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MINUTES

Thirty-fourth Meeting of the General Advisory Committee
to the U. S. Atomic Energy Commission

March 23 and 24, 1953
Washington, D. C.

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FIRST SESSION
(March 23, 1953)

The Committee met in executive session at 9:35 a.m. All members, the Secretary, and Mr. Tomei were present.

A period was devoted to reading the documents which had been forwarded to the Committee and to informal discussions.

The Committee was interested in the matter of Mr. Christophilos and the invention of the strong focussing principle, reviewed by Dr. Rabi.

Mr. Christophilos

There was a general feeling that a person who had worked out this important principle prior to its discovery in this country would be a valuable man at any of several laboratories, and that Brookhaven should grow no moss in its efforts to employ him. Dr. Buckley and Dr. Fisk said that the patent question should give no real difficulty, provided the patent applications were filed before his employment.

Dr. Rabi asked about developments on Dr. von Neumann's suggestion of a summer study on long-range weapon possibilities. Mr. Whitman said that Dr. Bradbury had seemed lukewarm to the suggestion, on the ground that such a study was essentially already going on between Los Alamos and Sandia. Mr. Quarles had seemed open-minded about it. Mr. Whitman felt that the proposal needed a presentation by Dr. von Neumann and Dr. Fisk. It had not yet been possible to do anything from the DOD; action in Washington would be facilitated by evidence of enthusiasm in New Mexico. It was mentioned that the idea had not been for Los Alamos to sponsor the work but for the DOD to do it with Los Alamos cooperation. It was suggested that the RDB's Atomic Energy Committee might take the matter up, and ask Dr. von Neumann to discuss it with them.

Weapon Summer Study

[redacted]

Dr. Rabi had learned from Dr. Smyth and Mr. Zuckert that $5 x 10^6$ had been restored to the budget for accelerator construction. He felt this figure insufficient, but had been told that it was a step of expedience, and that it might be possible to increase the amount later. Dr. Rabi also said that it was believed that various difficulties in applying the strong focussing principle could be overcome, and that the construction savings which it would make possible would be important in the 50 Bev region, although not so important at 10-15 Bev.

Accelerators

Dr. Wigner mentioned that he had visited G.E. and was impressed by the greater efficiency of the work they do for themselves than that of the work they do for the government. He took this to support his position against the government's building a pilot plant for nuclear power. An inefficient and costly pilot plant would be a black mark on the future.

Civil Power

At 10:30 a.m. Dr. Rabi left the meeting; Dr. Buckley presided in his absence.

Discussion continued on the nuclear power question. Dr. Buckley said that the Commission has a clear directive to propose changes in the Act which would make an engineering step possible. Dr. Wigner amplified his view on subsidy, saying that his point was not that subsidy is a good thing, but rather that power development should not be kept in government hands. If it is kept under government control, it will be increasingly difficult to get private companies into the development. He felt that it should be possible to make a government subsidy without using taxpayer's money to give preference to one company over another, e.g. that uranium could be furnished at its average instead of its marginal price. In answer to a question from Dr. Buckley, Mr. Murphree said that government's demonstration

Wigner View

plant for coal hydrogenation, at Louisiana, Missouri, was considered by private industry as largely a waste of time for what was accomplished. A rather lengthy discussion developed, bringing in such points as: government responsibility to develop a field in which it has a monopoly; the adverse effect of a high cost pilot plant; the cost of the Arco separation plant; the need for motivation in the power field; the overall gain which would result if a lot of people got into the power field and started thinking how they would go about developing it.

At 11:00 a.m. Dr. Rabi returned and resumed the chair.

At 11:05 a.m. Mr. Dean, Mr. Zuckert, and Mr. Boyer met with the Committee. Mr. Tomei was absent.

Meeting with the Commissioners and General Manager

Reviewing recent developments, Mr. Dean mentioned the appointment of Admiral Strauss as advisor to the President. On March 18 the National Security Council adopted a resolution that a study should be made on how to cut the budget of the DOD and AEC, the latter by $300-500 x 10^6; and Admiral Strauss had been directed to investigate this policy, and make a recommendation by March 31. Mr. Dean went on to say that the Commission has looked at several questions related to the possible abandonment of the Portsmouth project, but had not yet got down to details. He said the argument for having a diffusion plant top at Portsmouth comes down mainly to the question of the vulnerability of the Oak Ridge top. To achieve budget cuts of the proposed magnitude would necessitate cutting out operations of the scale of Portsmouth.

Admiral Strauss

Portsmouth

Mr. Dean said that the Commission had developed a power policy statement, and had discussed it with the NSC. The reaction was in general favorable, although the NSC was definitely against subsidy, whereas the AEC

Power Policy Statement

felt that the policy statement should not exclude the possibility of subsidy. He said that the Commission had not yet developed views on the question of the cost at which uranium might be furnished. The Commission's attitude was more or less against a long term arrangement to purchase plutonium.

In answer to a question from Dr. Rabi, Mr. Dean said that the Commission has not yet defined its university contract policy, but a staff paper on the subject is being worked up.

