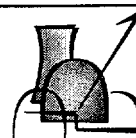


Revision 1 to EPRI TR-102348 “Guideline on Licensing Digital Upgrades”

April 26, 2001

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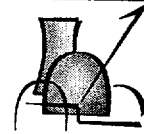
Agenda

- ❖ Project Overview and Purpose of Meeting
- ❖ Perspectives
- ❖ Project Description
 - Background
 - Project Schedule
 - Technical Approach
- ❖ Discussion
 - Technical questions
 - NRC interaction and interfaces
- ❖ Wrap up (action items, expectations)

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Expected Outcome

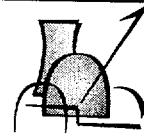


- ❖ Understand and provide feedback on proposed approach to Licensing Guideline revision
- ❖ Participate in Guideline revision effort
 - NRC stakeholders
 - Utilities - I&C design, licensing
 - Vendors
 - NEI - 50.59 Task Force

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Instrumentation & Control - Time to Look Ahead

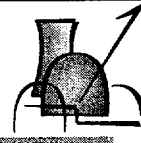


- ❖ Early 90's
 - Analog-to-digital technology shift inevitable
 - Obsolescence of equipment, vendor support, workforce expertise
 - Licensing uncertainties discouraged upgrades
- ❖ Mid 90's
 - Technical and licensing issues stabilized
 - Utilities prepared for deregulation
 - Cost issues discouraged I&C upgrades
 - Obsolescence worsening

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Instrumentation & Control - Time to Look Ahead

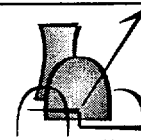


- ❖ Today
 - Shift to strategic viewpoint
 - ◆ Consolidation of companies
 - ◆ License renewal - long plant lives ahead
 - Proven digital solutions readily available
- ❖ Implications for I&C
 - Obsolescence will ultimately degrade performance, reliability
 - 'Upgrade' viewed as optional - it is not
 - Component and system upgrades coming
 - Potential exists for considerable licensing actions ahead

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Ground Work Has Been Laid

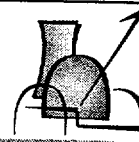


- ❖ NRC guidance
 - Standard Review Plan Chapter 7
 - Reg Guides
 - NUREGs
- ❖ NRC endorsements
 - Licensing
 - EMC testing
 - Commercial grade equipment
 - PLC qualification requirements
 - On-line monitoring for calibration reduction
 - Qualified PLC-based platforms
 - IEEE standards
- ❖ Proven model for successful utility, EPRI, NRC interactions

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NRC Perspectives

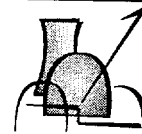


- ❖ Eileen McKenna
- ❖ Jose Calvo
- ❖ Others

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Licensing Guideline Revision

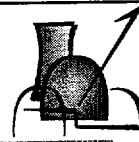


- ❖ TR-102348, "Guideline on Licensing Digital Upgrades," 1993, now obsolete
 - New 10CFR50.59 language and criteria
 - New NEI guidance (96-07, Revision 1)
 - New guides and standards on digital issues
- ❖ EPRI project with NEI support
- ❖ Funding from:
 - US DOE Nuclear Energy Plant Optimization (DOE/NEPO) Program
 - EPRI

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Licensing Guideline Revision Project Approach

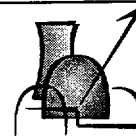


- ❖ Review existing guidance and precedents
 - New 10 CFR 50.59 rule and NEI 96-07 Rev 1
 - BTP-19 on D-in-D & D
 - NUREGs, NUREG/CRs, ALWR
- ❖ Recruit EPRI/NEI Task Force
 - Utilities - I&C design, licensing
 - Owner's groups
 - Standards committees - IEEE, ISA
 - Vendors
 - NEI - 50.59 Task Force

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Project Approach, cont'd



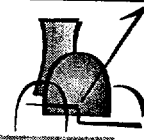
- ❖ Formulate technical basis / approach consistent with and complementary to NEI 96-07, Revision 1
- ❖ Use review cycles to refine approach and revise drafts
 - Industry-wide review
 - Informal discussions with NRC
- ❖ Approach NRC through NEI
 - Submit Guideline to NRC for endorsement (supersede GL 95-02)
 - Involve all NRC stakeholders
 - Fee waiver per 10 CFR 170.21 J

"Fees will not be assessed for requests/reports submitted to the NRC as a means of exchanging information between industry organizations and the NRC for the purpose of supporting generic regulatory improvements or efforts."

