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PER DOC REVIEW JAN 1995

TO: Major General L. R. Groves
FROM: E. Fermi and R. F. Bacher
SUBJECT: One Kilowatt Water Boiler

1. Construction. It is estimated that the construction can be accomplished in three months with two experienced physicists and three assistants; Fermi would expect to spend about 100 hours on the planning and designing of the machine.

The construction will require building a large concrete shield (about 3,000 cu. ft.). Shop work is estimated to require an average of two machinists during the period of construction and the time of an experienced welder for two weeks.

The bulk of the materials (lead, graphite and beryllium oxide) is already on hand.

The construction involves fabrication of a new stainless steel sphere with cooling installations, piping and pumps for removing the decomposition gases and for handling the solution.

2. Operation. The same technical staff could operate the machine and take care of service irradiations for the remainder of the project. It is estimated that Fermi would devote about one fifth of his time to this work.

3. Decontamination. It is estimated that the material can be decontaminated in four weeks. In order to accomplish this the following preparations should be made: Build a shed 10'x15' for housing the equipment; procure a stainless steel reservoir shielded with lead, a stainless steel separating column 4" in diameter and 8' long for the ether extraction, and a small stainless steel pump for handling the solution.

The decontamination could be carried out by four men.

4. Use. The machine would provide a neutron source of strength intermediate between the Argonne graphite pile and the P-9 pile. Such a source would greatly expand the possibilities for obtaining nuclear information and would also save considerable time on experiments that are now performed with weaker sources.

cc: J. R. Oppenheimer

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I. Problems

1. There is an undesirable conflict in building Omega between the water boiler and critical assembly groups.
2. This will be emphasized by
 - a) Desired expansion of the activities of the critical assembly work;
 - b) Future probable increase of water boiler activities when the cyclotron is removed from the project; and
 - c) Requirements for space of any group concerned with power reactor research.
3. There is an additional undesirable organizational conflict arising from the fact that critical assembly and power reactor work are very similar.

However, the M Division feels strongly that their responsibility means that critical assemblies must be done by them and I feel equally strongly that the power reactor should be a Physics Division function.

II. Solutions - Space

1. Abandon water boiler, turning over Omega to critical assemblies and power reactor.

I believe this is unsound as a policy either on interim or permanent basis. It results in loss of a very powerful research tool - the strongest neutron source continuously available.

2. Move water boiler.

This is practically equivalent to (1) for the interim period since it will result in a 3-6 month loss of the boiler. It will also require personnel and considerable construction of shielding even if a building is available. The shielding is a precision pouring job.

3. Move critical assembly, freeing Omega for water boiler.

This would require building construction, the main item of which would be about 2000 sq. ft. of concrete slab. Such space would be adequate for both critical assemblies and power reactor. It appears that the construction involved would be less than that involved in (2). It is not an immediate solution any more than (2), but this construction time would probably not interfere with the reactor program if accomplished in a reasonable time (2-3 months?). It is the only solution consistent with the policy of maintaining present research facilities, carrying out necessary weaponeering, and investigating power reactor problems.

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III. Solutions - Organizational

1. The water boiler group can be a well functioning group only if the space problem is solved. At present this group has to leave Omega when critical assemblies are done. It is definitely not feasible to have such a group on a part-time basis with part-time idleness. It is equally unfeasible to have such personnel assigned to part-time work in any other group.
2. Single "critical assembly" group.

Since the present critical assembly function and the contemplated power reactor work are both "critical assemblies" in a complete sense, one group should have both responsibilities. As pointed out above, utilization of combined space is practical. The main portion of the activities of such a group would be in power problems and should therefore be under the jurisdiction of the Physics Division.

3. Have a power reactor group in physics, critical assembly group in M.

This would be inefficient in personnel, and would introduce further space complications.

IV. Auxiliary Considerations.

It is highly desirable to have a power reactor program.

- a) It is the only program which can justify the laboratory to everyone in peace-time.
- b) This laboratory is well suited to carry out such work.
- c) The importance of the work carries the obligation to start such a program without delay.
- d) It serves to integrate the work of the Physics Division.
- e) It is a condition that Morrison and Placzek remain.

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