeared that one could do this through the concept of "nuclear cruise".

Status of ANP Program

Col. Krisberg then gave a very clear presentation of the possibili ties of combining nuclear and chemical fuels into a single power plant. He described a liquid metal turbojet engine designed to be powered by nuclear fuel alone, by chemical fuel alone, or by both nuclear and chemical fuels.



He illustrated the concept of nuclear cruise as follows: take-off and climb to 35,000 feet on chemical fuel alone, unlimited cruise on nuclear fuel at about Mach .9 until near the target, climb to 50,000 feet and sprint over target for up to 600 nautical miles at Mach 2 on both nuclear and chemical fuel, descend to 35,000 feet for return cruis on nuclear fuel and land on chemical fuel alone.

[redacted]

Col. Krisberg pointed out that (1) the performance, both augmented and emergency, of such a plane is set by the chemical fuel and that adequate cruising performance could be obtained with a 150-megawatt reactor; (2) the temperatures involved are of the order of 1400°F and are within the range of known reactor design; (3) the controls are simp and, (4) the shield weights are of the order of only 60,000 to 70,000 pounds.

He also noted that operational difficulties were reduced over thos which would be encountered with completely nuclear fueled aircraft. He said that the take-off and landing on chemical fuel alone meant that (1) there would be no exposure of base personnel to nuclear radiation; (2) no special runways would be required as such a plane could take off from a 6600-foot runway; (3) crews could be trained without use of nucl power; and, (4) the reactor could be cooled if necessary by moderate us of chemical fuel on the ground after a mission.

Col. Krisberg showed a slide of a six-engine, delta-winged, aircra which he said would weigh about 290,000 pounds and which could operate as described with a 125,000 megawatt reactor and chemical fuel.

Mr. Whitman asked what would be the chemical contribution to thrust during the sprint when both nuclear and chemical fuel were used. Col. Krisberg said that this would be about 25%.



Gen. Keirn, in response to Mr. Murphree's question as to which type of reactor was considered best, stated that he thought that both the General Electric heterogeneous reactor and the ORNL-Pratt & Whitney "fireball" reactor would work. He thought that we should go ahead with

the reactor experiments to see what their performances are. Col. Krisberg mentioned that the Nuclear Development Associates was studyin a sodium-cooled stainless steel heterogeneous reactor which might be acceptable. He said that work on the supercritical water reactor had been curtailed.

At 4:45 p.m. Dr. von Neumann left the meeting.

Dr. Rabi asked about the time scale on the development of aircraft in which these reactors could be used. Gen. Keirn said that the time scale will probably follow the usual pattern. The Air Force has two or three study contracts at about the $400,000 level now, but the early sixties seemed to be the best answer. Col. Krisberg said that Boeing and Convair have looked over the field, and made preliminary design studies of the "fireball" in some specific plane designs.

There ensued a general discussion of the proposed budget for these programs. It was agreed that about $8,500,000 for ORNL and about $5,000,000 for Pratt & Whitney for the fluid fuel reactor for fiscal year 1955, and about $5,400,000 for the General Electric heterogeneous reactor studies seemed proper. Gen. Keirn had remarked that the $5,000,000 increase over fiscal year 1954 for the fluid fuel reactor was all that they could do for the first year even on a crash basis.

Mr. Whitman then inquired if the AEC program was tailored to a specific proposal or if it were flexible enough so that the reactor could be used for missiles, if that were desirable. Col. Wassell state that the initial reactor experiments would occupy the next two years an at that time we would have to decide on the end use.

[redacted]



In answer to specific questions, the Committee was informed that about 60-75 pounds of fissionable material were required for the fluid fuels reactor, and about 15-25 pounds were required for the GE heterogeneous reactor.

At 5:15 p.m. the ANP session was adjourned. After a 10-minute break, Mr. Davis began his presentation. The others present were the Committee (except Dr. von Neumann and Dr. Libby), the Acting Secretary, Mr. Tomei, and Mr. Tammaro.

Fuel Element Fabrication Costs

Mr. Davis discussed the problem of high costs for PWR fuel element fabrication, and inquired if there were any suggestions on how such costs could be reduced. After some discussion, Mr. Murphree suggested that perhaps many reactor designers were still laboring under the impression that reactors should be designed for a minimum amount of fissionable materials rather than lowest overall costs. He thought that fabrication costs might be lowered by using more fissionable materials, cheaper structural materials even though they absorbed neutrons, and greater tolerances on design.

