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MANHATTAN DISTRICT
File No. Man. 600.1 (R- Monsanto)

Dear Paul:

During recent weeks many of us have been attempting to set down in writing those things which we believe should be called to the attention of the Atomic Energy Commission and I know that many such memoranda have already reached you. Many of these concern themselves with questions of administration, super-secrecy and other characteristics of the Project which it is necessary to change. Since all of us seem to be in complete agreement on these matters, there is little reason for me to discuss them once more. Rather, I would like to devote my attention to a subject which (to my mind) has not received much attention, namely, what should the Commission try to do with the Manhattan Project in accordance with its directive - and what is its directive?

It is the purpose of this letter to demonstrate, in not too exhaustive a fashion, that the policies expressed in the Atomic Energy Act, which furnish the directives of the Atomic Energy Commission, and the best interests of science and technology will be served by a program of active sponsorship of the production, distribution and use of isotopes, that nearly all the present or planned objectives of Clinton Laboratories are in harmony with such a major program within the Project and are actually parts of it, that the rewards of such a program are potentially the most far-reaching, the most immediate and the most fundamental and that they will be obtained in nearly every field of pure or applied science.

Directives of the A.E.C.

The Commission is appointed under the Atomic Energy Act of 1946 and derives its authority and charter from that Act. The following is quoted from Section 1 of the Act (the underlining is mine, and the phrases dealing with defense and security are omitted): "It is hereby declared to be the policy of the people of the United States that . . . .the development and utilization of atomic energy shall . . . . be directed toward improving the public welfare, increasing the standard of living, strenghening free competition in private enterprise and promoting world peace." (It should be noted that the first two of these four objectives imply scientific and technical developments; it is these upon which attention will be focussed.

The second two depend upon the policy with which the technical results are handled). "It is the purpose of this Act to effect the policies set out (above) by providing for the following major programs relating to atomic energy:

1) A program of assisting and fostering private research and development to encourage maximum scientific progress . . .

3) A program of federally conducted research and development to assure the government of adequate scientific and technical accomplishment.

4) A program for government control of the production, ownership, and use of fissionable material to assure the common defense and security and to insure the broadest possible exploitation of the field."

(Note that only item 3 can be interpreted as encouraging research and development at Project rather than off-Project locations; the other two make no differentiation between Project and non-Project laboratories).

Properties

To effect these, the Commission is in possession of two large isotope separations plants, a large production pile, and research laboratories with or without experimental piles, and cyclotrons, one of which is additionally equipped to assemble bombs and perform other such specialized experiments. It can be assumed that the production plants, in conjunction with Los Alamos, will adequately maintain the "common defense and security" aspects of the bill. However, the Act recognizes, as do we, that there is much for the benefit of "the public welfare" and "the standard of living" which can be derived as by-products of these factories as well as from the research institutes such as Clinton Laboratories or by reasonable extensions of these differing activities.

In sum, then, the Commission has these facilities in operation and certain sums of money with which to prosecute major programs relating to atomic energy and to develop and utilize atomic energy to improve the public welfare and increase the standard of living (consistent with the requirements of the common defense and security). What can it do to effect these?

Interpretation of Directives

Before answering this question we must first get a working definition of what is meant by "improving the public welfare" and

"increasing the standard of living". Then we may look at the attributes and peculiarities of atomic energy to see which of them may fit our definition and, hence, will lend themselves to programs which will "insure the broadest possible exploitation of the field" as defined. I submit that for the two phrases in question we may use the more familiar terms "research" and "development". It is no trick of logic to demonstrate that the public welfare is improved by increasing man's knowledge of his environment (i.e., of nature) and that the concepts derived from such new knowledge are what eventually yield the new processes and products which increase the standard of living. This definition implies, as does the Act itself, that the fruits of research and development "relating to atomic energy" may be realized in fields of human endeavor far removed from that of nuclear physics. This is what I believe is meant by "the broadest possible exploitation of the field".

