713914

January 3, 1946

CL-WFC-7

To: Memo

From: W. E. Cohn

Re: THE NATIONAL DISTRIBUTION OF RADIOISOTOPES FROM THE MANHATTAN ENGINEER DISTRICT

A plan for the distribution of pile-produced radioisotopes is presented herewith. Because of the dependency of distribution upon availability and demand, consideration of the latter must precede the former. Hence, this report is divided into three parts, as follows:

I. THE AVAILABILITY OF RADIOISOTOPES

II. THE DEMAND FOR RADIOISOTOPES

III. THE DISTRIBUTION OF RADIOISOTOPES

An appendix, containing recommendations and remarks on the general policy of distribution, follows these.

PART I: THE AVAILABILITY OF RADIOISOTOPES

1. Introduction

The invention of the chain-reacting pile has made it possible to produce many new radioisotopes and to produce large quantities of well-known active species. These are produced by the fission process itself and by the exposure of foreign materials to the neutrons emitted in fission. Wide publicity has been given to these processes, in and since the Smyth report, with the result that there exists in the public mind the idea that many radioisotopes are available from pile operation at this time. Since radioisotopes are much in demand by scientists for research purposes, a persistent and ever-increasing demand for the release of such materials has been initiated, with the result that a distribution system must be set up at the earliest possible moment.

Those in a position to know what piles can and cannot do and what they are and are not doing, although entirely in sympathy with the principle of wide distribution of radioisotopes to the scientific fraternity at large, desire to point out that any distribution system constructed without relation to the facts as they exist will be an illusory achievement, doomed to dismal failure and productive of widespread disillusionment and recrimination. In addition to the scientific facts of the present situation, it is also necessary to consider the many groups concerned, both inside and outside the project, and the special needs and demands of each before any enduring distribution system can be achieved.

In the pages which follow, there is presented a brief exposition of these facts and needs and a distribution system based upon these.

2. Radioisotope Production in the Manhattan Project

2.1 Creation of Radioisotopes

To the writer's knowledge, the only piles which may in any way be used for the creation of radioisotopes in quantity are those at Argonne, Clinton Laboratories, and Hanford. The first of these is an experimental unit of low power and not suited to large scale production. The Clinton

Laboratories pile is a research and development unit of intermediate power with sufficient excess neutrons and facilities to permit the creation of fairly large quantities of many radioisotopes. The Hanford piles, of the highest power and flux yet realized, can out-produce by many fold the Clinton Laboratories pile, but they are less flexible for the exposure of foreign materials.

2.2 Separation of Radioisotopes (from each other and from parents)

Once created, either in fission or by neutron capture, a radioisotope exists in a mixture with either the exposed material (e.g., P^{32} in sulfur) or other radioisotopes (e.g., fission products) or both (e.g., uranium and fission products). While there are certain uses (usually physical) to which such mixtures can be put, radioisotopes are by and large useless to anyone until they are isolated from any or all of the following: parent, admixed radioisotopes and impurities. In other words, chemical and radiochemical purity are usually determining factors in the value of any radioisotope. From experience, we may list the following criteria which are also of importance in describing a radioisotope to a potential user: amount, specific activity (i.e., amount of carrier), concentration, solvent, chemical state.

It is thus clear that the production of most radioisotopes in a usable form involves two separate and distinct processes: creation and separation. The one is physical, involving merely the exposure (under controlled conditions) of a certain material; the second is chemical, involving the isolation, concentration and chemical work-up of the exposed material.

2.3 Production of Radioisotopes

Viewing the three pile-sites mentioned above with this in mind, it may safely be stated that, with the exception of Plutonium, only Clinton Laboratories has devoted any effort in the direction of radioisotope production, that only Clinton Laboratories has facilities and personnel at this time which have had experience in radioisotope production and that only Clinton Laboratories is in a position to state with authority and some accuracy what the immediate future of radioisotope production and availability may be, the forms in which radioisotopes will be available, etc. The latter, in the nature of prediction, takes into account the possibilities at Hanford; in this connection, the experience of Clinton Laboratories personnel with the Hanford process and piles should permit proper consideration of the latter as a radioisotope production site to be given.

