



U.S. NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

**Thursday,
July 12, 2007**

PROJECT PLAN

Digital Instrumentation and Control

*Approved by the Digital I&C
Steering Committee*

Revision: 7/12/2007

DIGITAL I&C PROJECT PLAN

PURPOSE:

The purpose of the Digital Instrumentation and Controls (I&C) Project Plan is to identify the objectives and the scope of the project including the short-term and long-term deliverables. The Project Plan defines the roles and responsibilities of the digital I&C Steering Committee and the Task Working Groups (TWGs). It describes the process to develop Interim Staff Guidance (ISG) for the review of digital I&C technology for new reactors, operating reactors, and fuel cycle facilities. The digital I&C project plan accounts for issues related to the review of the anticipated licensing actions including digital upgrades at operating reactors and fuel cycle facilities, new reactor Combined License (COL) and Design Certification applications, and new fuel facilities.

OBJECTIVES:

The specific short-term objective of this plan is to identify digital I&C technical and regulatory issues for which ISG can be developed in time to support the review of the anticipated licensing actions. The long-term objectives of this plan are to continue stakeholder interactions to refine and enhance digital I&C regulatory guidance or identify consensus standards that could be endorsed as regulatory guidance. The deliverables associated with the long-term objectives are to develop recommendations that will be used to update the Standard Review Plan (SRP) and Branch Technical Positions (BTPs), and other regulatory documents, e.g., NUREGs or Regulatory Guides (RGs), and revise regulations, as appropriate, through established agency processes.

BACKGROUND:

The basis for the project plan is derived from the November 8, 2006, Commission meeting, the December 6, 2006, Staff Requirements Memorandum (SRM) (ADAMS Accession No. ML0640033), and the January 12, 2007, memorandum from the Executive Director for Operations (EDO) that chartered the Digital I&C Steering Committee (ML063390606). The plan was updated to reflect the Commission's directive following the June 7, 2007, meeting with the Advisory Committee on Reactor Safeguards (ACRS) and the associated SRM M070607, dated June 22, 2007, that directed the staff to include in the Digital I&C Project Plan activities to support development of the final regulatory guidance on diversity and defense-in-depth.

DIGITAL I&C STEERING COMMITTEE:

The Digital I&C Steering Committee provides oversight and guidance on key digital I&C technical and regulatory issues, and interfaces with industry on those issues. The primary responsibilities of the Steering Committee are (1) to interface with industry representatives on plans for resolution of digital I&C issues, (2) to oversee and facilitate resolution of technical and regulatory issues related to the deployment of digital I&C, and

(3) to ensure effective inter-office coordination on digital I&C issues. The Steering Committee will monitor the NRC line organizations' progress on Digital I&C Project Plan implementation and review specific goals and deliverables. The Steering Committee will approve the initial Digital I&C Project Plan and subsequent revisions to the plan. The Steering Committee will approve Interim Staff Guidance generated by the Task Working Groups.

TASK WORKING GROUPS:

The digital I&C Task Working Groups (TWGs) were established to include technical staff from appropriate NRC offices to focus on six key areas. The TWGs interactions with industry counterparts were designed to facilitate discussion of technical and regulatory issues and the development of recommendations to effectively address digital I&C concerns for each TWG area. The NRC representatives in each TWG are responsible for the development of their individual TWG project plans and the execution of those plans. The TWGs coordinate actions between groups to ensure consistency and alignment.

INDUSTRY CONTACTS:

The TWGs interface with industry-identified contacts in each of the key areas. The industry contacts will interact as necessary with reactor vendors, licensees, applicants, and other industry stakeholders to obtain design information that may be needed to support the work of the TWGs.

The industry contacts have provided input to the problem statements, deliverables, and milestones related to individual TWG project plan objectives. The industry contacts have provide input on the schedules for completing the deliverables. Some industry contacts have indicated that they will provide technical papers to the TWGs to address specific issues. The TWGs have considered industry's input in the development of the project plan.

NRC LINE ORGANIZATIONS:

The NRC line organizations will schedule and perform tasks identified in the individual TWG project plans. The line organizations will interface with the TWGs and report to the Steering Committee on progress, status, problems, and timeliness for preparing short-term deliverables such as Interim Staff Guidance and the long-term deliverables such as recommendations to revise regulatory guidance, and recommendations for revision to industry standards, as necessary.

INDIVIDUAL TWG PROJECT PLANS:

The TWGs have developed an individual TWG project plan for each of the 6 key areas:

- TWG #1: Cyber Security
- TWG #2: Diversity and Defense-in-Depth
- TWG #3: Risk-Informing Digital I&C
- TWG #4: Highly-Integrated Control Room–Communications
- TWG #5: Highly-Integrated Control Room–Human Factors
- TWG #6: Licensing Process

MILESTONES AND DELIVERABLES:

The project plan identifies the major milestones and planned deliverable dates for the TWG activities. The short-term deliverable dates are driven by the need to have ISG in place to review anticipated licensing actions for operating reactors, new reactors, and fuel cycle facilities. The TWG interactions with industry provide the necessary vehicle for updating the short-term and long-term deliverable dates based on identified industry needs for the development of design and procurement specification new plant simulators and for the design and implementation of digital retrofits at existing plants.

UPDATE PROCESS:

The Steering Committee will approve the initial Digital I&C Project Plan and subsequent revisions to the Digital I&C Project Plan.

The project plan represents a significant effort across multiple program offices and requires commitment of time from key managers and technical staff. The availability of resources, the need for contract effort, and the schedule for deliverables will be updated on a continual basis through insights from an enterprise project management tool. As resource, workload, and availability information increase in resolution, so will the forecasted dates identified for the long-term activities in this plan. Where "To Be Determined (TBD)" is indicated in this plan, specific dates are being developed. As the TWGs project efforts proceed, and industry planning data increases in resolution, deliverable dates will be identified for long-term activities that reflect best-estimates from planning-tool insights. The best-estimates will consider information on resource impacts, current schedules and budgets.

APPENDICES:

1. Project Plan - TWG # 1 Cyber Security
2. Project Plan - TWG # 2 Diversity and Defense-In-Depth
3. Project Plan - TWG # 3 Risk-Informing Digital I&C
4. Project Plan - TWG # 4 Highly Integrated Control Room - Communications
5. Project Plan - TWG # 5 Highly Integrated Control Room - Human Factors
6. Project Plan - TWG # 6 Licensing Process Issues

TWG #1: CYBER SECURITY

1. BACKGROUND:

In December 2005 the NRC Office of Nuclear Security and Incident Response (NSIR) endorsed Nuclear Energy Institute (NEI) guidance document NEI 04-04, "Cyber Security Programs for Power Reactors," Revision 1, dated November 18, 2005, as an acceptable method for establishing and maintaining a cyber security program at nuclear power plants. In January 2006, the NRC published Revision 2 to Regulatory Guide (RG) 1.152, "Criteria for Use of Computers in Safety Systems of Nuclear Power Plants," as "acceptable for complying with the Commission's regulations for promoting high functional reliability, design quality, and cyber security for the use of digital computers in safety systems of nuclear power plants."

In October 2006, NRC, NEI, and industry representatives met and discussed, among other things, how to resolve differences between the various regulatory guidance documents pertaining to cyber security of power reactors. The primary objective of this effort will be to provide a coherent set of guidance for future Combined License (COL) applications, or existing licensees who may be developing plant-specific Digital Instrumentation and Control (DI&C) system upgrades. A specific problem statement (see Section 3) was developed based on the October 2006 meeting and subsequent input from industry for consideration by the Cyber Security Task Working Group (TWG#1).