University Contract Policy

The proposal for an additional test facility site, Mr. Dean said, presents many difficulties, including financial ones. A thermonuclear facility is being activated at Bikini, but an additional site on the continent would be very hard to get. In the Executive Branch the test program is being questioned more and more as a "waste of fissionable material". Mr. Dean said that if the Committee felt strongly in favor of another continental test site he would welcome documentation for the case. The Division of Military Application has not made an urgent recommendation on this subject. The Nevada site is being used to within about 90% of capacity.

Additional Test Site

Dr. Rabi asked about the status of the revised Ground Rules for Dealing with the GAC, which had apparently not been circulated. Mr. Dean and Mr. Boyer said that they would check to insure that they were circulated, with copies to the Committee.

Revised Ground Rules

Dr. Rabi also asked about the status of information exchange with the British. Mr. Dean said that there was a current specific problem which the GAC should look at, involving cooperation with Canada -- the question of flat plate fuel element development. Both countries are interested (Dr. Wigner said that the flat plate element was originally a Canadian

Information Exchange

development); and interchange appears legal under the Amendment to Section 10 of the Act. There has been an exact precedent for such interchange, in the case of round fuel elements. Mr. LeBaron has opposed the interchange. Mr. Dean hoped that the GAC would look into the matter and be able to say how important it is.

The discussion of cooperation with other nations continued until the end of this Session.

With regard to British security practices, Mr. Dean said that they now have full background investigations on new applicants, and have agreed to make such investigations on all people already in the program. However, in the present atmosphere, exchanges with the United Kingdom, and possibly even with Canada, would be very difficult. The Commission would like to propose broad interchange with the Canadians on reactor development and power reactors. Through lack of interchange we are losing much good will and cooperation from the Canadians.

Dr. Wigner observed that there is a similar problem with the South American countries. We might gain a great deal by making "swimming pools" or other research reactors available to them. Mr. Dean said that there is a political problem with the Belgians, who are turning to other countries, e.g. to Norway for heavy water and to the French for know-how.

The following were some of the other thoughts expressed. It will be devastating when the Kremlin offers to give a little uranium-235 to other countries. Our present policy is forcing the development of atomic energy technologies in other countries. It puts us in a poor bargaining position, e.g. for ore. Section 10 of the Act contains the basic prohibition against releasing data on reactors capable of producing power or plutonium; this

prevents us from helping other countries industrially, which is politically very unfortunate.

It was suggested that in addition to the proposed legislative changes for encouraging U.S. industrial participation in the power program the Commission might well also recommend changes which would make it possible to help other countries industrially. Mr. Dean said a possible mechanism would be to give the Commission broad discretion to deal with other countries in the interest of the United States. Dr. Rabi said that the times are against it.

This Session was adjourned at 12:30 p.m.

SECOND SESSION
(March 23, 1953)

At 2:00 p.m. the Committee, with all members present, met with Dr. Claus and Dr. Western, of the Division of Biology and Medicine, and with Dr. L. J. Henderson, Dr. E. H. Plessett, Dr. F. J. Krieger, and Dr. W. W. Kellogg, of the Rand Corporation, to discuss Project Gabriel. The Secretary and Mr. Tomei were present.

Project Gabriel, Rand Work

Dr. Claus referred to a summary paper covering the Rand work to date; and said that Rand was concentrating on the physical, chemical, and meteorological aspects of the problem, while a project was being set up under Dr. Western to concentrate on the biological aspects.

Dr. Kellogg reviewed the work done by Rand, dealing only with air bursts. He emphasized the complexity of the problem. A tentative conclusio based on AFOAT observations is that there is no fall out from an air burst. Their analysis, therefore, dealt with rain out. Dr. Kellogg said it was assumed that the region in which droplets grow in a rain cloud is that

[redacted]

between the 0° and -15° isotherms, and that hence scavenging of bomb debris happens only beneath the -15° isotherm. This assumption coupled with information on the cloud height and the height of the -15° isotherm (about 21,000 feet in summer, 15,000 feet in winter) gives the fraction of the cloud scavenged by rain. Knowledge is available on the altitude reached by the top of the cloud as a function of yield of burst. Unfortunately the altitude reached by the cloud bottom has not usually been reported. Eddy diffusion theory indicates that the vertical increase of cloud size is proportional to $(\text{time})^{1/2}$. It was assumed, on the basis of AFOAT sniffing, that the lateral growth is at the rate of three knots.

Dr. Kellogg displayed sample calculations of dose rate versus time after shot that rainfall occurred. At low yields the contamination shows an initial decrease with yield because of the higher cloud rise. It was concluded that in a thunderstorm there would not be much rain-out because the updrafts push the cloud above the region through which the rain falls.

There are virtually no data available with which to test the predictions One report on rain-out in the Salt Lake City area indicated a contamination of less than one percent of the maximum which would have been predicted.

Dr. Kellogg emphasized the incompleteness of the present treatment of the problem and the severe inadequacy of the available data. He said that there were gaps in the present picture with respect to: local hot spots, diffusion, and dependence of cloud height on yield, especially at higher yields. (The predicted height for the Mike cloud was 80,000 feet; the observed height was 120,000 feet.) Our own tests have been carried out under carefully selected weather conditions. It is hoped to arrive at a more logical picture of the effects of different weather conditions.

At 3:00 p.m. this presentation was completed, and the visitors left.