The program of "assisting and fostering private research and development to encourage maximum scientific progress" implies, in addition, the essential oneness of science, the fact that basic scientific discoveries arise in all places where research is active, that there is no essential difference in significance or importance between Project and non-Project laboratories, aside from the degree of support given them (and probably the ability to work with fissionable material). Thus, all fields and all places in which there is research relating to, utilizing or developing atomic energy are commended to the attention of the Commission.

Attributes of Atomic Energy Which May Be Exploited

We may now consider the characteristics of atomic energy which may be exploited, utilized or developed in research and development programs of the country. It is safe to assume that the heart of the matter is the chain reaction, for this is the common denominator of bombs and piles, which are what is really meant by "atomic energy". Bombs may be classed under the "common defense and security" provisions. Considering only the peacetime benefits or applications of atomic energy, one must concern himself with the manifestations of piles. These are three in number: power, radiations and isotopes. Regardless of whether one is chiefly interested in the advance of theoretical knowledge or in the invention of new products or new processes of industrial significance, one has only these three attributes of piles with which to work. Our present objectives of high flux piles or of power piles, and so on, are only preliminary steps to getting more or better power, radiations and radioisotopes for subsequent use in one fashion or another.

9 These manifestations include also the produce of the isotope separation plants which, by virtue of their existence and potentialities, are contributory to "atomic energy" and are, therefore, both administratively and philosophically a part of the Project. Because of the fact that the same basic nuclear properties are involved, and because of their importance in solving nuclear problems, such instruments as the cyclotron, betatron, etc., are to be considered as part of the "atomic energy" armamentarium, with two of the same manifestations (radiations, isotopes).

I interpret the Commission's charter, then, apart from the manufacture of fissionable materials for military purposes, to assist, foster and insure in all laboratories including its own, the maximum scientific and technical progress in all fields of pure and applied science which can be derived from the study and use of nuclear power, nuclear power, nuclear radiations and the isotopic species producible by piles, isotope separators and related instruments.

Importance of Isotopes

If this be acceptable as a working definition of the Commission's directive, I should like to state and discuss my opinion that this purpose will best be served by a program of actively sponsoring the production, distribution and use of isotopes. That such is not only permitted but encouraged and directed by the Atomic Energy Act is indicated in the following quotations:

> Section 3(a) -----The Commission is directed to exercise its powers in such manner as to insure the continued conduct of research and development activities in the fields specified below by private or public institutions or persons and to assist in the acquisition of an ever-expanding fund of theoretical and practical knowledge in such fields. To this end the Commission is authorized and directed to make arrangements (including contracts, agreements and loans) for the conduct of research and development activities relating to
>
> (1) nuclear processes;
> (3) utilization of ------radioactive materials for medical, biological, health ------purposes;
> (4) utilization of -------radioactive materials and processes entailed in the production of such materials for all other purposes, including industrial uses;
>
> Section 4(d) -----For the purpose of increasing the supply of radioactive materials, the commission ------ (is) authorized to expose materials of any kind to the radiation incident to the processes of producing or utilizing fissionable material.

Such a program is in harmony with the present objectives of Clinton Laboratories and of the Project as a whole (indeed, one can demonstrate that vigorous pursuit of radioisotope distribution adds to, rather than detracts from, present programs) but more important is the demonstrable fact that significant and far-reaching results from it may be expected in every field of pure and applied science, not just in nuclear sciences. Nor should the politically-important fact be overlooked that results from isotope usage will be the first to come from the exploitation of atomic energy; the groundwork of experience, instrumentation and problems has been laid during the past ten years. In the immediacy of results from their use, in the wide range of scientific fields where they are applicable, in the variety of fundamental and practical discoveries which will be made with them, and in the number of investigators whose work they will aid, isotopes - particularly the radioactive varieties - far outrank in importance nuclear radiations and nuclear power.