2. SCOPE:

TWG #1 will be focusing its efforts in addressing inconsistencies within existing NRC and industry cyber security guidance documents. Specifically, the working group will be evaluating the differences between Regulatory Guide 1.152, and NEI 04-04. Chapter 7 of the SRP (e.g., SRP Appendix 7.1-D) will be reviewed to assure consistent cyber security guidance. The resulting deliverable will be used to modify these documents to build a coherent set of guidance. These documents will potentially be consolidated to provide consistent guidance based on existing requirements.

The development of guidance documents in support of the final cyber security rule, 10CFR73.55(m), is beyond the scope of this working group. The evaluation of specific cyber security technologies, such as firewalls and intrusion detection systems (IDS), is also not within the scope of this task.

3. PROBLEM STATEMENT:

Problem 1 Cyber Security Requirements for Safety Systems: Regulatory Positions 2.1 - 2.9 of RG 1.152 and NEI 04-04 provide conflicting guidance for implementing cyber security requirements for safety systems at nuclear power plants.

4. DELIVERABLES:

1. Cyber Security Requirements for Safety Systems: Develop Interim Staff Guidance to document the regulatory and design guidance developed by the Cyber Security TWG #1 relative to cyber security for digital systems used at nuclear power plants. Fuel cycle facilities may also use this guidance, as appropriate.

5. Milestones, Assignments, and Deliverables:

TWG#1: CYBER SECURITY					
Milestones, Assignments and Deliverables	Deliverable	Due date	Fcst/Actual	Lead	Support
NEAR-TERM					
Problem 1: Cyber Security Requirements for Safety Systems					
Complete gap analysis of RG1.152R2 and NEI 04-04	✓	Apr 30	A	NRC	NEI
Industry to provide changes to NEI 04-04 to address issues identified in the gap analysis	✓	Jul 19	F	NEI	n/a
Issue draft Interim Staff Guidance	✓	Jul 20	F	NRC	n/a
Discuss draft Interim Staff Guidance in public meeting		Aug 14	F	NRC	NEI
Receive comments		Aug 22	F	NRC	n/a
Issue Interim Staff Guidance	✓	Sep 28	F	NRC	n/a
LONG-TERM					
Problem 1: Cyber Security Requirements for Safety Systems					
Review Industry developed consensus standard that addresses acceptable cyber security practices		TBD		NRC	n/a
Recommend revisions to RG 1.152 and SRP	✓	TBD		NRC	n/a
Complete rulemaking on 10CFR73.55(m)	✓	TBD		NRC	n/a
ACRS Interaction (as needed)		TBD		NRC	n/a
CRGR Interaction (as needed)		TBD		NRC	n/a
Issue draft regulatory guidance related to proposed rule 10CFR73.55(m), including endorsement of industry standard(s)	✓	TBD		NRC	n/a

TWG#1: CYBER SECURITY					
Milestones, Assignments and Deliverables	Deliverable	Due date	Fcst/Actual	Lead	Support
Issue revised RG	✓	TBD		NRC*	n/a
Issue revised SRP	✓	TBD		NRC*	n/a

* Issuance of revisions to RGs and SRP will be conducted through established agency process.

TWG # 2: DIVERSITY AND DEFENSE-IN-DEPTH

1. BACKGROUND:

NRC regulations require licensees to incorporate diversity and defense-in-depth into a nuclear facility's overall safety strategy to ensure that abnormal operating occurrences and design basis events do not adversely affect public health and safety. The responsibility for incorporating appropriate diverse systems and defense-in-depth approaches into safety system designs lies with the licensee. The responsibility for independently evaluating the design lies with the NRC.

Historically, safety system designers have relied on three strategies for addressing potential common cause failures (CCFs): functional defense-in-depth, functional diversity, and system diversity. These approaches have worked well in analog protection systems because CCFs were assumed to be caused by slow processes such as corrosion and equipment wearing out, which could be identified by an operator in sufficient time to prevent multiple failures. This assumption, while shown to be valid for analog safety systems, does not fully address the potential for CCFs in software-based safety systems.

Implicit in the development of digital safety systems is the need to eliminate or mitigate the effects of potential CCFs during the safety system development process. However, the ability to identify CCF vulnerabilities during the system development phase has become especially problematic as the complexity of safety systems has increased. Consequently, the NRC published requirements and guidance for identifying and mitigating CCFs by analyzing safety system designs to ensure an acceptable level of diversity and defense-in-depth was present.

Guidance for performing diversity and defense-in-depth analyses of systems to identify appropriate diversity and defense-in-depth in nuclear power plant instrumentation and control system designs is provided in NUREG/CR-6303, "Method for Performing Diversity and Defense-in-Depth Analyses of Reactor Protection Systems" (ML9501180332), as well as Branch Technical Position (BTP) 7-19, "Guidance on Evaluation of Diversity and Defense-in-Depth in Digital Computer-Based Instrumentation and Control Systems" [Chapter 7, "Instrumentation and Controls," of NUREG-0800, "Standard Review Plan for Review of Safety Analysis Reports for Nuclear Power Plants"]. This guidance was developed for nuclear power plant safety systems; however, the diversity attributes and associated criteria identified in the guidance are applicable for other nuclear facilities as well. The intention of this guidance is to provide the licensee and the staff a means for assessing whether additional diversity is required in a digital safety system on the basis of the safety system and nuclear power plant design features. The industry indicated that guidance to address the problem statements identified below is needed to provide additional details for clarification and to reduce potential regulatory uncertainty.

The NRC staff is also working closely with the industry to improve the current guidance as appropriate, and the Diversity and Defense-in-Depth Task Working Group (TWG#2) will develop guidelines and recommendations for confirming that sufficient diversity and defense-in-depth has been incorporated into a digital safety system design.

In addition, the NRC staff has been interacting with the Advisory Committee on Reactor Safeguards (ACRS) on this subject. Recently, ACRS made recommendations regarding diversity and defense-in-depth following its meeting with the staff on Digital I&C. The digital I&C project plan has been updated to include two action items: (1) Develop an inventory and classification (e.g., by function or other characteristics) of the various types of digital hardware and software systems that are being used and are likely to be used in nuclear power plants, and (2) Evaluate the operating experience with digital systems in the nuclear and other industries to obtain insights regarding potential failure modes. Insights developed from these actions are expected to be useful as the staff develops and refines regulatory guidance for diversity and defense-in-depth.

2. SCOPE:

The following areas and associated activities will be addressed by TWG #2:

- a. Describe existing regulatory requirements and regulatory guidance associated with diversity and defense-in-depth requirements, without consideration of specific nuclear facility designs (e.g., existing nuclear power plant designs and new nuclear power plant designs). This description will define the recommended boundaries for the ultimate products of TWG #2.
- b. Identify acceptable diversity and defense-in-depth strategies for implementing digital safety functions and systems. The strategies will be based upon existing guidance and the approaches taken by other countries, industries, and agencies; and upon recommendations from the scientific community and academia.
- c. Determine the criteria supporting operator actions in lieu of automated system responses to design basis and other accidents. For example, when operator responses to instrumentation indications could be credited for mitigating certain types of design basis accidents.
- d. Identify consensus standards that could be endorsed as regulatory guidance. For example, ANSI/ANS Std 58.8-1994 © (2001), "Time Response Design Criteria for Safety-Related Operator Actions," may provide acceptable guidance for crediting operator actions as part of a diversity strategy for certain classes of design basis events.
- e. Develop one or more Interim Staff Guidance (ISG) documents to document, by inclusion or reference, the guidance developed or identified by this TWG. The ISG will include references to suitable standards and other guidance that can be used to develop and license safety system diversity and defense-in-depth features.

