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From: *NR* Amy Cabbage *NR* *RES* *NR*
To: *NR* Bagchi, Goutam; Caruso, Ralph; Cheok, Michael; Eckenrode, Richard; LaVie, Steve; Li, Hulbert; Manoly, Kamal; Marinos, Evangelos; Orechwa, Yuri; Palla, Robert; Reinhart, F. Mark; *NR* Rubin, Mark; Shoop, Undine; Snodderly, Michael; Sullivan, Edmund; Terao, David; Trimble, David
Date: *NR* Mon, Mar 11, 2002 12:10 PM *RES* *NR* *NR* *NR*
Subject: *NR* Re: Fwd: Issues for ACRS response

See attached list of questions that have been raised by the ACRS associated with new reactor licensing. Please consider these questions/issues during the PBMR pre-application review.

T/54

From: Stuart Rubin *RES*
To: John Flack
Date: Wed, Mar 6, 2002 7:59 PM
Subject: Re: Fwd: Issues for ACRS response

John:

Some of the ACRS questions are also appropriate for consideration as part of the PBMR preapplication review in selected topical areas (e.g., high temperature materials, chemical attack, fuel performance). We will need to be ready to address these as part of the ACRS's review of the PBMR preapplication review.

Peggy: Please forward the attached ACRS questions to the RES and NRR staff involved in the review of the Exelon White papers.

Thanks.

Stu

>>> John Flack 03/05/02 08:43AM >>>

RES

Please review attached ACRS questions. We should find a place in the plan where they would be addressed by our future research infrastructure.

Thanks,

John

CC: Alan Rubin; Amy Cubbage; Donald Carlson; Jocelyn Mitchell; Joseph Muscara; Julius Persensky; Steven Arndt

Questions to be Addressed in Staff Response to ACRS

On February 14, 2002, ACRS wrote to the Chairman on "Review and Evaluation of the Nuclear Regulatory Commission's Safety Research Program." The majority of questions raised in the letter are to be found in NUREG/CP-0175, "Proceedings of the Advisory Committee on Reactor Safeguards Workshop on Future Reactors." The following is a list of the questions for which ACRS expects responses:

1. Should we "force-fit" non-LWR designs into the current regulatory structure that is heavily focused on LWRs and the structuralist approach to defense in depth or should licensing take a "clean-sheet" risk-based approach?
2. Do we need additional risk acceptance criteria (e.g., frequency-consequence curves) for designs for which core damage frequency and large, early release frequency are ill-posed concepts?
3. How do we quantify and deal with PRA uncertainty for the new concepts?
4. How robust must the containment (if any) be in view of the lack of experience with new designs and potentially large uncertainty in risk assessments?
5. What is the acceptability of significantly reduced emergency response for designs with low source terms and long warning times before release?
6. What is the acceptability of no additional ECCS for designs that have a great deal of water in the primary vessel and no pipes to break at locations that would drain the water (e.g., IRIS)?
7. What role will "licensing by test" play in the regulatory process?
8. Can the frequency of air ingress and a graphite/fuel fire be demonstrated to be acceptably low for those designs that use coated particle fuel?
9. How do we establish LOCA frequencies for new plants for which there is not an extensive data base? The reliability of simplified passive safety systems?
10. For the new designs, will we have appropriately qualified/validated PRAs and TH, neutronic, and safety assessment codes?
11. Are there any new human performance and I&C issues?
12. What process will be used to develop design basis accidents for the new designs? How will risk-significant SSCs be identified? What will be the regulatory treatment of non-safety systems?
13. What use can be made of previous NRC reviews of derivative designs?
14. For the new designs, what will be the regulatory approach with respect to: a) many new plants; b) multi-unit/module sites?

15. How can we assure the required fuel quality for designs for which the safety case relies heavily on fuel integrity (focus on process vs. product)? Validation of fuel performance? Accident source terms for design basis events? High burnup?
16. How will once-through cores that last 5 - 10 years be monitored and inspected? Acceptability of new "smart" on-line health monitoring systems?
17. How will financial related requirements apply to the new concepts and business environment? Extension of Price-Anderson? NRC fee structure for multi-modules? Decommissioning?
18. What is the acceptability of natural circulation cooling as an accident recovery strategy? What is the availability and validation status of appropriate analytical models?
19. What database exists for the lifetime temperature and irradiation behavior of graphite? How do the "new" graphites compare to the "old" ones?
20. Can the NRC develop the manpower, resources, and technical expertise required for assessing the future concepts?
21. Is there a sufficient database on high temperature material behavior for the gas-cooled concepts with high exit temperatures? What are the gas turbine safety issues for high temperature helium cycles?
22. What new NRC research is needed? Participation with Industry? Use of international research and data bases?
23. Are new approaches/criteria needed for licensing multi-purpose plants (e.g., power plus desalination, industrial/residential heating, hydrogen production, coal conversion)?
24. What will be the spent fuel storage requirements for new fuel types/geometries. Potentially damaged fuel spheres/particles?

In addition, the letter raises the following issues on future reactors:

- The most pressing issue related to AP1000 certification is what confirmatory research is needed to evaluate the adequacy of the AP600 separate effects and integral test database for application to AP1000.
- Some of the new designs may also challenge current defense-in-depth precepts. For example, the traditional balance between prevention and mitigation may not be offered by new designs that rely heavily on fuel integrity during accidents rather than mitigating systems. Uncertainty criteria to allow setting appropriate limits on defense-in-depth requirements may need to be developed.
- The agency needs to determine what independent capabilities and technical databases it must have to assess the safety implications of new technologies.
- The agency needs to conduct selected independent verification, analysis, and testing.

Under, "Use of Formal Decision-Making Methods to Support Regulatory Decisions", the ACRS refers to NUREG-1635, Vol. 4 and states:

- We observed that the decision-making processes used in the regulatory framework process often appear overly subjective and recommended that the staff initiate a research program to investigate how best to use formal decision-making methods to make regulatory decisions more objective and transparent and, thus, more defensible.

Reference is also made to an ACRS letter of October 12, 2001 with the statement:

- We observed that formal decision analysis could be helpful in making the action matrix and the selection of thresholds for the performance indicators more objective and scrutable.

The ACRS also states that informal communication indicates that RES has recognized the merit of developing formal approaches to support the agency's decision-making processes but has not initiated any work in this area.