

**Westinghouse Owners Group  
Large Break (LB) LOCA Redefinition Program**

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Presentation to NRC  
March 17, 2000**

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**Westinghouse Owners Group  
LBLOCA Redefinition**

- **Desired Outcomes from this Meeting**
  - Describe the WOG Proposed Program for the Redefinition
  - Identify Issues Associated with the Redefinition
  - Establish a Process for WOG and Industry to Interact with the NRC to Move Ahead with the Redefinition

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## Westinghouse Owners Group LBLOCA Redefinition

- **Presentation Overview**
  - Introduction
  - Background
  - Program Approach
  - Safety Benefits
  - Examples of Potential Benefits
  - Program Plan
  - Potentially Affected Regulatory Requirements/Issues
  - Status
  - Rule-Making
  - Identification of Break Size Limit

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## Westinghouse Owners Group LBLOCA Redefinition

- **Presentation Overview (cont.)**
  - Safety Margin
  - Containment
  - Analytical Codes
  - February 2000 Option 3 Workshop
  - Industry Comments
  - Conclusions
  - Process for Moving Forward

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## Westinghouse Owners Group LBLOCA Redefinition

### Background

- November 20, 1998 WOG Letter to Commissioner Diaz
  - Identified LBLOCA as Highest Priority Regulatory Issue
- January 12, 2000 NEI Letter to Chairman Meserve
  - Identified 10CFR50.46 and Appendix K to Part 50 as Prime Candidates for Assessment and Change
- NRC Options Presented as February 2000 Option 3 Workshop

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## Westinghouse Owners Group LBLOCA Redefinition

- **Program Approach**
  - Licensing - Consistent with Risk-Informing Part 50
    - SECY-99-264 (Proposed Staff Plan for Risk-Informing Technical Requirements in 10 CFR Part 50)
  - Risk-Informing the Technical Requirements Complements Risk-Informing the Special Treatment Requirements and Adds Clarity/Consistency to the Regulations
  - Changes to 10 CFR Part 50
    - 50.46 Acceptance Criteria for ECCS
    - Appendix A GDC (LOCA definition)
    - Appendix K (I.C.1)

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## Westinghouse Owners Group LBLOCA Redefinition

- **Program Approach (continued)**
  - Redefine the Design Basis LOCA
    - Size
    - Attendant Consequences
  - Maintain an Acceptable Margin of Safety
  - Technical Justification
    - Use Risk-Informed Technology to Show Low Risk of LBLOCA
      - Utilize the Framework Contained in Regulatory Guide 1.174
    - Use Leak Before Break Analysis to Justify Break Size
      - Define New Limiting Break Size & Reanalyze, as Necessary, to Obtain Benefits
      - Intent is to Reduce Break Size Down to SBLOCA Range

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## Westinghouse Owners Group LBLOCA Redefinition

- **Safety Benefits**
  - Focus Resources on Activities of Greater Risk Significance
  - Reduce Burden of Revising and Maintaining LBLOCA Design/Licensing Basis
  - Consistency within the Regulations
  - Consistency in Various Individual Analytical Applications
  - Provides a More Realistic Basis for Design Evaluations
  - Promotes Realistic Equipment Testing Requirements

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## Westinghouse Owners Group LBLOCA Redefinition

- **Examples of Potential Benefits**
  - **Avoided LBLOCA-Related Regulatory Issues**
    - Reduced Scope of Generic Issues
  - **Tech Spec Relaxations**
    - Diesel Generator Start Time
    - Accumulators
  - **Reduced Analytical Cost/Maintenance**
    - Post LOCA Issues
      - Control Rod Insertion
      - Hot Leg Switchover
  - **Peaking Factor Increases**
  - **Power Uprates**
  - **Reactor Vessel Internals**
    - Barrel Baffle Bolts

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## Westinghouse Owners Group LBLOCA Redefinition

- **Program Plan**
  - **Program Objective**
    - Pursue Rule-Making under SECY-98-300, Option 3 to Allow Redefinition of the Limiting LOCA Break Size Required for Plant Licensing Basis
  - **Program Tasks**
    - **Phase 1 - Scope and Feasibility**
      - Determine Benefits and Costs of Program
    - **Phase 2 (Target - June 2000) - Prepare Technical Justification for Rule-Making**
      - Industry Coordination
      - Prepare Generic Topical Report(s)
      - Identify Implementation Methodology
    - **Phase 3- Rule-Making (Target - 2002)**
      - Support Rule-Making Activities
      - Implementation Guidance
    - **Plant-Specific Implementation(s)**

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## Westinghouse Owners Group LBLOCA Redefinition