- f. Recommend ISG to be incorporated into NRC Standard Review Plans and other regulatory guidance.
- g. Address the action items stemming from the Commission meeting with the ACRS.

3. PROBLEM STATEMENT:

Nuclear industry and NRC guidance does not explicitly identify what constitutes acceptable diversity and defense-in-depth in nuclear facility safety system designs. The following issues should be addressed to resolve this issue.

- Problem 1 Adequate Diversity: Additional clarity is desired on what constitutes adequate diversity and defense-in-depth. Determine: 1) How much diversity and defense-in-depth is enough; 2) If there are precedents for good engineering practice; 3) If sets of diversity attributes and criteria can provide adequate diversity; 4) How much credit can be taken for designed-in robustness in determining the required amount of diversity; and 5) Identify consensus standards that could be endorsed, if available.
- Problem 2 Manual Operator Actions: Clarification is desired on the use of operator action as a defensive measure and corresponding acceptable operator action times.
- Problem 3 BTP-19 Position 4 Challenges: Current guidance policy addresses system-level actuation in BTP-19, Position 4. Industry has proposed that further clarification is needed relative to when and if credit can be taken for component-level versus system-level actuation of equipment. Clarification is needed on the rationale for when and why BTP-19, Position 4 would not be applicable.
- Problem 4 Effects of Common-Cause Failure: BTP-19 guidance recommends consideration of CCFs that "disable a safety function." However, additional clarity is desired regarding the effects that should be considered (e.g., fails to actuate and/or spurious actuation).
- Problem 5 Common-Cause Failure Applicability: Clarification is desired on identification of design attributes that are sufficient to eliminate consideration of CCFs (e.g., degree of simplicity).
- Problem 6 Echelons of Defense: As described in NUREG-0737 Supplement 1, "Clarification of TMI Action Plan Requirements," the following plant safety functions must be controlled to mitigate plant accidents:
- 1. Reactivity control
 - 2. Reactor core cooling and heat removal from the primary system

3. Reactor coolant system integrity
4. Radioactivity control
5. Containment conditions

BTP-19 guidance references the following echelons of defense described in NUREG/CR-6303, "Method for Performing Diversity and Defense-in-Depth Analyses of Reactor Protection Systems" for maintaining the above safety functions within safe margins for nuclear power plants:

1. Control systems
2. Reactor Trip System (RTS)
3. Engineered Safety Features Actuation System (ESFAS)
4. Monitoring and indications

Additional clarification is desired regarding how the echelons of defense for maintaining the above safety functions should factor into diversity and defense-in-depth analyses. A particular concern is that the current BTP-19 guidance does not consider plant design characteristics and operating procedures that affect how diversity and defense-in-depth are actually used to maintain the safety functions.

Problem 7 Single Failure: Additional clarification is needed regarding the acceptance criteria for addressing CCFs versus the acceptance criteria for addressing single failures in safety system designs.

4. DELIVERABLES:

The Diversity and Defense-in-Depth TWG #2 will develop near-term ISGs for the problem statements by September 30, 2007, as necessary. Additional guidance may be developed as part of the long-term activities, as necessary. TWG #2 will recommend the ISGs to be incorporated into the SRP and other regulatory documents, e.g., NUREG or Regulatory Guides, in the longer term, as needed. TWG #2 will address the following issues and propose the following specific products:

1. Adequate Diversity: ISG will be developed by September 30, 2007. Additional ISG will be developed regarding adequate diversity that considers engineering approaches and acceptance criteria that have been developed in other countries, industries, and agencies. Additionally, academia and scientific organization recommendations for implementing appropriate diversity and defense-in-depth strategies will be considered in developing the guidance.
2. Manual Operator Actions: ISG will be developed that describes the conditions under which operator actions can be credited as a diverse method for initiating safety functions. Development of this guidance will be coordinated with the efforts of the Highly Integrated Control Room - Human Factors TWG #5.

3. BTP-19, Position 4 Challenges: ISG will be developed that describes the conditions under which credit can be taken for component-level versus system-level actuation of equipment. This guidance will address upgrades for currently operating nuclear plants and fuel cycle facilities, as well as new plant designs. Changes to BTP-19 may be recommended to make the guidance generically applicable to all plant designs.
4. Effects of Common-Cause Failure (CCF): BTP-19 guidance recommends consideration of CCFs that "disable a safety function." ISG will be developed to guide the process for evaluating potential CCF analyses and for specifying the failure states that should be integrated into safety system design basis analyses (e.g., fails to actuate and/or spurious actuation).
5. Common-Cause Failure Applicability: ISG will be developed for digital system design attributes that are sufficient to eliminate consideration of CCFs. These attributes will include recommended diversity strategies and acceptance criteria for attributes such as degree of simplicity, complexity, and robustness.
6. Echelons of Defense: ISG will be developed to describe appropriate levels of defense-in-depth in safety system designs.
7. Single Failure: ISG will be developed that addresses the conditions under which software failures are to be considered CCFs or single failures in plant design basis analyses.

5. MILESTONES, ASSIGNMENTS, AND DELIVERABLES:

TWG #2: DIVERSITY AND DEFENSE-IN-DEPTH					
Milestones, Assignments and Deliverables Diversity and Defense-in-Depth	Deliverable	Due Date	Fcst/Actual	Lead	Support
NEAR-TERM					
Problem 1: Adequate Diversity					
Develop draft Interim Staff Guidance		Jun 21	A	NRC	N/A
Issue draft Interim Staff Guidance	✓	Jun 22	A	NRC	n/a
Discuss draft Interim Staff Guidance in public meeting		Jun 22	A	NRC	NEI
Receive comments		July 6	A	NRC	n/a
Issue Interim Staff Guidance	✓	Sep 28	F	NRC	n/a
Problem 2: Manual Operator Action					
Develop draft Interim Staff Guidance		Jun 14	A	NRC	NEI
Issue draft Interim Staff Guidance	✓	Jun 22	A	NRC	n/a
Discuss draft Interim Staff Guidance in public meeting		Jun 22	A	NRC	NEI
Receive comments		Jul 6	A	NRC	n/a
Industry to provide white paper		Jul	F	NEI	n/a
Issue Interim Staff Guidance	✓	Sep 28	F	NRC	n/a
Problem 3: BTP-19, Position 4 Challenges Problem 4: Effects of Common-Cause Failure Problem 5: Common-Cause Failure Applicability Problem 6: Echelons of Defense Problem 7: Single Failure					
Industry to provide white paper on Effects of Common-Cause Failure	✓	Jul 20	F	NEI	n/a

