UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

October 10, 1979

The Honorable Morris K. Udall, Chairman
Committee on Interior and Insular Affairs
House of Representatives
Washington, DC 20515

Dear Congressman Udall:

The Advisory Committee on Reactor Safeguards has reviewed the questions you asked concerning the development of a hybrid power reactor design based on existing technology that would incorporate "plant features that maximize safety" in a single design to be developed by DOE and approved by the NRC. Answers to your questions are provided below.

Question 1:

> "What would be the advantages and disadvantages of a regulatory system in which the only plants eligible for licensing would be those built in accordance with the DOE design?"

Answer:

> There might be advantages from a single design incorporating the best combination of features to "maximize safety". The ACRS believes a more desirable approach would be to establish a design team consisting of a Nuclear Steam Supplier and Architect-Engineer combination for each of the four water cooled reactor systems and the HTGR system to develop a design incorporating the most desirable features appropriate to that system. These designs should be carried out with the understanding that they would not be constrained by preestablished design concepts, current marketing restraints such as patent or proprietary limitations, or the preferences of specific utility customers. They would consider capital and operating costs, and reliability as well as safety.
>
> A fifth LWR team composed of experts having a broad engineering background would be asked concurrently to arrive at an optimum conceptual design, drawing on all LWR technology. Each team would be requested to provide a recommended standard plant, optimized for safety. In addition, it is recommended that each design team be asked to provide two additional design variants, defining what additional safety measures they would include for say, 5 and 10% additional cost, and what incremental improvements in safety this would provide.

These results could then be evaluated to determine whether one or more should be required for use to the exclusion of all others in the licensing process. Such an action would be essential prior to establishing legislation restricting the licensing of nuclear power plants to a specific set of design requirements.

The ACRS has reservations about the DOE's ability to establish a suitable integrated design. Its internal resources are limited and the design capabilities of its laboratories and contractors have become inactive in the reactor system design areas to a level where teams who have the overall breadth of knowledge for such a challenging assignment would be difficult to organize. If you are suggesting that DOE be the contracting agent for drawing together teams of industrial participants, this might be a workable arrangement.

The ACRS would prefer that the study not be rigidly constrained by either a literal interpretation of the term "existing technology" or the avoidance of some research and development. Any system which departs significantly from the existing approaches will require some experimental work to verify its performance characteristics before an explicit design can be reviewed and approved.

Operational experience with an HTGR is limited in the United States to Peach Bottom 1 and Fort St. Vrain whose power levels and components are not prototypic of a large commercial size plant. The ACRS believes that considerable component research and development, as well as a large body of research in other areas might be needed to define a standard HTGR, and some years of successful operational experience with a commercial size plant would be appropriate before accepting the design as a standard plant mandated by act of Congress.

Further, the term "existing technology" can have several meanings, but to most it would mean using only features that are already in use on currently designed plants. The ACRS believes that, regardless of current use, there should be some freedom to introduce safety features that measurably enhance safety in quantitative risk terms if the economics are tolerable and the time constraints associated with verification will permit. A basic design that could incorporate such changes now or in the future would be an advantage if this capability were realistically established.

In proceeding with a study of this type the basis for comparison and selection of the best safety features would be difficult to define. An attempt should be made to preestablish a set of criteria for judging the safety features provided by design that would assist in selecting the most desirable plant for the intended purpose.

If only one design were developed for licensed use its advantages might include:

1. A well established configuration that may be safer than current plants with identifiable features generally accepted as meeting public safety needs.

2. An opportunity to concentrate attention on a single system with characteristics understood by a large number of plant owner/operators thus simplifying the educational problem and improving operational reliability.

3. Over a long period, some economic advantages if a number of reactor plants were to be constructed, since multiple units of the same design could spread the design costs over a broader base, realize the economics of quantity production and permit centralized inventory of parts and components by utility groups to reduce capital inventory while enhancing maintenance related reliability factors.

4. Quality Assurance improvements derived from standard inspection methodology and equipment plus broader statistical knowledge of system and equipment problems after a period of use.

5. Regulatory simplification because only one set of documents would be needed, and an improved review process could result.

Disadvantages of a single design might include:

1. Loss of operating experience. Although a hybrid design might use many components and parts which have established quality and performance as the result of previous use experience, the new arrangements resulting from hybridization could have behavioral properties which were not adequately understood because of lack of system operating experience. The existing systems have about 20 years of use experience to draw upon, much of which might be sacrificed by departing from the established system designs.

2. Commercial advantage to the manufacturer with the most knowledge and most extensive facilities corresponding to the selected design since each of the existing manufacturing facilities in the U. S. is currently oriented to only one nuclear steam supply system. This might cause competitor organizations to withdraw from industrial participation. The loss of a large portion of existing expertise would be damaging to public safety, not only because of limited participation in the new design, but because of the loss of continuity in keeping track of those designs already in use.

3. Design inflexibility. One design would not maximize safety for every utility in every location thus reducing the opportunities for economic and safety tradeoffs.

4. Narrowing of design perspective. The multiviewed attention to safety areas provided by using several design teams to develop design variations would be lost.

5. Potential for a common flaw disabling the entire nuclear power complex, representing a serious economic risk.

Question 2:

"To what extent would such a design reduce the number of items on the NRC's list of high priority, unresolved generic safety issues?"

Answer:

Improved design could eliminate some of the generic safety issues not resolved for existing plants, but not all. In any case the ACRS believes that the current licensing and regulatory program must continue to address generic problems. A new design effort should not be permitted to defer their resolution.

Question 3:

"How much time would be required to specify an optimum design consisting of a hybrid of current designs?"

Answer:

The depth of study and the level of design detail needed would determine the lapsed time. The ACRS does not have a well founded basis for estimating the time requirements but can offer the following as a rough time estimate:

Preparation of an initial comparison of existing systems	Approx. 2 years
Selection of engineering features for incorporation in a single design	Approx. 1 year
Development of a design in sufficient detail for cost estimating to establish an economic basis	Approx. 2 years
Review and approval of safety features by NRC personnel	Approx. 3 years

Construction of the first plant could begin immediately thereafter.

The proposed design approach could have merit but, until a substantial effort has been applied, its net value cannot be adequately measured. The proposed requirements should not be established on a mandatory basis without the collective willingness of the affected industry.

We hope this response serves your need.

Sincerely,

Max W. Carbon
Chairman