3. Radioisotope Production Facilities at Clinton Laboratories

With certain exceptions (Pu, experimental quantities of H^3 and C^{14}, hecta-curie amounts of Ba-La, and certain so-called "service irradiations", in which the exposed material is sent to the user without chemical processing), all of the radioisotope production experience at Clinton Laboratories lies in one Section (C-IV, comprising 15 men) in the Chemistry Division. An attached report by W. E. Cohn, in charge of this Section, entitled "Radioisotope Production Facilities at Clinton Laboratories", (A) issued December 7, 1945, summarizes the situation with regard to this group. Because of the considerations outlined in the preceding section, this report also constitutes a fair summary of the situation of the Manhattan Engineer District in this regard.

4. Radioisotopes Available for Distribution

Since radioisotopes are characterized by decay, it is clear that the accumulation of stockpiles of them is possible only in the case of the relatively longer-lived species. Thus, we may place all radioisotopes in two groups: those whose half-life permits of accumulation, and hence of a "stock-on-hand", and those which are available at a given time only, this time being immediately following the creation process. Since, as discussed in the memorandum referred to in the last section, radioisotopes are not routinely produced, the shorter-lived radioisotopes (half-life 60 days or less) are not likely to be on hand at any given moment (Ba^{140} and La daughter excepted); furthermore, the memorandum referred to points out that there is little likelihood of any radioisotope being produced on order or in other than certain standard forms since the limited space, equipment and personnel are committed to a developmental program without which this field will not progress.

Therefore, we may expect only the longer-lived radioisotopes in certain specific forms to be on hand at a given time. Even this list is less than what an inspection of the list of long-lived emitters might indicate. Certain reactions do not proceed in the pile. The limitation of work to that which was essential during the war permitted the exploration of certain species and not that of others. Whether short-lived or long-lived, for some of the created species adequate separation processes have not been achieved; for others, isolation in only certain amount, state, purity or specific activity is possible.

For these reasons, no simple adequate listing of material either "on hand" or "preparable with notice" can be presented by Clinton Laboratories nor can rates of production be given. However, useful listings can be made as follows:

4.1 Radioisotopes which (a) have been or (b) might be created by pile exposure of specific materials, regardless of whether or not separation processes are known. (The exposure of material which is to be shipped without processing is known as a "service irradiation".)

4.2 Radioisotopes which have been created by piles and for which separations processes (a) are known but not developed, (b) are known and have been experimentally developed, (c) are known and have been developed to a routine state. Such a listing, for items falling into the latter two categories, should also include the following information insofar as it is known: unit quantities which have actually been separated with present facilities; time and effort required (in man-days); chemical characteristics of final product (solvent, solids, carrier, character, purity, etc.); physical characteristics of final product (half-life, radiation and radiation hazard, associated radiations, etc.).

4.3 Radioisotopes (long-lived) on hand, with data listed in 4.2 above.

4.4 Radioisotopes (short-lived) expected to be produced at stated times, with data listed in 4.2 above.

5. Summary of Present Radioisotope Production at Clinton Laboratories

Present A brief listing, corresponding roughly to 4.2 above, entitled "Survey of Radioisotope Production (at Clinton Laboratories)", is attached. (B)

In addition, listings can be made of the creative ability of the Hanford piles with regard to specific radioisotopes. Of particular interest in this regard are the fission products (see attached memorandum) (C) H^3, C^{14}, and P^{32}. All of these can be created in vastly increased amount at Hanford; in the case of P^{32}, the specific activity can simultaneously be raised above the minimum needed for clinical use due to the higher flux at Hanford. The increased specific activity which can be attained at Hanford should be noted.

PART II: THE DEMAND FOR RADIOISOTOPES

1. Introduction

The foregoing sections demonstrate that there are certain radioisotopes in varying amounts, purities, etc., sporadically available for distribution from Clinton Laboratories, with a possibility, within a year or two, of substantially increasing and steadying the supply. In order to construct a workable distribution system for such a variegated supply, it is necessary to consider, in addition, what may be called the existing market (i.e., the demand) for radioisotopes. Then, by comparing supply and demand, we may devise a distribution system which has a chance of operating fairly and efficiently. Therefore, we turn to a consideration of the types of requests which may be received and the radioisotopes which will be in demand; these will then be reviewed in the light of what is available.

Without enumerating the manifold purposes to which radioisotopes may be put, we may classify the uses as follows:

1.1 Teaching:

(a) class-room demonstration of the laws of decay and growth, properties of radiation, etc.;

(b) use in student laboratories to teach the principles of radiochemistry and radiochemical analysis;

(c) to devise and test apparatus and procedures for research use.