TWG #2: DIVERSITY AND DEFENSE-IN-DEPTH					
Milestones, Assignments and Deliverables Diversity and Defense-in-Depth	Deliverable	Due Date	Fcst/Actual	Lead	Support
Develop draft Interim Staff Guidance		Aug 6	F	NRC	NEI
Issue draft Interim Staff Guidance	✓	Aug 10	F	NRC	n/a
Discuss draft Interim Staff Guidance in public meeting		Aug 14	F	NRC	NEI
Receive comments		Aug 22	F	NRC	n/a
Industry to provide white paper on Common-Cause Failure Applicability	✓	Aug 31	F	NEI	n/a
Issue Interim Staff Guidance	✓	Sep 28	F	NRC	n/a
Inventory and Classification of Digital Systems					
Develop draft assessment results	✓	Sep 28	F	NRC	n/a
Provide assessment results with appropriate recommendations on staff guidance	✓	Dec 31	F	NRC	n/a
Evaluation of Digital Systems Operating Experience Insights					
Develop draft assessment results	✓	Sep 28	F	NRC	n/a
Provide assessment results with appropriate recommendations on staff guidance	✓	Dec 31	F	NRC	n/a

TWG #2: DIVERSITY AND DEFENSE-IN-DEPTH					
Milestones, Assignments and Deliverables Diversity and Defense-in-Depth	Deliverable	Due Date	Fcst/Actual	Lead	Support
LONG-TERM					
Problem 1: Adequate Diversity					
Develop revised draft Interim Staff Guidance		Oct 1	F	NRC	N/A
Issue draft Interim Staff Guidance	✓	Oct	F	NRC	n/a
Discuss draft Interim Staff Guidance in public meeting		Oct	F	NRC	NEI
Receive comments		Nov	F	NRC	n/a
Issue Interim Staff Guidance	✓	Dec	F	NRC	n/a
Common Long-Term Actions for All Problem Statements					
Work with other organizations to incorporate diversity and defense-in-depth standards into consensus standards, as appropriate		TBD	F	NRC	n/a
Recommend revisions to SRP, BTP, and other regulatory documents, e.g., NUREG or Regulatory Guides, as appropriate.	✓	TBD	F	NRC	n/a
ACRS interaction (as needed)		TBD	F	NRC	n/a
CRGR interaction (as needed)		TBD	F	NRC	n/a
Issue revised RG	✓	TBD	F	NRC*	n/a
Issue revised SRP	✓	TBD	F	NRC*	n/a

* Issuance of revisions to RGs and SRP will be conducted through established agency process.

TWG #3: RISK-INFORMING DIGITAL I&C

1. BACKGROUND:

The Risk-Informing Digital Instrumentation and Control (RIDIC) Task Working Group (TWG #3) will address issues related to the risk assessment of digital systems with particular emphasis on risk-informing digital system reviews for operating plants, new reactors and fuel cycle facilities. The TWG efforts will be consistent with the NRC's policy statement on probabilistic risk assessment (PRA), which states, in part, the NRC supports the use of PRA in regulatory matters "to the extent supported by the state-of-the-art in PRA methods and data and in a manner that complements the NRC's deterministic approach and supports the NRC's traditional defense-in-depth philosophy."

Although digital I&C systems are intended to be at least as reliable as the analog systems they replace, digital systems have unique failure modes. Of significant concern are digital I&C system common cause failures that can propagate to multiple safety channels and divisions thereby defeating the defense-in-depth and diversity that was considered adequate for an analog I&C system. Since digital systems play an increasingly important role in nuclear facility control and safety systems, the need for risk assessment methods for digital I&C systems is evident.

The current methodology for evaluating a digital I&C system in either an operating plant or new reactor involves a broad range of deterministic guidance for the development, testing, implementation, and maintenance of digital systems to manage digital system failures. This guidance is "process based" in that the regulatory guidance is designed to provide software and hardware of "high quality" with adequate diversity (of various types) such that the potential for failure, including common cause, is minimized. Specific guidance is provided to assess defense-in-depth and diversity by identifying potential vulnerabilities to digital system common cause failures that could disable a safety function. Where potential vulnerabilities are identified, diverse means are put in place to perform either that safety function or a different safety function. However, these reviews typically involve significant staff effort in the determination of adequate defense-in-depth and diversity when using current staff guidance.

To address this, TWG #3 task will evaluate the feasibility of risk-informing the digital system evaluations with the intent of improving the effectiveness and efficiency of the digital system review process while adhering to the five key principles of risk-informed decision-making including adequate defense-in-depth and diversity when implementing a digital I&C system either as a retrofit or new reactor installation.

2. SCOPE:

One of the key concerns with the current state-of-the-art in digital system modeling is it does not yet support risk-informed decision-making for digital systems, particularly with respect to software reliability quantification. Therefore, adequate digital system risk and reliability methods are needed to support the integration of digital systems into a risk evaluation method. After this risk method is developed, the NRC must also develop additional staff policy or guidance to support risk-informing digital system reviews.

As part of risk-informing the current regulatory process for the review of digital systems, there is a need to develop NRC guidelines to establish quality and completeness of digital system risk and reliability modeling in current generation plant PRAs and PRAs being developed to support Part 52 Design Certifications (DC) and Combined Licensee (COL) applications. These PRAs need to be completed in the near-term. Although current guidance (i.e., Regulatory Guide 1.200) provides attributes associated with PRA quality, there is limited guidance available as to the completeness of digital I&C system modeling, the level of detail needed in digital I&C system modeling, and the uncertainties associated with digital system modeling. Guidance as to what risk metrics are appropriate for evaluating digital I&C systems in operating reactors and DC and COL PRAs also may be needed. Additionally, in the near-term, guidance on how risk-insights could be used to support digital I&C systems reviews in the evaluation of key digital system issues, such as diversity and defense-in-depth and inter-channel communications is needed.

The NRC is actively working to develop tools and methods to perform risk assessments of nuclear power plant digital systems. NRC is investigating both traditional fault tree/event tree methods and dynamic methods that may be used to support risk-informed digital system reviews. The NRC staff recognizes the industry's interest in risk-informing digital system reviews, and seeks to leverage insights and approaches developed by industry in the staff resolution process. However, the NRC also recognizes the challenges in integrating digital systems into PRAs and the practicality of using a PRA to assess digital systems. Therefore, guidance on how to risk-inform digital system applications and associated performance based acceptance guidelines to support licensing of operating reactor upgrades, new reactors, and fuel cycle facilities is also needed.

TWG #3 recommendations are not expected to involve changes to NRC policy or rulemaking. However, recommendations proposed may impact the regulatory burden for both NRC staff and industry. When developing recommendations, these burdens will be considered in conjunction with the potential benefit.

Therefore, the following will be addressed by the TWG #3:

- a. The use and application of risk-insights in the evaluation of digital I&C systems for both operating and new reactors.

- b. Tools and methodologies to enable improved risk assessments of digital I&C systems in nuclear power plants.
- c. Regulatory guidance to enable the use of risk-informed decision-making in the evaluation of digital I&C systems for operating and new reactors.

The following define the limitations of the scope of TWG #3:

- a. Work products will be consistent with the five key principles of risk-informed decision-making
- b. Work products will be consistent with the Commission direction outlined in Staff Requirements Memorandum (SRM) to SECY-93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light Water Reactors (ALWR) Designs".
- c. Security issues (i.e, cyber security) are not within the scope of TWG #3.

3. PROBLEM STATEMENT:

The NRC and nuclear power industry share the goal of risk-informing the decision-making in licensing reviews of digital systems for current and future reactors and fuel facilities. However, currently there is no detailed guidance on what would constitute adequate digital system modeling in probabilistic risk assessments (PRAs), including: modeling of digital system common-cause failures (including software), level of modeling detail, failure data, adequacy of modeling methods, uncertainties and interfacing digital system models with the rest of the PRA. There is also no detailed guidance on integrating risk insights into digital system reviews or risk-informing digital system reviews.

