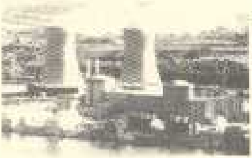
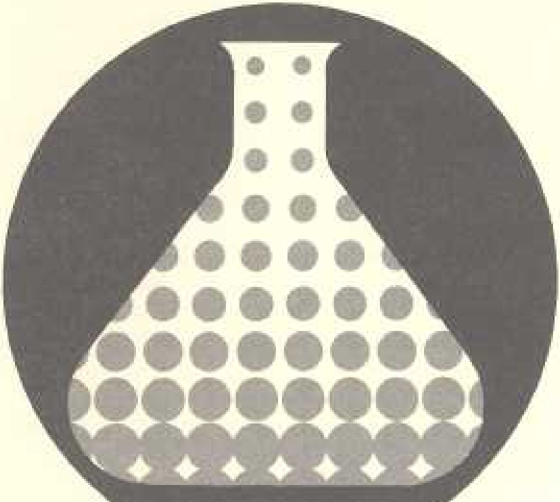


Three Mile Island

Research and Development



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This is the fourth in a series of issue papers brought to you by the shareholders of the General Public Utilities Corporation.

The March 28, 1979 accident at Three Mile Island (TMI) brought our nation's nuclear power program to a standstill. Confidence in nuclear technology and the nation's ability to regulate it was temporarily shaken.

As months passed and the results of several investigations into the accident were reported, it was clear the systems designed to protect the safety of the public worked.

The information already gained from the accident has been of significant importance to the nuclear industry. Among the lessons learned from the accident have been the need for:

- Better systems of sharing information
- Improved operator training
- More specific operating procedures
- Improved equipment

Also, we now know it's necessary to have additional insurance coverage to finance the substantial cost of both replacement power and plant recovery.

And a large amount of valuable information will be uncovered as we decontaminate TMI Unit 2. A failure to take advantage of this available information would be unfortunate indeed.

Let's examine a few of the specific research and development (R&D) opportunities available:

Core Behavior

The TMI accident produced core conditions never before seen in a nuclear power plant. As a result of extreme plant conditions, the effects of the accident on fuel materials, control rods, core structure, in-core instruments and almost every material involved in the construction of a nuclear power plant will be of great interest to the entire nuclear industry.

Of most obvious value will be the collection of data on the nuclear fuel exposed during the accident. Other areas that will provide significant information include: the degree of core melting, possible alloying, the zirconium-water reaction and fission product migration.

For example, TMI accident data indicates the reaction rate of the zirconium fuel cladding with water at high temperatures may be less than previously believed. It's possible the reaction was limited by the steam flow and the formation of a hydrogen blanket layer on the zirconium.

In another area, the TMI post-accident analysis cast doubt on the previously held certain belief that a core meltdown would

produce unconstrained results. Examination of the materials making up the core barrel, the primary vessel and the many welds, will be of use in determining the capability of nuclear plants to handle accidents that are beyond its design basis.

Careful study of the TM I Unit 2 core before it is disturbed by the cleanup operation offers the equivalent of an important safety experiment that can yield data on core configuration and fuel damage never before available from small test experiments.

The information we expect to collect as cleanup continues will facilitate present and future licensing criteria. The data may help validate accident computer codes which will increase confidence in their use. Risk assessment will be improved and reactor design changes evaluated.

Fission Product Studies

A broad spectrum of radioactive fission products were released in the plant during the accident. The release primarily occurred when the nuclear fuel, which received insufficient cooling water, overheated and its cladding failed. This failure released fission products into the steam which spread into the containment building. The accident provided an opportunity to learn where these fission products ended up; how many were airborne; what percentage was retained in the water, and to what degree they were deposited on the floor, walls and other plant components.

An example in this category that already has proven significant is the degree of retention of radioactive iodine in the cooling water as compared to its dispersion as a gas. Accident analysis has used the estimated airborne dispersion and dosage resulting from radioactive iodine to set the limiting dose and exclusion area boundaries for nuclear power plants. Prior to the accident the estimates of iodine believed to be retained in water were much lower than actually shown from accident data. The meaning: previously estimated dangers to the public from the release of iodine into the environment were too high. Application of these findings along with the potential changes in exclusion area boundaries and population impact could be most important in the design and siting of future nuclear plants.

Decontamination and Waste Disposal

As the physical scrub down in the plant continues, there will be an unequaled opportunity to determine the relative efficiency of both materials and techniques as well as the most economic methods.

There have been and there will continue to be future instances of radioactive contamination. Although the probability of contamination occurring on a large scale that is detrimental to public health is low, the availability of the most effective and economic cleanup methods for a spill of any size will be very useful.

The post-TMI accident cleanup will also offer the opportunity to demonstrate new technology for processing and disposing of radioactive waste by converting the waste into a glass-like substance. This process, known as vitrification, already has been proven feasible on a laboratory scale and can be scaled up to fullsize in the course of the cleanup. Information on the stability of the vitrified radioactive materials will be valuable in planning, conducting and regulating future waste disposal activities.

Dealing with the waste from the TMI Unit 2 decontamination program will provide an integration of several individual R&D pieces of work through the handling of a complete decontamination operation from beginning to end.

Environmental Qualification of Equipment and Materials

Another category of materials, components and equipment subjected to extreme radiation, temperature and humidity conditions includes the wiring, insulation, motors and connectors. These materials and equipment must be able to withstand accident environments. Up to now relatively little has been known about their capability to do so.

Recent regulatory requirements now demand this material be carefully examined for its ability to withstand accident conditions.

Careful examination of similar equipment coming out of TMI Unit 2 will provide a pool of reliable data to better define regulatory requirements in this category. The end results will be important from a safety standpoint and have a significant financial impact on all nuclear plants.

Full utilization of the information made available by the TMI Unit 2 accident can provide an unequalled source of knowledge to insure even greater nuclear safety in today's and tomorrow's electric generating plants.

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