

NRC Commission Briefing

**Digital I&C:
An Industry Perspective**

November 8, 2006

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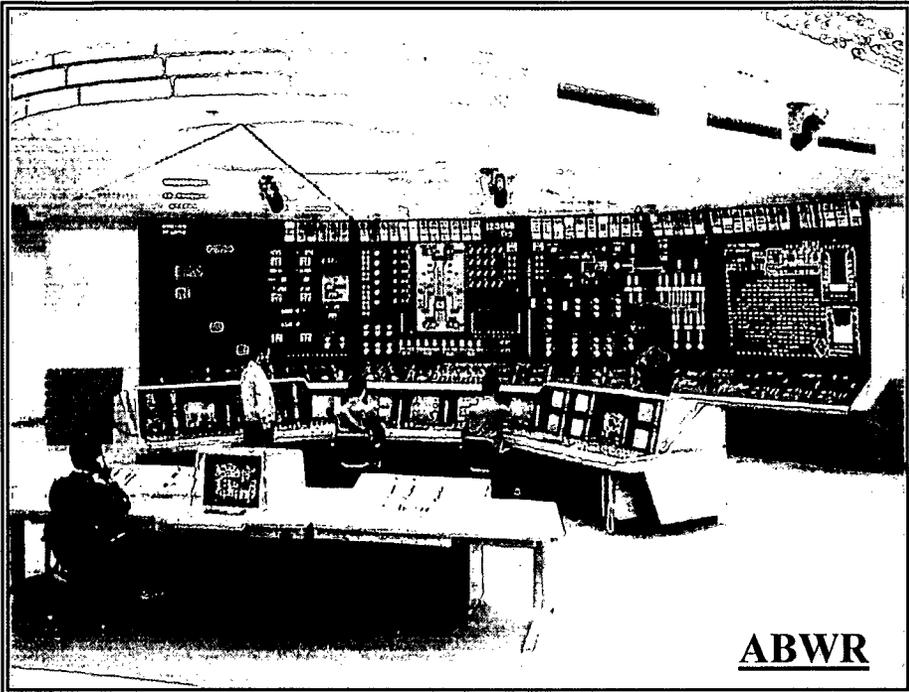
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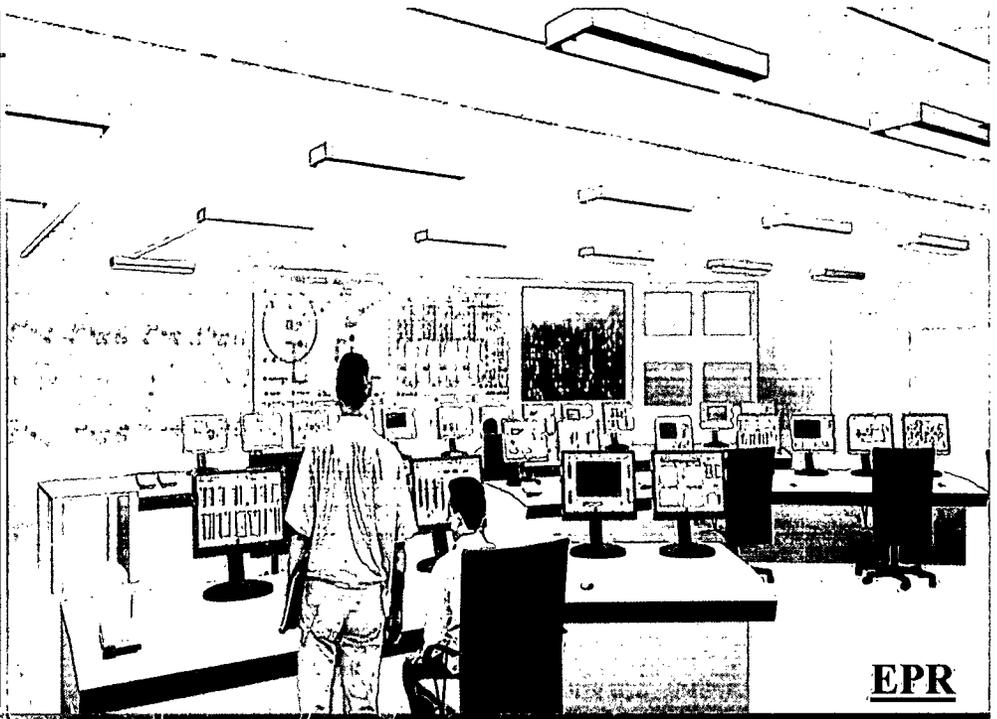