"L" Category of Information

Mr. Davis next discussed the problem of distributing reactor technology information to industry and to friendly foreign countries. He said that they were convinced that the bulk of reactor technology information could be placed in an area which would not require full background investigation of all persons having access to it. The Committee was in

[redacted]

agreement with these views; and expressed the hope that the proposed revisions of the Atomic Energy Act would permit the establishment of such a "grey" area of information.

Materials Testing Accelerator Program

Mr. Davis reviewed the technical accomplishments of the MTA projec to date. He said that this program has demonstrated that (1) a vacuum of the order of $1 \times 10^{-6}$ mm of mercury could be obtained in large cavities with mercury pumps; (2) ion sources could be produced to give two amperes peak and one-half ampere average currents into a 4-inch hol with an efficiency of 35%; (3) cavity excitation in such a machine coul produce 100 milliampere currents at 12 Mev for 20 hours; and, (4) spark and focussing problems can be solved. He said that high energy physics studies have shown that the number of neutrons per incident deuteron at 300 Mev is from 4 to 11, and that with 500 Mev we might get 25 neutrons per incident deuteron, and at 700 Mev we might get as much as 42 neutro per deuteron.

No target is in hand, but there does not appear to be any concern about the feasibility of a suitable target.

Mr. Davis went on to say that it was planned to start up the low energy end of the 50-megacycle accelerator in October.

Dr. Rabi inquired if there were any production or reactor development interest in continuing these studies. Mr. Davis said that there w no direct interest.



The members agreed that any further interest in these studies was in the research field, and therefore expressed doubts as to the wisdom of further expenditures for the project.

At 6:35 p.m. this Session was adjourned.

THIRD SESSION
(May 28,1954)

The Chairman called the meeting to order at 9:30 a.m. All members except Dr. Libby were present. The Acting Secretary and Mr. Tomei were also present.

Materials Testing Accelerator Program

It was generally agreed that there did not seem to be any Production Division or Reactor Development Division interest in MTA. The Committee members thought that this project did not warrant support by the Research Division.

Aircraft Nuclear Propulsion Program

All the members agreed that the ANP program as presented made real sense for the first time. Dr. Wigner remarked that an overall study group on the technical aspects of this subject seemed to be worthwhile. It was agreed, however, that the Committee should not initiate a study, but that the Committee should request a comprehensive paper on ANP for the next GAC meeting.

"L" Category of Information

The members agreed to reaffirm their support for the establishment of an area of relatively non-sensitive information which could be disseminated to certain classes of individuals without the requirement for full background investigation.

Fuel Element Fabrication Costs

The consensus of the Committee was that the reduction of fuel element fabrication costs was highly desirable. Mr. Murphree felt that perhaps too much design emphasis was being placed on the use of minimum quantities of fissionable material. The members agreed.



Citation for Los Alamos

Copies of the proposed Presidential citation were distributed. The members agreed to endorse it, but wished to suggest that certain changes be made in the text.

Nehru Proposal

The Nehru proposal to cease testing atomic and hydrogen weapons was discussed. The members unanimously agreed that weapons tests are so important to the weapons development program that the U.S. should give them up only if we received equivalent valuable consideration in return.

In order to respond to Mr. Strauss' question as to whether a violation of an agreement not to test could be determined, the Secretary was asked to secure information on this subject from AFOAT-1.

International Scientific Conference

The Chairman pointed out the aspects of the proposed international scientific conference which he thought deserved attention. First of all, he said, such a conference would be a diplomatic maneuver in a scientific field and would focus interest on, and perhaps elicit world scientific support for, the President's proposal. He thought that it could be made a real forum for the exchange of information in the fields of biology, medicine, basic science and engineering. He suggested that an international organizing committee should do most of the work of planning the conference.

Dr. Fisk thought that the conference would seem reasonable if attention were focussed primarily on industrial and medical utilization of atomic energy, that it might possibly also include a forum on the technic implication of the President's proposal, and that it probably should not include papers on social and political matters. Dr. Warner thought that a session might be in order on what the several countries would do if they were given the fissionable material.



