11-13-59

EBR-I

The objectives of building EBR-I included, first, the investigation of the feasibility of breeding in a fast reactor by actual demonstration and, second, to gain experience in the design and use of a liquid metal reactor coolant system.

Operation with two highly enriched uranium core loadings established that a breeding ratio of at least one had in fact been accomplished, and additional measurements indicated that values as high as 1.2 to 1.3 could be expected in a larger reactor of modified design.

During operation with the second fuel loading, instability at power to coolant ratios above normal became apparent. In the investigation of this effect, the core was damaged, and the experiments were terminated. It became clear then that objective number three must be the further understanding of fast reactor kinetics with specific emphasis upon explaining the EBR-I instability.

A third core (Mark III) was thus designed which had the ability of resisting motion of its components by being made very rigid. Coolant flow could also be in either series or parallel through the inner blanket and core.

Experiments with this arrangement have indeed proven that a fast reactor does not exhibit any inherent kinetic characteristics which would produce instabilities at levels which are many times design full power.

The completion of this investigation must rest upon the demonstration that reactor characteristics may be varied at will. Among these is the prompt positive power coefficient. By removing support from the center of the fuel elements, it is expected that a prompt positive coefficient will be seen. This

would aid in the explanation of the second loading instability. Experiments of this type are currently being accomplished.

Following the completion of the kinetic studies, operation of the Mark III core will be for the irradiation of various fuel samples which will be placed in the reactor. It is expected that this operation would be completed by July, 1960.

A full plutonium core (Mark IV) is being designed for installation into the reactor following the Mark III core. Fuel elements will contain one percent aluminum plutonium alloy. This high enrichment is necessary because of the small size of the reactor.

Operation of this core should result in information by comparison with previous ones. However, since the material will not be that which is proposed for larger future reactors, this test will mean little in evaluating new materials.

It is expected, as is usually the case, that actual operation will point out new problems and thus might be worthwhile on that basis. The decision to operate with a plutonium core has been made largely through the urging and interest of the AEC.

Completion of the Mark IV operation is expected to be by July, 1961. Following this, the reactor could be used to irradiate carbides or oxides of uranium or plutonium in the form of full core loadings. Since the reactor is small, it would probably have to be loaded with fuel in the blanket

section, thus thinning the blanket and increasing the power which would be produced in the outer air cooled blanket. Cooling of this would be a problem unless it were completely redesigned or replaced with one of non-fissionable heavy metal.

Operation with loadings such as this would continue to July, 1964. By this time other larger fast breeder reactors such as EBR-II should be available for such tests. If this is the case, discontinuation of operation of this reactor at that time would be in order.

EBR-I

STAFF MANPOWER REQUIREMENTS

FY 1960	1961	1962	1963	1964	1965
3	4	5	5	4	0

MAJOR ITEM COSTS

FY 1960 $100,000

Facility modification for Pu loading
- New fuel subassemblies
- Additional instrumentation
- Vault modification (ventilation)
- Cave modification (new manipulators, revised ventilation)
- Possible hood over reactor
- Cost of fuel not included

FY 1961 $50,000

Reactor parts for ceramic loading

FY 1962 $150,000

Modify reactor outer blanket
Fuel elements

FY 1963 $50,000

Fuel elements

FY 1964 $25,000

Fuel elements