



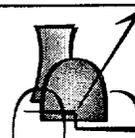
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***Revision 1 to EPRI TR-102348  
“Guideline on Licensing  
Digital Upgrades”***

*April 26, 2001*

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***Agenda***

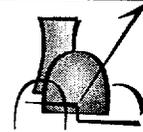
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- ❖ Project Overview and Purpose of Meeting
- ❖ Perspectives
- ❖ Project Description
  - Background
  - Project Schedule
  - Technical Approach
- ❖ Discussion
  - Technical questions
  - NRC interaction and interfaces
- ❖ Wrap up (action items, expectations)

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## *Expected Outcome*

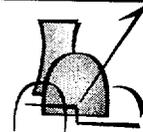


- ❖ Understand and provide feedback on proposed approach to Licensing Guideline revision
- ❖ Participate in Guideline revision effort
  - NRC stakeholders
  - Utilities - I&C design, licensing
  - Vendors
  - NEI - 50.59 Task Force

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## *Instrumentation & Control - Time to Look Ahead*

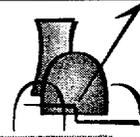


- ❖ Early 90's
  - Analog-to-digital technology shift inevitable
    - Obsolescence of equipment, vendor support, workforce expertise
  - Licensing uncertainties discouraged upgrades
- ❖ Mid 90's
  - Technical and licensing issues stabilized
  - Utilities prepared for deregulation
  - Cost issues discouraged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

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## ***Instrumentation & Control - Time to Look Ahead***

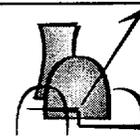


- ❖ Today
  - Shift to strategic viewpoint
    - ✦ Consolidation of companies
    - ✦ License renewal - long plant lives ahead
  - Proven digital solutions readily available
- ❖ Implications for I&C
  - Obsolescence will ultimately degrade performance, reliability
  - 'Upgrade' viewed as optional - it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

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## ***Ground Work Has Been Laid***

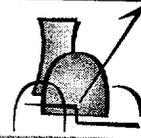


- ❖ NRC guidance
  - Standard Review Plan Chapter 7
  - Reg Guides
  - NUREGs
- ❖ NRC endorsements
  - Licensing
  - EMC testing
  - Commercial grade equipment
  - PLC qualification requirements
  - On-line monitoring for calibration reduction
  - Qualified PLC-based platforms
  - IEEE standards
- ❖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

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## *NRC Perspectives*

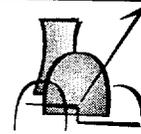


- ❖ Eileen McKenna
- ❖ Jose Calvo
- ❖ Others

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## *Licensing Guideline Revision*

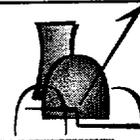


- ❖ TR-102348, "Guideline on Licensing Digital Upgrades,"  
1993, now obsolete
  - New 10CFR50.59 language and criteria
  - New NEI guidance (96-07, Revision 1)
  - New guides and standards on digital issues
- ❖ EPRI project with NEI support
- ❖ Funding from:
  - US DOE Nuclear Energy Plant Optimization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

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## ***Licensing Guideline Revision Project Approach***

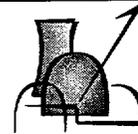


- ❖ Review existing guidance and precedents
  - New 10 CFR 50.59 rule and NEI 96-07 Rev 1
  - BTP-19 on D-in-D & D
  - NUREGs, NUREG/CRs, ALWR
- ❖ Recruit EPRI/NEI Task Force
  - Utilities - I&C design, licensing
  - Owner's groups
  - Standards committees - IEEE, ISA
  - Vendors
  - NEI - 50.59 Task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

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## ***Project Approach, cont'd***



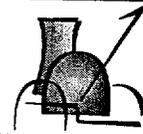
- ❖ Formulate technical basis / approach consistent with and complementary to NEI 96-07, Revision 1
- ❖ Use review cycles to refine approach and revise drafts
  - Industry-wide review
  - Informal discussions with NRC
- ❖ Approach NRC through NEI
  - Submit Guideline to NRC for endorsement (supersede 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*

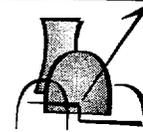


- ❖ Russ Bell, NEI
- ❖ James Boatwright, TXU/STARS
- ❖ Eric Claude, MPR
- ❖ Kristin Davis, MPR
- ❖ Ray DiSandro, Exelon
- ❖ Larry Erin, Westinghouse/IEEE
- ❖ Bob Fink, MPR
- ❖ Bruce Geddes, Calvert Cliffs
- ❖ Wayne Glidden, FirstEnergy/NUSMG
- ❖ John Hefler, Altran
- ❖ Lynnette Hendricks, NEI
- ❖ Tim 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*

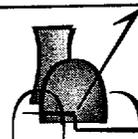


- ❖ October 2000 First meeting of small working group
- ❖ December 2000 Complete approach for revised guideline
- ❖ March 2001 Full Task Force meeting
- ❖ April 2001 First meeting with NRC
- ❖ June 2001 Issue first draft for industry and NRC review
- ❖ July - Sept. 2001 Discuss draft with NRC
- ❖ Oct. 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

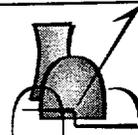


- ❖ Defines regulatory framework for performing digital system upgrades
  - Includes methods for 50.59 evaluations
  - Discusses other digital issues with regulatory implications
- ❖ Endorsed by GL 95-02 with clarifications:
  - Document engineering judgement
  - System-level treatment