Dr. Wigner suggested that we consult the Marshall Plan experience before going ahead. He added that he thought real trouble was ahead if we did not require some valuable consideration in return for the material

At 10:55 a.m., after further discussion on whether the President's Plan should be included in the Conference, this subject was postponed. A 5-minute break was taken.

At 11:00 a.m. the following individuals joined the Committee: Ge

Weapons Matters

K. E. Fields, Dr. Herbert York, Dr. Carson Mark, Dr. Paul Fine, Dr. Al Graves, and Col. E. T. Dorsey.

Dr. Graves presented the preliminary results of the CASTLE tests.

Preliminary CASTLE Results

The results are presented below in tabular form.

| SHOT | TOTAL ESTIMATED YIELD (Megatons) | F | FISSION YIELD, IN MEGATONS | WEIGH OF DEV (lbs) |
|---|---|---|---|---|
| | 15±.5 | | | 23,00 |
| | 11±.5 | | | 43,00 |
| | .11±.03 | | | |
| | 7±1.5 | | | 32,00 |
| | 13.5±2.0 | | | 43,00 |
| | 1.7±.3 | | | 6,30 |

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The general agreement between predicted and observed values for a [redacted] for [redacted] is very good, but not too good for [redacted]

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The [redacted] is being manufactured and stockpil first. The [redacted] will be manufactured and stock piled later on, when all the necessary steps have been taken.

94

Dr. Graves then explained the general features of the Pacific test area and the general weather conditions prevailing during the spring of 1954. He pointed out that favorable weather conditions do not occur often for such tests, and that it is necessary to work flexibility into the test plans. He went on to say that the barge technique was good, and that it provided sufficient flexibility to allow the CASTLE tests to be completed. Dr. Graves felt that even though the fall-out from [redacted] was such that a dose of 400 r was obtained over an area of 5,000 square miles, we could test such things again if we were willing to wait for the right meteorological conditions.

Dr. York then gave an interesting analysis of the [redacted] test results.

Future Program at Los Alamos

Dr. Mark then described the plans at Los Alamos for future weapons. He discussed their experiments on fast neutron interactions with lithium. He estimated that the contribution from lithium-7 might be as much as [redacted]

Dr. Mark gave the following statistics for the four classes of weapons based on the CASTLE tests:

| MODEL | BASED ON | WEIGHT OF WEAPON (lbs) | ESTIMATED YIELD (Megatons) | REMARKS |
|---|---|---|---|---|
| | | 43,000 | | |
| | | 43,000 | | |
| DELETED | DELETED | 17,500 | DELETED | DELETED |
| | | 8,000 | | |
| | | 3,000 | | |

At 12:40 p.m. this Session was adjourned for lunch.

FOURTH SESSION
(May 28, 1954)

At 1:35 p.m. the session on Weapons Matters was resumed with the same attendance.

In response to a question by the Chairman as to what would happen if no further tests could be held, Dr. Mark said that the 3,000 pound thermonuclear weapon would cause concern until and unless tested. Dr. York agreed and also pointed out that in the development of very small weapons, more tests may be needed therefore than for large weapons.

Livermore Program

Dr. York gave a brief summary of the present and tentatively proposed program at Livermore. He said that the development of a 3,000 po thermonuclear weapon was the goal but that they would be looking at a 1,500 pound weapon as a possibility. They plan to continue their work

with

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Dr. von Neumann inquired about the possibility of 10 KT weapons. Dr. York said that while there were no plans for a nuclear test of this size weapon, Livermore personnel thought that there was a chance that a weapon of this size could be done with hydrides. Dr. York said that some hydride chemical studies were in progress at Livermore.

Dr. York then discussed the possibility of developing small diamet small yield weapons. He said that Livermore had looked at three such devices and proposed to test one or two next spring. He mentioned the following as distinct possibilities.

(a)

(b) DELETED

(c)

The Committee then decided to consider the fall-out problem.



[redacted]

Fall-out Problem

At 2:10 p.m., Dr. J. C. Bugher and Capt. W. L. Guthrie of the AEC; Gen. A. R. Luedecke, Dr. H. S. Scoville, Col. H. H. Kaesser, and Capt. R. H. Maynard of the AFSWP; and Dr. Lester Machta of the Weather Bureau entered. Gen. Fields, Dr. Graves, Dr. Mark, and Dr. Fine remained for the discussion. In addition to the Committee, the Acting Secretary and Mr. Tomei were also present.