PROBLEM 1 Modeling Digital Systems in PRA: Existing guidance does not provide sufficient clarity on how to use current methods to properly model digital systems in PRAs for design certificate applications or license applications (COL) under Part 52. The issue includes addressing common-cause failure modeling and uncertainty analysis associated with digital systems.

PROBLEM 2 Risk Insights: Using current methods for PRAs, NRC has not determined how or if risk-insights can be used to assist in the resolution of specific key digital system issues.

PROBLEM 3 State-of-the-Art: An acceptable state-of-the-art method for detailed modeling of digital systems has not been established. An advancement in the state-of-the-art is needed to permit a comprehensive risk-informed decision making framework in licensing reviews of digital systems

4. DELIVERABLES:

1. Modeling Digital Systems in PRA:

- a. Issue guidance addressing use of current methods in modeling of digital systems for design certification and COL application PRAs.
- b. In the longer-term, update regulatory guidance as needed (SRP, Regulatory Guides, etc.).

2. Risk Insights:

- a. Develop, if possible, an acceptable approach for using risk insights to assist in the resolution of specific key digital system issues. Include consideration of proposed industry methods.
- b. If an acceptable approach can be established, issue guidance and acceptance criteria for use of risk insights in digital systems.
- c. In the longer-term, update regulatory guidance as needed (SRP, Regulatory Guides, etc.).

3. State-of-the-Art:

- a. Identify an approach to implement appropriate collaboration with and leverage the capabilities of the industry, international counterparts, other industries and NRC staff and contractors to develop the technical basis for state-of-the-art methods for modeling of digital systems to support risk-informed decision-making for digital systems, including: (1) review of current modeling methods (including software modeling), (2) characteristics of acceptable modeling methods, (3) assessment of failure data, (4) criteria for level of modeling detail, (5) assessment of uncertainties, and (6) defining how to interface digital system models with the rest of the PRA.
- b. Issue regulatory guidance on risk-informed decision-making review methods applicable to digital I&C systems.
- c. Update NRC PRA data, models and tools to support NRC assessment of digital system risk and reliability.

5. MILESTONES, ASSIGNMENTS, AND DELIVERABLES:

TWG#3: RISK-INFORMING					
Milestones, Assignments and Deliverables	Deliverable	Due date	Fcst/Actual	Lead	Support
NEAR-TERM					
Problem 1: Modeling Digital Systems in PRA					
Industry to provide white paper discussing lessons-learned and proposed guidelines associated with modeling of digital systems for DC and COL applications	✓	Jul 3	A	NEI	n/a
Develop draft Interim Staff Guidance		Nov 23	F	NRC	n/a
Issue draft Interim Staff Guidance	✓	Nov 28	F	NRC	n/a
Discuss draft Interim Staff Guidance in public meeting		Nov 30	F	NRC	NEI
Receive comments		Dec 7	F	NRC	n/a
Issue Interim Staff Guidance	✓	Mar 2008	F	NRC	n/a
Problem 2: Risk Insights					
Industry provides white paper that proposes simplified modeling methods using risk insights to support reviews of digital systems.	✓	Aug	F	NEI	n/a
Problem 3: State-of-the-Art					
No near-term deliverables					

TWG#3: RISK-INFORMING					
Milestones, Assignments and Deliverables	Deliverable	Due date	Fcst/Actual	Lead	Support
LONG-TERM					
Problem 1: Modeling Digital Systems in PRA					
No long-term deliverables					
Problem 2: Risk Insights					
Consider industry white paper		TBD	F	NRC	n/a
Initiate Regulatory Guidance revisions as appropriate		TBD	F	NRC	n/a
Problem 3: State-of-the-Art					
Develop risk-informed decision-making review methods applicable to digital systems	✓	TBD	F	NRC	n/a
Initiate Regulatory Guidance revisions as appropriate		TBD	F	NRC	n/a

TWG#3: RISK-INFORMING					
Milestones, Assignments and Deliverables	Deliverable	Due date	Fcst/Actual	Lead	Support
Common Long-Term Actions for All Problem Statements					
Work with other organizations to incorporate risk assessment guidance into consensus standards, as appropriate				NRC	NEI
Recommend revisions to SRP and other regulatory documents, e.g., NUREG or Regulatory Guides, as appropriate.	✓	TBD	F	NRC	n/a
ACRS interaction (as needed)		TBD	F	NRC	n/a
CRGR interaction (as needed)		TBD	F	NRC	n/a
Issue revised RG	✓	TBD	F	NRC*	n/a
Issue revised SRP	✓	TBD	F	NRC*	n/a

* Issuance of revisions to RGs and SRP will be conducted through established agency process.

TWG #4: HIGHLY-INTEGRATED CONTROL ROOM— COMMUNICATIONS

1. BACKGROUND:

The Highly Integrated Control Room-Communications Issues (HICRc) Task Working Group (TWG) will address HICR design issues related to communications involving digital equipment in nuclear safety service. This action is needed to support development of the design and procurement specification for simulators for new plants and for the design and implementation of digital retrofits at existing plants. Specifically, this TWG will address all communication design provisions between safety divisions¹, and between safety and non safety divisions. In this context, “communication” means any transmittal or reception of data, information, or commands.

There are clear potential advantages to the implementation of some types of cross-divisional communication within digital systems. However, preservation of adequate independence for digital systems communications is essential. The objective of this task working group is to evaluate cross-divisional communication interactions and to clarify design and licensing criteria by which beneficial interactions may be accomplished while maintaining adequate safety margin.

2. SCOPE:

The following types of communication interactions will be addressed by TWG #4:

- a. Communication among redundant electrical divisions
- b. Communication between any safety channel and anything external to that channel's division
- c. Control of safety equipment in multiple divisions from a single workstation
- d. Control of safety equipment from a nonsafety workstation
- e. Commingling of safety and nonsafety controls or indications on a single workstation
- f. Connection of nonsafety programming, maintenance, and test equipment to redundant safety divisions during operation

The following are explicitly excluded from the scope of this task:

- g. Communication within a single safety division
- h. Communications which do not involve a safety channel

¹ The terms “channel” and “division” are used herein in accordance with the definitions of those terms in IEEE 603-1991.

Cyber-Security, Diversity and Defense-in-Depth, and Human Factors (HF) considerations are all closely related to the general concept of cross-divisional communications. These issues are being addressed by TWGs #1, #2, and #5, respectively. Therefore coordination with each associated TWG will be necessary to ensure that HICRc TWG #4 activities are consistent with, and supportive of, the solutions that they will provide.

Except as specifically addressed in the resolution of the issues identified above, physical separation and electrical isolation requirements for digital equipment are the same as for non-digital equipment. Physical separation and electrical isolation will not be addressed separately in this task. Similarly, seismic and environmental qualification requirements are not included in this task.

3. PROBLEM STATEMENT:

Problem 1 Inter-Divisional Communications Independence: Industry and NRC guidance documents do not define at a sufficient level of detail the requirements for inter-divisional communications independence.