1.2 Research (in universities, institutes, etc.):

(a) physics and chemistry;

(b) biochemistry, physiology and other fundamental life sciences;

(c) clinical (research and therapeutic) involving administration to humans;

(d) industrial (process development, etc.).

1.3 Applied science:

(a) medical use in therapy;

(b) industrial use in laboratory or plant processes.

2. Priorities

The order of classification given above is of fundamental importance in any distribution scheme, for it is the order of (a) increasing amounts of material required, (b) increasing dependence upon steady supply, and (c) increasing dependence upon specified composition of material.

For these reasons, the order as given should also be the order of relative priority for materials not available in amounts sufficient to satisfy all qualified applicants; the goal in such cases should be the maximum gain from the minimum material. Making radioisotopes available in small amount to teachers and investigators will contribute to the number of qualified scientists in the field of nuclear science; it is a "plowing-back" enterprise. In the fields of research, there is little question but that the greatest advantage to society accrues from research in the basic physical and natural sciences. From such research will stem not only the applications of radioisotopes themselves in the applied sciences, such as medicine and engineering, but also the invention and devising of new treatments and new processes quite apart from those depending upon radioisotopes.

Research involving the use of human material (here called clinical research) offers less overall gain to society per unit of radioisotope material than does research in the basic sciences. The principal reasons for this are (a) the size of the experimental animal, requiring larger amounts, (b) the complexity and inaccessibility of the human organism (e.g., sacrifice is prohibited), (c) the lack of standardization of research material, requiring the use of larger numbers of the already very large organisms, (d) the non-existence of bona-fide clinical uses for radioisotopes in present-day medicine other than as palliatives in certain special forms of cancer. Furthermore, legal responsibilities that involve purity and constancy of supply must be avoided. Hence, if rationing is in order, it is both wise and safe to encourage research in the basic sciences at the expense of clinical investigation. Such a policy offers the greatest long-range gain to clinical knowledge itself as well as to applied science in general.

Industrial research is placed at the bottom of the Research group for at least three reasons: (a) the results of such research are, in general, applicable only to a specific process or industry and do not constitute a fundamental advance; (b) such research is usually not published and made available to all; (c) the supplying of one company in a given field requires the simultaneous supplying of all competing companies. However, certain of the requirements for research in the basic sciences (1.2a and b) apply, such as the use of small amounts on an irregular basis, the ability to utilize unstandardized material, etc.

The placement of routine medical use and routine industrial use in the last two positions of general importance requires little explanation. There is no routine generally-applicable medical usage of radioisotopes, with the exception of clinical research in certain special forms of cancer; in addition, purity requirements, constancy of supply and legal responsibilities enter into consideration. Routine industrial use avoids the legal responsibilities to a large degree, but has the additional drawback of being arranged for private profit as against the public benefit; in addition, industry-wide coverage must be guaranteed.

The priority listing set forth thus depends chiefly upon the factors of public benefit, characteristics of supply, legal responsibility and moral responsibility.

3. Probable Requests

With these remarks, we may endeavor to anticipate the types of requests which will be received.

3.1 Teaching: small quantities of many different species, with minimum processing and purity requirements. It should be possible to fill this need easily from materials not in demand by research workers.

3.2 Research:

(a) Physics and Chemistry

Research workers in these fields will request a variety of radioisotopes, usually in small amounts and with minimum processing specifications, since most of them will be able to process materials themselves. Requests for very large amounts of radiation, with the character of the source unimportant, may be received (e.g., physicists for special sources, chemists for radiation chemistry studies); these will not be difficult to prepare except for low energy β sources. Timing of receipt and continuing needs will be relatively unimportant. In general, economy of use may be expected and it may even be possible to consider the return or re-using of relatively scarce materials (e.g., H^3 or C^{14}) or long-lived materials used as sources. On the other hand, it may be necessary to omit supplying scarce items to wasteful processes (e.g., mass spectrograph).

It is anticipated that some demand for the relatively scarce H^3 and C^{14} will come from organic chemists and for H^3 in quantity from physicists. To some extent, H^2 may substitute for H^3 and C^{13} for C^{14} in tracer work for which quantitative mass spectrography is available.

(b) Biochemistry and Related Life Sciences

Several difficulties are anticipated in complying with requests from workers in these fields. Biological experiments require more material in higher purity with less carrier (higher specific activity) and at more definite times than physical or chemical experiments. The chief difficulty, however, arises from the fact that the radioisotopes of greatest interest to biologists are either those which are available in smallest amount (if at all) or which have short half-lives, thus raising a timing problem since the material cannot be stored.

