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WE DID NOT ALMOST LOSE DETROIT

A Critique of the John Fuller Book: "We Almost Lost Detroit"

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(A Critique of <u>We Almost Lost Detroit</u> by John Fuller)

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INTRODUCTION

The Book, We Almost Lost Detroit, by John Fuller has been reviewed by those who participated in the Fermi project. The book treats many of the often discussed legitimate issues of the nuclear power controversy from the point of view of the nuclear critic using the Fermi 1 fast breeder fuel melting incident as a vehicle for such a discussion. The unique aspect of the work is that considerable detail is provided of both a technical and documentary nature tending to add credibility to the views of the author as perceived by the average lay reader. In some quarters the work is being cited as some sort of technical authority. Herein lies the major danger of the book because the treatment of much of the source information is distorted such that the average reader without technical background could easily be misled to agree with the anti-nuclear stance of the author. For this reason, this rebuttal has been prepared to help correct some of the inaccurate impressions that may be conveyed to the average reader.

CRITIQUE OF TECHNIQUE

We Almost Lost Detroit is an interesting combination of historical fact, colorful adjectives, a few mistakes, and extremely carefully chosen excerpts cleverly combined to lead the reader inexorably to the conclusion that nuclear power is too dangerous to be handled by fallible man, and that the government knows this, but is unwilling to admit it.

One very effective device used to draw the readers to such a conclusion is to state a technical fact, but out of context, omitting the precise situation to which it applies and any qualifying remarks, and then to expand the significance of the fact through a carefully controlled scenario. Erroneous impressions are also given through the use of "leading" statements and terms that cannot be explicitly labeled as false, but in the context in which they are rendered leaves the reader little place to go but to the predetermined anti-nuclear conclusions. A mood of impending disaster is created by the simple use of well chosen modifiers and phrases sprinkled throughout the book.

This assessment is derived chiefly from a review of the portions of the book that deal with the Fermi 1 fast breeder reactor project and with the various reactor safety studies sponsored by the Atomic Energy Commission. It is in these areas that there is considerable local experience and/or documentation to draw upon. For this reason the major portion of the rebuttal discussion that follows will deal with these two subject areas.

THREE MAJOR THEMES

It is felt that a direct rebuttal to specific passages including callouts to appropriate references is the most fair and the most effective way to attempt to correct the misleading impressions that are conveyed. However, some background information is first given to help counter three of the major themes or impressions conveyed throughout the book. These impressions may be stated as follows:

- We almost lost Detroit as a result of the Fermi 1 fuel melting incident of October 5, 1966.
- Any mistake in nuclear power plant design, construction, or operation will most likely lead to disaster.
- The government performed a reactor safety study hoping to show that the risk to the public is low, but when the risk turned out to be high, they suppressed the study.

We Did Not Almost Lose Detroit

Fuller cites the results of a University of Michigan study[1] contracted for by the designers of Fermi 1, that shows the rather severe public consequences that would result from an assumed release of fission products from Fermi 1, as some sort of measure of the public threat that existed as a result of the Fermi 1 fuel melting incident. However, the significance of the Fermi 1 fuel melting incident with regard to public safety is best understood by comparing the extent of the actual accident both with the hypothetical accident that was used by the designers as the basis for containment design, and with the assumptions used in the University of Michigan study.

The Fermi 1 containment system was designed to accommodate the effects of an energy release that would result from a secondary criticality accident involving an assumed collapse of half of the total reactor core into the other half.[2] The October 5 melting incident caused by coolant blockage of two of the 103 fuel subassemblies that comprised the core resulted in the melting of about half of the fuel in the two affected subassemblies, or only about 1% of the fuel in the core.[3] Thus, the event was well within the safety envelope used as the design basis for the containment.

Now, note that the severe public consequences calculated in the University of Michigan study assumed all of the fission products normally contained in over 4,000 pounds of highly burned up reactor fuel were arbitrarily released to the atmosphere as if the reactor vessel, primary shield tank, and containment building did not even exist (see also comments on page 20). Compare these conditions to the actual fuel melting incident that involved some 40 pounds of low fission product content fuel* that melted and slumped several inches within the affected subassemblies with all containment barriers remaining intact and producing no radiation excesses to anybody.

Nevertheless, this real accident was significant. There was uncertainty in the degree of melting and core geometry dictating a cautious approach to preclude additional damage to the plant and to permit an accurate diagnosis of the cause of the accident. Future designs should and will be improved to minimize the probability of a similar occurrence and further reduce the public risk should it occur. But the difference between what actually happened on October 5, 1966, at the Fermi 1 plant and what was arbitrarily assumed in the University of Michigan study is enormous!

Any Mistake Will Not Produce Disaster

Fuller uses the Fermi 1 project and related fuel melting incident as well as several other reactor accidents as vehicles to convey the theme that any mistake in reactor design or operation will most likely lead to disaster. This contention is contradicted by Fuller himself by spending

*The actual Fermi 1 fission product activity on October 5, 1966 was several thousand times lower than the activity assumed in the University of Michigan study.

considerable time describing various Fermi 1 defects and by alluding to numerous "abnormal occurrences" among nuclear power plants (p. 229, Fuller). While most such occurrences are trivial, they are documented, they do result from some kind of mistake, and yet there has been no resulting public radiation injury, much less a disaster.

