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ACRS MEETING MINUTES/SUMMARY OF THE
IMPROVED LWRs SUBCOMMITTEE
JULY 10, 1990
BETHESDA, MARYLAND

PURPOSE

The purpose of this subcommittee meeting was to review and discuss the NRC and industry proposals for the completeness of designs issue for the evolutionary light water reactors and passive designs.

Attendees:

ACRS
C. Wylie, Chairman
I. Catton, Member
C. Michelson, Member
D. Ward, Member
M. El-Zeftawy, Staff

NRC
H. Pastis, NRR
K. Hart, SECY
A. V. Cook, OCM
K. Connaughton, OCM
M. Taylor, EDO

OTHERS
E. Kennedy, ABB/CE
C. Brinkman, ABB/CE
A. Heymer, NUMARC
P. Ng, NUMARC
M. Rowden, NUMARC
R. Szaley, NUMARC
F. Hudson, Duke Power
L. Rib, AECL
B. McIntyre, W
J. Berga, EPRI
G. Brown, Stone & Webster
D. Rehn, Duke Power
J. Gutieanez, Newman
J. Chambers, GE

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Meeting Highlights, Agreements and Requests

1. Mr. Wylie, Subcommittee Chairman, stated the purpose of the subcommittee meeting and introduced the other ACRS members.

2. Mr. M. Virgilio, NRR, briefed the subcommittee regarding the NRC staff interpretation for the level of detail required for design certification under 10 CFR Part 52. He indicated that the final rule's provision on scope of completeness of design section 52.47 reflect a policy that certain designs, especially designs which are evolutions of light-water designs now in operation, should not be certified unless they include all of a plant which can affect safe operation of the plant except its site-specific elements. Examples of designs which are evolutions of currently operating light-water designs are General Electric's ABWR, Westinghouse's SP/90, and Combustion Engineering's System 80+. Full-scope may also be required of certain advanced designs, namely, the "passive" light-water designs such as General Electric's SBWR and Westinghouse's AP6000. Considerations of safety, not market forces, constitute the basis for the final rule's requirement that these designs be full-scope designs. Long experience with operating light-water designs more than adequately demonstrates the adverse safety impact which portions of the balance of plant can have on the nuclear island. Given this experience, certification of these designs must be based on a consideration of the whole plant, or else the certifications of those designs will lack that degree of finality which should be the mark of certification.

Currently the staff is presenting the Commission with four levels of design detail. The level of detail associated with a design certification is analyzed in terms of three factors:

- The scope of an application for design certification
- The material to be developed by the applicant and made available for audit, and
- The information certified by rulemaking

The staff has examined four levels of detail, the corresponding degree of standardization achieved, compliance with Part 52, and the safety and economic benefits devised from each. These four levels are:

Level 1 -

The degree of standardization resulting from this level of detail and the certification process will provide

identical physical, functional and performance characteristics of all structures, systems, and components affecting safety, except for site specific characteristics.

Level 2 -

The degree of standardization resulting from this level of detail and the certification process will provide physically similar, and identical functional and performance characteristics of all structures, systems, and components affecting safety, except for site specific characteristics.

Level 3 -

The degree of standardization resulting from this level of detail and the certification process will provide identical functional and performance characteristics of all systems, structures and components, except for site-specific characteristics.

Level 4 -

The degree of standardization resulting from this level of detail and the certification process will provide at least a product line type of standardization.

Mr. Virgilio indicated that it is not clear that the design detail necessary to realize a Level 1 degree of standardization is consistent with part 52 regarding the content of the application. He commented that level 1 is probably not commercially feasible, because the Level of detail required in a Level 1 certification would make it difficult to assure continued availability of components with all the certified attributes over the life of certification. Level 2 provides the maximum degree of standardization while avoiding to some extent the Level 1 concern. The third level of detail presented characterizes the industry proposal (incorporating the two-tiered approach) as the staff understands it. The fourth level of detail (product-line standardization) would not constitute an acceptable application for design certification under the current provisions of Part 52, because it is not sufficient to allow the staff to reach its final conclusion on all safety issues in a one-step process.

In Levels 1, 2 and 3, the content of the application in terms of information germane to the staff's safety findings is the same. However, the scope and depth of detail required for Levels 1 and 2 will be beyond what the staff has traditionally

needed to conduct its licensing reviews under NUREG-0800 the Standard Review Plan (SRP).

The staff licensing review of an application for design certification for all levels will deviate from the traditional practice, with the addition of inspection tests, analyses, and acceptance criteria (ITAAC). The staff feels that the ITAAC will provide reasonable assurance that a plant which references the design is built and will operate in accordance with the design certification.