[redacted] Test

Dr. Scoville described the general fall-out pattern from the [redacted] test. From available data it appears that in an area of over 5,000 squa miles of ocean, a dose of 500 r would have been obtained in the first 5( hours from shot-time; and in an area of over 1,000 square miles, a dose of 2,000 r would have been obtained in the first 50 hours. It was pointed out that the natives on the island of Rongerik received 150 r before being evacuated.

Dr. Scoville said that from the radiochemistry data obtained on the [redacted] was estimated. From the intensity and pattern of the fall-out, he estimated that 6 megaton-equivalent of fission products fell out from the explosion. Dr. Bugher confirmed that about [redacted] of the activity fell out.

Dr. Bugher then mentioned that the particles which fell out on the Japanese ships were about 300-350 microns in size. Dr. Graves said the particles from the barge shots were 10-50 microns in size, and more soluble than the particles from the other shots. The smaller particles fall slower, and therefore the 500 r area is smaller and the 200 r area larger from the barge shots.

Dr. Scoville said that the fall-out extrapolated from the Nevada shots very well. Dr. Machta observed that about [redacted] fall-out had been obtained in Nevada on the much smaller tests.

Capt. Maynard then described the wind structure at minus two hours, minus one hour, and at [redacted] shot-time. Generally, at shot time the wind was 35 knots WSW from 0 to 55,000 feet, and 40 knots East from 65,000 to 95,000 feet. Capt. Maynard pointed out that this sharp reverse of wind favored heavy fall-out from 65,000 feet and below on small areas.

Dr. Graves said that [redacted] was fired on a dry day, and that small clouds were condensed over a region of about 100 miles. On the second [redacted] shot a rather large cloud was generated. He estimated that the [redacted] cloud rose to about 110,000 feet.

After a short discussion it was agreed that extrapolation from known data indicated there would have been no significant fall-out if the [redacted] fireball had not reached the ground. Dr. Graves advised that the radius of the [redacted] fireball was about 8,000 feet, and that [redacted] had been fired from seven feet above the ground.

Mechanism of Fall-out

Dr. Graves informed the Committee that about 2,000,000 tons of coral went up at the [redacted] explosion, and that much of the material came back calcium carbonate. There was considerable discussion of the scavenging action of such material. It was generally agreed that a great deal more study was involved before the mechanism of the fall-out was understood fully.

Bad Weather Shots

Capt. Maynard advised the Committee that since rain normally fell from clouds much lower than 10,000-15,000 feet, a [redacted] explosion from that altitude would not have much fall-out. He said that there was no

indication of a correlation between the IVY-George shot and unusual weather events. He stated that it was his opinion that no type of weather would precipitate the fission products from a 50-100 KT weapon, but that essentially all the activity from a 10 KT or less weapon would be brought down by a rainstorm.

Gen. Luedecke, in answer to Dr. Rabi's question, said that the Department of Defense did not have any plans to find out what the proce is when the fireball just touches the ground. He confirmed this by saying that no one seemed to be worried about an air drop from the fall out or rain-out standpoint when the fireball did not touch the ground.

Employment of Large Weapons

Gen. Luedecke, in response to a question by Dr. Fisk, said that ou present concept of the use of a 10-megaton weapon was to fire it at ground level under proper wind conditions. Dr. Machta said that the general wind conditions over the U.S. and over Europe were roughly similar to that described for the Pacific area.

At 3:55 p.m. all visitors except Dr. Mark and Dr. Fine left the meeting.

Los Alamos Program

Dr. Mark then discussed the planned weapons development program at Los Alamos. He said that they were trying to design weapons of above 1 KT yield. He said that they are currently looking at [redacted] and [redacted] systems in spherical geometry. The [redacted] system, he said, is considered as about the right size for air defense.

Dr. Mark said that Los Alamos had had no experience with plane geometry. He said that one could get compression of [redacted] in such systems. Dr. Mark advised that the weight of [redacted]

systems got out of control and that Los Alamos was not actively workin on such systems. He remarked also that spherical implosions would hav to be given up if one desired to reach [redacted] devices.

