NON-CONCURRENCE PROCESS
COVER PAGE

The U.S. Nuclear Regulatory Commission (NRC) strives to establish and maintain an environment that encourages all employees to promptly raise concerns and differing views without fear of reprisal and to promote methods for raising concerns that will enhance a strong safety culture and support the agency's mission.

Employees are expected to discuss their views and concerns with their immediate supervisors on a regular, ongoing basis. If informal discussions do not resolve concerns, employees have various mechanisms for expressing and having their concerns and differing views heard and considered by management.

Management Directive, MD 10.158, "NRC Non-Concurrence Process," describes the Non-Concurrence Process (NCP), http://nrcweb.nrc.gov:8600/policy/directives/catalog/md10.158.pdf.

The NCP allows employees to document their differing views and concerns early in the decision-making process, have them responded to (if requested), and attach them to proposed documents moving through the management approval chain to support the decision-making process.

NRC Form 757, "Non-Concurrence Process" is used to document the process.

Section A of the form includes the personal opinions, views, and concerns of a non-concurring NRC employee.

Section B of the form includes the personal opinions and views of the non-concurring employee's immediate supervisor.

Section C of the form includes the agency's evaluation of the concerns and the agency's final position and outcome.

NOTE: Content in Sections A and B reflects personal opinions and views and does not represent official factual representation of the issues, nor official rationale for the agency decision. Section C includes the agency's official position on the facts, issues, and rationale for the final decision.

At the end of the process, the non-concurring employee(s):

- ☐ Concurred
- ☐ Continued to non-concur
- ☑ Agreed with some of the changes to the subject document, but continued to non-concur
- ☐ Requested that the process be discontinued

  - ☐ The non-concurring employee(s) requested that the record be non-public.
  - ☑ The non-concurring employee(s) requested that the record be public.

- ☐ This record is non-public and for official use only.
- ☑ This record has been reviewed and approved for public dissemination.

NRC FORM 757
NRC MD 10.158
(7-2011)

U.S. NUCLEAR REGULATORY COMMISSION

NON-CONCURRENCE PROCESS

NCP TRACKING NUMBER
NCP-2014-003

SECTION A - TO BE COMPLETED BY NON-CONCURRING INDIVIDUAL

TITLE OF SUBJECT DOCUMENT	ADAMS ACCESSION NO.
Incorporation by Reference of Institute of Electrical and Electronics Engineers Standard 603-2009	ML113191306

DOCUMENT SIGNER	SIGNER PHONE NO.
Eric Leeds	415-1270

TITLE	ORGANIZATION
Division Director	NRR/ Division of Engineering (DE)

NAME OF NON-CONCURRING INDIVIDUAL(S)	PHONE NO.
Royce Beacom, Richard Stattel, Steven Wyman, Clifford Doutt, Samir Darbali	415-2781

TITLE	ORGANIZATION
Electronics Engineer	NRR/ DE/ EICB

☐ DOCUMENT AUTHOR ☑ DOCUMENT CONTRIBUTOR ☐ DOCUMENT REVIEWER ☐ ON CONCURRENCE

REASONS FOR NON-CONCURRENCE AND PROPOSED ALTERNATIVES

The current version of the proposed rule to incorporate IEEE 603-2009 by reference has been modified to include a restriction on data communications for the digital instrumentation and control (I&C) safety systems in new reactors. However, the remaining portion of the proposed rule, applicable to operating reactors, permits two way communications with the safety system based primarily on meeting the same safety requirements as delineated by the current regulations and guidance. The new reactors' communications restriction is apparently intended to simplify the regulatory decision making process by specifying the design of the applicant's I&C data communication architecture. Thus the prescriptive restriction removes the necessity for the staff to use their judgment when applying the guidance that is available.

However, the opposite effect may turn out to be true. The existing burden to complete the review of plant wide highly complex I&C architectures would remain unresolved. In fact, the NRC staff's review could be made more troublesome and prolonged given the greater review uncertainty (e.g. without a review plan and associated guidance) should an applicant choose the alternative.

The new reactor applicants are likely to pursue the alternative process as delineated in Clause 50.55a(z) for the following reasons:
I. The alternative process would permit the applicants to maintain the use of two way data communication which is the predominate state of I&C architectures utilized by past and current licensee applications under the staff review of new and operating reactors;
II. The alternative approach would also very likely be preferable because redesign of the applicants' I&C system to meet the communications restriction could negatively impact existing and proposed safety and non-safety features;
III. Redesign could aggravate commercial issues already associated with the expansion of platform vendors' systems to nuclear applications. These issues could include, for example, time and schedules for engineering staff development to customize the systems to the restrictive design requirements for new reactors.

The staff has already shown the ability to make the safety determination on the existing digital I&C technology based on current regulations, guidance, and engineering judgment as well as conventional judgment albeit by means of a non-concurrence on the US-APWR design certification. Use of engineering judgment is essential in this case when considering risk vs. benefit (i.e., undefined hazards vs. safety features) of the entire system which is far beyond existing or proposed guidance in the industry. The Interim Staff Guidance (ISG) on data communication issues for the current regulation was developed by the NRC Digital I&C steering committee and is being included into permanent guidance. This guidance was written using an inclusive, public, consensus approach by the NRC staff incorporating operational experience and verifiable technology trends (e.g. two way communications) with full stakeholder input. The results were applied to operating reactors and should be consistently applied to new reactor licensing. The restrictive portion of the new rule does not support the existing digital I&C technology, the existing regulatory approach or the new approach reflected in the ISG on data communications.