The Committee met at 3:05 p.m. with General K. E. Fields, Major K. B. Cooper, Dr. P. C. Fine, and Dr. F. K. Pittman, to discuss requirements for lithium-6, tritium, boron-10, and uranium-233.

Shot

General Fields began by mentioning that the first shot in the current test series, [redacted] had yielded 15-20 kilotons, and had just about the [redacted] the yield would have been 11 kilotons.

Lithium-6 Requirements

Turning to the question of lithium-6 requirements, he said that a thorough discussion taking into account effects on the weapon spectrum, etc., was not yet possible. Final goals could be set much better in about 6 months. A budget of $\$150 \times 10^6$ has been requested for a second separation plant, three times the capacity of the first plant. The following is the targeted yearly production for 95% lithium-6, or alternatively, 30% lithium-6.

	FY 54	FY 55	FY 56
Li-6 95%			
or			
Li-6 30%			

[redacted]

[redacted]

At 3:35 p.m. the Chairman left the meeting; Dr. Buckley presided in his absence.

- The latest increases in estimated cost of Li-6 are due to troubles with the stirrers and the baffles of the Elex process. Dr. Libby asked why the estimated cost of the new plant showed the same unit cost for Li-6 as the first plant, instead of reflecting any improvements. Dr. Pittman said the figure was the best budget estimate that could be given at the moment, but that the plant would probably cost less than the estimate.

With respect to tritium, General Fields said that an enriched loading will soon be made in the DR pile at Hanford, that the excess reactivity in the first two Savannah River reactors will be used for tritium production, and that the third one is to be fully enriched (operation in about a year from now). The following are targeted yearly production figures for tritium:

Tritium Production

[DELETED]

At 3:40 p.m. the Chairman returned.

General Fields said it is hoped to accumulate field data on logistics, necessary handling facilities, etc., for boosted implosion weapons. There exists a requirement for a limited number of [redacted] Thermonuclear weapons could use up most of the projected tritium production. The FY 54 tritium figures are essentially decisions, the FY 55 figures will be, those for FY 56 are tentative. General Fields felt the figures were not too high,

[DELETED]

[redacted]

to achieve a big bang with a relatively small weapon. Thermonuclear weapons may be cheaper than fission bombs for "hard" targets requiring high overpressure and for some target complexes.

The increase of the delivery problem with time was mentioned. Dr. Wigner asked whether studies have been undertaken to assess the value of materials in relation to their deliverability. General Fields said there were no combined studies as yet.

Boron-10 Requirements

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In answer to questions from Dr. Libby, General Fields said that there was no immediate indication that attempts to economize would jeopardize the weapon program, but that pressures to cut the budget might affect the expansion program. Any interference of the test programs would be serious. He also said that the facilities for Project Whitney are getting all the money they can use at present.

Dr. Buckley asked about the status of uranium-233. General Fields cited DOD [redacted]

as one kiloton. He said he could report on the status of this weapon at the next meeting.

- At 4:30 p.m. Dr. Malcolm Henderson joined the meeting.

Dr. Libby asked if it would not be desirable to make designs and cost estimates for calutron or diffusion separation of plutonium isotopes to produce Pu useable in a gun or of improved properties for the primary bombs in thermonuclear weapons. It was stated that the Research Division is looking into this.

Separation of Pu Isotopes

Returning to the question whether budget cuts were likely to impair weapon work, General Fields said there had been difficulty getting money for a new divisional laboratory and administration building at Los Alamos. There is an appropriation of $\$6.5 \times 10^6$ for this purpose, but it is held up by the Bureau of the Budget because of the current stop order. The existing buildings are fire traps, and the new construction is badly needed. It would buy a lot in morale, and its denial would have a long term serious impact.

New Divisional Laboratory at Los Alamos

At 4:35 p.m. General Fields, Major Cooper, Dr. Fine and Dr. Pittman left the meeting. Dr. Henderson remained to review developments in intelligence. All members of the Committee, the Secretary, and Mr. Tomei were present.

Dr. Henderson said that there was new information about equipment and activities in Richter's laboratory in Argentina. The laboratory was beautifully equipped, with Speedomaxes, spectroscopes, a cloud chamber, and counting equipment (none ever reported to have counted). There is only Richter's word that successful thermonuclear experiments were carried out.

Intelligence Matters

Argentina

[redacted]

He claims to have achieved temperatures of 20-30 x 10^6 degrees in an electri arc, into which were injected Li and D, producing a thermonuclear reaction. An Argentine investigating commission declared him a fraud. Richter now wants to come to the U.S.

Mesh

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Monte-
bello

Dr. Henderson said that the French have picked the site for their third pile, a production unit. He also mentioned that radioactive xenon was recently detected in the air at Philadelphia. The activity ratios indicate it was too young for 60-day cooling. There is a possibility that it was released by Oak Ridge.

At 5:10 p.m. Dr. Henderson left the meeting.

Dr. Libby expressed doubt that it is safe to conclude that the Russians have U-235. It was variously felt that this was a question of

[redacted]

little importance, not altering the nature of the problem, and that it was of surpassing political and military importance.

The Committee returned to the question of information interchange. It was felt that the GAC should give Mr. Dean as much ammunition as it could for his defense of the Technical Cooperation Program. Dr. Fisk agreed to prepare a list of arguments supporting TCP.