Dr. Mark said that Los Alamos Scientific Laboratory was not doing any flat plate experiments. Dr. Fine told the Committee that Livermor was doing such work at Inyokern and at Los Alamos.

At 4:15 p.m. the session was adjourned for 15 minutes, during whi period the Committee left to see a film on CASTLE.

At 4:30 p.m. the Committee returned to meet with Dr. S. G. Englis

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At 4:45 p.m. this Fourth Session was adjourned.

FIFTH SESSION
(May 29,1954)

The Saturday session of the Meeting was called to order by the Chairman at 9:30 a.m. All Committee members (except Dr. Libby), the Acting Secretary, and Mr. Tomei were present.

Dates, Next Meeting

After some discussion, during which Dr. Wigner and Dr. Buckley stated that they probably could not attend, the Committee voted to hav the 41st Meeting of the GAC at Sandia and Los Alamos, New Mexico, on



[redacted]

July 12, 13, and 14, 1954; this meeting to replace the Weapons Subcommittee meeting that had been scheduled to be held at those places at that time.

The Chairman then suggested that the Committee review the various items which had been discussed at the earlier sessions so that proper advice could be given to the Commission.

Nehru Proposal

The members agreed with the Chairman that the Committee should reiterate their belief that weapons tests should be continued.

International Conference

The Chairman stated that he thought that the proposed internationa conference should be directed mainly at technical matters, and that the social and political aspects should take their natural place. Dr. Fisk agreed that the technical matters should dominate the program, and suggested that there might be a place on the agenda for statements from each country on what they would propose to do with any special material which might be allocated to them from the President's proposed international pool.

Dr. Wigner stated that while he was enthusiastic for the President to have made his statement, he would go along on a technical conference he had reservations on any other type of meeting. He expressed his belief that the Marshall Plan experience should be consulted before we plunged again into a program which did not involve a quid pro quo from the receiving country.

Mr. Whitman was enthusiastic about the President's Plan and about the conference, and stated that he was happy to support a bold attempt. Dr. Buckley inquired if scientists were the proper people to be discuss

such matters. Mr. Murphree also did not like the idea of mixing technical and political matters at an international scientific conference.

The Chairman then suggested that the Committee advise Mr. Strauss that the GAC was of the opinion that the conference should be a technica one. He further suggested that each member state his own views to the Commission when they joined the Committee.

Press Speculations

The members agreed that they had no comments on the speculations which had appeared in the press on hydrogen weapons development.

Successor to Dr. Beckerley

Dr. Wigner suggested that someone who has been in the AEC program b brought in for the position of Director of the Office of Classification. The Chairman agreed that this was a good principle, and asked that individual members give their views to the Commission.

Fall-out

The Chairman stated that he was impressed by the very able presenta tion on fall-out and that his views on this subject had changed.

Dr. von Neumann reported that preliminary results from Project Aureole confirmed the results reported by the Division of Military Appli tion. He stated too that a large (say >50 kiloton) weapon exploded at an altitude of, say, 1½ fireball radii or more would probably not produc a local fall-out, that the same explosion near to the ground would produ heavy local fall-out, and that a small explosion (say <10 kiloton) at any conventional height (below the rain-bearing layers of the atmosphere was likely to be "rained out" to 50% or more. He mentioned that over a of Europe the probability of rain within the next six hours is between twenty and thirty percent, and the probability of rain within the next forty eight hours is almost a certainty.

Dr. von Neumann also pointed out that studies had shown a very dire proportion between weapon yield and acreage covered by the fall-out.

The Chairman inquired whether lethality were the best criterion of damage. Dr. von Neumann thought that forced evacuation of an area was a very important consideration.

Dr. Fisk suggested that the Committee point out their interest in fall-out studies from both offensive and defensive points of view. The Committee agreed that the staff seemed to have considered the problem very well, but that these studies on fall-out, dosage, rates of decay, etc., should continue.

The members agreed with Mr. Whitman's suggestion that the Committee should recommend that the Commission get out some authoritative information on the fall-out problem as soon as possible. All agreed that an incorrect statement could cause trouble but that periodic public statements on fall-out effects, similar to Mr. Strauss' statement on the CASTLE tests, would be very helpful.

The Committee then considered several aspects of the world-wide long-range fall-out problem. Dr. von Neumann mentioned that the Sunshine studies indicated that about 10,000 megatons seemed to be the limit with a concept of "tolerance" that may be too strict.

