ACRS MEETING WITH THE U.S. NUCLEAR REGULATORY COMMISSION

June 4, 2009

OVERVIEW

MARIO V. BONACA

Accomplishments

- Since our last meeting with the Commission on November 7, 2008, we issued 16 Reports
- Topics included:
  - Containment accident pressure credit issue
  - Selected Chapters of the ESBWR design certification application

- Vogtle early site permit application and limited work authorization
- Technical basis for revising 10 CFR 50.46(b) loss-of-coolant embrittlement criteria for fuel cladding materials
- Pressurized thermal shock rule

- Regulatory Guide on managing the safety/security interface
- Regulatory Guide on cyber security programs for nuclear facilities
- Options to revise NRC regulations based on ICRP recommendations

License Renewal

Since November 2008:

- Completed review of the Vogtle license renewal application
- Performed interim review of four applications (Beaver Valley, Indian Point, Three Mile Island Unit 1, and Susquehanna)
- Performed interim review of the NIST research reactor

- **Discussed with the staff the status of license renewal activities, interim staff guidance, and implementation of the recommendations from the self assessment**

- **Will perform final review of six applications, including NIST research reactor, during CY2009**
- **Will review updates to the GALL Report and license renewal guidance documents**

Extended Power Uprates

- **We have expressed concerns with credit for containment accident pressure associated with EPUs in our February 16, 2007, and March 18, 2009, reports**
- **We will review the Browns Ferry Unit 1 EPU after receiving the complete safety evaluation report**

- **Browns Ferry Units 2 and 3 EPU application review has been deferred by the staff at the request of TVA. ACRS will review this application after receiving the complete safety evaluation report.**

New Plant Activities

- **Completed review of the SER Chapters for the ESBWR design certification application**
  - **Provided six interim letters on 20 Chapters**
  - **Will review the resolution of open items and the ACRS issues and the final SER**

- **Completed review of the early site permit application and limited work authorization for the Vogtle plant**
- **Reviewing topical reports associated with the US-APWR design**
- **Reviewing revisions to the AP1000 Design Control Document**

- **Review of the SER on the EPR design certification application will start in July 2009**
- **Review of the SER on North Anna COL application, referencing ESBWR design will begin in June 2009**

- **Will continue to interact with the NRO staff to establish schedule for review of design certification and COL applications to ensure timely completion of ACRS review**

Ongoing/Future Activities

- Advanced reactor research plan
- Combined license applications
- Design certification applications
- Digital instrumentation and control systems

- Extended power uprates
- Fire protection
- High-burnup fuel and cladding issues
- Human reliability analysis
- License renewal applications
- New fuel designs and materials
- Next generation nuclear plant (NGNP) project
- Pellet clad interaction failure under EPU conditions

- **Research quality assessment**
- **Revisions to regulatory guides and SRPs**
- **Risk-Informing the regulations**
- **Safeguards and security matters**
- **Safety culture**
- **Safety research program report**
- **Seismic issues**

- **State-of-the-Art Reactor Consequence Analyses (SOARCA) Project**
- **Sump strainer issues**
- **TRACE code applicability to new reactors**
- **Waste management, radiation protection, decommissioning, and materials issues**
- **Watts Bar Unit 2 operating license**

Crediting Containment Accident Pressure in the NPSH Calculations

William J. Shack

NPSH Margin

- Satisfactory performance of the ECCS and containment heat removal system pumps requires adequate NPSH margin
- RG 1.1: Emergency core cooling and containment heat removal systems should be designed so that adequate NPSH is provided to system pumps assuming no increase in containment pressure from an accident

Defense in Depth/Additional Safety Margin

- To maintain defense in depth, it is desirable that ECCS function not depend on containment integrity, so that an unexpected loss of containment integrity not lead automatically to core melt
- Intent of RG 1.1 is to ensure that this independence of the ECCS function be maintained consistently for all reactors

- **Sump strainer blockage is a complex issue. Difficult to provide a demonstrably "conservative" answer. Desirable to maintain margin to address uncertainties**

Extended Power Uprates

- For some plants, demonstrating adequate NPSH for EPU operation would require:
  - Credit for all of the predicted containment accident pressure
  - Reliance on operator action to maintain NPSH

