



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

SEP 22 1980

MEMORANDUM FOR: Frank Schroeder, Acting Director  
Division of Safety Technology, NRR

FROM: Thomas E. Murley, Acting Director  
Office of Nuclear Regulatory Research

SUBJECT: MEMORANDUM JOHN AHEARNE TO ACTING EDO "NEW SAFETY  
CONCEPTS FOR FUTURE CONSTRUCTION," SEPTEMBER 11,  
1980

Enclosed is our report for your response to the subject  
memorandum.

A handwritten signature in cursive script that reads "T. Murley".

Thomas E. Murley, Acting Director  
Office of Nuclear Regulatory Research

Enclosure: As stated

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## RES INPUT TO "NEW SAFETY CONCEPTS FOR FUTURE CONSTRUCTION"

The issue of NRC's involvement in developing new safety concepts was addressed in 1978 and was resolved by the publication and partial implementation of NUREG-0438, "Plan for Research to Improve the Safety of Light-Water Nuclear Power Plants." Resource limitations (~\$0.8M in FY 1979, \$1.0M in FY 1980) delayed significant progress, but work was initiated on alternate containment designs, decay heat removal systems and improvements in the operator-machine interface. After TMI, a renewed interest developed in improving all aspects of reactor safety. Research previously considered confirmatory was now being reexamined to identify what could be learned about improving safety. There are many such areas within the RES program. These are described below with an indication of how research results might lead to improvements in safety. Some concepts are only practical with respect to the construction of future plants. Others are more generally applicable.

### Alternate Containment Concepts

RES has established the feasibility and risk reduction potential of vented, filtered containment and has generated several alternative design concepts. Molten core retention devices are also being examined. Emphasis is on developing the functional requirements and design basis for such systems. The perceived benefit of alternate containment designs is to reduce the probability and magnitude of uncontrolled releases of radioactivity during severe accidents.

### Alternate Decay Heat Removal Systems

RES has developed design criteria and conceptual designs for an add-on decay heat removal system. This relatively simple, single-train add-on can improve safety by increasing the reliability of the decay heat removal function.

### Advanced Display and Diagnostic Systems

RES has installed graphic display equipment in the LOFT control room and technical support center. This equipment is being used to give NRC practical experience in the design and utilization of improved operator-process communication systems. This information will help the regulatory staff assess the need for and adequacy of improvements in the human-machine interface.

### Advanced Instrumentation

The need of RES to verify the accuracy of computer calculations through experimentation has resulted in the development of instruments considerably more sophisticated than those in commercial use. The feasibility

of applying instrumentation such as liquid-level detectors and two-phase flow detectors is being investigated. These can improve safety by providing direct measurements of key variables as opposed to relying on derivation from other measurements.

#### Noise Diagnostics

RES has spearheaded developments in noise diagnostics as an aid to the early detection and diagnosis of abnormal events within the reactor system. A prototype system has been installed at Sequoyah. Experience gained here will help the regulatory staff assess the need for widespread application of this technique.

#### Nondestructive Examination

RES has been instrumental in advancing the state-of-the-art in ultrasonic and acoustic emission detection techniques. These methods contribute to improving safety by increasing the likelihood that flaws in the primary and secondary system pressure boundaries are detected before escalating into a serious threat to system integrity.

#### Protection Against Sabotage

RES has reviewed the vulnerabilities of nuclear power plants to internally and externally initiated sabotage. Among the results are recommendations for revising the layout of future plants to reduce the likelihood of successful sabotage.

#### Plant Systems Analysis

RES is using probabilistic and deterministic methods to analyze the reliability of key plant systems. Recommendations are provided for reducing the risk associated with the unavailability of these systems.