For pub. in Millions

UAC - 5792

MASTER TID-14912

STATE OF NUCLEAR TECHNOLOGY - JANUARY, 1962

A. Crewe, S. Lawroski & B. I. Spinrad

Nov. 1961

We believe that 1961 will be regarded as a year of transition in nuclear technology. It has been a year in which an approach to economic nuclear power has been assured; and a year in which considerable progress has been made towards new frontiers for nuclear energy.

The year's chronology reflects a very real change in the mood of the nuclear industry. The year began with the very unfortunate SL-1 incident. Coming on the heels of a depressed situation within the nuclear industry, this incident reinforced a mood of pessimism as to whether nuclear power could become industrially important in the reasonable future.

As the year advanced, however, one by one the unfolding events effectively removed much of this pessimism.

First of all, as the information on the possible causes of the SL-1 incident has accumulated and has been appraised, a definite impression has developed that a combination of improved management and more attention to certain features of design could prevent such incidents from recurring. Moreover, the relatively small spread of radiation from this otherwise severe incident has inspired increased confidence in the safety of nuclear power and has placed it in a more rational perspective in relation to public hazard.

The growing maturity of the nuclear industry became apparent in several other ways. The Yankee plant achieved successful operation, and the Dresden plant after considerable review and rework was restarted and again brought to power. Perhaps of less symbolic significance, but of even greater potential importance, was the contribution of industry to the state of water reactor technology as evidenced by the number of industrial laboratories which produced research and development results of real significance both technically and economically.

Work performed under the auspices of the U. S. Atomic Energy Commission

This paper was submitted for publication in the open literature at least 6 months prior to the issuance date of this Microcard. Since the U.S.A.E.C. has no evidence that it has been published, the paper is being distributed in Microcard form as a preprint.

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

DRAFT

The predominant industrial interest continues to be in the fields of boiling water and pressurized water reactors. Solid proof of industry's confidence in the status of water reactor technology appeared in the form of proposals by both manufacturers and utilities to provide completely private industrial plants whose costs appear to be competitive with those of fossil systems at least in high fuel cost areas. Thus, it appears that the transition of an infant industry, needing support from the Government for its advancement, to a full-fledged private industrial undertaking, has been reached in the boiling and pressurized water reactor areas. Similarly, there are signs that in the field of nuclear superheat, where BORAX V, Pathfinder, and BONUS are being constructed with government support, the successful operation of these first generation plants will make nuclear superheat available for consideration on a fully industrial basis within a few years. Approximately a half dozen industrial organizations are already engaged with private funds in the development of superheat reactors or other systems which they judge to be capable of achieving competitive status with water reactors within a relatively short period.

In the one type of central station power reactor where the development objectives are admittedly longer range, namely, in the field of fast reactors and more particularly fast breeder reactors, this transition to a purely private incentive is not expected to occur in the near future. However, in this particular area there were some encouraging signs in 1961. Of greatest significance was the achievement of dry criticality in the EBR-II system. This is important as a harbinger of the completion of the entire EBR-II project, which in our opinion is the most significant current project in the direction of developing systems of high performance and with the best neutron economy for central station power.

page 2

While the EBR-II explores the long range objective of total utilization of our uranium resources, other fast reactor concepts are being investigated for ~~short-range~~ application of this type of system to commercial power. Illustrative of these are the proposed Core B for the Fermi reactor and the Fast Oxide Breeder (FOB) reactor concept. Both of these lead to some degree of optimism about achieving economies in the production of power from fast reactors, while compromising to a greater or lesser degree the capabilities for breeding.

Another fast reactor which achieved startup in 1961, the Los Alamos Molten Plutonium Reactor Experiment (LAMPRE), is of particular interest and importance. It not only has potential for central station power application, but, more significantly, represents a breakthrough of our technology into an area of new concepts. The ultimate applications of these concepts are at best only dimly perceived at present. Thus, LAMPRE, with its features of high temperature, liquid fuel, compactness and breeding potential is an exciting system.

Systems such as LAMPRE illustrate what we consider to be a most important trend in nuclear technology. The same trend is revealed by the successful performance of the Tory test and of the ¹⁹⁶⁰ Kiwi tests which occurred in the previous ~~year as well~~ as by the successful performance of the SNAP reactor tests. Such advanced systems show promise of achieving greater use of the unique features of atomic energy than does the application to central station power generation. These experiments illustrate the compactness, the high temperature capability, the high power density, and the extremely portable nature of ~~nuclear~~ systems powered by nuclear fuel. These features can be exploited immediately for applications in space technology. We also believe that they have an almost certain probability of exciting capabilities in industrial use.

These and similar systems represent to us the frontiers of nuclear technology.

page 3

Because their future applications, except for such national programs as space, are to a large degree unpredictable ^{but} nevertheless are certain to occur, we consider that the National Laboratories should have a special interest in their development. Perhaps it is for this reason that we consider this entire area to be so exciting.

Finally, it is appropriate to mention a very different application of nuclear energy which was demonstrated dramatically in 1961. This is the successful use in the Transit IV A Satellite of a radioisotope-powered and thermo-electrically transduced electrical source. We regard this device to be a forerunner for a whole host of applications, particularly in the communications field, where sources of relatively small power but of long life and extreme ruggedness and reliability can be well utilized.

Thus, we believe that in 1961 nuclear technology achieved a status which assures its industrial application in central station power and which marks the real beginnings in the exploitation of the more unique capabilities of nuclear energy.

LEGAL NOTICE

This report was prepared as an account of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

A. Makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or

B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method, or process disclosed in this report.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission, or employee of such contractor, to the extent that such employee or contractor of the Commission, or employee of such contractor prepares, disseminates, or provides access to, any information pursuant to his employment or contract with the Commission, or his employment with such contractor.