Dr. Wigner pointed out that radioactive strontium absorbed by plants soon finds its way into the life cycle of animals and men, and that a total of three or four kilograms of Pu, incorporated into the bodies of men, would give every living person a lethal dose. Dr. von Neumann remarked that strontium seemed to seek out humans but that plutonium did not; Dr. Rabi pointed out that we could not form conclusions on the basis of the Rongerik natives but that the entire ecological problem had to be faced. He suggested that studies be stepped up in this field.

Dr. Fisk was impressed by the cheapness of killing [redacted] of T

Defense Measures

equivalent) and the large areas of destruction (500 r over an area of 5000 square miles) now possible with the large weapons. He said that t impact of these two things on our defensive program was important. He asked whether these facts were really in the minds of the Departments c Defense and State and whether the Federal Civil Defense Administration had a feeling for them.

Mr. Whitman said that he thought the "rowboat on the New Jersey shore" concept was serious. The Committee then discussed this and othe aspects of the clandestine small weapon problem, and agreed that the situation was indeed serious. Dr. Rabi mentioned that while some group were working on the problem he was not reassured. Dr. Fisk suggested that the Committee could include something on this item at the meeting with the Commissioners and General Manager.

Pricing of Fissionable Materials

Mr. Whitman thought it a fine thing that the AEC was proposing to establish a pricing policy on fissionable material. He thought that it was reasonable for the AEC to put a floor on the price of these materia based on the fuel value, and to pay what the materials are actually worth to the AEC above that floor.

CASTLE Tests

The members agreed with the Chairman's suggestion that the Committ express its gratification and applause for a fine job on the CASTLE tes

Midwest Accelerator

Dr. Fisk thought that the Argonne National Laboratory should be encouraged in their efforts to obtain a high energy accelerator for ANL and that the other group should not be encouraged. Dr. Wigner agreed that the ANL accelerator should be supported, and remarked on the need for an accelerator for the Oak Ridge National Laboratory.

[redacted]

The Committee then recessed at 10:50 a.m.

The Committee was joined by Mr. Strauss, Mr. Zuckert, Dr. Smyth, and Mr. Nichols at 11:15 a.m.

Meeting with the Commissioners and General Manager

Dr. Rabi reviewed the several recommendations which the Committee were prepared to make.

Dr. Rabi reported that the Committee had discussed the MTA project with [redacted] and others, and could discern no interest from the Production Division or the Reactor Development Division. He said that neither the Research Division nor the Committee could find a reason for the continuance of the project. Mr. Nichols said that he would reconsi the future of the project. (Appendix B, item 1)

Materials Testing Accelerator Program

ANP Program

Dr. Rabi reported that the GAC had had an excellent discussion on the status of the ANP program, and that they were impressed with the effort. He said that the GAC would not be commenting on the military value of such a system or the wisdom of combining the chemical and nucl fuels in the same unit. Dr. Rabi said, however, that the Committee liked the idea as a way to go.

Mr. Nichols inquired whether the Committee had looked at the Nuclear Development Associates reactor. Dr. Rabi said that the GAC did not get much detail on this and suggested that they would like to see a report on it. (Appendix B, item 2)

"L" Category of Information

Dr. Rabi said that the GAC thought that the idea of a grey area of information was a good one, and was willing to endorse it. Dr. Smyth asked if the GAC would give them a letter on this particular subject. Dr. Rabi agreed to do this promptly. (Appendix B, item 10)

Dr. Rabi then reported that while the GAC did not have a positive suggestion to make on how to lower fuel element fabrication costs, they felt that not enough study is given to the importance of balancing costs against the quantity of fissionable materials used. Mr. Whitman felt the idea that fissionable material rather than dollars was the scarce item should be reexamined. (Appendix B, item 3)

Fuel Element Fabrication Costs

Dr. Rabi reiterated the GAC belief in the importance of weapons test programs. He said that the GAC cautioned not to enter into any agreements to stop weapons tests unless such would be a really signific step in disarmament. As an example of the kind of arguments that could ensue, Dr. Rabi said that while the explosion of a large weapon could b detected it might be debated for six months or so that it was a meteor. (Appendix B, item 10)