- **Rule-making**
  - Utilize Rule-Making Based on SECY-98-300 Option 3
  - Rule-Making with Option of Retaining Current Licensing Basis
  - Regulatory Impact
    - 10 CFR 50.46
    - 10 CFR 50 Appendix K
    - 10 CFR 50 Appendix A General Design Criteria
  - Ideally, the Regulations Should Define what the Implementing Methodology must Achieve, Rather than how the Requirements must be Satisfied
  - Provides Broadest Range of Benefits
  - Minimizes Staff Resources versus Exemption Requests

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## Westinghouse Owners Group LBLOCA Redefinition

- **Potentially Affected Regulatory Requirements/Issues**
  - SRP/FSAR (15)
  - Reg Guides (10)
  - USIs (21)
  - GSIs (12)

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## Westinghouse Owners Group LBLOCA Redefinition

- **Identification of Break-Size Limit**
  - Utilize Risk Insights and LBB Analyses to Support Rule-Making
    - Exclude Breaks Demonstrated to be “Not Credible” by LBB from Licensing Basis
    - Ensure break size from LBB is supported from PRA perspective
    - Generic Aspects of the Program
      - Demonstration of the Principle
      - LBB Methodology
        - NUREG-1061, Volume 3 and Draft SRP 3.6.3
      - WOG Target Value for the Maximum Break Size is in the SBLOCA range
        - Achievable for Most or all Plants
        - Eliminates all Break Sizes Down to the Range of Break Sizes Currently Evaluated in a Typical FSAR for SBLOCA, Simplifying the Change in the DBA to “Remove LB and Retain SB”.

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## Westinghouse Owners Group LBLOCA Redefinition

- **Safety Margin**
  - Risk-Informed Approach Maintains the Defense-In-Depth Philosophy that Underlies the Safety Regulations (SECY-98-300)
  - CDF and LERF Ensure Margins for Health and Safety of the Public
    - LBLOCA Initiating Event Frequency May Be Requantified in Support of Quantitative Health Objectives (QHOs)
  - Redefinition of LBLOCA, Retains LOCA as a DBE
  - Other DBAs Continue to Maintain Adequate Margin
  - Focus Resources on Activities of Greater Risk Significance
    - Optimize Surveillance Requirements
    - Operator Training
    - Post-Accident Operator Actions

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## Westinghouse Owners Group LBLOCA Redefinition

- **Containment**
  - Provides Safety Margin and Defense-in-Depth
    - Remains the Intact Fission Product Barrier in Event of Design Basis LOCA
  - Maintain Structural Integrity

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## Westinghouse Owners Group LBLOCA Redefinition

- **Analytical Codes**
  - Large Break LOCA Evaluation Models can be Eliminated for Plants who Pursue the Revised Licensing Basis
  - No Changes to Remaining Codes/Analyses Required to Support the Rule Change

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## Westinghouse Owners Group LBLOCA Redefinition

- **February 2000 Option 3 Workshop**
  - Relax Simultaneous Failure Assumptions
  - Relax Appendix K Conservatism
  - Make Best-Estimate Analysis Less Burdensome
  - Treat Break Size and Location Probabilistically
  - Large Break LOCA Redefinition

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## Westinghouse Owners Group LBLOCA Redefinition

- **Conclusions**
  - Maintains Acceptable Margin of Safety
  - Key Part of Risk-Informing Part 50
  - Consistent with Intent of Reactor Oversight Process
  - Single Approach to Reduce Burdens Imposed by an Unrealistic Event
    - Complementary to the 1987 GDC-4 Rule Change
    - Integrates Pursuit of Individual Applications in a Cohesive One Time Rule Change
    - Eliminates the Need for More Complex Levels of Analysis
  - Consistent with Technological Advances/Knowledge
  - Reduces both Staff and Industry Resources Associated with LBLOCA
  - Increases Efficiency and Effectiveness

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## Westinghouse Owners Group LBLOCA Redefinition

- **Process For Moving Forward**
  - Use 50.59 Rule Change Process as a Model
  - Establish Regular NRC - WOG/Industry Interaction
  - Desired Product is an Amended Rule

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## Westinghouse Owners Group LBLOCA Redefinition

- **Potentially Affected SRP/FSAR Sections**
  - 2.3.4 Short-Term Diffusion Estimates for Accidental Atmospheric Releases
  - 3.6.2 Determination of Rupture Locations and Dynamic Effects Associated with the Postulated Rupture of Piping (BTP MEB-3-1)
  - 3.9.3 ASME Code Class 1, 2, and 3 Components, Component Supports, and Core Support Structures
  - 4.2 Fuel Design
    - 6.2.1 Containment Functional Design
    - 6.2.2 Containment Heat Removal Systems
    - 6.2.3 Secondary Containment Functional Design
  - 6.3 Emergency Core Cooling System

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## Westinghouse Owners Group LBLOCA Redefinition