In a memorandum entitled "Radioactive Isotopes" (Cohn to Allison, 1/27/44), a copy of which is attached, radioisotopes are grouped in classes according to their relative interest to biologists (i.e., importance in biology). The radioisotopes of greatest interest are C^{14} (25,000 year) and H^3 (25 year), followed by P^{32} (14.6 day) and S^{35} (88 day), these in turn by Ca^{45} (180 day), Sr (55 day Sr^{89} and 30 year Sr^{90}, the latter with a 60-hour Y daughter, occur together in fission), Na^{24} (14.8 hour), K^{42} (12.4 hour) and I^{131} (8 day). All other radioisotopes are of much less interest to biologists. It is noted that (1) only two (Sr and I) of the fission products, which are the radioisotopes available in greatest quantity, are in the list at all, (2) those which lead the list are the most scarce, (3) all except these either have short half-lives (P, Na, K, I) or have not been pile-produced in pure form or in sufficient quantity (S, Ca). (E) and (E)

These eventualities are cause for concern since of all the sciences the biological, particularly biochemistry, have the greatest need for the "tracer" method. This arises from the complexity of living organisms and their importance to society. There is, therefore, a case to be made for giving top priority with regard to certain radioisotopes to this field over the others, and for a careful selection of investigators within the field to the end that the best usage is made of the available material.

(c) Medicine: Clinical and therapeutic research involving administration to human beings.

With rare exceptions, demands in this category will be limited to those radioisotopes listed in (b) above. In terms of quantity, the demand will be led by P^{32}, probably followed by Sr and I; these are isotopic (or homologous, in the case of Sr) with biologically important elements and have received a good deal of attention in recent years as palliatives, perhaps potential cures, for certain types of cancer. Due to the co-existence of 30-year Sr^{90} with 55 day Sr^{89}, fission Sr may not be usable in humans. The P^{32} requirements should be met by Hanford exposures of phosphates (see Part I), reserving the smaller quantities of carrier-free P^{32} produced at Clinton Laboratories for other investigators. For the scarce H and C isotopes there will be little justifiable demand; the fundamentally important experiments for which these are necessary can be done far more efficiently in smaller and more easily controlled organisms or parts thereof and there exists no such demonstrable case for clinical research as there does for P^{32}, Sr and I. We anticipate little or no demand for the fission species.

With regard to this class of demand, it must be recognized that administration to humans places extreme demands, both moral and legal, upon the specifications and timing of the radioisotope material supplied. Because of these factors, it is believed that this class of demand must be administered differently than all others, by competent medical authorities.

(d) Industrial Research

No accurate forecast of types or amounts of radioisotopes in this group can be made. Certain considerations, involving the balance of private profit vs. public benefit and also the necessity for industry-wide coverage, have been mentioned. The actual requests will not differ much from those discussed under Physics and Chemistry ((a) above) except the probable requirement of larger amounts for a given experiment.

3.3 <u>Applied Science</u>:

(a) Medical Use in Therapy

It is possible that there may be requests for certain isotopes for such purposes; these will be limited practically exclusively to P^{32} and I^{131}. Such requests should be honored only by a competent medical board (see comments under 3.2-c above), if at all.

(b) Industrial Use in Laboratory or Plant Processes

These requests may well span the entire periodic table but will be slow in appearing, pending research (3.2-d above). Continuing needs, based upon routine processes and imposing timing commitments on the production site, will eventually have to be met.

PART III: THE DISTRIBUTION OF RADIOISOTOPES

1. Introduction

It is clear from the foregoing that the distribution of radioisotopes from the Manhattan Engineer District at this time would not be a simple matter even if problems of security and of health hazards were not present. Distribution will not be a simple matter of ordering and shipping*; nearly every request will involve some negotiation between the recipient and the producing laboratory, at least with regard to the first shipment. In addition, it must be remembered that absolute guarantees of physico-chemical state, purity, amount, timing, etc., cannot be given, and that there is the matter of legal responsibility and health protection in connection with the utilization and final disposal of all radioactive materials.

For these reasons, it is believed that the distribution system must take into account all basic facts relating to the production and the use of radioisotopes, and that the final control must rest with the producing laboratory until such time as both production and use become routine and common practice. A system which accomplishes these objectives is outlined in the following.

