

**ACRS MEETING WITH  
THE U.S. NUCLEAR  
REGULATORY  
COMMISSION**

**April 7, 2005**

# **OVERVIEW**

**GRAHAM B. WALLIS**

# Overview

## Major Accomplishments

- **Since our last meeting with the Commission on June 2, 2004, we issued 24 Reports.**
- **Topics included:**
  - **Draft Final 10 CFR 50.69, “Risk-Informed Categorization and Treatment of Structures, Systems, and Components for Nuclear Power Plants”**

# Overview

- Construction authorization request for the MOX Fuel Fabrication Facility**
- Proposed resolution of Generic Safety Issue 185, “Control of Recriticality Following Small-Break LOCAs in PWRs”**
- Draft proposed rule on post-fire operator manual actions**

# Overview

## Future Plant Designs

- **Completed review of the AP1000 design**
- **Reviewed pre-application submittals for ACR-700 and ESBWR designs**
- **Issued AP1000 Lessons Learned Letter**

# Overview

## Future Plant Designs

- **Reviewing proposed technology-neutral framework document for new plant licensing**
- **Reviewing early site permit applications (North Anna, Clinton, and Grand Gulf sites)**

# Overview

## Future Activities

- **Risk-informed and performance-based regulation**
- **Thermal-hydraulic codes**
- **Materials and metallurgy**
- **Advanced reactor designs**
- **Rules and regulatory guidance**
- **Resolution of GSIs**
- **Revisions to SRP**

# Overview

## Future Activities

- **High-burnup fuel issues**
- **Use of MOX fuel in commercial reactors**
- **Report on the NRC Safety Research Program**
- **Assessment of research quality**
- **Core power uprates**

# Overview

## Future Activities

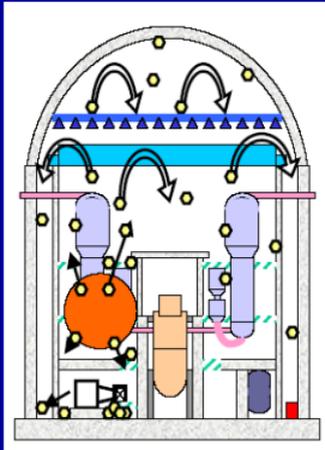
- **License renewal applications**
- **Digital I&C matters**
- **Fire protection**
- **Human factors and human reliability assessment**
- **Operating plant issues**

# **PWR SUMP PERFORMANCE**

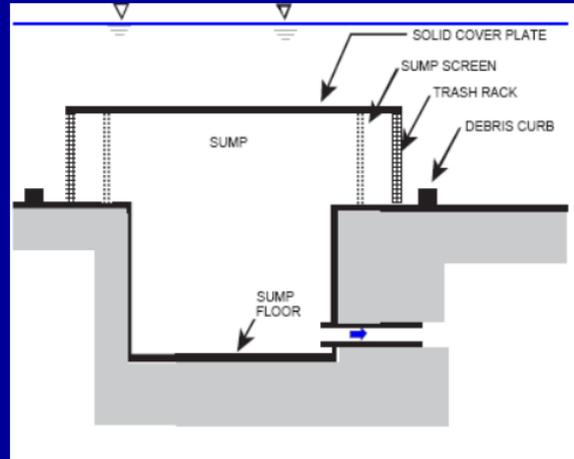
**Graham B. Wallis**

# PWR Sump Performance

## PWR LBLOCA and Sump



LBLOCA Event Occurring in a PWR



ECCS Sump Pit and Debris Screens

# PWR Sump Performance

## Staff and Industry Activities

- **Regulatory Guide 1.82, Revision 3**
- **Bulletin 2003-01**
- **Generic Letter 2004-02**
- **NRC Research Reports**
  - **Technical Basis Report**
  - **Pressure drop through filter beds**
  - **Chemical effects**
- **NEI Guidance Document and Staff SER**

# PWR Sump Performance

## ACRS ISSUES

- **RG 1.82, Rev. 3 does not describe methods acceptable to the staff for meeting the requirements**
- **Generic Letter asks for calculations which are dependent on adequate technical guidance**