- a. Industry Standards (e.g. IEEE 7-4.3.2-2003, "IEEE Standard Criteria for Digital Computers in Safety Systems of Nuclear Power Generating Stations") do not provide sufficient guidance for inter-divisional communications independence within digital systems.
- b. NRC regulatory guidance (e.g. Regulatory Guide 1.152, "Criteria for Digital Computers in Safety Systems of Nuclear Power Plants") does not provide explicit guidance for inter-divisional communications independence within digital systems.
- c. The protection system division separation and isolation requirements in existing regulations (10CFR50.55a (h), "Protection and Safety Systems," which incorporates IEEE603-1991, "Criteria for Safety Systems for Nuclear Power Generating Stations," among other things) does not define for digital systems "the degree [of independence] necessary to retain the capability to accomplish the safety function during and following any design basis event requiring that safety function."
- d. Existing Standard Review Plan (SRP) Chapter 7 includes conflicting guidance regarding communication independence.

4. DELIVERABLES:

1. Inter-Divisional Communications Independence:
 - a. Issue Interim Staff Guidance (ISG) that will document an acceptable degree of communications independence for digital systems.
 - b. Facilitate a revision to IEEE 7-4.3.2.
 - c. Recommend revisions to Regulatory Guide 1.152.
 - d. Recommend updates to the Standard Review Plan guidance to provide acceptable regulatory and licensing criteria for communications independence of digital systems.

5. DISCUSSION:

TWG #4 will consider the possibility that the needs of new and existing facilities are different, and will include accommodation of such differences in the guidance documentation, if necessary. It is initially anticipated that there will be no difference in the guidance for new and existing facilities.

Final guidance relating to control room design is needed to support final specification and design of the simulators for new plants. It is anticipated that the first simulators will need to be ordered in mid-2009, and that about 18 months will be required between the time the guidance is issued and the first simulators are ordered. The guidance is therefore needed by early 2008. To allow for a reasonable amount of schedule float, TWG #4 anticipates completing its ISG by September 30, 2007.

It is noted that support of simulator procurement requires only that the conceptual design of the control room be completed. It does not require that the details of the internal workings of the operator interfaces be fully developed. The efforts of TWG #4 will influence the nature and layout of the control room in that requirements relating to the disposition and application of operator interface workstations could be affected, but those influences will be limited to whether various operator-interface design provisions will or will not be considered acceptable (for example, whether or under what design constraints it might be acceptable for a single control station to include both safety and nonsafety functions). The efforts of other TWGs will have greater influence upon control room design and layout, such as TWG #2 working on Diversity and Defense-in-Depth (D3) requirements, and TWG #5 working on details of Human-Machine Interfaces (HMI) from a Human Factors (HF) standpoint.

TWG #4 will produce guidelines describing appropriate design provisions and limitations. These guidelines will include a statement of the fundamental requirements and specific regulatory criteria that must be observed. The HICRc TWG #4 will also provide recommendations for revisions to RG1.152, IEEE 7-4.3.2, applicable SRP sections, and other regulatory guidance and industry standards as deemed necessary.

TWG #4 will give due consideration to the burdens that might be imposed upon both applicants and NRC staff as a result of specific guidance. For example, acceptance of a certain provision might require detailed staff review in an area not presently subject to such review. This would impose a burden upon an applicant in that additional materials must be assembled for inclusion in the application package, some of which may be proprietary and thus require the development of a redacted version as well as the full version, and upon the NRC in the actual review of the subject details. The cost of such a provision in terms of resources, review effort, and review time extension should be considered in relation to the potential benefits of such an approach relative to an approach that is simpler from a regulatory point of view.

6. CRITICAL PATH AND STEPS TO SUCCESS:

In order to accomplish its mission, the HICRc TWG #4 may need to have timely access to detailed information concerning proposed reactor designs. The TWG will make every reasonable effort to obtain specific design information needed to support its work, relying principally upon the efforts of the industry contacts assigned by NEI. However, if extended correspondence with reactor vendors is required in an effort to obtain the needed information, or if information availability is restricted by intellectual property rights issues or other issues, the TWG may recommend deferral of review of the respective designs until such design details are made available, or recommend other compensatory action to the NRC Digital I&C Steering Committee. In such a case, the TWG would proceed on the basis of generic considerations. The NRC Digital I&C Steering Committee should be advised promptly if such a situation occurs.

The primary efforts of TWG will include the following:

- a. Develop a statement describing the existing regulatory requirements and regulatory guidance associated with cross-divisional interactions, without consideration of specific proposed designs. This statement will establish the fundamental restrictions and requirements, or boundaries, for the ultimate products of TWG #4.
- b. Develop a detailed and prioritized listing of the design concepts to be considered by TWG #4. The TWG will address the associated design and licensing issues in accordance with this prioritization. To support the development and prioritization of this listing, the TWG will request that the industry contacts provide their collective best estimate of the types of cross-channel interactions that have actually been proposed or planned, with indication of the level of interest in the use of each type. Consideration should include new plants, existing plants, and fuel cycle facilities. The objective of this information is to ensure that TWG #4 addresses the types of interactions that are of greatest interest to industry. For example, perhaps many system designers plan to use scratchpad-based data exchange and some but very few plan to use Ethernet-based direct communication between safety processors: then TWG #4 would address the more widespread practice first and the less widespread practice later. If it determines that some type of interaction is planned for use by only a very few

suppliers but that type of interaction is highly desirable or problematical, TWG #4 may choose to address that issue early in order to inform stakeholders of the type of interaction that may be easy or difficult to license.²

- c. Obtain preliminary results of the on-going NRC/RES research project concerning communications issues regarding highly-integrated control rooms. This research is exploring similar issues in other countries, and it is expected that the results may be useful to TWG #4.
- d. Develop a list of regulatory and design requirements applicable to each type of interaction. Include the basis for each requirement.
- e. Develop a draft annotated outline for the guidance document(s), including draft acceptance criteria for each item.
- f. Industry (via its TWG representative) review and comment on the draft outline and proposed acceptance criteria.
- g. Develop detailed guidance recommendations to be implemented in the Interim Staff Guidance document(s).
- h. Develop regulatory and design guidance document(s) addressing communications independence for digital systems. The guidance should include specific acceptance criteria for types of interactions found to be acceptable, and should also include descriptions of types of interactions found to be unacceptable.

² This prioritization will not preclude or affect NRC consideration of interactions proposed in license requests that have already been submitted or that are submitted in the future. License requests that fall outside the recommendations of the TWG or that are contrary to them will be considered by the NRC on a case-by-case basis.

7. MILESTONES, ASSIGNMENTS, AND DELIVERABLES:

TWG #4: Highly-Integrated Control Room—Communications					
Milestones, Assignments and Deliverables	Deliverable	Due date	Fcst/Actual	Lead	Support
NEAR-TERM					
Problem 1: Communications Independence					
Identify regulatory & design requirements with basis for each type of interaction		Mar 8	A	NRC	NEI
Receive industry proposals for HICR communication design concepts	✓	Jun 1	A	NEI	n/a
Issue draft Interim Staff Guidance	✓	Aug 10	F	NRC	n/a
Discuss draft Interim Staff Guidance in public meeting		Aug 14	F	NRC	NEI
Receive comments		Aug 22	F	NRC	n/a
Issue Interim Staff Guidance	✓	Sep 28	F	NRC	n/a
LONG-TERM					
Problem 1: Communications Independence					
Industry to work with IEEE on modifications to 7-4.3.2 and issue	✓	TBD	F	NEI	NRC
Recommend revisions to SRP and other regulatory documents, e.g., NUREG or Regulatory Guides (RG 1.152), as appropriate.	✓	TBD	F	NRC	n/a
ACRS Interaction (as needed)		TBD	F	NRC	n/a

TWG #4: Highly-Integrated Control Room—Communications					
Milestones, Assignments and Deliverables	Deliverable	Due date	Fcst/Actual	Lead	Support
CRGR Interaction (as needed)		TBD	F	NRC	n/a
Issue revised RG 1.152	✓	TBD	F	NRC*	n/a
Issue revised SRP	✓	TBD	F	NRC*	n/a

* Issuance of revisions to RGs and SRP will be conducted through established agency process.