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Task Force Members

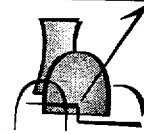


- ❖ Russ Bell, NEI
- ❖ James Boatwright, TXU/STARS
- ❖ Eric Claude, MPR
- ❖ Kristin Davis, MPR
- ❖ Ray DiSandro, Exelon
- ❖ Larry Erin, Westinghouse/IEEE
- ❖ Bob Fink, MPR
- ❖ Bruce Geddes, Calvert Cliffs
- ❖ Wayne Glidden, FirstEnergy/NUSMG
- ❖ John Hefler, Altran
- ❖ Lynnette Hendricks, NEI
- ❖ Tim Hurst, Hurst Technology/ISA
- ❖ Ron Jarrett, TVA/IEEE
- ❖ James Kilpatrick, Calvert Cliffs
- ❖ Fred Madden, NEI
- ❖ Jerry Mauck, Framatome/ISA
- ❖ Wade Messer, Duke
- ❖ Joseph Naser, EPRI
- ❖ Roy Raychaudhuri, Sargent & Lundy
- ❖ Clayton Scott, Triconex/ISA
- ❖ Rob Slough, TXU/STARS
- ❖ BP Singh, DOE
- ❖ Bill Sotos, STP/STARS/ISA
- ❖ Jack Stringfellow, Southern Nuclear
- ❖ Dinesh Taneja, Bechtel
- ❖ Ray Torok, EPRI
- ❖ Dan Wingbermuehle, AmerenUE/STARS

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Project Schedule

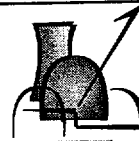


- ❖ October 2000 First meeting of small working group
- ❖ December 2000 Complete approach for revised guideline
- ❖ March 2001 Full Task Force meeting
- ❖ April 2001 First meeting with NRC
- ❖ June 2001 Issue first draft for industry and NRC review
- ❖ July - Sept. 2001 Discuss draft with NRC
- ❖ Oct. 2001 Complete guideline
- ❖ Dec. 2001 Submit guideline to NRC for formal approval
- ❖ TBD NRC issue endorsement in _____(?)

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Highlights of Original Guideline

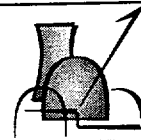


- ❖ Defines regulatory framework for performing digital system upgrades
 - Includes methods for 50.59 evaluations
 - Discusses other digital issues with regulatory implications
- ❖ Endorsed by GL 95-02 with clarifications:
 - Document engineering judgement
 - System-level treatment

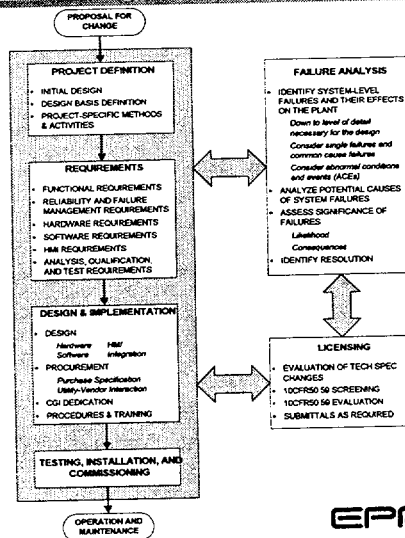
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Overall Approach Remains the Same



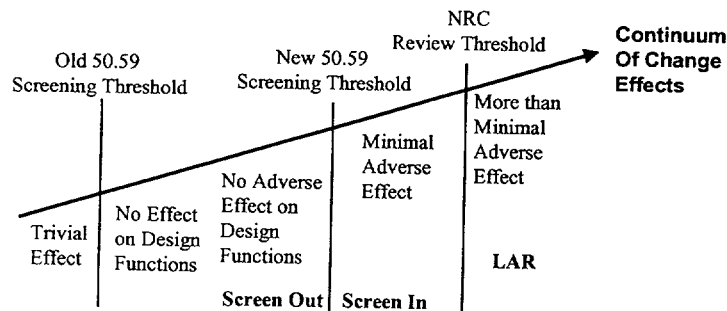
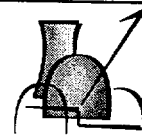
- ❖ Apply "life cycle" approach to digital mod process
- ❖ Rely on failure analysis to provide input to design and licensing processes
- ❖ Address regulatory concerns through good engineering in modification design and evaluation
- ❖ Expand safety significance and complexity theme



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Approach Consistent with NEI 96-07, Rev. 1

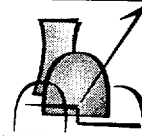


Licensing Guideline to be consistent with and complementary to NEI 96-07 to address digital specific issues as they relate to determinations required throughout this process

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New Guides and Standards for Technical Evaluations