Topics

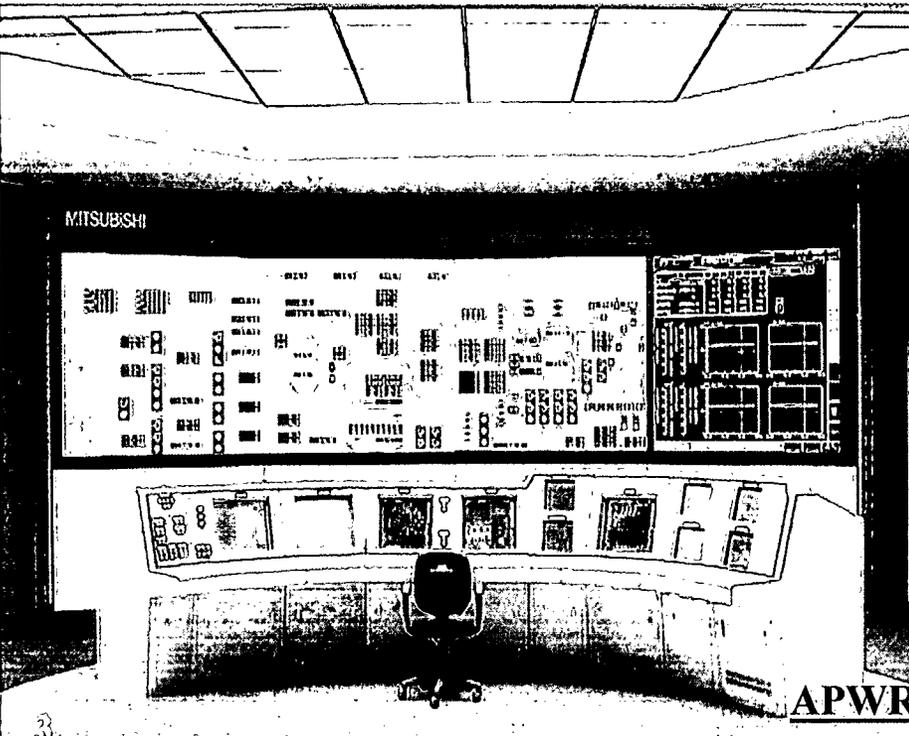
- **Application of Digital Technology**
- **Need for a Shared Vision**
- **Ongoing Activities**
- **Problem Statement**
- **Success Criteria**
- **Requested Actions**
- **Conclusions**