2. Organization for Distribution

2.1 Policy Committee

This committee is to make all public and general announcements concerning availability and distribution of radioisotopes, formulate and announce general policies relating to relative priorities among general fields, recognized institutions, health protective standards, legal responsibilities, costs, etc., and set up mechanisms for the settling of priorities and controversies (see below). Its composition and mode of action should be such as to make it, in the eyes of the scientific and general public, the governing body. Its authority should stem from the Manhattan Engineer District or the Atomic Energy Commission, when such is established.

This committee should be appointed by the President of such a scientific and scientifically representative body as the National Academy of Science upon request of the Manhattan Engineer District accompanied by specifications of

*Negotiations to arrange for the routine shipment of radioactive materials by a common carrier must be undertaken.

the type of board desired. Its membership need not be limited to members of the appointing body (National Academy of Science). The specifications should be such as to insure a group of scientists representing the major divisions of pure and applied science, academic, medical and industrial, interested in radioisotopes. Equitable geographic representation should be asked. While this committee should be relatively well acquainted with the nature and use of radioisotopes, it should be representative of the scientific fraternity at large and not of special interests or groups within it. Members of this committee in the number of about 10 could be taken from the following list: I. Langmuir, A.H. Compton, H.C. Urey, J.R. Oppenheimer, R.S. Stone, E.U. Condon, L. Pauling, W.M. Latimer, P.A. Leighton, J.C. Stearns, H.A. Barker, C.F. Cori, W.C. Johnson, T.R. Hogness, S.K. Allison, J. Franck, E. Fermi, F. Daniels, K. Fajans, F.H. Spedding, L.A. DuBridge, S.L. Warren, A.B. Hastings, G.B. Kistiakowsky, J.R. Zacharias, L. Michaelis, J.R. Coe, L.W. Nordheim, O. Meyerhof, D. Burk, F.F. Nord, H.A. Bethe, E.P. Wigner, R.E. Zirkle, W.O. Fenn, McK. Cattell, P. Bard.

It is essential that all scientists feel that this Board represents the interests of science at large; rationing and priorities are unpleasant enough even when justly administered. It is assumed that this group, functioning as a Policy Committee, will first seek information relating to basic policy from all interested organizations, from persons representative of unorganized individuals (e.g., university biochemists) and from those having detailed knowledge of the production of radioisotopes. This may perhaps best be done at a general meeting called by it, at which both verbal and written reports (such as this one) and other pertinent information will be considered. Those invited to this meeting* should be chosen with a view towards aiding a general but indicative assessment of relative needs, uses and production, and of such related problems as institutional responsibilities, the dissemination of necessarily related information (instrumentation, radiochemical techniques, etc.), health hazards, shipping problems, etc. A preliminary circularization of chosen individuals or organizations may be undertaken by the committee in order better to define certain of these areas of discussion. A further advantage of a general meeting of the type proposed would be that all interested parties would understand the factors entering into the general policy of distribution.

Following this meeting, the committee will formulate and announce the policy and the general mechanism of distribution and will take those steps necessary to put the system into effect. This will probably take the form of a carefully worded announcement in certain widely circulated scientific journals, stating the general terms of availability and qualifications; this announcement will request a written response (in the form of a

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*The individuals listed in the following Sections could be such invited conferees.

preliminary application with statement of qualifications) from those interested in receiving radioisotopes in the forms in which they are available. A standard form or type of application should be prepared to send to each applicant.

Once having arrived at this point, the Policy Committee may disband until called into meeting by the Executive Secretary of the Allocation Board (see below) and become the nucleus of an Advisory Panel with the functions indicated below.

2.2 Advisory Panel

This group is a relatively large and unorganized body of individuals whose function is largely that of refereeing requests, advising on priorities and responsibilities of applicants, evaluating proposed problems, etc., in conformity with general policy and upon request of the Executive Secretary. This is analogous to the refereeing of papers for publication in scientific journals. The members should be appointed by the Policy Committee in such a manner as to ensure broad geographical and scientific representation. It is essentially an expansion of the Policy Committee, but the primary specification should be the ability to evaluate and judge fairly the qualifications of applicants and the proposed use of radioisotopes by them.

For the reasons advanced in Part II (The Demand for Radioisotopes), it is believed to be desirable to have the Advisory Panel divided into as many subgroups as needed; there should be one for each of the major fields of Research (and Teaching), Clinical (defined here as use in humans, whether experimental or therapeutic), and Industrial (whether research or routine).