Information Interchange

This Session was adjourned at 5:30 p.m.

THIRD SESSION
(March 24, 1953)

The Committee met at 9:05 a.m. with all members and the Secretary in attendance. Mr. Tomei was present during parts of the morning session.

Dr. von Neumann commented on bomb requirements for lithium-6. The function of this isotope is to react with neutrons to make tritium. However, it is not at all clear what concentration of Li-6 (vs Li-7) is necessary or indeed that the natural isotopic mixture would not suffice. Dr. Libby pointed out that Li-7 also gives the n,t reaction and said one should not proceed with a $150 x 10^6 Li-6 plant until the cross sections have been measured in the relevant energy range. Dr. von Neumann said that: (1) everyone is dubious on the concentration needed in the various Sausage modifications; it may depend on the geometry and the particular situation, however (2) probably sooner or later we will need Li-6. After some discussion, Dr. Rabi asked the Weapons Subcommittee to look into this matter.

Lithium in Bombs

Dr. von Neumann next brought up the question of the tendency to think of meeting budget cuts by reducing the expansion program. He felt it would be ill-advised to cut out Portsmouth, because (1) one cannot be at all sure

Expansion Program Weapon Requirements

that even the expansion program would lead to an excess of fissionable material in 5-7 years, and (2) great advantages are to be gained from the flexibility in weapon designs permitted by an adequate supply of fissionable material. For example, the use of 30-inch weapons delivered by fighters might lead to enormously greater effectiveness than 60-inch weapons delivered by bombers. It is very important to keep such design parameters free, and not limited by the amount of available material. Mr. Whitman again expressed his position against the concept that one can predict a limit to the number of bombs needed. One must have tremendous numbers on hand, far greater than the number which will actually be shot. The sentiment of the Committee was that it would be unfortunate to discontinue Portsmouth, and that the point of weapon flexibility was particularly important.

Security Clearances

At 9:35 a.m. the Committee met with Captain J. A. Waters, Mr. F. Hammack, Mr. Boyer, and Mr. W. J. Williams, to discuss the Commission's security clearance policies.

Dr. Rabi explained that the Committee was interested in the clearance policies for scientific personnel, and in such matters as the time required to obtain clearances, the use of the National Laboratories for unclassified research, etc.

Captain Waters reviewed clearance process. Security clearance is required by law for access to restricted data. It is granted on the basis of an investigation by the FBI or the Civil Service Commission of the individual's character, loyalty, and associations. An FBI investigation is required for access to the more sensitive areas of information, as determine by the Commission. An FBI investigation takes about 45 days and costs $205. A Civil Service investigation costs $196.

Mr. Boyer mentioned that there are 9 or 10 categories of sensitivity, the most sensitive being stockpile and production figures. It is expected that the Civil Service investigations will step higher and higher into these areas.

P Approval

Captain Waters emphasized the fact that P security approval is not a security clearance, but is rather an administrative precaution. It is granted by the Manager of Operations, directly or after consultation with the local FBI. Normally, a central file check is made by the FBI. There is no minimum requirement for P approval.

Grades of Clearance

The Chairman inquired about "grades of Q Clearance". Mr. Boyer replied that a Q clearance does not say "the doors are wide open". It is the policy to compartmentalize information, in particular stockpile, production, and thermonuclear information. Access to the compartments is based on need to know and is not a degree of clearance. When access is to be extended to more sensitive areas the files are rechecked for derogatory information.

Mistakes in Security Files

The Chairman asked what happens when a mistake is found in some derogatory item in the files, e.g. a mistake of identity. Captain Waters replied that it would be taken up with the FBI, who would undertake a verification and then correct their own records. The derogatory misinformation is <u>not</u> removed from the file, but the record would show the correction. A statement of the AEC's evaluation of a case is placed in the AEC file, but does <u>not</u> in general go to the FBI file. Hence no mechanism operates automatically for informing a new employer (another agency, such as the DOD) that a person has been granted clearance by the Commission. In this sense the files are incomplete. Mr. Hammack said that if there were derogatory

information the Commission would check on possible previous hearings, etc. This often accounts for delays in reaching clearance decisions.

Clearance Details

Clearance is never denied without a hearing, unless the employer's request is withdrawn. If clearance is denied a local board, the individual has the right to have his case gone over by the Personnel Security Review Board, which will then make a recommendation to the office of the General Manager. If a Manager of Operations disagrees with the result of a hearing, favorable or unfavorable, he may take it up with the General Manager. The General Manager may refer a doubtful case to the PSRB. He may sometimes check with the Commissioners. In any case, final authority to grant or refuse clearance rests with the General Manager.

Security Risks in Unclassified Work

Dr. Rabi asked about the policy in regard to using unclearable people for unclassified work. Mr. Williams said this could be approved for unclassified work not at the National Laboratories. However in the National Laboratories special consideration has to be given to the danger of leaks, to the fact that visitors may assume a man is O.K., and so on. The local manager would have to consider a case very seriously before granting P approval to a person with substantial derogatory information in his record. He (Mr. Williams) felt that such a person should not be employed at a National Laboratory.