ABWR



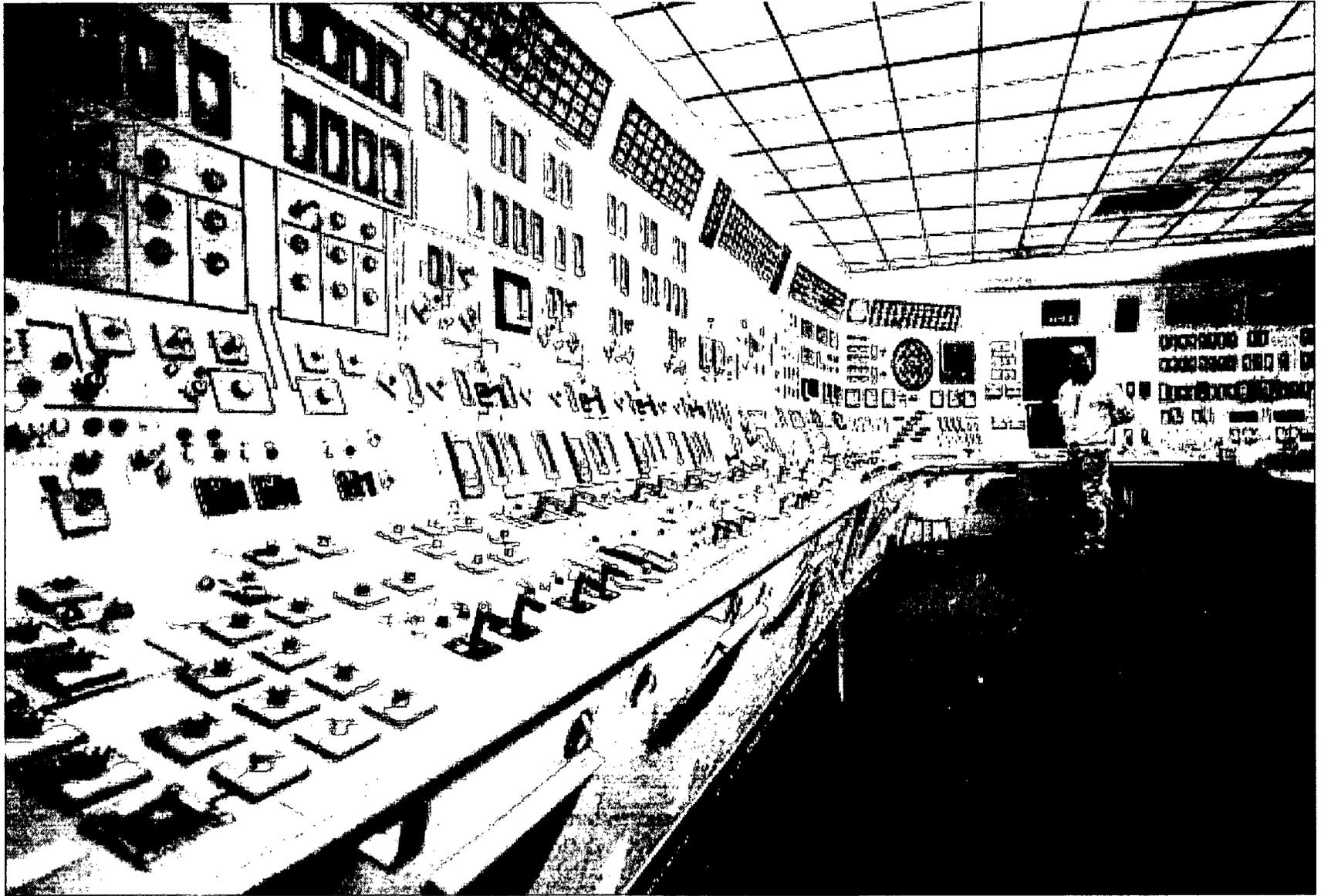
EPR



APWR



AP1000



Digital Technology

- **Necessary for the future of the Nuclear Industry**
 - **Improved reliability and performance = enhanced safety**
 - **Addresses obsolescence and spare/replacement parts issues**
 - **Reduces burden on operators (surveillances, automation)**
 - **New Plant I&C Systems**

Digital Technology Applications

- **Not a “new” technology**
- **Embraced by other industries and countries as superior to analog technology**
 - **Energy, airline, military, aerospace and petroleum industries**
 - **Foreign nuclear power plants**
 - **U.S. nuclear power plants - Secondary Systems (Feedwater Control Systems), some Primary Systems (not fully integrated)**

Need For A Shared Vision

The safety, reliability, and efficiency improvements gained by using digital technology in U.S. nuclear power plants dictate that the behaviors and actions of both the regulator and industry embrace and encourage its timely deployment and safe implementation.

