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Christiana Lui
Mail Stop T10-K8
US Nuclear Regulatory Commission
Washington DC 20555

Subject: Review comments on NRC Long-Term Research: FY2009 Activities

Dear Ms. Lui,

Thank you for the opportunity to comment on your research planning document; "U.S. Nuclear Regulatory Commission Long-Term Research: FY2009 Activities." We found the document to be well-written and comprehensive. We have divided our comments into General and Specific, below.

General Comments

1. Several of the topical areas that Sandia has been supporting NRC on are elements of the research plan; including spray mitigation, decision making tools, PRA and HTGR model development. Continued collaborations with the NRC in these areas will result in enhanced plant safety. Work on the HTGR will address guidance that has been defined in the 2005 Energy Policy Act.

2. Development of advanced PRA methods is a concept that holds significant promises for increasing our understanding of severe accident progression. In particular, replacement of some of the traditional Level 1/Level 2 components, like accident progression event trees (APETs) with a more seamless code-based tool (like MELCOR) where sampling methods are used to start at level 1 and propagate through level 3 will provide a better understanding of severe accident progression while increasing the emphasis on best-estimate analyses. Development of dynamic event trees also holds promise in providing a better understanding of Level 2/3 severe accident progression.

3. Future efforts not addressed in the plan that may be worth considering are;

    a. The plan does not address the issues related to RES support for <u>equipment qualification</u> of components for new/advanced reactor designs. For example, RES could propose reestablishing the equipment qualification verification testing programs of the 1970's and 1980's. RES might also propose reassessment of the current regulations defining the bases for equipment qualification for sufficiency in the current realms of advanced manufacturing techniques (see Section 2.4.5 on page 17, for example) and digital

applications. Coupled with equipment qualification is development of improved quality control and quality assurance processes. Addressing and prioritizing the systems and components related to safety for new plants will create significant benefits for the ITAAC process.

b. Development of alternative source terms for advanced reactors (e.g., HTGR, LMR).
c. The introduction of digital systems and associated sensors may create an environment of information overload. Initiating research in developing ways to turn this data into knowledge may be very useful. In addition, the vulnerability of these new systems to cyber-security threats needs to be thoroughly investigated.
d. Long-term studies may be needed to assess the impact of increasingly scarce water supplies on siting of new facilities. Many of the new facilities may have to be sited on the coast, which brings along other problems.

Specific Comments

1. Page 7: GNEP - The section on GNEP recognizes that tools will need to be developed to analyze new reactors and facilities and that safety margins will need to be determined. Sandia will continue to brief NRC on LDRD activities in this area (e.g., the development of the BRISC code under design to provide 3D thermal-neutronic analysis of fast reactor severe accidents, and evaluation of sodium issues associated with spray fires and concrete interactions).
2. Page 10: Plant aging - Second paragraph in section 2.2.3 discusses need to monitor for degraded plant components, such as dry well liner walls, pipes and nozzles, welds, etc. Davis Bessie presents an interesting case as it was not detected until significant corrosion had occurred. Ways of detecting precursors or symptom analysis associated with such aging aspects would be a great contribution. Perhaps more advanced PRA taking into account actual plant age with potential degraded components, lifetimes, etc., could help quantify risks associated with old plants.
3. Page 12: Digital I&C - Much work needs to be done with respect to equipment qualification, cyber-security, and vulnerability analysis. Research has an active program in digital I&C and increased collaboration in this area is important with the recognition that new plant license applications will include digital I&C. For example, coupling digital system hardware/software response to MELCOR (fast running mode) to evaluate the consequences of DI&C failures would be a significant step forward in understanding the safety regimes of digital I&C systems.
4. Page 14 and 15: Advanced computing – The development of the BRISC code may serve as a strong complement to the efforts in enhancing CFD capabilities. In addition, much analytic work has been done in recent years in estimating structural response of plant containment structures to severe accident impact loadings. Work needs to continue in code (Lagrangian and Eulerian) validation and verification to better understand system structural response. This is particularly important in light of the new requirement in 10CFR52 to evaluate the response to aircraft impacts.
5. Page 16: Advanced modeling for Level 2/3 (MELCOR/MACCS) - Progress on using MELCOR in an uncertainty analysis mode is pointing the direction for advanced Level 2/3 PRA based on code response to the plant damage states. This will leverage with the "Faster than Real time" version of MELCOR being developed for emergency response and decision making activities for NSIR, by providing a fast running code for use in large Monte Carlo activities. As NRC looks at new reactor designs (e.g HTGR) we may move away from quantitative health objectives currently expressed as CDF and LERF, and more towards an allowable dose versus likelihood continuous curve. The methods developed in this work will be enabling technologies in an evolved regulatory framework.

6. Page 16: Advanced Offsite Consequence Code – Some additional features that could potentially enhance these efforts include: integration of new tools with real-time weather data and GIS, and also possible integration with regional array of dose rate measurements.
7. Page 18: Offsite mitigation strategies - Continued collaboration with spray testing mitigation techniques will be mutually beneficial to the NRC and SNL.
8. Page 19: Fire testing on cables and fiber optics – Leveraging this work to better understand the effects of fire and smoke damage to digital I & C systems would provide better fidelity in assessing design basis accident responses of I & C systems to fires.
9. Page 20: Advanced quantitative risk assessment - Collaboration on development of methodologies to include digital I&C system response into PRA analyses would be extremely beneficial.

If you have any questions concerning these comments, please do not hesitate to call. Sandia National Laboratories looks forward to supporting the NRC in addressing these important research areas.

Sincerely,

cc:

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