The members should be men who know the detailed use of radioisotopes and the applications of them to the solution of specific research problems; they should be capable of making recommendations to applicants in matters of instrumentation, alternative possibilities, cooperative ventures, consulting or technical aid, etc. In addition, knowledge of the production processes and the states in which pile-produced radioisotopes are made or can be made would be valuable.

(a) Advisory Subcommittee for Research

The members of this subcommittee should possess the requisite ability to judge the responsibilities and adequacies and to recommend relative priorities of applicants from the research fields of physics, chemistry and biochemistry (construing the latter in the broad sense).

(b) Advisory Subcommittee for Clinical (Human) Use

The chief reason for setting this group up as separate entity from the Research group is that of medico-legal responsibility involved in the use or treatment of humans, experimentally or otherwise. For this reason, in addition to those listed above, the members of this group should be chosen from medical men on or formerly with the Project; these alone have the necessary background.

(c) Advisory Subcommittee for Engineering and Industry

This group owes its separate identity to the considerations of Part II, relating to the profit-making and competitive nature of industry and the relative secrecy of its methods. Its composition may be specified more exactly after the setting of policy with respect to industrial demands. If these are limited to publishable research, the requests may be handled by the Advisory Subcommittee for Research.

Members of the Advisory Panel could be selected from the list given above, together with representation from the list given below of men closer to the laboratory.

Advisory Subcommittee for Research:

1. Physics: W.D. Fowler, L.W. Alvarez, A. Langsdorf, Jr., W.H. Zinn, S. Dancoff, P. Morrison, M. Deutsch, A. Roberts, P. Abelson, L. Ridenour, W.G. Pollard, M.L. Pool, J.M. Cork, A.H. Snell, E.O. Wollan

2. Chemistry: R.W. Dodson, C.S. Garner, R.W. Connick, G.T. Seaborg, J.W. Kennedy, N. Sugarman, W.F. Libby, J.R. Irvine, C.D. Coryell, G.E. Boyd, J.E. Willard, M. Burton, A. von Grosse, L.L. Quill

3. Biology: T.H. Davies, M.D. Kamen, D.M. Greenberg, W.A. Perlzweig, C.H. Werkman, A.K. Balls, P.S. Henshaw, C.E. Dunlap, D. Rittenberg, V. Du Vigneaud, J.R. Raper, K.S. Cole, L. Jacobson, R. Overstreet, E.S.G. Barron, E. Ponder, A.M. Potts, F.L. Haven, E. Chargaff, W.D. Armstrong, F. Lipmann, F.W. Klemperer, O.H. Lowry, O. Schales, B. Vennesland, F.S. Robscheit-Robbins

<u>Advisory Subcommittee for Medicine</u>: A.M. Brues, P.F. Hahn, L. Hempelman, H.L. Friedell, Leon Jacobsen, Shields Warren, G. Stead, J.E. Wirth, S.T. Cantril, J.J. Nickson, C.P. Rhoads, B.V.A. Low-Beer, Oliver Cope, A.D. Bass

<u>Advisory Subcommittee for Engineering and Industry</u>: M.C. Leverett, M.D. Peterson, C.M. Cooper, C.H. Greenewalt, C.A. Thomas, L. Squires, K.K. Darrow, J. Chipman, T.H. Jukes, E.C. Bills

2.3 <u>Allocation Board</u>

This group, in contradistinction to the Policy and Advisory groups, is a working organization which must be prepared to accept a long term of office. Its function is to receive, from its Executive Secretary, the specific applications for radioisotopes and any recommendations of the Advisory Panel members relating thereto, and to specify shipments in accordance with these and in conformity with the policy set by the Policy Committee. Its members should be appointed by the governing agency of the Project (Manhattan Engineer District or Atomic Energy Commission) to represent the Project; these members must have detailed knowledge and good judgement relating to both the application of radioisotopes in specific scientific fields and the production of these materials within the Project for they will have the responsibility of balancing supply and demand. They should also recommend expansions and changes in the supply program, the addition of new facilities, new piles, etc., to the Project authorities. As the representatives of the producing body, they must have the final power to accept, table or reject any request. The other two groups (specified in 2.1 and 2.2 above) exist primarily to aid and protect this board in its efforts to balance supply and demand.