Ongoing Activities

- **New plant guidance is being developed**
 - **Draft Regulatory Guide (DG-1145)**
 - **Standard Review Plan updates**
- **NRC Staff is still forming opinions on several key issues**
 - **Adequate diversity in digital applications (BTP-19)**
 - **Risk informing reviews**
 - **Inter-channel communications**

Ongoing Activities (Continued)

- **Research efforts are ongoing to support advanced technologies and control rooms**
 - **Expected to result in changes to existing guidance and new guidance being developed**

Obstacles Exist

■ **Regulatory Guidance Issues**

- **Current guidance / regulations being updated**
 - **New plant design certifications have been and are based on existing guidance**
- **In some cases current guidance does not reflect changes in staff positions**

■ **Technical Issues Need To Be Addressed**

- **Duke Energy submittal review identified potential generic technical issues and apparent changes to existing guidance (BTP-19)**
- **Recent new plant discussions indicate technical issues will need to be addressed – some generically**
- **No criteria for incorporating risk insights into digital applications**

Obstacles Exist (Continued)

■ Process

- Many issues cross multiple organizations and disciplines, leading to coordination issues and untimely resolution**
- Lack clear guidance for amendment submittal content / timing**

Problem Statement

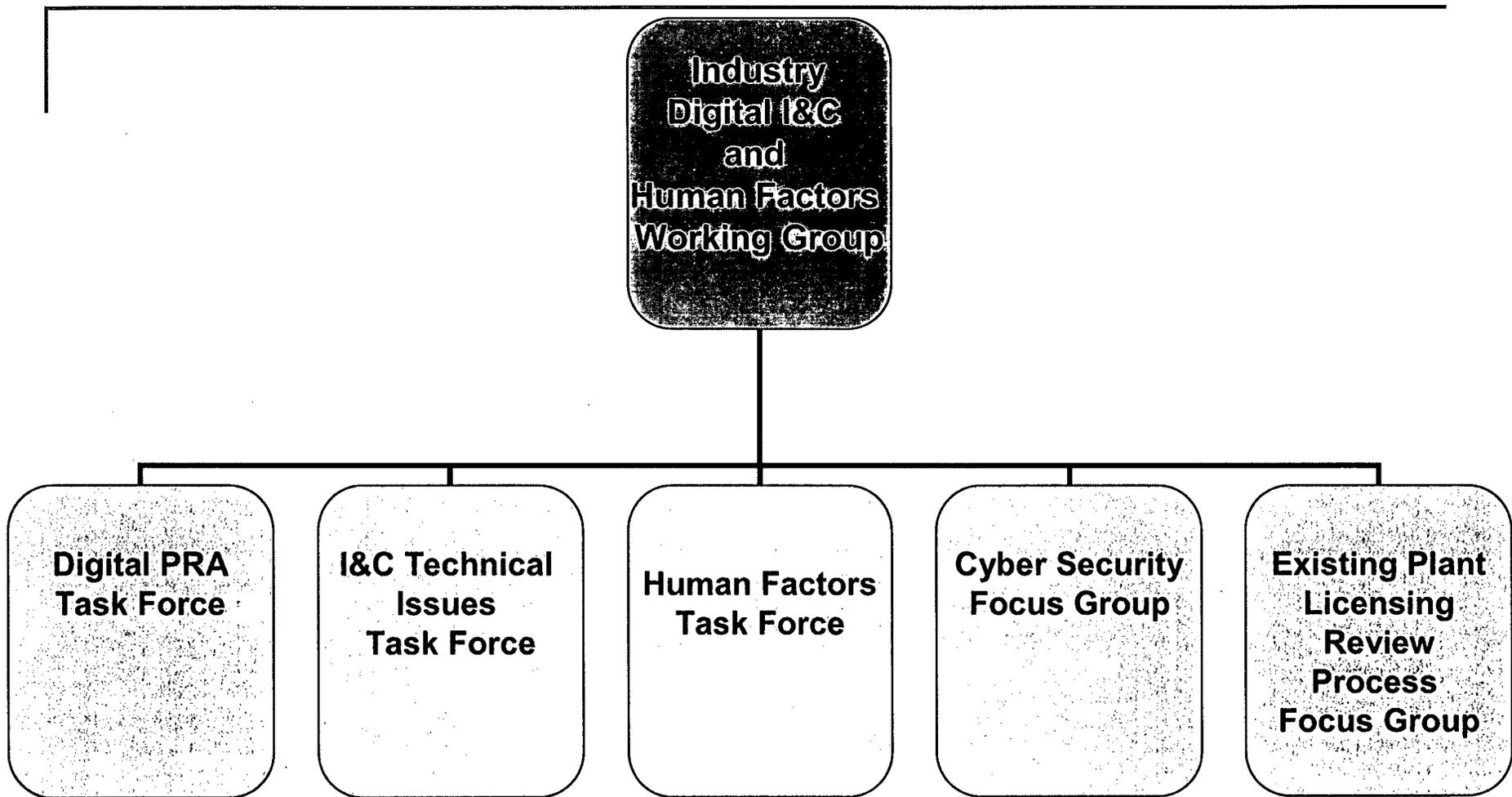
- **In spite of recent activities, there is no clear success path for resolving long-standing technical and process issues, causing...**
 - **Existing plants to delay and/or change plans for digital upgrades**
 - **Issue resolution in the I&C and human factors areas are a critical path activity for new plants**
 - **Potential removal of important features from or addition of unnecessary complexity to the I&C systems**