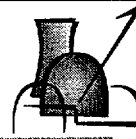
- ❖ Revised Standard Review Plan (SRP)
 - Chapter 7
 - Branch Technical Positions
- ❖ New NUREGs
- ❖ New Regulatory Guides
- ❖ Electromagnetic compatibility (EPRI TR-102323)
- ❖ Commercial grade equipment (EPRI TR-106439)
- ❖ Many others

These provide methods, techniques, and tools to design and evaluate digital systems

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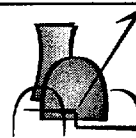
Guideline Contents



- ❖ Intend to use same basic structure
 - ❖ *Digital Upgrade Process* - discusses digital issues in life cycle of design change
 - ❖ *Additional Guidance on Digital Issues* - guidance for design/technical evaluation
 - Failure analysis
 - Digital system quality and dependability
 - Software common mode failure and defense-in-depth and diversity analysis
 - Safety significance, complexity, and risk insights
 - Human-system interface
 - Digital-to-digital upgrades
- NEI ➤ Others to be addressed as appropriate

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Guideline Contents (Cont.)

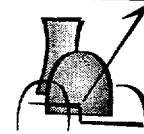


- ❖ *Licensing and 10CFR50.59* - guidance for implementing 50.59
 - New screening criteria
 - Revised 50.59 criteria
 - License amendment requests
- ❖ Examples to be included throughout
 - Illustrate decisions and thresholds

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Digital Upgrade Questions

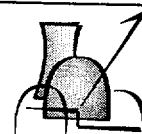


- ❖ Need to provide clarifications to NEI 96-07 on:
 - What's adverse (screening), e.g., "fundamental" change?
 - When to treat software common mode failure in defense-in-depth and diversity analysis?
 - How to address likelihood of malfunctions?
 - How to address results of malfunctions?

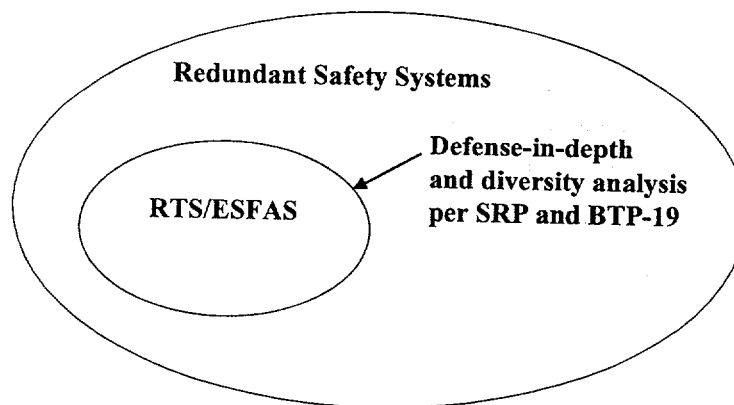
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Software Common Mode Failure



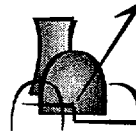
All Plant Systems



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Key 50.59 Issues - Likelihood of Malfunctions (Criterion 2)

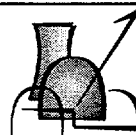


- ❖ Prior approval not required if the change has no more than a minimal increase in likelihood of occurrence of a malfunction
 - Expectation is that digital upgrades to obsolete equipment will result in more dependable systems
- ❖ Is likelihood of malfunction increased by software?
 - Challenge in answering is that software reliability is not easily quantified
 - But methods exist and are being used to assure that digital system design is high quality
- ❖ Per NEI 96-07, Rev. 1, if there's no clear trend towards increasing likelihood, then it is considered no more than minimal
 - Evaluation of quality attributes is needed to show that sufficient quality exists, and likelihood of malfunction is no more than "minimal"

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Key 50.59 Issues - Results of Malfunctions (Criterion 6)

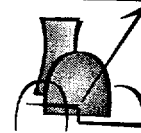


- ❖ Prior approval not required if the change does not create a possibility for a malfunction with a different result
- ❖ Does digital upgrade cause malfunctions with different results?
 - Per NEI 96-07, Rev. 1, possible malfunctions are limited to those as likely to occur as those described in the UFSAR
 - Evaluation of failure modes and effects is needed to determine whether credible failures can create different results
 - Special consideration of software common mode failure for RTS/ESFAS
 - Level of detail consistent with UFSAR

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Wrap Up



- ❖ Develop digital upgrade approach to:
 - Maintain safety
 - Focus utility and NRC resources
 - Facilitate upgrades with predictable licensing process
- ❖ Consensus needed to be successful
 - Utilities
 - Regulators
 - Vendors and system integrators
- ❖ Need NRC support
 - Informal discussion/review
 - Endorsement of Guideline

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