By and large, men of the type needed are now to be found only within the Project, and it is fairly obvious that they should be chosen from the personnel at Clinton Laboratories, the major production site at present and in the immediate future. The present Radioisotope Committee at Clinton Laboratories, and its associates*, is composed of men who know, from experience, the facts relating to general scientific use and application of radioisotopes in all fields, modern instrumentation, radiochemical techniques, and health protection; they know the details of production, since they are in charge of it at Clinton Laboratories and (see Part I: 4 and 5) can represent Hanford. Since they effectively represent all the above fields of research, they can evaluate the overall need of any applicant within those fields in terms of availability.

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*J.R. Coe, C.D. Coryell, A.H. Snell, M.C. Leverett, L.W. Nordheim, W.E. Cohn.

Other matters which the producing laboratory must settle relate to timing, physical and chemical state, and such; some direct negotiation may enter into the filling of the initial request from any applicant. It must also be the final authority on what materials can be exposed in the pile.

3. Functioning of the Organization

Requests on a standard form will be received by the Executive Secretary. He will act upon these, if all the necessary information is supplied and all qualifications seem filled, by forwarding a copy of this application, with comments, to the Allocation Board. The Allocation Board will either accept the request at this time or ask the Secretary to secure specific advice, recommendations, evaluations, etc. for it from a member or members of the proper subcommittee of the Advisory Panel and/or the applicant. When the request is accepted, tabled or rejected, the Secretary will be notified. The Allocation Board may correspond with the applicant, relative to timing and other pertinent information, either directly or through the Secretary.

APPENDIX

RECOMMENDATIONS ON POLICY

1. Cost of Radioisotopes

Radioisotopes should be distributed free of charge (except perhaps for the cost of shipping) except insofar as use by industries for non-publishable work is permitted, for the following reasons.

(a) A reasonable cost accounting is impossible at this time and will not be possible until a stabilized system is set up in the future with regard to supply, demand and use.

(b) Any radioisotopes distributed from the Project as now constituted are produced by public funds and are part of a program dedicated to the public welfare.

(c) Radioisotopes are of primary interest and value to research scientists who operate for the public welfare and who should be supported wherever possible by public funds.

(d) The support and encouragement given to science by the free distribution of radioisotopes will be a step in the direction of recompensing fundamental science for the drain put upon it by the Project during the war.

2. Distribution Should Be to Qualified Applicants Only

A qualified applicant is one who can satisfy reasonable and intelligent requirements as to his ability to use radioisotopes effectively and safely. It should be mandatory that he demonstrate the existence of adequate health protection and monitoring devices and/or assistance as well as his ability to accomplish safely any processing or handling involved. It should be demonstrated, in addition, that the applicant understands how to use the material requested in the solution of the problems at hand. Use by any other than the original applicant should be forbidden, unless permission is granted in writing by the Allocation Committee.

3. Distribution Should Be Made Through Recognized Institutions Only

The legal responsibility for the safe use and disposal of radioactive material from the Project must be placed upon the user and hence upon the institution with which he is connected. For this reason, as well as technical simplification of shipping problems, applications should be sent by the individual applicant through his institution and shipment should be made from the Project to the institution for the individual. In this way, the transaction is between a responsible institution and the Project, said institution having the responsibility for safe usage and disposal.

4. Full Publicity on Policy, Distribution and Use Should Be Given

Besides publication of policy, it is recommended that periodic publication of all shipments of radioisotopes be made as a demonstration of fairness. It is further recommended that the Project receive reports of the results of radioisotope work which it has supported, either directly or as reprints of published articles.

5. A Broad Interpretation of Distribution Is Necessary

For maximum effectiveness in promoting research, a radioisotope distribution program must include the distribution of related information relative to radiochemical techniques, methods of preparation, properties, instrumentation, health protective measures, etc., by direct consultation, by written report or recommendation and by exchange and/or training of scientific personnel.

6. Factors in the Assessment of Priorities

a. Value of the problem

b. Uniqueness of solution by radioisotope use and by the isotope requested.

c. Possible other sources of supply.

d. The obligation to honor continuing orders - that is, repeated shipments of relatively short-lived material to permit prosecution of an extended research problem.

e. A certain minimum amount should be declared available upon request without priority for uses classed under Teaching.

f. No qualified application should receive a zero priority. The minimum response should not be less than that amount specified as available upon request for teaching purposes.

7. Continuity of Policy Should Be Sought by Consultation with Those in a Position to Indicate Future Policy