Information normally contained in procurement specifications and in construction and installation specifications and audited will be included or referenced in the application for a design certification if it is necessary for the staff to make its safety findings. In Levels 1 and 2 essentially the entire application will be certified. In Level 3 the design certification will contain much less detail than provided in Levels 1 and 2, plus the rulemaking approval of Tier 2 along with the industry-proposed Section 50.59-type change mechanism.

The staff used the HVAC system as an example to show how much detail would be expected for each of the four levels.

The staff estimates that 800 million to 1.09 billion (1990 dollars) are required to develop a complete plant. This estimate refers to total A/E and utility engineering costs (design and design implementation) to the point of fuel load, not including site and QA/QC engineering.

On the basis of staff discussions with industry representatives, it appears that the prospective applicants for design certification of evolutionary light-water reactors expect certification will require 50% - 60% of all design to be complete for a cost of $150 million to $350 million for Level 3. Estimates are $600 million for Level 1, and $400 million for Level 2.

It should be noted in considering the percentage of engineering complete, the industry believes a large portion of the safety-significant engineering associated with the design will be completed earlier under Part 52 than in the traditional Part 50 process.

In conclusion, Mr. Virgilio noted that the staff is seeking advice from the ACRS and guidance from the Commission regarding the level of detail to be required in an application for design certification and subsequent rule certifying the design under 10 CFR Part 52. The staff is currently finalizing its SECY-paper to the Commission on this subject.

3. Mr. R. NG, NUMARC, commented that NUMARC is a non-profit organization that represents the nuclear industry on generic regulatory issues and it includes the vendors and most of the major architect engineers. Mr. NG noted that the Nuclear Power Oversight Committee (NPOC) has asked NUMARC to coordinate various activities with regard to assessing options for enhancing standardization. He indicated that NUMARC feels at this time that standardization should not be imposed by regulation. The ITAAC document is not a substitution for design detail.

4. Mr. D. Rehn, Duke Power Company, outlined the recent work that was performed by the industry to implement the design certification process according to 10 CFR Part 52.

He indicated that 10 CFR Part 52 design certification applications will contain more design information than current operating license applications under 10 CFR Part 50.

- Design information will be analogous to that in a final FSAR, minus as-built construction, as-procured (nameplate) details that have sometimes been submitted, and site specific details.

- A detailed delineation of inspections, tests, analyses and acceptance criteria, with appropriate cross-references to the SSAR/FSAR will be provided.

- Results of the probabilistic risk assessment will also be included in the application.

As an example for the level of design detail, utilizing a specified room with a pump, heat exchanger and valve, a certified design application would:

- Define safety functions and performance requirements of each component and its respective system.

- Specify location of room and general arrangement of major components.

- Resolve generic safety issues such as fire protection, seismic, security and environmental qualification.

- Specify location of major piping, HVAC ductwork, and cable tray in the room.

The only differences that would be observed at different plants are:

- Differences in appearance due to the potential for different component vendors
- Differences in local pipe and cable routing to support vendor-specific component configurations

Mr. Rhen stated that the practical workability or flexibility will be considered in the following:

- As-build deviations
- Startup, operating, maintenance problems
- Obsolescence
- Equipment improvements

The level of design detail depends on "How much flexibility section 50.12 will provide depends in large part on how much detail is present in a design certification, and just how much detail is present will be an issue which will have to be resolved in each certification rule making."

Mr. Rehn outlined the ITAAC objectives as follows:

- Retain as much as possible of the existing NRC regulatory inspection and review processes.
- Define acceptance criteria in such a manner that the acceptance criteria would be completely interwoven with plant safety.
- Incorporate industry inspection, test, analysis and acceptance criteria experience gained during the construction and operation of current plants.
- Incorporate NRC "Sign-As-You-Go" approval process pioneered by NRC Region II and Georgia Power in the Vogtle Readiness Review.

The ITAAC is for those inspections, tests, analyses and acceptance criteria which are necessary and sufficient such that if the inspections, tests and analyses are performed and the acceptance criteria are met then there is reasonable assurance that the plant has been constructed and will operate in accordance with the terms of the combined license. It is not a substitute for lack of design, lack of design detail, or unresolved safety issues.

The acceptance criteria shall be very specific and quantitative;

- Containment leakage shall not produce site boundary doses during a design basis accident in excess of 25 rem whole body and 300 rem thyroid.

- The residual heat removal system shall be able to reduce reactor coolant temperature to less than 140F within 20 hours of reactor shutdown.

Conformance with acceptance criteria shall be directly demonstrated either by inspection, test or analysis. Acceptance criteria should be derived from general design criteria or similar regulatory and safety requirements such as 10 CFR Part 100. Nonconformances are unacceptable, absent Commission approval.