On several previous occasions I have set forth the reasons for the importance of isotopes (radioactive and separated stable) and have listed specific uses to which they have been or may be put. Suffice it to say here that isotopes, used tracer-wise or as analytical aids, are a tool of research the significance of which has been compared (by eminent, responsible and informed scientists) with that of the microscope. Isotopes are also, because of their pecular nuclear properties, objects of study whose importance is best assessed by recalling that the chain of discovery, from radioactivity itself by Bequerel to fission by Hahn and including the elucidation of atomic and nuclear structure, is woven about the study of radioactivity. The fact that radioisotopes are sources of radiation for physical and biological studies and applications may be added to complete the triumvirate of characteristics which distinguish these materials: tracers and analytical aids, sources of radiation and a means of studying subatomic phenomena. Because of this variety of intrinsic properites, rendering isotopes of the greatest importance in both physical and biological sciences and immediately applicable to studies both fundamental and applied, it is this manifestation of atomic energy the exploitation of which is most likely to yield the greatest advance of science and technology, the greatest benefits to mankind, the benefits hopefully hinted at in the Atomic energy Act, the benefits which the Atomic Energy Commission is directed to seek.

History, Status and Description of Present Isotope Distribution Scheme

This development - the production and distribution of isotopes - was of such obvious first-rank importance that even the Manhattan District, which has no charter to exploit atomic energy in the interest of science, technology and mankind, was forced to act. The die was cast by the Secretary of War in November of 1945; by January of this year Clinton Laboratories had prepared a plan; in February the District set up the Isotopes Branch in the Research Division in Oak Ridge; in about May, Monsanto agreed to undertake the production required; in June the first public commitment was made with the publishing of the catalogue and the method of procurement; and in August the first shipment was made. Since then, radioisotope shipments have been going out at an ever-increasing rate (some 200 shipments in the first four months).

It might seem, then, that the need has been met and that the present system, plus those improvements gained with experience, is all that is required. I do not take this view. It is obvious why the District, lacking directives and interest in long-range or fundamental problems, should move only far enough and fast enough to meet the minimum requirements; it is similarly obvious why Monsanto, with no responsibilities to science in general and no charter to outspeed the District, should do likewase. The result is that only a minimum response to the need has been made; there is much to be done before we can claim that we have even initiated the kind of active sponsorship of radioisotope production, distribution and use which I believe we should have. What do the present shipments amount to relative to the actual needs of the country (or of the world)? Probably not over a fraction of a percent.

Deficiences in Present System

One method of rounding up the many things which should be done is to review briefly certain characteristics of the present system. At present, only radioactive isotopes are being distributed. These are being made by utilizing a small fraction of the facilities of the Clinton pile together with some of its excess power and a couple of laboratories, together with about six members of the scientific staff. It is required that there be no interference with other research and development work; this requirement is jealously guarded by the staff. Under great difficulties (of a non-technical nature) some use may be made of the Hanford piles which will permit the production of radioisotopes not now available in the requisite quality (see below). The distribution office (Isotopes Branch) is in the District, not at Clinton Laboratories, and it can speak to the technical personnel at the laboratory only through Army intermediaries. A price policy has been adopted which demands that isotopes be sold at "the cost of production"; this policy was adopted in order not to prejudice the ability of private enterprise to go into the business for profit at a later date, to free the Army of any chance of difficulty with the Congress or the Director of the Budget on grounds of giving away government property, and not to prejudice the Commission's freedom of action. Monsanto is afraid that the Army auditors will detect a loss in its administration of the isotope program, while the Army has the same fear of the General Accounting Office; as a result, prices and the production system are perpetually snarled up in red tape and auditors, with more time and money being wasted in being certain that no penny is unaccounted for than the entire produce being distributed will gross. The result is prices which severely restrict isotope usage. No affirmative authority in either Monsanto or the Army has been set up at Oak Ridge; this side of St. Louis or Washington one can get only negative answers, which rather impedes the development of the program. Many available and desired isotopes are needlessly and foolishly classified. Contractual red tape has prohibited so far any utilization of the isotope separators or of other machines (e.g., cyclotrons) in the production system. Nothing is being done in the way of spreading information on protection techniques and devices, instrument developments and other essential parts of radioisotope usage, chiefly because of security policies and staff disinterest.