- **Reliance on COP credit for long duration**

- **In some cases, pump cavitation is expected even after crediting all of the predicted accident pressure**

ACRS Position on COP Credit

- **NRC should seek to maintain independence of containment function and accident mitigation and additional margin for NPSH**

ACRS MARCH 18, 2009 LETTER

- **Intended primarily to address voluntary requests for a change in the licensing basis**
- **SRP should be revised to state that, if COP credit is granted based on risk information, all subsequent licensing applications involving COP credit should also include risk information**

- **Demonstrate that it is not practical to reduce or eliminate the need for COP credit by hardware changes or requalification of equipment**
- **If credit for COP is granted, it should be limited in amount and duration**

- **If operator actions are required to maintain overpressure, it must be demonstrated they can be performed reliably, and that any increase in risk is acceptably small**

Recommendation on Analyses and Revision of RG-1.82

- **Continue to use guidance in RG-1.82 Rev. 3 and the licensing-basis analyses assumptions and methods to show that the available NPSH exceeds that needed for the ECCS and containment heat removal system pumps**

- **If COP credit based on the licensing-basis analyses is not small and limited in duration, RG-1.82 should be revised to request additional analyses and information that demonstrate the COP credit needed is small and limited in duration on a more realistic basis**

- **Such information could include thermal-hydraulic analyses that reduce conservatism but account for uncertainties and PRA results that show that large COP credit is needed only for very low-probability events**
- **If operator actions are required, it should be shown they can be implemented in procedures and performed reliably and that any resulting increases in risk are small**

ACRS Position on Decisionmaking

- **Granting COP credit should depend on integrated decisionmaking that considers less conservative estimates of the COP credit; the likelihood of scenarios that require COP credit; and the operator actions required to maintain NPSH**

Conclusion

- **Our March 18, 2009 letter is consistent with long-standing ACRS position**
- **Expect to provide technical input to the development of Revision 4 to RG-1.82**

- **Had a briefing on a draft of the staff's White Paper. While comprehensive, it did not resolve the ACRS concerns**
- **In the review of any particular application for credit, the fidelity of containment and core calculations need to be taken into account**

- **BWROG submitted and staff reviewed a more realistic methodology for evaluating COP credit**
- **ACRS awaits the staff's safety evaluation of the BWROG methodology**

Pressurized Thermal Shock Rule

J. Sam Armijo

Rule Requirements

- **This rule requires plant-specific evaluations of vessel embrittlement and flaw distributions. It also requires evaluation of new surveillance data to ensure detection of unexpected embrittlement trends**

Three Plant Study

- The screening limits are based upon a detailed study of the PTS challenges at three plants
- Medium and large LOCAs were the major contributors to the through-wall cracking frequency (TWCF), which is the risk metric

Generalization

- A generalization study evaluated the variability of PTS challenges from internal events in plants not included in the detailed study
- The likelihood and severity of the important PTS challenges were determined to be representative of those for the entire fleet of PWRs

- **A bounding analysis on the effects of external events showed that their contribution to TWCF was less than that of internal events**
- **Together with the generalization study on internal events, this finding provides assurance that plant-specific analyses of PTS challenges are not needed**

- **The Committee concurs with the staff's conclusion that plant-specific evaluations of PTS challenges are not needed and that the screening criteria in 10 CFR 50.61a may be applied to the entire fleet of PWRs**

Recommendations

- **To aid in the implementation of the rule, the staff should undertake an effort to verify and document the capability of NDE procedures that will be used to characterize the flaw distributions in reactor vessels**

- **An effort is needed to plan for the most effective use of surveillance samples to ensure that any deviations from the current understanding of embrittlement trends in reactor vessels will be identified in a timely manner**

Digital I&C Matters

George E. Apostolakis

- **Reviewed Regulatory Guide 5.71, “Cyber Security Programs For Nuclear Facilities”**
- **Reviewed Digital I&C Interim Staff Guidance 5, “Highly-Integrated Control Room-Human Factors Issues,” and 6, “Licensing Process”**

ACRS March 19, 2009 Report

- **RG-5.71 on cyber security should not be published until it is revised to:**

  -Provide a reference DI&C computer, communication, and network security framework that identifies assets, associated plant functions, vulnerabilities, interaction, and access pathways