TWG #5: HIGHLY INTEGRATED CONTROL ROOM— **HUMAN FACTORS**

1. BACKGROUND:

Nuclear power plant personnel play a vital role in the productive, efficient, and safe generation of electric power, whether for conventional light water reactors (LWRs), advanced light water reactors (ALWRs), new reactors, or fuel cycle facilities. Operators monitor and control plant systems and components to ensure their proper functioning. Test and maintenance personnel help ensure that plant equipment is functioning properly and restore components when malfunctions occur. In order for them to accomplish their tasks safely they need access to accurate and timely information to maintain situation awareness, make informed decisions, and take appropriate actions. The role of the human factors engineering (HFE) regulatory review process is to ensure that the needed information is available.

Operating reactors, new reactors, and fuel-cycle facilities with modernized control stations are expected to present new operational and maintenance environments due to the expanded use of digital systems. This could lead to concepts of operation and maintenance that are significantly different from conventional control rooms. New control rooms are expected to be fully computer-based, that is, fully digitized with computer displays and soft controls. Procedures are likely to be computerized and control actions may be taken directly from the procedure display or automated, with the operator only in the position to monitor and bypass the automation. Different training and qualifications may be required for the plant staff because of the need to focus on monitoring and bypassing automatic systems, rather than taking active control as they do now. Higher-levels of knowledge and training may be needed to respond to situations when automatic systems fail. These activities will pose new and challenging situations for operators and maintainers. Regulatory staff will need new tools, developed from the best available technical bases, to support licensing and oversight tasks. The ultimate goal is to minimize human error contribution to the risk associated with the design, construction, operation, testing, and maintenance of these new facilities.

Current regulations and guidance that address human performance issues were developed primarily for the review of conventional LWRs. New or revised regulations and guidance may need to be developed to address the new generation of control rooms. A sound technical basis needs to be developed as part of the guidance development process. The HFE aspects of new control stations should be developed, designed, and evaluated on the basis of a structured systems analysis using accepted HFE principles at the same time as other systems are being designed. The needs of personnel must be considered as a part of the system design from the initial concept development stage so that the role allocated to personnel is appropriate, as specified in regulatory review guidance such as, NUREG-0711; consensus standards from IEEE and ANS; and industry design guidance from NEI and EPRI.

2. SCOPE:

The scope of this effort is limited to human factors issues for new reactors, conventional LWRs, and, where applicable, fuel cycle facilities. The scope includes human-system interfaces, human to human interface and personnel issues, during design, construction, testing, operations, and maintenance of these facilities. Because of the cross-cutting nature of human factors, the Highly Integrated Control Rooms - Human Factors Task Working Group (TWG #5) will interface with all other Digital I&C TWGs.

3. PROBLEM STATEMENT:

Existing Human Factors Engineering review guidance, regulatory positions, and acceptance criteria could be modified or developed, as needed, to facilitate consistent and efficient licensing of new digital Human-System Interface technology at operating and new reactors and certain fuel facilities.

1. Minimum Inventory. Review existing NRC regulatory positions and acceptance criteria, and make necessary changes, to better define minimum inventory of alarms, controls, and displays needed to implement the emergency operating procedures and bring the plant to a safe condition; eliminate any inconsistencies in the use of minimum inventory that exist in current NRC guidance; and consider development of a process approach to the development of a plant-specific minimum inventory of alarms, displays and controls.
2. Computerized Procedures and Soft Controls. Review existing NRC regulatory guidance, positions, and acceptance criteria, and make necessary changes, to facilitate consistent and efficient licensing of computerized procedures and soft controls in highly integrated control rooms. Develop guidance and acceptance criteria, if necessary, to minimize the impact of degraded digital instrumentation and controls associated with computerized procedures and soft controls on human performance.
3. Safety Parameter Display System (SPDS). Review existing NRC regulatory guidance, positions, and acceptance criteria to determine the need to revise 10CFR50.34 (f)(iv) and associated guidance, and make necessary changes, relative to safety parameter display consoles to ensure consistent understanding of the term "console."
4. Graded Approach to Human Factors. Review existing NRC regulatory guidance, positions, and acceptance criteria, and make necessary changes, to facilitate consistent and efficient licensing using a graded approach to the review of human factors aspects of highly-integrated control rooms.

4. DELIVERABLES:

1-4. All Problem Statements

- a. A listing of regulatory guidance documents, industry standards, and regulations (if needed) that should be revised.
- b. Written feedback/comments on papers prepared by NEI concerning minimum inventory, graded approach to human factors, and manual operator actions in support of TWG #2 and human factors aspects of multi-channel VDUs in support of TWG #4.
- c. Interim Staff Guidance describing or clarifying the current regulatory guidance and acceptance criteria on each of the identified problem areas will be developed.
- d. Final guidance, acceptance criteria, and regulations (if needed) addressing each of the problem areas will be developed.
- e. Recommend revisions to the Standard Review Plan and other regulatory guidance document, as appropriate, to provide acceptable regulatory and licensing criteria for new reactors, modernized LWRs, and fuel facilities.

5. MILESTONES, ASSIGNMENTS, AND DELIVERABLES:

TWG #5: Highly-Integrated Control Room—Human Factors					
Milestones, Assignments and Deliverables	Deliverable	Due Date	Fcst/Actual	Lead	Support
NEAR-TERM					
Problem 1. Minimum Inventory					
Received industry proposal on minimum inventory	✓	May 25	A	NEI	n/a
Industry to provide input for consideration in development of Interim Staff Guidance	✓	Jul 20	F	NEI	n/a
Prepare Interim Staff Guidance		Aug 6	F	NRC	n/a
Issue draft Interim Staff Guidance	✓	Aug 10	F	NRC	n/a
Discuss draft Interim Staff Guidance in public meeting		Aug 14	F	NRC	NEI
Receive comments		Aug 22	F	NRC	n/a
Issue Interim Staff Guidance	✓	Sep 28	F	NRC	n/a
Problem 2. Computerized Procedures and Soft Controls					
Industry to provide input for consideration in development of Interim Staff Guidance	✓	Jul 20	F	NEI	n/a
Prepare Interim Staff Guidance		Aug 6	F	NRC	n/a
Issue draft Interim Staff Guidance	✓	Aug 10	F	NRC	n/a
Discuss draft Interim Staff Guidance in public meeting		Aug 14	F	NRC	NEI
Receive comments		Aug 22	F	NRC	n/a
Industry to provide white paper	✓	Aug 31	F	NEI	n/a
Issue Interim Staff Guidance	✓	Sep 28	F	NRC	n/a