The following points were brought out in the remainder of this discussion. Only about 0.6% of requests for Q clearance are turned down. Clearances which have been in effect for several years are rechecked; sometimes one is revoked on the basis that derogatory information has been picked up by the FBI. If a clearance has been declined or revoked and the

individual decides at some subsequent time to appeal his case, the appeal is permitted if re-employment is in question. However reconsideration of the case may be very time-consuming. There is a troublesome tendency for persons cleared for a temporary project to ask to have their Q clearance maintained after the work is finished; this is becoming a problem. About 400 hearings have been held. Every case goes through Mr. Williams' office. About 85% of the cases which contain some item of derogatory information are handled by informal interview rather than a formal hearing.

At 10:35 a.m., Captain Waters and Mr. Hammack left the meeting. The Committee then met with a group from the Division of Reactor Development. The visitors present were: Dr. L. R. Hafstad, Dr. D. H. Loughridge, Dr. R. P. Petersen, Mr. James Lane, Dr. Stuart McLain, Mr. Fox Trowbridge, Mr. Dean, Mr. Zuckert, Mr. Boyer and Mr. Williams.

Reactor Matters

Mr. Dean began by mentioning the legislative changes which the Commission feels are necessary to encourage the entry of private capital into the power field. Legislation is needed:

Proposed Legislative Change

(1) to permit private ownership of reactors,

(2) to permit the owners to engage in the production of fissionable material,

(3) to permit private ownership of fissionable material,

(4) to authorize the Commission to sell or lease fissionable material as fuel for reactors, and

(5) to continue the Commission's responsibility for security and safety aspects.

Dr. Buckley was concerned about the matter of ownership, "a red flag". If the same purpose could be accomplished through lease, it would be much easier to get legislation for that adopted. Mr. Dean said there are two problems, the fuel and the materials produced in the reactor. Some people seem to want free rein with fission products. Mr. Trowbridge said the only alternative to private ownership of the product would be a government commitment to purchase the product. Dr. Buckley felt the government could commit itself to leaving the product there, without committing itself to buy it. The question of private ownership was discussed at some length. The Committee in general seemed to have some reservations as to the necessity for private ownership. Mr. Murphree favored it.

Patents

Mr. Murphree raised the question of patents. Mr. Dean said that the Commission has been very conservative in this regard, and needed to be much more liberal, as permitted by the Act. Various views expressed on this question were the following. The main difficulty in liberalizing the patent policy is the security system. (The Commission, however, still files secret patents with the Patent Office to satisfy the disclosure requirement.) A big difficulty would be to determine whether an invention resulted from the use of taxpayers' funds. (The analogous problem in military contracts has been worked out fairly well.) A great body of information has been built up in the National Laboratories, and it would not take much extrapolation for a newcomer to jump to a patent application. Patents are a big incentive for the chemical companies, much less so for utilities. The patent situation should be resolved stepwise, otherwise the whole business will founder. The Commission's present patent policies are a great irritation.

CC

Mr. Murphree took a strong position in favor of a more liberal patent policy. A liberalization affecting only AEC contractors would be insufficient, as would a Patent Compensation Board. What the field needs is for many more people to get into it on their own hook, and go ahead on their own money in the hope of their own advantage. The inventions of importance are going to be unpatentable under the present Act.

Mr. Dean said that the Commission at this point planned to express its intent to liberalize as permitted under the present Act. He agreed that it would be desirable to raise the patent question in the hearings on proposed legislation.

Civil Power Program

Next, Dr. Hafstad reviewed the civil power program. He presented much of the information with visual aids, charts, sketches, tables, etc.; the details are not recorded here. He said that the program must rest on the assumption that uranium will substantially contribute to the country's primary energy consumption, with increasing importance as shortages in the common fuels develop. (Mr. Murphree doubted that one could accurately predict long range oil shortage.) Dr. Hafstad said that starting about 1960 nuclear energy could begin to make a significant contribution.

He showed charts of the estimated cost of plutonium as a function of time and the estimated cost of power from various reactors, these being closely interrelated. The reactor types which at present look most promising for power only are: (1) pressurized, water-moderated reactor (light water with enriched U-235 or heavy water with normal uranium); and, (2) sodium-cooled, graphite-moderated reactor. The homogeneous reactor looks promising but not yet at hand.

The HRE has operated at 1500 kw, 250°C. The thermal coefficient of reactivity tends to make it self-regulating. Corrosion is still troublesome, and there is a large budget for corrosion research. At present the corrosion rate of the stainless steel is about 6 mil/yr. This could be reduced, according to Mr. Lane and Dr. McLain, to less than 1 mil/yr if titanium were used, or with stainless steel at lower uranium concentrations. Some members of the GAC expressed discontent with the HRE program, especially the large sum ($1 x 10^6) being spent for work on corrosion. Others felt, however, that it is a good program, since the HRE is a relatively cheap reactor, is working, and data are coming out. About 1/3 of the ORNL effort is on the homogeneous reactor.

Homogeneous Reactor

The breeder is the other long term approach. One breeder could produce the fuel for 196 reactors in 30 years if the breeding gain were 1.5, or for 10 reactors if the breeding gain were 1.0. The breeder in its present form does not look economically promising for power. It has much delicate and expensive machine work. To be economically competitive it needs radical changes, such as fluid fuel and pyrometallurgical separation processes.