# PWR Sump Performance

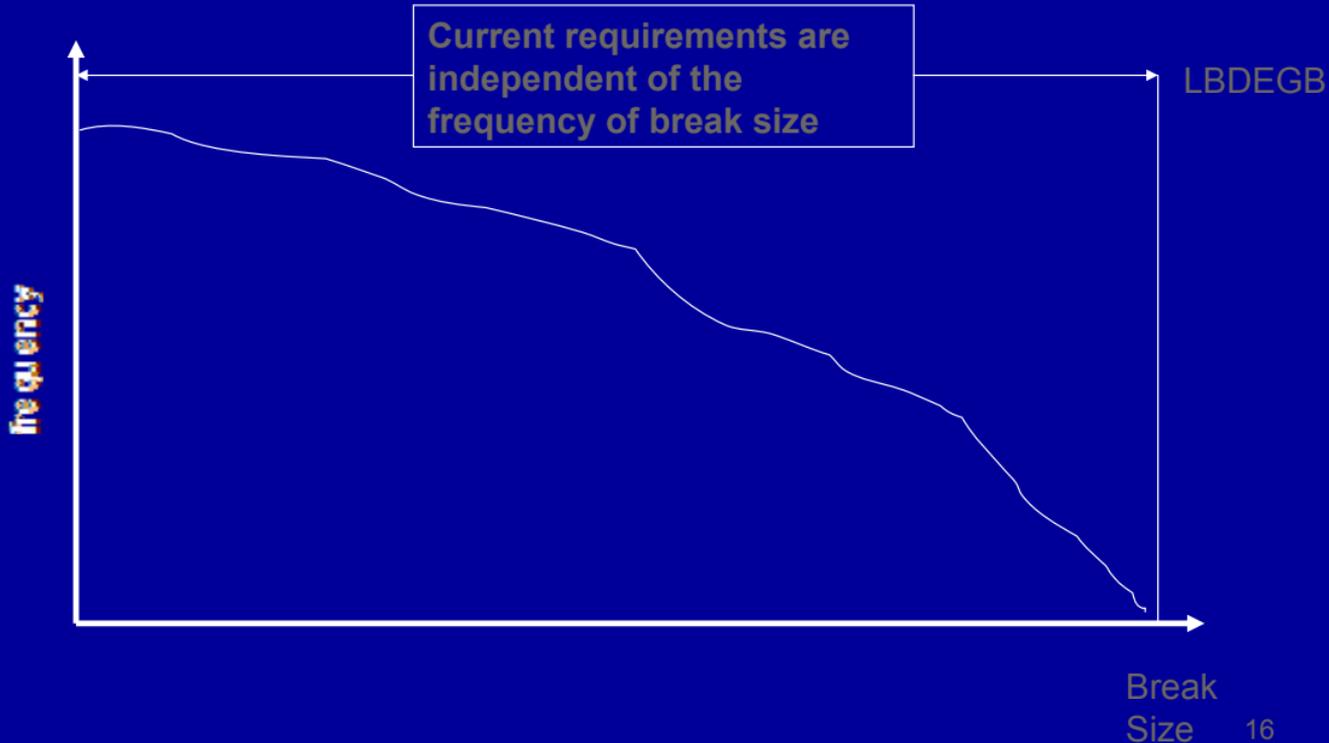
## ACRS ISSUES

- **Guidance contains errors and inadequacies**
- **Alternative solutions, possibly risk-informed**
- **Need for additional research**