The immediate insufficiencies of the present program become apparant when one lists the individual isotopes which are known against those which are available and considers also the quantity and quality (specific activity) of each in the various ways in which it can be made. Such a listing is in preparation. What the pile produces it usually makes in large quantities, but many important radioisotopes are either not producible in present piles at all or are produced in too poor a specific activity for widespread use.

Recommendation for Immediate Action

The things which should be done may be considered in two groups: those which can be done immediately and those which require time. Certainly the first thing to be hoped for is an enlightened and aggressive policy of

supplying isotopes on the widest possible scale. This is discussed in the Atomic Energy Act as follows:

> Section 5(c)2: -----The Commission is authorized to distribute, with or without charge, by-product materials (defined as "any radioactive, (non-fissionable) material yielded in or made radioactive by exposure to the radiation incident to the processes of producing or utilizing fissionable material") to applicants seeking such materials for research or development activity, medical therapy, industrial uses or such other useful applications as may be developed -----(and) shall give preference -----(to those) proposing to use such materials in the conduct of research and development activity or medical therapy. -----

A vigorous policy, which would imply support of research on a more fundamental basis than now, would make it possible to remove the price barriers and to utilize those facilities not now being exploited. Among the latter are the isotope separators, the use of which would improve significantly the quality of many radioisotopes, and the Hanford piles, now all but inaccessible by virtue of red tape. Cyclotron irradiations on a routine basis should be procured, utilizing Project facilities for chemical processing and distribution, to expand the list of available isotopes. The restrictions on producing and distributing H^2, H^3 and other currently "classified" materials should be lifted. Facilities and manpower, commensurate with the importance of this program, should be committed and the Isotopes Branch (the only survivor, it is hoped, of a needless hierarchy) integrated with the technical staff. Programs aimed at supplying radioisotopes in the many and devious forms in which they are needed should be initiated; the most obvious of these is a C^{14} synthetic program. An active consulting and to whatever extent it is feasible - supply service involving instrument and protective devices should be started and consultation by staff members should be freely given for the benefit of both parties, both here and elsewhere. This can be worked out in conjunction with such existing groups as [redacted] the Radiological Society, [redacted] the Radiobiology Section of the Research Grants Division of the National Institute of Health, and the Clinton Laboratories Training School. The embryonic standards program is an additional essential which should be pushed.

Recommendations for Longer-Range Action

There are many long-range expansions which should be planned and executed. A production cyclotron or cyclotrons, instead of the use of existing instruments, would free outside cyclotrons for research and at the same time permit a modicum of cyclotron research here. A betatron may be needed. A high-flux pile (such as that contemplated now) is needed to enhance the specific activity of pile-produced radioisotopes. Our supply and demand should be integrated with Canada as soon as possible and on an ever-expanding world-wide scale as fast as conditions permit. In order to make it possible for non-Project groups to work with the shorter-lived radioisotopes, facilities for such groups should be provided here. Finally, in order to develop leadership in the field, we should carry on a degree of radioisotope research here sufficient to stimulate an appropriate level of instrument, standards, health-physics, "hot" technique and organic synthetic development work; without direct relationship

to tracer and other isotope work these programs will not yield the leadership which should be given.

Conclusion

In other words, I advocate going into the isotope supply business to the fullest extent on the grounds that effort applied in this direction will, like a catalyst, give the greatest yield per unit effort expended. I believe that such a program will not only aid science in general but will aid research at this location; were this not the case, I should still advocate the program, for even in its present limping state it is stimulating research on a broader and wider scale than any which can be done solely within the Project.

Waldo E. Cohn

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