



UNITED STATES
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D.C. 20555

May 6, 1991

Project No. 669

Mr. E. E. Kintner, Chairman
Advanced Light Water Reactor
Steering Committee
GPI Nuclear Corporation
100 Interspace Parkway
Parsippany, New Jersey 07054

Dear Mr. Kintner:

SUBJECT: CLARIFICATION OF ISSUES FOR EVOLUTIONARY ADVANCED LIGHT WATER REACTORS (ALWRS)

SECY-90-016 and the associated staff requirements memorandum dated June 26, 1990, provided guidance on evolutionary light water reactor certification issues and their relationships to current regulatory requirements.

In subsequent meetings between the Electric Power Research Institute (EPRI) and the staff, questions arose on implementation of the guidance for certain issues. The following discussions provide clarification of these issues.

1. Anticipated Transients Without Scram (ATWS)

The Commission approved the staff position that diverse scram systems shall be provided for evolutionary ALWRs in accordance with 10 CFR 50.62 (ATWS Rule). The Commission also stated that if the applicant can demonstrate that the consequences of an ATWS are acceptable, the staff should accept the demonstration as an alternative to the diverse scram system.

Clarification Issue: Whether an analysis of ATWS transients would be required if a diverse scram system were installed.

Clarification: The requirement for a diverse scram and the other actions required by 50.62 were the result of deliberations by the staff which considered the results of extensive ATWS analysis for each vendor design. While the results of these deliberations were prescriptive design requirements, rather than ATWS analysis acceptance criteria, staff conclusions were predicated upon those analysis results. Therefore, the requirements for diverse scram and other 50.62 actions were those steps the staff believed to be necessary given the ATWS response of currently operating reactors.

The staff is not attempting to establish ATWS acceptance criteria for Advanced Light Water Reactors, if 50.62 actions are complied with. However, in order for the staff to have confidence that 50.62 actions are proper and adequate, each ALWR designer must submit an ATWS assessment as part of his Design Certification documentation. These analyses should be provided to demonstrate that design specific features of proposed ALWR plants do not result in ATWS behavior which is significantly more severe than considered by the staff previously. Such

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110

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severe behavior could call into question the adequacy of 50.62 requirements for these advanced designs, which are intended to offer greater levels of safety.

2. Intersystem LOCA

The Commission approved the staff position that designing, to the extent practicable, low-pressure systems to withstand full reactor coolant system (RCS) pressure is an acceptable means for resolving this issue. Systems that are not practical to design to this pressure should provide three alternative features (restated in clarification below). The Commission also supported the ACRS comment that all elements of the low pressure system be considered (e.g., instrument lines, pump seals, heat exchanger tubes, and valve bonnets).

Clarification Issue: Whether systems which do not have access to the reactor coolant system (e.g., for PWRs, the CCW (shell) side of the RHR heat exchanger) would be required to withstand full RCS pressure.

Clarification: The shell side of the RHR heat exchanger is a secondary pressure boundary not directly interfacing with the RCS, and therefore is not required to withstand full RCS pressure. Access via multiple isolation valves is a different matter since these valves can be opened (or fail open). An amplified discussion of the staff's approach for treatment of this issue is provided below. Future evolutionary ALWR designs should reduce the possibility of a loss-of-coolant accident (LOCA) outside containment by designing, to the extent practicable, all systems and subsystems connected to the reactor coolant system (RCS) to full RCS pressure.

The "extent practicable" phrase is a realization that all systems must eventually interface with atmospheric pressure and that for certain large tanks and heat exchangers it would be difficult or prohibitively expensive to design such systems to full reactor system pressure, and thus, may be alternatively designed to its ultimate rupture strength taking into account corrosion, erosion, or other degradation mechanisms that may be present.

It should be noted that the degree of isolation or number of barriers (for example three isolation valves) alone is not sufficient justification for using low pressure components designed to the ultimate rupture strength criterion. For example, piping runs should always be designed to meet the normal operating design limits under RCS pressure, as should all associated flanges, connectors, packings including valve stem seals, pump seals, heat exchanger tubes, valve bonnets, and RCS drain and vent lines.

However, for all interfacing systems and components which do not meet the design limits for full RCS pressure, it should be justified for each case why a lesser design limit is acceptable. This justification must be based upon engineering feasibility analysis and not solely risk benefit trade-offs. For those interfaces where acceptable justification on the impracticability of full RCS pressure capability has been provided, there must be a demonstration of compensating isolation capability. For example, it should be demonstrated for each interface that the degree and quality of isolation or reduced severity of the potential pressure challenges compensate for and

justify the safety of the low pressure interfacing system or component. Adequacy of pressure relief and piping of relief back to primary containment are possible considerations. In addition, as identified in SECY-90-016, those systems that have not been designed to withstand full RCS pressure should provide:

- (1) the capability for leak testing of the pressure isolation valves (PIVs),
- (2) valve position indication that is available in the control room when isolation valve operators are deenergized, and
- (3) high-pressure alarms to warn control room operators when rising RCS pressure approaches the design pressure of the attached low-pressure systems and both isolation valves are closed.

The designer should make every effort to reduce the level of pressure challenge to all systems and subsystems connected to the RCS.

Designers should provide the following as part of the application for design certification:

- (1) an identification of all interfaces to the RCS indicating design and ultimate pressure capabilities for these systems, and
- (2) a color coded simplified P&ID showing piping and component ultimate pressure capabilities, clearly identifying the interface junctions.

3. Equipment Survivability

The Commission approved the following position regarding the measures to ensure that systems and equipment required only to mitigate severe accidents are available to perform their intended function (e.g., environmental qualification):

Features provided for severe accident protection (prevention and mitigation) only (not required for design basis accident) need not be subject to (a) the 10 CFR 50.49 environmental qualification requirements, (b) all aspects of 10 CFR Part 50, Appendix B quality assurance requirements, or (c) 10 CFR Part 50, Appendix A redundancy/diversity requirements. The reason for this judgment is that the staff does not believe that severe core damage accidents should be design basis accidents (DBA) in the traditional sense that DBAs have been treated in the past.

Notwithstanding that judgment, however, mitigation features must be designed so there is reasonable assurance that they will operate in the severe-accident environment for which they are intended and over the time span for which they are needed. In instances where safety related equipment, (which is provided for design bases accidents) is relied upon to cope with severe accident situations, there should also be a high confidence that this equipment will survive severe accident conditions for the period that is needed to perform its intended function. However, it is not necessary for redundant trains to be qualified to meet this goal.

May 6, 1991

Mr. E. E. Kintner

- 4 -

Clarification Issue: What is meant by "prevention" features which are required to have measures to ensure they can perform their intended functions in severe accident environments?

Clarification: In general discussions of severe accidents we consistently refer to prevention and mitigation as means to address issues. The SECY paper and its associated staff requirements memorandum were written using this severe accident terminology, and only address mitigation features for the purposes of equipment survivability.

Questions should be directed to the Project Manager, Tom Boyce, at (301) 492-1396.

Sincerely,

Original Signed By:

Dennis M. Crutchfield, Director
Division of Advanced Reactors and
Special Projects
Office of Nuclear Reactor Regulation

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