Nehru Proposal

Dr. Rabi reported that the Committee members had diverse opinions on the international conference. He said that some members felt that t conference should be a technical one during which there would be an opportunity to discuss the President's Plan. He then asked the members to express their views. (Appendix B, item 4)

International Conference

Mr. Whitman said that he was enthusiastic about the technical conference-President's Plan idea and that such a meeting would be quite important. He thought that there should be technical papers dealing wi the peaceful applications of atomic energy. He said that he also felt that there should be a session on how the various countries felt they could capitalize on the plan. While he was a little afraid of the inte national organizing committee approach, he did not feel strongly on thi point

Mr. Whitman further said that he felt that such a conference should be held outside of the United States; he preferred Bermuda as the site. He said that he did feel strongly that we ought to go all out for the conference.

At this point there was some discussion of the visa difficulty involved in inviting foreign scientists to the United States for such a meeting. Mr. Strauss pointed out that the State Department would have to steer the proper course for the U.S. in this regard.

Dr. Wigner said that he thought the President's speech to the United Nations was an excellent move whether the plan were eventually implemented or not. He feared that if we did not require a clear quid pro quo there would be no clear measure of what we should give in return In general he thought that the Marshall Plan experience should be consulted in this case. He otherwise favored a technical conference.

Dr. von Neumann favored a technical conference at a place like Bermuda. He thought that the State Department should sponsor it. He al suggested that it was desirable to have an international organizing committee, and to have the President's Plan as a part of the agenda.

Dr. Warner thought it best to keep the conference confined to technical subjects.

Dr. Fisk felt that the conference should be devoted to the industri and medical uses of atomic energy, including isctopes; and to a forum on the technical aspects of the President's Plan. He suggested that diplomacy and negotiation be kept as a by-product. He cautioned that not too much should be expected of such a conference. He thought that Bermuda rather than Geneva would be a good place for the conference

Mr. Murphree felt that two types of conferences might be held. One type would be a straight technical conference, and the second type would be primarily to discuss the President's Plan. Mr. Murphree questioned the desirability of trying to cover both types of conferences in one meeting due to the different nature of the people that would be involved in the two types of discussion; a straight technical conference was favored.

Mr. Strauss wondered how the President's Plan got into the International Conference discussion, and Dr. Rabi replied that there was a question as to whether the Plan should be a part of the Conference.

Dr. Buckley felt enthusiastic about the President's Plan. However, he felt that a scientific conference was not a place to work out the implementation of the President's Plan.

Dr. Rabi felt that the President's Plan would come up at the Conference in one way or another, and therefore one should be prepared for it. He said the reason for having the meeting abroad was that the pressure for giving things would be very much less.

Mr. Strauss thanked the Committee members for their advice, and said that he found it most helpful.

Director of Classification

Dr. Rabi said that there was an opinion within the GAC that the Commission should try to get someone from inside the AEC organization to replace Dr. Beckerley. Generally, he said, the GAC feels that the AEC does not make enough use of such people. Mr. Whitman and Mr. Murphree gave [redacted] a good recommendation. The names of [redacted] (ORNL), [redacted] (LASL), and [redacted] (ANL) were mentioned by individual GAC members as the kind of people they had in mind for the job. (Appendix B, item 5)

CASTLE Tests

Dr. Rabi expressed the Committee's appreciation for the very fine briefing on the CASTLE tests. He said that each of the members was gratified at the success of the tests. (Appendix B, item 8)

[redacted]

Dr. Rabi said that the GAC endorsed the proposed Presidential citation for Los Alamos but suggested some changes in the language. Dr. Buckley then expressed some misgivings in making a citation like this on the thermonuclear program. There followed some discussion on the possibl effect that such a citation might have on the other laboratories. It was finally agreed that no repercussions from the other laboratories were to be expected. (Appendix B, item 8)

Citation for Los Alamos

Dr. Rabi said that the GAC had been informed that the fall-out results were about what the scaling laws would predict. He reported that the acreage covered by fall-out by a particular activity is proportional to the yield of the weapon. He then discussed briefly the difference between the fall-out from the barge and coral shots.

Fall-out

In particular he pointed out that large explosions 1½ fireballs high would cause little fall-out, while small explosions where the cloud did not go above the rain strata would cause high fall-out.

Dr. Rabi reported further that he was convinced that the explosion of large bombs makes no real changes in the weather, except for local perturbations.