Breeder

Dr. Hafstad reviewed the ANL-CR&D cooperation in a power breeder project. ANL, which has overall responsibility for the breeder program, is to be directly responsible for conceptual design and laboratory work on a zero power unit. CR&D is to assist ANL and thus learn about the reactor business. Simultaneously, it is to evaluate the future prospects of a reactor of this type, and make a recommendation on a full scale unit. The breeder will not be pushed unless it looks attractive.

ANL-CR&D Collaboration

[redacted]

Several of the visitors had left during the discussion; those remaining at this point were Mr. Dean, Mr. Boyer, Dr. Hafstad, Mr. Lane, and Dr. Petersen.

Mr. Murphree and Dr. Buckley expressed the view that the study was fine but that there are other things more important than going to the pilot plant stage by building one of the reactors and making it run. What is essential is to establish pretty definitely the breeding gain one can expect and make a dependable economic analysis.

Power Costs

Finally, a detailed chart of estimated costs of power from different types of reactors was displayed. Some of the figures were: ca. 11 mill/kwh for the sodium-cooled graphite reactor, 28.5 for the CVR, ca. 9 for a pressurized light-water reactor with boiling, about 9 for the homogeneous reactor. These are estimated net power costs, assuming a fuel credit of $10/g for plutonium. Dr. Hafstad said that these figures show nuclear power to be almost, but not quite competitive, and that a liberal patent policy would encourage private capital to enter the field right now.

At 12:30 p.m. this Session was adjourned.

FOURTH SESSION
(March 24, 1953)

The Committee met in executive session at 1:50 p.m. All members and the Secretary were present.

Arguments in Support of TCP

The first matter considered was Dr. Fisk's draft of arguments in suppo of the Technical Cooperation Program. After slight subsequent revision this statement read as follows.

Some Considerations in Support of the Technical Cooperation Program

General

1. The British have for many generations been producers of great inventions and scientific advances. They still are. For example: discovery of electron, neutron, artificial transmutation, etc., development of the jet engine.

2. Failing to get help in reactor technology from us, other countries are turning to Britain, France, Holland for help. This includes Belgium, which controls the Congo ores.

   We will take an awful licking if and when the USSR offers to help other countries with industrial power information, and possibly fissionable materials.

3. Our foreign trading position, particularly with respect to ore, profits from the operation of this program, and suffers when the exchange of information is curtailed.

4. By withholding reactor technology, we force its development abroad instead of maintaining a reliance of other nations on the U.S.

Specific

1. We have reaped great advantage in our Krypton intelligence program as a result of information received from the British.

2. There is reason to think that our bomb debris intelligence program (especially with respect to Joe-3) would be advanced by information which the British have as a result of their Montebello test shot.

3. Our intelligence on "mesh", bearing on the question whether Russia has U-235, has been advanced by technical information obtained from the British.

4. The flat plate fuel element is a Canadian idea which we should develop jointly. If this is successful, it could lead to more than doubling the output of Savannah River.

5. The British have developed a "fumeless" process for dissolving hot slugs, permitting retention of Krypton. All information on this is obviously of interest to us.

6. Sir W. G. Penney not only made great contributions to our bomb program at Los Alamos, but is without doubt the leading expert on weapons effects. His knowledge of weapons effects would undoubtedly be valuable to us.

7. Early (1941) British work on heavy water reactors provided considerable stimulus to our own work (OSRD) which led to the Manhattan Project.

8. - The British production experience could be helpful to us.

(Secretary's note: Immediately after the meeting a copy of this statement was transmitted to Mr. Dean for whatever use he might wish to make of it.)

The various points made in this statement were discussed, and the statement was approved by the Committee.

A number of Committee members were very much in favor of making information on reactor technology available to friendly nations. Dr. Rabi, as devil's advocate, listed the following arguments against giving reactor development information.

(1) loss of secrecy, hence, security.

(2) giving up a competitive position to others.

(3) the feeling of giving away something for nothing.

To these, Dr. Wigner added

(4) if we give information away too soon we decrease our bargaining position.

These points were considered pro and con. The Committee found itself in agreement that the Technical Cooperation Program should certainly be continued and extended. In general it favored interchange of some information on reactor technology, within limits of maintaining our security, but did not attempt to define these limits. Dr. Fisk pointed out that "security" has a positive meaning, is a dynamic matter, related to accomplishment, and must not be confused with "secrecy". The feeling was that the Chairman's Report to Mr. Dean should contain a general statement of affirmative

character on the desirability of maintaining and extending the Technical Cooperation Program. (Appendix B, item 9)

Dr. Wigner returned to his suggestion of a specific step in making reactor technology available to friendly nations who wish to start atomic energy projects of their own, namely that the U.S. offer them a small research reactor of reasonably advanced design, possibly a swimming-pool type reactor. This would not jeopardize any information with which a potential enemy would be unfamiliar. It might involve the release of a small amount of fissionable material (2 to 3 kg), but such an amount would not materially influence our stockpile, nor enable the recipient to produce nuclear weapons. The advantages to be gained from such a step could include: access to raw materials, and various other contributions to the security of the United States, as quid pro quo; good will, and a continuous insight into the atomic energy projects of the recipient countries as well as a more permanent dependence of these projects on our help. The sooner an arrangement of this type were made with another country the greater would be the benefit to that country, and the greater the compensation which we could expect. Conversely, after a certain point of development in that country has been reached such an offer would be without interest. The Committee agreed that this was an excellent suggestion, and endorsed it. (Appendix B, item 9)

Wigner Proposal to make Research Reactors available to Other Countries

On the motion of Dr. Buckley, seconded by Mr. Whitman, the Minutes of the Thirty-third Meeting were approved as submitted.

