

## Building Confidence into the xLPR Code

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Rockville, MD  
 8-10 March 2016

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## Overview

- What is xLPR?
- Cooperative Development
- Quality Assurance Program
- Independent Reviews
- Technical Outreach
- Verification & Validation
- Sensitivity Studies and Analyses
- Post-Release Support

**xLPR is Setting the Bar for Confidence in Probabilistic Fracture Mechanics**

**xLPR Possesses the Qualities that NRC is Looking for in a Probabilistic Fracture Mechanics Code**

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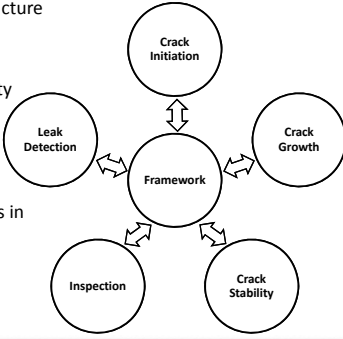
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## What is xLPR?

- Modular probabilistic fracture mechanics code
- Extremely Low Probability of Rupture
- Probabilistic analysis of degradation mechanisms in piping



```

    graph TD
      Framework((Framework)) <--> CrackInitiation((Crack Initiation))
      Framework <--> CrackGrowth((Crack Growth))
      Framework <--> CrackStability((Crack Stability))
      Framework <--> Inspection((Inspection))
      Framework <--> LeakDetection((Leak Detection))
      
```

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## Cooperative Development

**EPR** | ELECTRIC POWER RESEARCH INSTITUTE

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## Quality Assurance Program

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    graph TD
      A[Program Basis Requirements] --> B[Software Project Management Plan]
      A --> C[Software Quality Assurance Plan]
      B --> D[Work Plans]
      C --> E[Software Configuration Management Plan]
      D --> F[Requirements]
      D --> G[Design]
      D --> H[Implementation]
      D --> I[Test]
      D --> J[Release]
      E --> F
      E --> G
      E --> H
      E --> I
      E --> J
  
```

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## Independent Reviews

- External Review Board
- Project Integration Board
- Advisory Committee on Reactor Safeguards
- Independent Design Verification

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## Technical Outreach

- Public meetings
- Conference proceedings
- Journal articles
- Client workshops



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## Verification & Validation

- Verification – Establishes correspondence between product and its specifications
- Validation – Establishes whether product is fit for its intended purpose

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## Sensitivity Studies and Analyses

- Investigate drivers to rupture and uncertainty
- Develop procedures for running code and interpreting output
- Translate output into plant failure frequencies



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## Post-Release Support

- Users' group
- Ongoing maintenance
- Technical assistance
- Further development



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## Summary

- Confidence is intrinsic to the xLPR code
  - Rigorous quality assurance
  - Technical engagement at all levels
  - Comprehensive verification and validation testing
  - User support resources

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