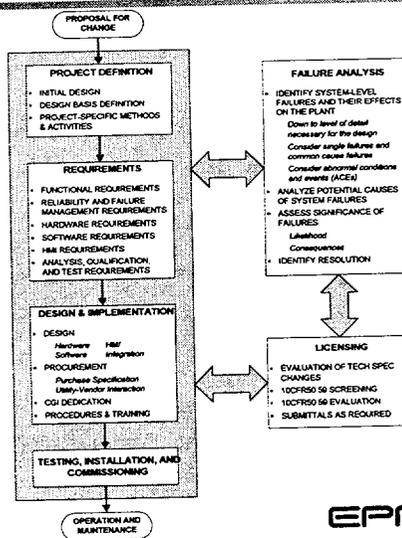
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## Overall Approach Remains the Same



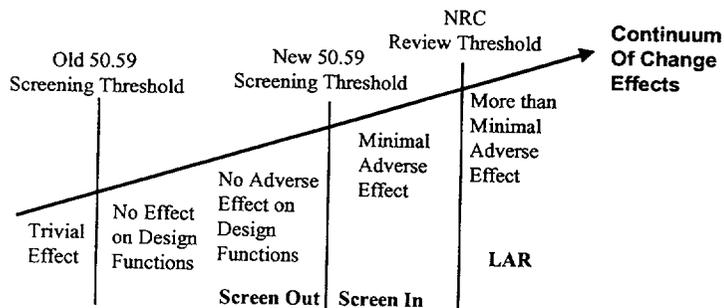
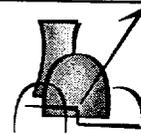
- ❖ Apply "life cycle" approach to digital mod process
- ❖ Rely on failure analysis to provide input to design and licensing processes
- ❖ Address regulatory concerns through good engineering in modification design and evaluation
- ❖ Expand safety significance and complexity theme



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## ***Approach Consistent with NEI 96-07, Rev. 1***

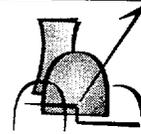


Licensing Guideline to be consistent with and complementary to NEI 96-07 to address digital specific issues as they relate to determinations required throughout this process

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## ***New Guides and Standards for Technical Evaluations***



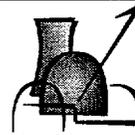
- ❖ Revised Standard Review Plan (SRP)
  - Chapter 7
  - Branch Technical Positions
- ❖ New NUREGs
- ❖ New Regulatory Guides
- ❖ Electromagnetic compatibility (EPRI TR-102323)
- ❖ Commercial grade equipment (EPRI TR-106439)
- ❖ Many others

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

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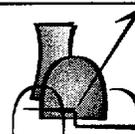
## ***Guideline Contents***



- ❖ 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.)***

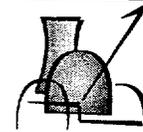


- ❖ *Licensing and 10CFR50.59* - guidance for implementing 50.59
  - New screening criteria
  - Revised 50.59 criteria
  - License amendment requests
- ❖ Examples to be included throughout
  - Illustrate decisions and thresholds

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## Digital Upgrade Questions

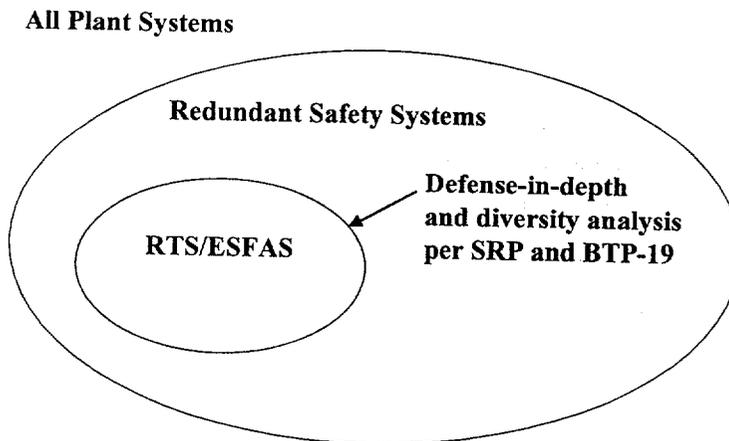
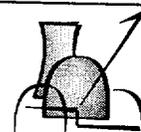


- ❖ Need to provide clarifications to NEI 96-07 on:
  - What's adverse (screening), e.g., "fundamental" change?
  - When to treat software common mode failure in defense-in-depth and diversity analysis?
  - How to address likelihood of malfunctions?
  - How to address results of malfunctions?

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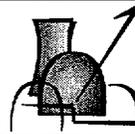
## Software Common Mode Failure



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## ***Key 50.59 Issues - Likelihood of Malfunctions (Criterion 2)***

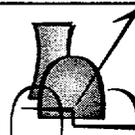


- ❖ Prior approval not required if the change has no more than a minimal increase in likelihood of occurrence of a malfunction
  - Expectation is that digital upgrades to obsolete equipment will result in more dependable systems
- ❖ Is likelihood of malfunction increased by software?
  - Challenge in 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)***

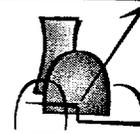


- ❖ Prior approval not required if the change does not create a possibility for a malfunction with a different result
- ❖ Does digital upgrade cause malfunctions with different results?
  - Per NEI 96-07, Rev. 1, possible malfunctions are limited to those as likely to occur as those described in the 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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