Minutes

The next subject discussed was that of the proposed legislative changes, as earlier outlined by Mr. Dean, and as presented in an attachment of a letter from Mr. Dean to the President, dated March 4, 1953. The

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Committee found itself in essential agreement with the policy statement, particularly Section 4, page 2. It did not wish to comment as yet on the proposed implementation of that policy (pages 4 and 5). There was a divergence of opinion on Section 5, page 3, which implies a policy against commitment to purchase weapon grade plutonium. All but three members were in agreement with Section 5, and against commitment to buy plutonium. Dr. Wigner and Dr. von Neumann favored such commitment, as an incentive to private entry into the power field. Dr. Libby supported the statement in general, but felt that there exist some commitments in specific cases, which must not be forgotten. It was agreed to say that the Committee was favorably impressed by the outline of legislative changes given by Mr. Dean, except for some doubts on the question of lease vs sale, and except for the divergence of opinion on commitments to purchase plutonium. (Appendix B, item 1)

Proposed Legislative Changes

The Chairman next asked Mr. Murphree if he wished to report on the meeting of the Subcommittee on Reactors, Materials and Production held the preceding evening. Mr. Murphree said that the meeting had dealt with chemical processing costs at the Idaho plant. This is a very expensive plant. Low throughput is an element in its high cost. Mr. Murphreee emphasized that high burnup is necessary to reduce chemical processing costs of power reactors, which are a big part of the total power cost. The Subcommittee felt that the major factor in the power program must be radical improvements over what is now known. Dr. Libby was critical of what has been done and said that private industry should be encouraged to work out better chemical processing, with its own money. He also thought the Commission should push hard on the separation of plutonium isotopes.

Meeting of Committee on Reactors, Materials and Production.

Chemical Processing Costs

[redacted]

On Gabriel, the Committee decided to make no specific comment. There was some feeling that it was being handled by the wrong Division in the AEC, that possibly the Research Division should direct it. Possibly the DOD, or specifically AFSWP, should investigate fall-out and take responsibility for the meteorology. (Appendix B, item 4)

Gabriel

In regard to the discussion on requirements for special materials, it was felt that detailed comment must await the report of the Subcommittee on Weapons, especially in view of the uncertainty about the essentiality of separated lithium-6. (Appendix B, item 2)

Special Materials

No attempt to reach a specific GAC view on the security clearance discussion was made at this time. Mr. Whitman thought the AEC was handling the problem very well; Dr. Libby and Dr. Rabi noted that there were operational difficulties at the National Laboratories.

Security Clearances

It was agreed to carry over to the next meeting consideration of the control of research in the multipurpose laboratories of the Commission, mentioned in Mr. Dean's letter to Dr. Rabi of March 20. (Appendix B, item 5

Control of Research

The Committee's position on Portsmouth, as described earlier in these Minutes, was reviewed.

May 14, 15, and 16, 1953, were suggested as days for the 35th Meeting. (These dates were confirmed during the meeting with the Commissioners and the General Manager.) It was suggested that the Military Liaison Committee should be invited to attend a session of this meeting, possibly to discuss long-range plans for atomic weapons (but not secrecy, security, or the Technical Cooperation Program). It was also suggested that the Committee might prepare a report to the President at the meeting.

Dates and Agenda for Next Meeting

At 3:00 p.m. the Committee met with Mr. Murray, Mr. Zuckert, and Mr. Boyer. All members of the Committee, the Secretary, and Mr. Tomei were present.

Meeting with the Commissioners and General Manager

Dr. Rabi began by reviewing the Committee's reaction to the proposed legislative and policy changes, and said the Committee hoped to return to these questions, perhaps on the basis of an outline to be prepared by Mr. Murphree. Mr. Murray said the only really difficult point was that of patents. Industry will wish very broad patent rights. Perhaps a 5-year breathing period (the first 5 out of the usual 17-year patent right period) as a moratorium on patent rights would be helpful? In any case the Commission would be very grateful for any help the Committee could give on the patent question (in general, not just the question of contractor patents).

Legislative Changes, Patents

Chemical Processing Costs

Dr. Rabi said that there has been little evidence of progress in chemical processing for breeding and power reactors, and it might be desirable to interest some very capable companies in the problem. Mr. Murphree observed that much progress has been made but the plants are still too expensive, and radical simplifications based on present knowledge or radical new developments are necessary. The present cost of separation for the breeder is about 7 mills/kwh, or about where the total cost should be. Dr. Libby suggested that private companies might be offered a chance to bid, for profit, on extracting the plutonium from a ton of uranium, Mr. Murphree stressed the point that high burnup, requiring less frequent processing for given energy release, is essential.