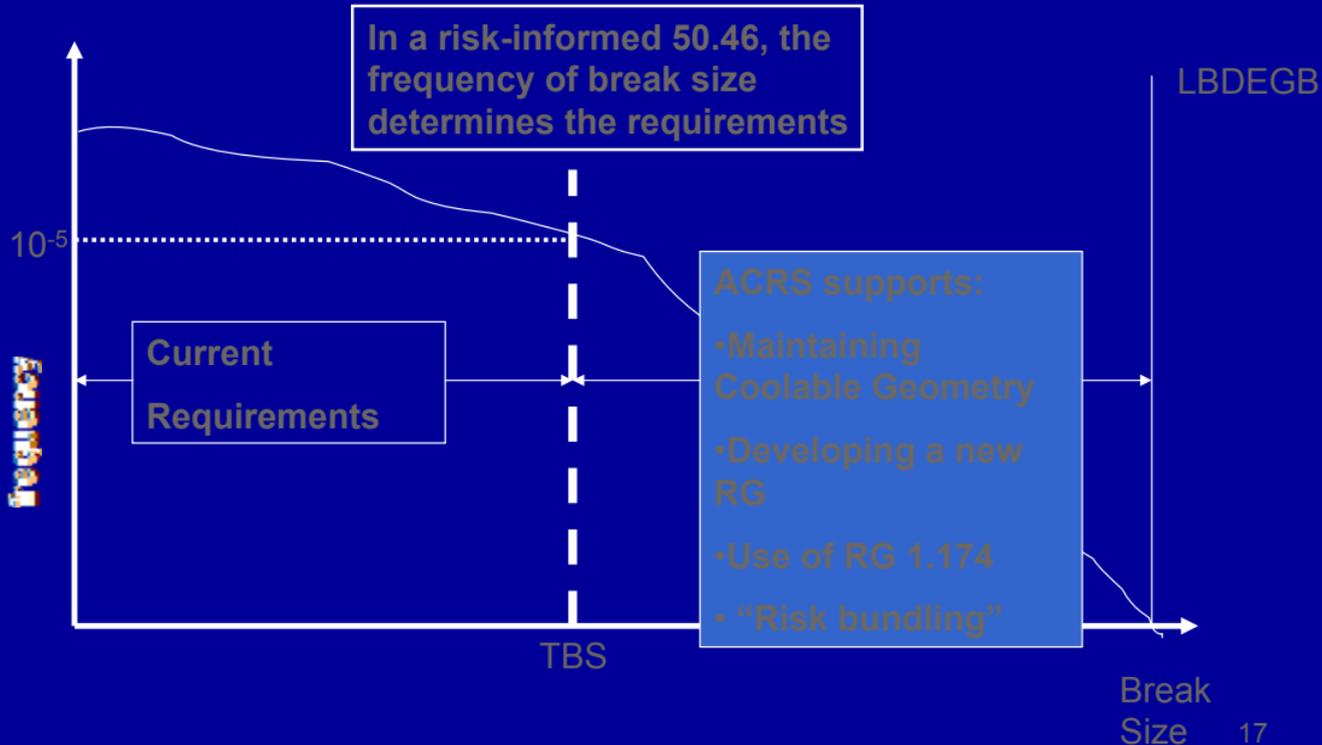
**RISK-INFORMING**  
**10 CFR 50.46**

**George E. Apostolakis**

# Risk-Informing 10 CFR 50.46

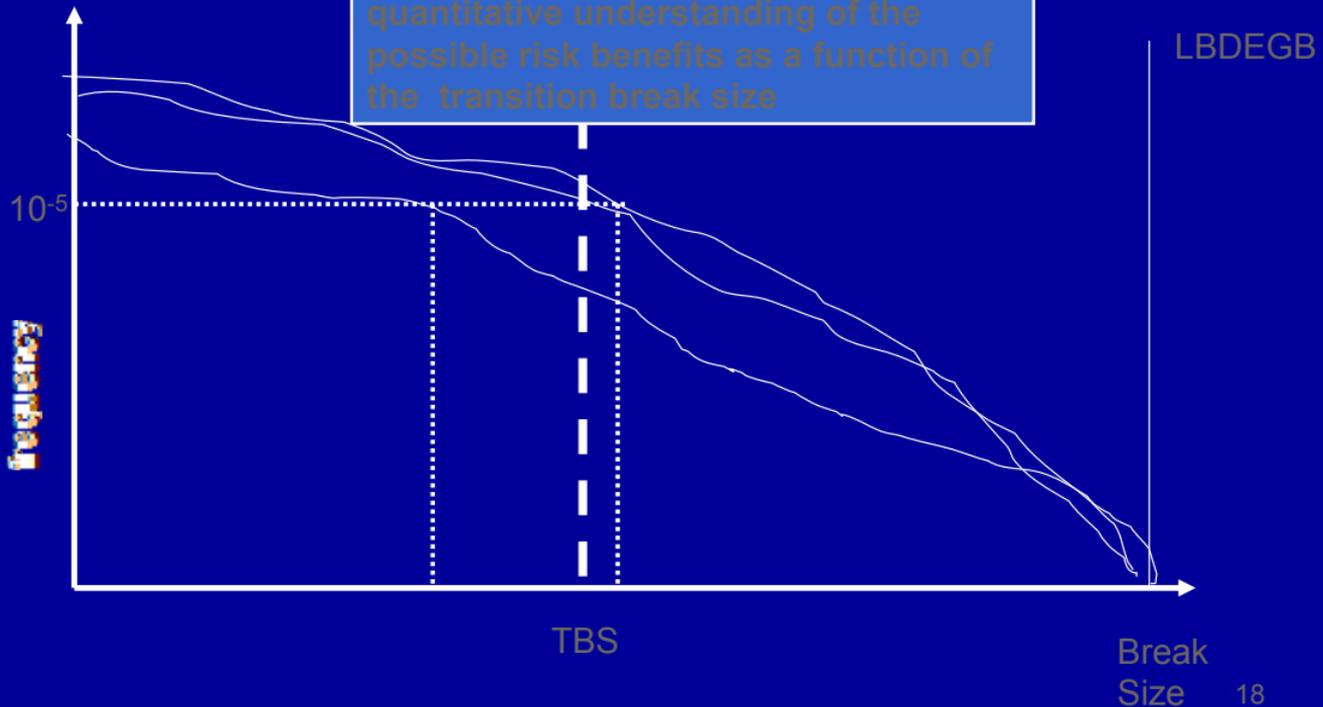


# Risk-Informing 10 CFR 50.46



# Risk-Informing 10 CFR 50.46

Uncertainties in expert opinions create uncertainty in TBS determination; ACRS supports the development of a quantitative understanding of the possible risk benefits as a function of the transition break size



# Risk-Informing 10 CFR 50.46

## ACRS Comments and Recommendations

- **The NUREG Report and the proposed rule should be issued for public comment**
- **Must demonstrate that coolable geometry is maintained for breaks greater than the TBS**
- **Any changes to the licensing basis should be consistent with RG 1.174**

# Risk-Informing 10 CFR 50.46

## ACRS Comments and Recommendations

- **Bundling of changes in risk due to unrelated changes in the licensing basis should be allowed**
- **Expert opinion elicitations should seek to produce a composite distribution that represents the group's (and hopefully the community's) judgment and properly reflect the associated uncertainties**

# Risk-Informing 10 CFR 50.46

## ACRS Comments and Recommendations

- **Eliciting expert opinions provides input to the decisionmaking process, i.e., the selection of the TBS**
- **A quantitative understanding of the possible risk benefits as a function of the TBS is needed**

**PTS REEVALUATION  
PROJECT —  
Technical Basis for Revision  
of the PTS Screening  
Criterion**

**William J. Shack**

# PTS Reevaluation Project

- **Irradiation makes reactor pressure vessels more susceptible to failure by thermal shock under some accident sequences**
- **PTS rule intended to prevent such failures**

# PTS Reevaluation Project

- **Reevaluation project includes:**
  - **Comprehensive study of scenarios that lead to PTS**
  - **More realistic evaluation of thermal hydraulics of PTS scenarios**
  - **More realistic distributions for flaw density and geometry**
  - **Improved PFM analysis code, FAVOR**
  - **Systematic consideration of uncertainties**

# PTS Reevaluation Project

## Subcommittee Meetings

### Materials and Metallurgy

September 2000  
January 2002  