He said that the GAC recommends that further studies be made toward understanding the process of fall-out and of obtaining more precise information on its extent, including the medium-range and long-range studies of the Aureole and Sunshine type.

Dr. Smyth inquired whether we should have continued studies of the ocean. Dr. von Neumann agreed, but stated that the results on the ocean are probably not as important as the land results. Also, fall-out into

the ocean is distributed into much greater depths, hence much more diluted than that over land.

Dr. Wigner expressed concern over the plutonium concentration and Dr. Rabi agreed that this was worthy of further study. Dr. Rabi went on to recommend that at a suitable time the AEC give out information to the public and to the responsible Government agencies. (Appendix B, item 9)

Defense Measures

Dr. Rabi then stated that clandestine operations with both small and large weapons worried the GAC. Mr. Whitman suggested that a really strong effort should be made on this problem. Dr. Rabi inquired whether it was understood within the Government just how cheap these weapons are. Mr. Strauss said that the AEC shared the concern of the GAC, and that excitement is generating within the military and within the AEC.

Pricing of Fissionable Materials

Dr. Rabi said that the GAC approved, and were happy over, the direction which the Commission policy was going on the pricing of fissionable materials. (Appendix B, item 6)

Midwest Accelerator

Dr. Rabi said that the GAC approved the plan to allow ANL to study the construction of a high energy accelerator for the Midwest, but did not approve this machine for Madison. (Appendix B, item 7)

Public Announcements

Mr. Whitman and other members suggested that it would be a good policy plan to come out every two or three months with an important publi release. He suggested that a statement on fall-out be released very promptly.



Monthly Reports

Dr. Wigner mentioned that he had not received the monthly reports of Commission activities in some time. Mr. Nichols advised him that the report had been discontinued, but that he would keep the GAC's need for information in mind.

[redacted]

Next GAC Meeting

Dr. Rabi announced that the Reactor Subcommittee would meet at the Argonne National Laboratory on July 7, 8, and 9, 1954; and that the 41st Meeting of the GAC would be held at Sandia and Los Alamos on July 13, and 14, 1954. He invited the Commissioners and General Manager to meet with the GAC at that time if they found it convenient. (Appendix page 5)

Whereupon the business of the 40th Meeting of the GAC having been completed, the meeting was adjourned at 12:45 p.m.

P. W. McDaniel
Acting Secretary

Attachments (2)

[redacted]

GENERAL ADVISORY COMMITTEE
to the
U. S. ATOMIC ENERGY COMMISSION
Washington 25, D. C.

May 25, 1954

The following is the tentative Schedule* for the 40th Meeting of the General Advisory Committee, to be held in room 213 on May 27, 28, and 29:

May 27 (Thursday):

9:30 a.m. — Executive Session
11:00 a.m. -- Meeting with the Commissioners and General Manager

1:30 p.m. — Research Matters.....Dr. T. H. Johnson
2:00 p.m. — Intelligence Matters.....Dr. Reichardt
2:15 p.m. -- International Conference on Peaceful Uses of Atomic Energy.....Commissioners, General Manager, Dr. T. H. Johnson, Dr. Bugher, Dr. Hafstad and Mr. Hall
3:00 p.m. -- Classification Matters....Dr. Beckerley
3:15 p.m. -- Reactor Matters.....Dr. Hafstad and Mr. Davis

May 28 (Friday):

9:30 a.m. — Executive Session
11:00 a.m. -- Weapons Matters.....Gen. Fields, Dr. Fine, Dr. York, Dr. Mark, Dr. Froman and Dr. Graves

1:30 p.m. -- Weapons Matters.....Gen. Fields, Dr. Fine, Col. Dorsey, Dr. Scoville, Dr. Bugher and Dr. Machta
4:30 p.m. -- Adjournment

May 29 (Saturday):

9:30 a.m. -- Executive Session
11:00 a.m. -- Meeting with the Commissioners and General Manager

Paul W. McDaniel
Acting Secretary



*Changes in Schedule may be found necessary in advance of or during the Meeting. The offices of the Commissioners, the General Manager, and the Secretary will be informed of any changes.

DISTRIBUTION: Commissioners (5)
General Manager (2)
Secretary, AEC (16)
Secretary, GAC (14)

[redacted]