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Dr. Rabi mentioned the Committee's concern on the cost of the Li-6

Special Materials plant, especially in view of the uncertainty as to what isotopic concentration will be required. He said the Committee had no definitive conclusions on this question, or on requirements for boron-10 and tritium, but that the Weapons Subcommittee would study the subject. (Appendix B, item 2)

Dr. Rabi next mentioned that the Committee was still unhappy about

Gabriel Gabriel, which does not seem to be converging rapidly, and reviewed the thoughts which had been expressed in executive session. Mr. Murray said the AEC would welcome all suggestions and help. Dr. Rabi said that his own feeling was that there are two parts to the problem: (1) the physical one of spread, fall-out, and the effect of weather; and, (2) the biological side, which could get going once (1) was better established. His own feeling was that (1) might profitably be put under the Division of Research.

Dr. Rabi said the GAC had not had a chance to consider and did not

Control of Research quite know what was meant by the question on the control of research. Mr. Boyer answered that the general problem was how to direct research to be sure the best possible job, with the greatest return for the taxpayers' money, is being done. A general comment from the GAC would be welcomed. Dr. Rabi asked if there were any specific problems. Mr. Boyer, referring to the fact that the National Laboratories still report through different Division heads, said that the Commission hopes to get the organization straightened out. Dr. Rabi said the Committee would return to these questions. (Appendix B, item 5)

The Chairman next reviewed the Committee's position supporting comple-

Portsmouth tion of the Portsmouth plant. The flexibility in the arms program, the

logistic arguments for deployment at many sites, and the facilitation of fighter delivery methods were stressed. In answer to Mr. Murray, Dr. Rabi said that the GAC would report and reaffirm its position with the added argument of flexibility. (Appendix B, item 6)

Dr. Rabi next reviewed the discussion on information interchange.

Technical Cooperation Program

He read Dr. Fisk's draft of arguments in support of TCP, and described Dr. Wigner's proposal to make experimental reactors available to other countries. Mr. Murray said he thought the first step in making reactor technology available might be with ore-producing countries, e.g. Canada and Brazil. There was some discussion as to whether it would be helpful to bring up these matters with the State Department and National Security Council in the light of our general foreign relations. Mr. Whitman said there is a strong position to take with Section 10 of the Act in its prohibition of aiding industrial development in other countries; this is in direct opposition to other expressions of our foreign policy, e.g. Point 4. It would be well to take this up at the level of the NSC.

Dr. Rabi next turned to the briefing on security clearance. He said

Security Clearance

that it was an excellent presentation, that the Committee understood the difficulty of the job; and he remarked on the devotion of Mr. Williams in these matters. Some of the Committee feel that policywise the problems of work in declassified areas are not yet completely straightened out. In areas which are not of high security sensitivity, the policy needs to be more flexible rather than tighter, so that important facilities can be made more available for research, and the country get its money's worth from them. (Appendix B, item 3)

[redacted]

The Committee would like to be helpful in the matter of the appropriation for the badly needed new administration building and divisional laboratory at Los Alamos. Mr. Zuckert said the Commission would welcome a comment from the GAC. (Appendix B, item 8)

New Divisional Laboratory at Los Alamos

With regard to the budget restoration for accelerators, Mr. Zuckert said it was not completely accomplished. It had been submitted to the Bureau of the Budget and awaited review by Admiral Strauss. Mr. Murray made the point that this was an example of a problem much more fundamental than one machine, namely the whole attitude toward the atomic energy program. As paraphrased by Mr. Zuckert, he felt that a statement from the GAC on the importance of maintaining the tempo of the program would be very desirable. Mr. Zuckert feared a big cut in research and development.

Maintaining Tempo of the AEC Program

At this point Dr. Libby left the meeting.

Dr. Rabi next mentioned that the Committee was considering a discussion with the MLC at its next meeting, possibly on long range weapon policy. Mr. Murray said it was a fine idea.

Meeting with the MLC

At 4:05 p.m. the visitors left, and the meeting continued in executive session. The subject discussed was what to do about Mr. Murray's appeal for a strong statement on the importance of maintaining the tempo of the atomic energy program. The members present agreed unanimously that such a statement should be written. The sense of the statement was to be that the AEC is in a period of very vigorous growth and development, and promises to strengthen the United States and increase the national welfare. It is important, in the opinion of the GAC, that this be continued with unabated vigor, in spite of budget stringencies. The statement should be unclassified

Statement re Maintaining Program

Letter to the President

It was agreed that the statement should be addressed as a letter to the President, also that the draft should be shown to Mr. Dean. (Secretary's note: The Chairman composed this letter, and it was transmitted to the President on March 26, 1953.) (Appendix C. See also Appendix B, item 7)

36th Meeting

It was suggested that the 36th Meeting be held sometime in July.

This final session of the Thirty-fourth Meeting was adjourned at 4:20 p.m.

Gabriel

(Secretary's note: After adjournment there was some further discussion about Gabriel and what to do about it. It was suggested that the Atomic Energy Committee of the RDB might look at the tactical aspects. The Chairman and the Secretary agreed to attempt to prepare a statement of the problem with suggestions as to how to approach it for review at the next meeting.)

Richard W. Dodson
Secretary

Attachments (3)

[redacted]