TWG #5: Highly-Integrated Control Room—Human Factors					
Milestones, Assignments and Deliverables	Deliverable	Due Date	Fcst/Actual	Lead	Support
Problem 3. Safety Parameter Display System					
No near-term deliverables					
Problem 4. Graded Approach to Human Factors					
No near-term deliverables					
LONG-TERM					
Problem 1. Minimum Inventory					
Develop guidance revision as appropriate		TBD	F	NRC	n/a
Problem 2. Computerized Procedures and Soft Controls					
Develop guidance revision as appropriate		TBD	F	NRC	n/a
Problem 3. Safety Parameter Display System					
Review safety parameter display system and related guidance to determine if gaps or inadequacies exist as related to digital systems to determine if 10CFR50.34(f) needs to be revised so that exemptions would not be needed to address SPDS and related functions		TBD	F	NRC	NEI
Document results of review					
Develop guidance and/or make revisions as appropriate		TBD	F	NRC	n/a
Problem 4. Graded Approach to Human Factors					
Receive industry proposal on graded approach to human factors		Sep	F	NEI	n/a
Review and comment on industry proposal		TBD	F	NRC	n/a
Develop guidance revision as appropriate		TBD	F	NRC	n/a

TWG #5: Highly-Integrated Control Room—Human Factors					
Milestones, Assignments and Deliverables	Deliverable	Due Date	Fcst/Actual	Lead	Support
Common Long-Term Actions for All Problem Statements					
Recommend revisions to SRP and other regulatory documents, e.g., NUREG or Regulatory Guides, as appropriate.	✓	TBD	F	NRC	n/a
ACRS interaction (as needed)		TBD	F	NRC	n/a
CRGR interaction (as needed)		TBD	F	NRC	n/a
Issue revised RG	✓	TBD	F	NRC*	n/a
Issue revised SRP	✓	TBD	F	NRC*	n/a

* Issuance of revisions to RGs and SRP will be conducted through established agency process.

TWG # 6: LICENSING PROCESS

1. BACKGROUND:

Guidance for the content of license applications and amendments involving licensing digital instrumentation and control (I&C) systems and components is contained in Regulatory Guide 1.206 (Combined License Applications for Nuclear Power Plants - LWR Edition) and Chapter 7 (Instrumentation and Controls) of NUREG-0800 (Standard Review Plan (SRP) for the Review of Safety Analysis Reports for Nuclear Power Plants). RG 1.206 was issued for preliminary use on March 30, 2007, and several revised sections of the SRP have been published recently.

However, licensing of digital instrumentation and control applications for operating reactors, has generally involved significant regulatory and industry efforts in specifying, developing, and reviewing the appropriate level of information needed to obtain regulatory approval. This is in part related to the clarity of the existing guidance, and in part as a result of seeking regulatory review, and approval of "first-of-a-kind" technology for which there is little or no direct precedent. The Licensing Process Technical Working Group (TWG #6) will address the safe, secure, and efficient licensing of digital technology for both new and operating reactors and fuel cycle facilities. The outcomes from each of the technical working groups will consider, as longer term goals, the adequacy and applicability of the guidance as it relates to licensing process.

The Licensing Process TWG #6 has the following objectives:

1. Identify the regulatory requirements, acceptance criteria, and guidelines that are to be addressed in Chapter 7 of the COL applicant's safety analyses report (SAR), which contains information about the plant's I&C systems, or 10CFR70, Subpart H.
2. Develop proposed resolutions to licensing process issues that emerge during the development and implementation of digital I&C technology for new plants.

To accomplish its objectives, TWG #6 will access up-to-date versions of relevant guidance documents and to information released by the other TWGs.

2. SCOPE:

TWG #6 will monitor the following licensing topics and add others as needed:

- a. The requirements and guidance for submitting, processing, and documenting digital I&C licensing actions, with emphasis on Regulatory Guide 1.206 and SRP Chapter 7.
- b. The stability and repeatability of the digital I&C licensing process.

- c. The interests of the agency, the industry, and public stakeholders.
- d. The resolution of licensing process disagreements about, for example:
 - i. policy and procedural issues
 - ii. the clarity of guidance and acceptance criteria for licensing submittal format and content
 - iii. the level of detail in licensing submittals
 - iv. the sequence of steps in the licensing process
 - v. scheduling conflicts
 - vi. thresholds for regulatory review

3. PROBLEM STATEMENT:

The NRC and the nuclear power industry share common goals for the safe, secure and efficient licensing of digital technology for both new reactors and operating reactors and fuel facilities. Key attributes that need to be addressed to facilitate digital technology licensing include:

- Problem 1 Level of Detail: Adequate guidance on the level of detail in COL applications for new reactors and licensing actions for operating reactors and fuel cycle facilities necessary to begin and complete the regulatory reviews.
- Problem 2 Applicability: Clear applicability of guidance for operating reactors and fuel cycle facilities compared to new reactors, including the applicability of operating reactor change processes to new plant COLs and the applicability of Chapter 7 and Chapter 18 of the Standard Review Plan (NUREG-0800) to digital instrumentation and control upgrades for operating reactors and fuel facilities.
- Problem 3 Clear Process Protocols: Clear licensing process protocols for developing the application and NRC review of digital technology licensing actions.

4. DELIVERABLES:

- 1. Issue Interim Staff Guidance addressing future Nuclear Energy Institute (NEI) Guideline (such as NEI 06-02 "License Amendment Request Guidelines"), which will provide specific guidance on the level of detail for digital instrumentation and control applications and applicability of NRC guidance for operating reactors, new reactors, and fuel cycle facilities;
- 2. Develop recommendations for conforming changes for licensing process to Chapter 7 and Chapter 18 of NUREG-0800 and Regulatory Guide 1.206, as necessary, to support outcomes of the other task working groups.

3. NRC Regulatory Issue Summary (RIS) 2002-22, dated November 25, 2002, endorsed the EPRI/NEI joint task force report, EPRI TR-102348, Rev. 1, NEI 01-01. The subject of that report was licensing digital upgrades. The issues discussed in that NRC endorsed report will be reviewed to assure the effectiveness of licensing process protocols. Discrepancies identified will be addressed by proposing changes to guidance documents.

5. MILESTONES, ASSIGNMENTS, AND DELIVERABLES:

TWG #6: Licensing Process					
Milestones, Assignments and Deliverables	Deliverable	Due Date	Fcst/Actual	Lead	Support
NEAR-TERM					
Problem 1: Level of Detail					
Problem 2: Applicability of Guidance					
Problem 3: Process Improvement					
No near-term deliverables					
LONG-TERM					
Problem 1: Level of Detail					
Industry to provide white paper	✓	TBD	F	NEI	n/a
Review and comment on industry white paper	✓	TBD	F	NRC	n/a
Problem 2: Applicability of Guidance					
Industry to provide white paper	✓	TBD	F	NEI	n/a
Review and comment on industry white paper	✓	TBD	F	NRC	n/a
Problem 3: Process Improvement					
Industry to provide white paper	✓	TBD	F	NEI	n/a
Review and comment on industry white paper	✓	TBD	F	NRC	n/a
Common Long-Term Actions for All Problem Statements					
Review guidance revisions from other TWGs		TBD	F	NRC	NRC
Work with other organizations to incorporate guidance into consensus standards, as appropriate		TBD	F	NRC	NEI

TWG #6: Licensing Process					
Milestones, Assignments and Deliverables	Deliverable	Due Date	Fcst/Actual	Lead	Support
Recommend revisions to SRP and other regulatory documents, e.g., NUREG or Regulatory Guides, as appropriate.	✓	TBD	F	NRC	n/a
ACRS interaction (as needed)		TBD	F	NRC	n/a
CRGR interaction (as needed)		TBD	F	NRC	n/a
Issue revised RG	✓	TBD	F	NRC*	n/a
Issue revised SRP	✓	TBD	F	NRC*	n/a

* Issuance of revisions to RGs and SRP will be conducted through established agency process.