- **Include examples and more specific guidance on how the requirements of 10 CFR 73.54 can be met**
- **Ensure that the guidance distinguishes between DI&C system and non-real-time information technology system architectures**

- **Address the issues of threat assessment, dependency analysis, and the use of Probabilistic risk assessment**

ACRS April 21, 2009 Report on Digital I&C Interim Staff Guidance 5 and 6

- Section 3, "Crediting Manual Operator Actions in Diversity and Defense- in-Depth (D3) Analyses," of ISG-5 should be revised to incorporate additional guidance on the estimation methods of the time required for operator action

- **Increased rigor in the supporting analyses should be required as the difference between the time available and the time required for operator action decreases**

- **Draft ISG-6 should not be issued until Sections C and D are revised to specify that sufficient design detail be provided to ensure deterministic behavior and independence of each DI&C safety train**

Options to Revise NRC Regulations Based on ICRP Recommendations

Michael T. Ryan

Staff Options

- No changes to existing framework
- Update parts of regulations, not previously revised, to conform to existing 10 CFR Part 20 concepts and quantities based on ICRP Publications 26 and 30
- Begin to further align NRC's regulatory framework with ICRP Publication 103

February 18, 2009 ACRS Report

- **ACRS endorses the staff's preferred option 3, which would begin to move toward greater alignment between 10 CFR Parts 20 and 50 and Appendix I of Part 50 with recommendations in ICRP Publication 103**

- **ACRS concurs with the staff position that NRC's current regulatory framework continues to provide adequate protection for the health and safety of workers, the public, and the environment**

- **The staff should continue its participation in ICRP and other national and international committees and standards organizations**
- **The NRC should not develop separate radiation protection regulations for plant and animal species**

Progress on Recommendations of the Independent External Review Panel on the Materials Licensing Program

Michael T. Ryan

- **The staff has addressed each of the recommendations of the Independent External Review Panel**
- **The staff has developed Interim Staff Guidance for reviewing new license applications**
- **Includes more detailed information gathering and on-site applicant visits**

- **Staff is developing a process to integrate the National Source Tracking and the Web-Based Licensing Systems as part of the License Verification System**
- **Efforts are under way to integrate all 37 Agreement States into this system**
- **This integration will take time and resources to complete and implement**

- **Staff is pursuing ways to add more detail to the physical security requirements as recommended by the Panel and will be addressed in currently planned rulemakings for larger sealed sources**

- **Adding Security with equal emphasis as Health, Safety, and Environment for materials licensees will require a change in the culture of the Agency**
- **The Agency and the Agreement States share this responsibility**

- **The staff has plans to accomplish the objectives developed from all of the Panel's recommendations**
- **Some short term goals have already been accomplished**
- **Additional progress will take time and resources**

Abbreviations

ACRS	Advisory Committee on Reactor Safeguards
BWR	Boiling water reactor
BWROG	Boiling Water Reactor Owners Group
CFR	Code of Federal Regulations
COL	Combined license
COP	Containment overpressure
CY	Calendar year
D3	Diversity and defense in depth
DI&C	Digital Instrumentation and Control
ECCS	Emergency core cooling system
EPR	Evolutionary Power Reactor
EPU	Extended power uprate
ESBWR	Economic Simplified Boiling Water Reactor
GALL	Generic Aging Lessons Learned Report
ICRP	International Commission on Radiological Protection
ESF	Engineered safety features
I&C	Instrumentation and control
ISG	Interim staff guidance
LOCA	Loss-of-coolant accident
NDE	Non-destructive examination
NGNP	Next Generation Nuclear Plant
NIST	National Institute of Standards and Technology
NPSH	Net positive suction head
NRC	Nuclear Regulatory Commission
NRO	Office of New Reactors
PRA	Probabilistic risk assessment
PTS	Pressurized thermal shock
PWR	Pressurized water reactor
RG	Regulatory Guide
SER	Safety evaluation report
SRP	Standard Review Plan
SOARCA	State-of-the-Art Reactor Consequence Analyses
TVA	Tennessee Valley Authority
TWCF	Through-wall cracking frequency
US-APWR	United States – Advanced Pressurized Water Reactor