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To: Dr. Max Carbon, Member
Adv. Comm. on Reactor Safeguards

Fm: Sidney Siegel, Consultant

Re: ACRS Subcomm. Meetings on Advanced Reactors, 9/12-13/78 at Sandia Labs., and 9/27/78 at ACRS offices.

A. LMFBR

The NRC safety R&D program on advanced reactors is focussed on four major issues:

Accident energetics
Containment system integrity
Structural integrity
Aerosol release and transport

The activities underway in these areas, particularly the experimental work, were described by the groups involved. It was reassuring to hear about and see the facilities now available for these experimental programs, and to be informed of the initial results of work in progress. This was a refreshing change from numerous prior meetings largely devoted to the development of computing codes for which there is still an inadequate data base, and questionable opportunity for verifying the code in complex situations.

In his opening overview, J. L. Walker, SLA, identified the Licensing and Regulatory Staff as the ultimate customers for the technology being developed at SLA and other laboratories. While this is proper so far as SLA is concerned, it is nevertheless very important that NRC clearly recognize who its clients are, namely the public and public policy makers. NRC must adopt program criteria, goals, and priorities which are in accord with the needs and perceptions of these clients, not merely the licensors themselves. It is far from clear that this has ever been done explicitly and systematically.

The experimental program at SLA is off to an encouraging start. Already, two important early results are available. First, in the area of accident energetics, it has been found that the magnitude of the fuel-coolant interaction may be larger than supposed in recent analytical estimates. This work requires intensive further study. Second, in the area of containment

integrity, it now appears that beds of fuel debris can be cooled and retained within the reactor vessel itself. The practical imprtance of these early results emphasizes the desireability of a continuing R&D program, maintained at a robust level over an extended period.

Numerous new facilities were described and shown. The ACPR upgrade, the development of advanced diagnotic tools, the pulsed reactors and devices such as REBA, the semi-scale rigs for investigating molten fuel-containment material reactions, all give the very competent and innovative SLA staff an unusual capability to conduct these programs. The limitations on future accomplishments will likely be budgetary rather than manpower or major facilities. However, the need for future facility improvements, such as a sodium loop in ACPR, must be kept in mind.

The diagnostics program has made good progress in the coded-aperture system for observing single-pin motion during in-pile power bursts, although even this is yet to be demonstrated. Whether this device will be capable of following the behavior of multi-pin assemblies remains questionable. Further work on diagnostics is essential.

The in-pile work on debris-bed behavior, at steady power levels adequately resembling decay heat power, is unique and very good. The initial results appear conclusive and encouraging. The investigations of reactions between molten fuel or sodium and concrete are progressing well at a semi-scale level. Useful reults are already available, and the chemistry of sodium-concrete reactions is beginning to be understood.

The critical experiment program at ANL, discussed on 9/27 in Washington, is providing good information on the physics of distorted cores. The trend of differences between experimental and calculated results is disturbing, and raises concerns about the level of uncertainty that must be assigned to purely analytical calculations of reactor behavior under transient conditions.

In summary, the experimental program on LMFBR safety, being supported at SLA, LASL, ANL, and other laboratories, seems to be progressing well and already producing significant results. The program is important, and, to repeat, should be maintained at a robust long-term level. In contrast, some of the purely analytical efforts, for example attempts to describe transition phase phenomena in all their complexity, appear less reassuring. Perhaps their prospects for success will improve as the experimental base becomes broader.

B. HTGR

The HTGR safety program is relatively modest, but seems satisfactory within its limitations. The HTGR nuclear power system is not likely to be a national requirement in the same way that the LMFBR ultimately will be. The only reactor manufacturer interested in the system has withdrawn from the field at present. I question the wisdom of allocating scarce R&D resources to this program under present conditions.