May 2002  
November 2004

### Thermal- Hydraulic Phenomena

January 2001  
May 2002  
December 2002  
November 2004

### Reliability & Probabilistic Risk Assessment

May 2002  
November 2004

## Full Committee Meetings

October 2000  
February 2001  
February 2002 (*Letter to EDO, Feb. 14, 2002*)  
July 2002 (*Letter to EDO, July 18, 2002*)  
February 2003 (*Letter to EDO, Feb 21, 2003*)  
December 2004  
March 2005 (*Letter to EDO, March 11, 2005*)

# PTS Reevaluation Project

## ACRS Recommendation

- **The acceptance criterion for vessel failure frequency should be based on considerations of large early-release frequency and not on core damage frequency**

# PTS Reevaluation Project

## ACRS Conclusions

- **Current PTS screening criterion is very conservative**
- **Improvements to the PFM code (FAVOR) and characterization of irradiated materials and development of more realistic flaw distributions may also provide a basis for reducing unnecessary conservatism in limits on heatup and cooldown**

# PTS Reevaluation Project

## ACRS Conclusions

- **Initial draft technical basis report needed revision to describe more clearly the basic phenomena, issues, approaches, and conclusions**
- **ACRS supported plans for peer review basis**

# PTS Reevaluation Project

## ACRS Conclusions

- **External peer review was valuable, and the staff response to the criticisms and questions has strengthened the technical**
- **Documentation for the project is not yet final, but significant progress has been made**
- **Comprehensive technical basis has been developed to revise the PTS Rule**

# **LICENSE RENEWAL/ EXTENDED POWER UPDATES**

**MARIO V. BONACA**

# License Renewal

- **Performed four interim (subcommittee) reviews and two final (full committee) reviews since June 2004**
- **Will perform two interim reviews and four final reviews during the remainder of CY 2005**
- **Will perform seven interim reviews and six final reviews in CY 2006**

# License Renewal

- **Reviewing updates to Generic License Renewal Guidance documents (SRP, GALL Report, and Regulatory Guide)**
- **Continue to review improvements to the license renewal process**
- **Will review Interim Staff Guidance on license renewal issues**