We All Need...

- **A stable, predictable, and timely licensing process for both new and existing plants, evidenced by:**
 - **Timely, generic resolution of emerging issues**
 - **Submittal of high quality license amendment requests, standardized to the extent possible**
 - **Using the right process when there is a need to take positions contrary to existing published guidance**
 - **Understanding that the application of mechanical system or analog design concepts to digital technology may not be the appropriate model**

We All Need...

- **Integration of activities in and across multiple areas and organizations**
 - **Human factors, I&C, cyber security, PRA, research**
 - **Industry, NRC, standards organizations, international organizations**
- **Use of risk insights to help us better understand system vulnerabilities and develop safer and more reliable digital designs**
- **Understanding of, agreement on, and, to extent possible, collaboration on research initiatives**



The Industry Digital I&C and Human Factors Working Group, along with its associated Task Forces and Focus Groups, provides an infrastructure for industry and vendors to effectively interface with NRC and address potential generic issues that arise from the implementation of digital technology.

Digital PRA Task Force

Coordinates industry efforts relative to the use of risk insights associated with digital technology for both existing and new plants. The group also reviews NRC research activities associated with digital applications.

I&C Technical Issues Task Force

Coordinates industry efforts relative to I&C technical issues associated with the application of digital technology for both existing and new plants.

Human Factors Task Force

Coordinates human factors and control room design issues associated with use of digital technology for both existing and new plants.

Focus Groups

Coordinate with existing NEI task forces to address issues related to cyber security and the licensing process.

Moving Forward

- **A commitment of resources (Industry & NRC) is needed to develop action plans and coordinate issue resolution in a timely, efficient manner**
- **Industry has developed an infrastructure to move digital I&C forward from a regulatory perspective**
- **Commission/Senior NRC Management attention is needed to help ensure consistency and coordination between multiple NRC offices (NRR-NRO-RES-NSIR)**

Requested Actions

- **Develop an interaction protocol that will capitalize on previous successful initiatives**
 - **Apply License Renewal Model for interactions**
- **In concert with stakeholders, develop an integrated plan to address issues with a well-defined scope and schedule for deliverables**
 - **Include a mechanism for getting “unstuck” on technical issues**
 - **Ensure changes to current positions are made in accordance with appropriate regulatory process and well communicated to stakeholders**

License Renewal Model Applied to Digital I&C

- **Develop a Digital I&C / Human Factors Steering Committee comprised of senior management (Deputy Office Director and above) from:**
 - **NRR**
 - **NRO**
 - **RES**
 - **NSIR**
- **Hold quarterly meetings with industry working group**
- **Hold frequent meetings with NRC technical staff and industry task forces / other stakeholders**
- **Conduct periodic Commission briefings**

Requested Actions

- **Endorse the application of risk insights into digital applications and reviews**
- **Direct the staff to work more closely with stakeholders to clearly define acceptance criteria in guidance documents (e.g. BTP-19)**
- **Conduct a near-term briefing so that both NRC and Industry can develop a full understanding of the implications research activities might have on both new and existing plants**