This should be no surprise. While great care is exercised in the design, construction, and operation of nuclear power plants, infallibility is recognized to be impossible and is not required. Thus, enormous safety margins are built into a nuclear plant.

A simple example - there must be an off-site supply of electricity to assure operation of important reactor systems. It is recognized that this source could be lost so a second off-site electrical source is provided, which is physically located a prescribed minimum distance from the first to reduce the chance that a single event would render both sources useless. Nevertheless, this event is deemed credible, and an on-site diesel generator is provided as backup, which is designed to provide the required electric power even in the middle of an earthquake at least as severe as any ever recorded in the area. Finally, it is recognized that there is a finite chance that such a diesel generator may be inoperable when required, so an independent second diesel generator is provided also designed for earthquake operation. This is but a single example of a myriad of design and operational features to provide a principle of defense in depth that can accommodate rather significant "mistakes," should they occur, without public harm. This philosophy of design and operation is set forth in some detail in the Code of Federal Regulations[4] and is further delineated by a series of Regulatory Guides that provide descriptions of acceptable procedures for carrying out the intent of the federal regulations.

Application of this defense in depth philosophy to individual nuclear power plants is achieved through regulatory procedures expedited by the federal government's Nuclear Regulatory Commission (NRC). First of all, an extensive licensing procedure is applied to every proposed plant. A preliminary environmental report and safety report is required before a construction permit is issued. While termed preliminary, these multi-volume documents provide a detailed description of the ability of the plant to conform to federal safety and environmental specifications.

Only after a significant session of additional questions and answers, public hearings, and a review by the Advisory Committee on Reactor Safeguards, a construction permit is issued. This procedure takes about two years. A similar procedure is again applied to obtain an operating permit with the reports containing more finalized data. Because of the attention to detail and the extensive review given to licensing reports, a single copy of all such licensing documents and associated correspondence for a single plant would produce a stack of paper 12 feet high.

Enforcement is accomplished by a program of auditing, inspection, and reporting. For example, there is a regulatory guide that summarizes reporting requirements for persons subject to NRC regulations; 110 different reports are listed.[5] A quality assurance program used in design and construction by the power plant owners, as well as the reactor vendor, and a program for plant operation is described in some detail in the safety analysis report.[6] These programs must satisfy the NRC. Inspections are made by safety personnel administratively independent of the operation they are inspecting and by the NRC. During the construction phase the NRC inspects a reactor some 25 to 30 times followed by 10 to 12 inspections during testing and about four per year during operation.[7] NRC inspections are both of the announced and unannounced variety with items of non-compliance, their significance, and description of corrective actions becoming a matter of public record.

Finally, neither safety criteria nor design is stagnant. From the very beginning of the nuclear program there has been an on-going program of research and development in nuclear safety. Such work is currently sponsored chiefly by the Energy Research and Development Administration (ERDA) and the NRC of the federal government, by the electric utility companies, and by many of the vendors associated with the supply of nuclear components. The scope of their work includes not only items related to potential nuclear power plant accidents, but to all major segments of the nuclear industry that have any potential for public risk. The goals of such programs are to more accurately assess the safety margins now existing and to reduce public risk where appropriate through improved design and construction.

Federal Government Believes Reactors to be Safe and Does Inform Public

Fuller devotes almost three chapters to a description of the attempts of the AEC to update an earlier reactor safety study normally labeled WASH-740.[8] The thrust of Fuller's story in these chapters is that the AEC hoped that the additional safeguards provided on the newer reactors would lead to reduced calculated consequences of accidents, were terribly surprised and disappointed when the results turned out worse than the earlier study, and therefore, suppressed the new report. While there are some elements of fact provided in the Fuller presentation in these chapters, the conclusions drawn as to the significance of the various reactor safety studies with regard to public risk are grossly misleading. Specific passages from the book in this subject area are rebutted in some detail in the following section. However, due to the complexity of the issue, it is felt instructive to provide a short overview and history of the safety studies in question. Direct quotes from the safety reports in question are utilized where practical to help give an accurate portrayal of their content.

WASH-740 Does Not Provide Accident Probabilities:

The earliest study reported was a safety study performed by Brookhaven National Laboratory for the AEC. The results were published in March 1957 in a formal report titled, "Theoretical Possibilities and Consequences of Major Accidents in Large Nuclear Power Plants," WASH-740.

The report considered a range of reactor accidents, the worst being an arbitrarily assumed cold release to the atmosphere of half of the fission product inventory produced from 180 days of operation at full power following a 24-hour holdup period. Further a pessimistic temperature inversion is assumed to occur. Thus, no mechanism is given to explain how such a release would occur and no credit is taken for engineered safeguards designed to reduce the probability nor magnitude of fission produce release