- **Potentially Affected SRP/FSAR Sections**
  - 6.4 Control Room Habitability Systems
  - 6.5.1 ESF Atmosphere Cleanup Systems
  - 6.5.2 Containment Spray as a Fission Product Cleanup System
  - 6.5.3 Fission Product Control Systems and Structures
  - 9.2.1 Station Service Water System
  - 9.2.5 Ultimate Heat Sink
  - 15.6.5 Loss-of-Coolant Accidents Resulting from Spectrum of Postulated Piping Breaks Within the Reactor Coolant Pressure Boundary

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## Westinghouse Owners Group LBLOCA Redefinition

- **Potentially Affected Reg Guides**
  - Regulatory Guide 1.1 (Safety Guide 1), Revision 0 (12/70) Net Positive Suction Head for Emergency Core Cooling and Containment Heat Removal Systems
  - Regulatory Guide 1.4, Revision 2 (6/74) Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Pressurized Water Reactors
  - Regulatory Guide 1.7, Revision 2 (11/78) Control of Combustible Gas Concentrations in Containment Following a Loss of Coolant Accident
  - Regulatory Guide 1.14, (Safety Guide 14) Revision 0 (10/71) Reactor Coolant Pump Flywheel Integrity
  - Regulatory Guide 1.27, Ultimate Heat Sink for Nuclear Power Plants

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## Westinghouse Owners Group LBLOCA Redefinition

- **Potentially Affected Reg Guides**
  - Regulatory Guide 1.46 (5/73) Protection Against Pipe Break Inside Containment
  - Regulatory Guide 1.52, Revision 2 (3/78) Design, Testing, and Maintenance Criteria for Post Accident ESF Atmosphere Cleanup Systems Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants
  - Regulatory Guide 1.82, Revision 2 (5/96) Water Sources for Long-Term Recirculation Cooling Following a Loss-of-Coolant Accident
  - Regulatory Guide 1.89, Revision 1 (6/84) Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Plants
  - Regulatory Guide 1.124, Revision 1, (1/78) Service Limits and Loading Combinations for Class 1 Liner-Type Component Supports

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## Westinghouse Owners Group LBLOCA Redefinition

- **Potentially Affected Unresolved Safety Issues (USIs)**
  - Water Hammer (A-1)
  - Asymmetric Blowdown Loads on the Reactor Primary Coolant Systems (A-2)
  - Westinghouse Steam Generator Tube Integrity (A-3)
  - Combustion Engineering Steam Generator Tube Integrity (A-4)
  - Babcock and Wilcox Steam Generator Tube Integrity (A-5)
  - Anticipated Transients Without Scram (A-9)
  - Reactor Vessel Materials Toughness (A-11)
  - Fracture Toughness of Steam Generator and Reactor Coolant Pump Supports (A-12)

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## Westinghouse Owners Group LBLOCA Redefinition

- **Potentially Affected Unresolved Safety Issues (USIs)**
  - Systems Interactions in Nuclear Power Plants (A-17)
  - Qualification of Class 1E Safety-Related Equipment (A-24)
  - Reactor Vessel Pressure Transient Protection (A-26)
  - Residual Heat Removal Requirements (A-31)
  - Control of Heavy Loads Near Spent Fuel (A-36)

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## Westinghouse Owners Group LBLOCA Redefinition

- **Potentially Affected Unresolved Safety Issues (USIs)**
  - Seismic Design Criteria - Short Term Program (A-40)
  - Containment Emergency Sump Performance (A-43)
  - Station Blackout (A-44)
  - Shutdown Decay Heat Removal Requirements (A-45)
  - Seismic Qualification of Equipment in Operating Plants (A-46)
  - Safety Implications of Control Systems (A-47)
  - Hydrogen Control Measures and Effects of Hydrogen Burns on Safety Equipment (A-48)
  - Pressurized Thermal Shock (A-49)

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## Westinghouse Owners Group LBLOCA Redefinition

- **Potentially Affected Generic Safety Issues (GSIs)**
  - A-13: Snubber Operability Assurance
  - B-14: Study of Hydrogen Mixing Capability in Containment Post-LOCA
  - C-1: Assurance of Continuous Long-Term Capability of Hermetic Seals on Instrumentation and Electrical Equipment
  - C-10: Effective Operation of Containment Sprays in a LOCA
  - C-11: Assessment of Failure and Reliability of Pumps and Valves
  - 121: Hydrogen Control for Large, Dry PWR Containment
  - 24: Automatic Emergency Core Cooling System Switch to Recirculation
  - 156.6.1: Pipe Break Effects on Systems and Components
  - 171: ESF Failure From LOOP Subsequent to a LOCA
  - B-17: Criteria for Safety-Related Operator Actions
  - B-61: Allowable ECCS Equipment Outage Periods
  - 191: Assessment of Debris Accumulation on PWR Sump Performance

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