Requested Actions

- **Issue a policy statement to capture these thoughts that can be used to:**
 - **Instill a sense of urgency on this effort**
 - **Acknowledge that the use of proven digital technologies will enhance safety, reliability, and efficiency at our nuclear power plants**

Conclusions

- **Business as usual will not result in success**
- **Both parties need:**
 - **A common Vision**
 - **An effective, efficient method for interacting and resolving issues**
 - **A clearly defined plan for moving forward**
 - **To regularly monitor progress**
- **It is imperative that we act now**

List of Acronyms

- **ABWR: Advanced Boiling Water Reactor**
- **APWR: Advanced Pressurized Water Reactor**
- **BTP: Branch Technical Position**
- **DG: Draft Regulatory Guide**
- **EPR: Evolutionary Power Reactor**
- **I&C: Instrumentation and Controls**
- **NEI: Nuclear Energy Institute**
- **NRC: Nuclear Regulatory Commission**
- **NRO: Office of New Reactors**
- **NRR: Office of Nuclear Reactor Regulation**
- **NSIR: Office of Nuclear Security & Incident Response**
- **PRA: Probabilistic Risk Assessment**
- **RES: Office of Research**



Digital Instrumentation and Controls

November 8, 2006

Acronyms

(excluding reactor identifiers)

COL	Combined Operating License
D3	Diversity and Defense-in-Depth
DOE	Department of Energy
FPGA	Field-Programmable Gate Array
I&C	Instrumentation and Controls
NRC	Nuclear Regulatory Commission
NRO	Office of New Reactor Licensing

Acronyms - continued

NRR	Office of Nuclear Reactor Regulation
NSIR	Office of Nuclear Safety and Incident Response
RES	Office of Nuclear Regulatory Research
SRP	Standard Review Plan

Agenda

- **Background**
- **Licensing activities**
- **Technical issues**
- **Research activities**
- **Conclusions**

Current Technology



Digital Technology



Digital I&C

Future Workload

- **Operating reactor modifications**
- **Design Certification**
- **Combined Operating Licenses**

Diversity and Defense-in-Depth (D3)

- **Current approach**
- **Improving methods**
- **Acceptable level of D3**
- **Digital control room**

Digital Risk Assessment

- **Industry proposed D3 analysis**
- **NRC initiatives to update modeling**
- **Future activities**

Highly Integrated Control Room

- **Communication independence**
 - **between safety channels**
 - **safety to non-safety**
- **Control room design**

Cyber Security

- **Guidance for safety systems**
- **Industry guidelines**
- **Issue and resolution**

Infrastructure Development

- **Updates to guidance**
- **Recruiting**
- **Training**
- **External contacts**

Digital System Research

- **Comprehensive research plan**
- **27 research projects that support program offices**
- **Products include technical review guidance and acceptance criteria**
- **Research supports current and future reactor key issues**

Diversity and Defense-in-Depth (D3)

- **Knowledge and technology has evolved**
- **Complex process to consider diversity attributes**
- **Develop combinations of D3 strategies**

Digital Risk Assessment

- **I&C licensing process is deterministic**
- **Developing modeling methods**
- **Other industries have used reliability and risk methods**
- **Goal is to establish a risk-informed review method**

Highly Integrated Control Room

- **Will provide licensing guidelines**
 - **Safety channel communications**
 - **Safety to non-safety system displays and controls**
- **Will develop review criteria**

Cyber Security

- **Cyber security assessments**
 - **Evaluating potential vulnerabilities**
 - **Safety system assessments**
 - **Safety to non-safety connections**

Additional Research Areas

- **Alternatives to micro-processor technology**
 - **Field Programmable Gate Array (FPGA) based technology**
 - **Develop review guidance**
- **On-line Monitoring**
 - **Provide guidance on analytical methods and uncertainty**

Conclusions

- **Evolving digital technology is a challenge from a regulatory perspective**
- **We are working closely with stakeholders to update guidance**
- **Leverage other sources**
- **Working to have the right people and procedures to license digital systems**