# License Renewal

- **ACRS comments and recommendations resulted in:**
  - **Proposed GL concerning failures of inaccessible/underground cables that disable accident mitigation systems**
  - **Inclusion of adequate information on TLAAAs in applications and independent staff evaluation of TLAAAs associated with reactor vessel embrittlement**

# License Renewal

- Inclusion of steam dryers in scope for Dresden and Quad Cities**
- Proposed revisions to GALL Report to ensure that**
  - Inspection frequency for buried piping is adequate**
  - Aging management of steam dryer cracking due to flow induced vibration is addressed**

# License Renewal

- Evaluation of operating experience at EPU levels**
- RES study on the need for phosphate limits at sites of plants applying for license renewal**

# Extended Power Uprates

## Waterford 3

- **8% EPU**
- **First use of EPU Review Standard RS-001**
- **Similar to EPU for ANO-2**
- **Large-transient testing should be waived because other approaches are more appropriate in this case**

# Extended Power Uprates

## Waterford 3

- **Generic concern identified regarding boron concentration and precipitation**
- **EPU should be authorized**

# Extended Power Uprates

## Upcoming EPU Requests

- **Vermont Yankee**
- **Browns Ferry**
- **Beaver Valley**
- **Hope Creek**
- **Ginna**

**DIFFERENCES IN  
REGULATORY  
APPROACHES BETWEEN  
U.S. AND OTHER  
COUNTRIES**

**Dana A. Powers**

# Differences In Regulatory Approaches

- **Focus on BWRs and PWRs**
- **Baseline Report by H. Nourbakhsh**
- **Strong influence of the U.S. regulatory system in many countries**
- **Great similarities in accepting the principles of traditional deterministic approach**

# Differences In Regulatory Approaches

- **Differences in use of quantitative risk estimates**
- **Greater attention by Europeans to severe accident management measures**
- **No major differences in response to:**
  - **Sump blockage**
  - **Vessel head penetration issue**

# Differences In Regulatory Approaches

- **The ACRS will endeavor to keep the Commission informed of significant differences in regulatory requirements between United States and other countries that come to its attention**

# Abbreviations

<b>ACR</b>	<b>Advanced CANDU Reactor</b>
<b>ACRS</b>	<b>Advisory Committee on Reactor Safeguards</b>
<b>ANO</b>	<b>Arkansas Nuclear One</b>
<b>BWR</b>	<b>Boiling Water Reactor</b>
<b>CFR</b>	<b>Code of Federal Regulations</b>
<b>CY</b>	<b>Calendar Year</b>
<b>ECCS</b>	<b>Emergency Core Cooling System</b>
<b>EPU</b>	<b>Extended Power Uprate</b>
<b>ESBWR</b>	<b>Economic Simplified Boiling Water Reactor</b>
<b>GALL</b>	<b>Generic Aging Lessons Learned Report</b>
<b>GL</b>	<b>Generic Letter</b>
<b>GSI</b>	<b>Generic Safety Issue</b>
<b>I&amp;C</b>	<b>Instrumentation and Control</b>
<b>LBDEGB</b>	<b>Large Break Double Ended Guillotine Break</b>
<b>LBLOCA</b>	<b>Large Break Loss-of- Coolant Accident</b>

# Abbreviations

<b>LOCA</b>	<b>Loss-of-Coolant-Accident</b>
<b>MOX</b>	<b>Mixed Oxide</b>
<b>NEI</b>	<b>Nuclear Energy Institute</b>
<b>NPSH</b>	<b>Net Positive Suction Head</b>
<b>NRC</b>	<b>Nuclear Regulatory Commission</b>
<b>PFM</b>	<b>Probabilistic Fracture Mechanics</b>
<b>PTS</b>	<b>Pressurized Thermal Shock</b>
<b>PWR</b>	<b>Pressurized Water Reactor</b>
<b>RES</b>	<b>Office of Nuclear Regulatory Research</b>
<b>RG</b>	<b>Regulatory Guide</b>
<b>RS</b>	<b>Review Standard</b>
<b>SER</b>	<b>Safety Evaluation Report</b>

# Abbreviations

<b>SRM</b>	<b>Staff Requirements Memorandum</b>
<b>SRP</b>	<b>Standard Review Plan</b>
<b>TBS</b>	<b>Transition Break Size</b>
<b>TLAAs</b>	<b>Time Limited Aging Analyses</b>
<b>U.S.</b>	<b>United States</b>