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For The Atomic Energy Commission
Robert L. Jackson for the
Chief, Declassification Branch

TO: Dr. Richard C. Tolman
FROM: E. Fermi

I believe that it is the common opinion of the great majority of the men who have been connected with the uranium projects that the interest of the nation would be poorly served unless steps be taken to continue in the post war period the supremacy in the field that, we believe, has been acquired by this country during the war.

Both reasons of military security and of industrial supremacy point in this direction. It is of course impossible to map out with any degree of detail or completeness what the development of nucleonics in, say, the next ten years is likely to be. One might attempt, however, to put down a few points that are probably going to be of importance. They are the following:

a) High Explosives. Although the chances that militarily useful high atomic explosives may be developed during the present war are good, it is not likely that the art may be brought to a high degree of perfection. We know of certain quite definite possibilities, for example the superbomb, that we do not attempt to develop at the present time because they are unlikely to affect the course of the present war. Still we know enough about them to feel reasonably confident that they will improve the explosive power by a large factor. Furthermore the present planning is greatly influenced by limitations in the production of useful elements and isotopes. If the availability of such materials were greater, methods of assembly that are now considered only as second choices, e.g. the autocatalytic methods, could come in the foreground.

b) Power Production. This is one of the most obvious possibilities both for war and peace-time uses. The availability of the primary materials does not make it appear very probable that atomic power may have in the near future a good chance of competing favorably with ordinary fuels or with hydro-electric power. In spite of this an extensive field for the use of atomic power may be found in a large number of applications where the small weight of the fuel is of primary importance. The propulsion of submarines and the possibility to install power plants for the development of territories of difficult access are typical military and peace-time applications.

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Power production may be considered both by large units of the general size of the Hanford piles or by small units in which 49 may be used or in any intermediate scale.

One should bear in mind also the possibility of using the power produced in the manufacture of 49 or of radioelements as a by-product that may serve to lower the cost of the 49 production. A simple and attractive application from this point of view may be to use the waste power for the heating of cities since in this case also low temperature power could be employed.

c) Use of Radiations. I believe that this particular field will prove of an extent that at present can only be guessed. Uses of radioactive substances as indicators will be invaluable in biology, chemistry and in numberless branches of industry for analyzing, checking and controlling various processes during the course of their development.

The radiations will be used in medicine probably by taking advantage of the variety of chemical properties of the active elements. Also the action of radiations in producing quickly mutations may prove valuable.

The experiments on graphite exposed to intensive radiations has indicated profound changes in the mechanical and thermal properties of this material induced by the neutron bombardment. This may be the beginning of a new technique of treating materials.

d) Development of piles. The development of piles will probably prove an essential step in the opening up of these various fields. At present it is evident that the pile technique is only in its infancy. New types of moderators and new cooling agents must be tested in all their various combinations. The problem of developing piles capable of fully utilizing the abundant fissionable substances, uranium 238 and thorium, is one of the fundamental problems for which we have the theoretical principle of a possible solution, namely the all-metal pile.

It is my conviction that at present we can only see the beginning of what will prove to be a much larger development than our imagination is capable to grasp now. I believe also that both the military and non-military possibilities are such that it is very essential for our country to keep steadily in the foreground of the development. I am skeptical of the chances of keeping ahead of the competition from abroad by a type of secrecy which is practicable and justifiable only in time of war and which in peacetime would lead to a loss of interest in the development on the part of a large number of scientists and consequently would achieve exactly the opposite end.

The wisest procedure seems to me to be that of opening the field as soon as possible to the free investigation by universities, industries, laboratories and private and public institutions. Experience has shown a number of times that this is the best way of furthering a technical and scientific development and to make sure

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that no important aspect of it is left unexplored.

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