Mr. Rehn noted that validation attributes will typically be used to verify physical plant assumptions or inputs used in preapproved analyses that demonstrate conformance with an acceptance criterion.

- Physical properties of concrete in a structural seismic analysis

- Containment volume in a containment pressure/temperature response analysis

5. Mr. M. Rowden, Chairman of NUMARC Lawyers Committee, described the "two-tiered" approach proposed by industry for design certification. He indicated that the two-tier approach to the structure of the Design Certification Rule is based on the specific requirements of Part 52 which distinguish between what will be submitted for NRC review in the design certification application and what will be contained in the Design Certification (DC) Rule itself.

Mr. Rowden stated that the two-tier structure which industry recommends is simply a means for formatting and documenting in the DC Rule the certified and the non-certified parts of the design, and specifying the change mechanisms governing each in accordance with the Part 52 requirements. The first tier would contain:

- A description of the certified design based on SSAR section 1.2, with detail comparable to that in current SERs; and

- The full array of inspections, tests, analyses and acceptance criteria which Part 52 requires

The second tier would:

- Reference the entire SSAR design description. The SSAR is the primary technical document of the design certification application and will be the basis for the NRC's Final Design Approval and Design Certification reviews. By referencing the SSAR in the DC Rule's second tier, the NRC would document the features and commitments that were the basis for NRC approval (beyond those certified in the first tier) and document the "matters ... resolved in connection with the issuance ... of a design certification" (per §52.63(a)(4)).

The second tier would also contain the "validation attributes", which the NUMARC report proposes as a bridge to demonstrating compliance with those first-tier acceptance criteria that are not readily measurable or otherwise verifiable by direct field inspector or test.

This second tier would be associated with the rule certifying the design (but not be part of the certification itself) and would include a change process like the current 10 CFR 50.59, that would allow changes without prior NRC review so long as no unreviewed safety question is presented.

6. As a result of the Subcommittee's discussion, some of the Subcommittee members expressed some concern in regard to the following:

- Mr. Michelson expressed some concern regarding which document that the NRC staff will be reviewing and certifying for the future designs. For example, is it the SSAR only or does it include the references also?

- Mr. Michelson questioned why the NRC staff does not have a comparison with the contents of the EPRI requirements document in dealing with the completeness of design issue, and how the EPRI requirements document folds in the certification process.

- Mr. Michelson commented that the staff should have a better definition for the severe accident issues. For example, it is not clear that if the fire or internal flood events are considered as severe accident issues.

- Mr. Michelson noted that it is not clear if the four-levels proposal by the NRC staff will meet the 10 CFR part 52 requirement.

- Mr. Ward expressed some concern regarding the criteria and level of PRA that are proposed to be performed for the future designs.

- Mr. Michelson questioned if the PRA will be part of the application for certification, and the components reliability numbers to be used in PRA analyses. In addition, if the PRA numbers have to be changed, what would be the mechanism for rule changes?

- Mr. Wylie questioned when the staff would visualize seismic changes in the supports and anchors.

- Mr. Michelson noted that additional information is needed at the design certification stage to investigate more about the environmental qualifications of the advanced control complex for the future designs.

- Mr. Michelson expressed some concern regarding the scope and level of detail of the licensing review basis (LRB) documents for future plants. He indicated that there is no clear definition from the staff describing the details of an LRB document as a policy issue.

- Dr. Catton expressed concern that in the staff's proposal regarding the four levels of details, it does not seem that there is an approved method or study to determine how to handle the hydrogen stratification in the containment for the new designs, and how to certify it.

- Mr. Michelson noted that there is a difference that needs to be clarified between the EPRI numbers (60 ~ 70%) and the NUMARC numbers (~ 33%) regarding to the level of design effort completion at the certification submittals.

- Mr. Wylie questioned the characterizations of system interfaces and the process to be used in the certification.

- Mr. Michelson questioned the treatment of open items after the FDA is granted.

Future Action

The Subcommittee Chairman is planning to brief the full committee on this issue at the (July 12-14) 363rd ACRS meeting. Representatives of the NRC staff and NUMARC will also give a brief

presentation to the full committee in July 12-14, 1990. The Committee may wish to write a report to the Commission regarding this subject.

Attachments: As stated

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NOTE: Additional meeting details can be obtained from a transcript of this meeting available in the NRC Public Document Room, 2120 L Street, NW, Washington, DC 20006, (202) 634-3273, or can be purchased from Ann Riley and Associates, Ltd., 1612 K Street, NW, Suite 300, Washington, DC 20006, (202) 293-3950.