☑ CONTINUED IN SECTION D

SIGNATURE

DATE 3/27/2014

SEE SECTION E FOR IMPLEMNATION GUIDANCE

NRC FORM 757
NRC MD 10.158
(7-2011)

U.S. NUCLEAR REGULATORY COMMISSION

NON-CONCURRENCE PROCESS

NCP TRACKING NUMBER
NCP-2014-003

TITLE OF SUBJECT DOCUMENT
Incorporation by Reference of Institute of Electrical and Electronics Engineers Standard 603-2009

ADAMS ACCESSION NO
ML113191306

SECTION D: CONTINUATION PAGE

CONTINUATION OF SECTION ☑ A ☐ B ☐ C

The uncertainty of the review of an alternative approach by the NRO staff would be outside both the proposed regulations and the associated guidance with unknown NRC staff review plans and schedules. This change in regulatory direction would only resurface the previous concerns raised by the industry on the predictability, consistency and timeliness of agency reviews of digital systems which the NRC has stated the guidance has been completed by the Digital I&C Steering Committee (ML11349A390).

Currently the NRC staff reviews highly complex I&C architectures with: 1) regulations that are safety performance based and do not dictate specific I&C architectural designs; 2) guidance developed in a public forum, as required by law, and consensually by the NRC Digital I&C steering committee with the use of engineering and conventional judgment.

1. Safety performance based regulations not dictating design

The regulation should be written such that the associated Regulatory Guides and the staff review plan can be used to determine if any particular system characteristic can be safely and reasonably implemented without being prescriptive of the system design. A proposed rule based on system safety performance requirements, as they are now, applicable to both operating and new reactors should be implemented. The proposed rule should be supported by guidance that provides a means for a licensee or applicant to meet the rule in a manner acceptable to the staff that is descriptive to the extent necessary to develop the application and anticipate the review by the staff. Developing guidance established on the existing safety performance based regulation was the objective and result of the DI&C plan and steering committee activities

2. Guidance with the use of engineering and conventional judgment

"Reasoned judgment within this and other areas of the Commission's statutory decision-making authority does not require, and in fact could be unduly restricted, by detailed prescriptive criteria." - NRC Chairman, Nils J. Diaz, April 4, 2006. Particularly for future applications, limits on the technology and scope of the design perceived when the rule criteria were written will have an impact on any prescriptive rule and may require an alternative to the rule with considerable staff judgment. Also the ability, or the willingness, of the applicant to clearly present his safety case can easily impact the suitability of any proposed regulation and guidance. As a result, a regulation that seems so restrictive and resultantly so easy to license may still require the use of the staff's engineering judgment. The staff's permission to use its judgment together with necessary guidance and regulation has been limited in the new reactor application reviews. As an example, the non-concurrence to the 7 year old US-APWR review on data communications independence invoked various requirements in 10 CFR including several criteria of IEEE Std 603. The response, in neither the text nor conclusion, did not address any requirements or the provide any reasoned judgment that the systems met those requirements. Relinquishing the use of the staff's reasoned judgment, when used with performance based regulations, would best serve the NRC and address the industry concerns on consistency between offices and timeliness of the reviews. This should be of the highest priority as well as the identification of all non-technical influences to the decision discussed in an open and collaborative forum.

If the new rule was approved, redesign of the architectures to new reactor applications would be required. The alternative route to use the existing architectures would not have a review plan or staff guidance. This would require the staff to use even further judgment, which has been limited to date, and the non-decisional situation, as it is being forced now, would be further extended for new reactor reviews and exasperate the industry's previously identified concerns. A prescriptive rule as stated by the Commission should not be used to supersede staff judgment where existing technology could be used if presented in a quality and complete application.

3. Summary and Recommendation for Proposed Alternative

The alternative comes in three parts:

a. Maintain consistent requirements for data communications independence:
   i. This should be compatible for new and operating reactors beginning with the existing IEEE-603-1991 requirement.
b. Complete permanent guidance on data communications independence
   i. This was committed to by the DI&C Steering Committee to the EDO to develop RG 1.152.
c. Permit NRC staff to use guidance and coincident regulations
   i. Use of guidance should be conforming to associated regulations.
   ii. NRC staff uses engineering and conventional judgment consistent with regulation and guidance.

SEE SECTION E FOR IMPLEMENTATION GUIDANCE

NRC FORM 757
NRC MD 10.158
(7-2011)

U.S. NUCLEAR REGULATORY COMMISSION

NON-CONCURRENCE PROCESS

NCP TRACKING NUMBER: NRC-2014-003

TITLE OF SUBJECT DOCUMENT: Incorporation by Reference of Institute of Electrical and Electronics Engineers Standard 603-2009

ADAMS ACCESSION NO.: ML113191306

SECTION B - TO BE COMPLETED BY NON-CONCURRING INDIVIDUAL'S SUPERVISOR

NAME: John Thorp

TITLE: Branch Chief EICB

PHONE NO.: 415-8508

ORGANIZATION: NRR/DE/EICB

COMMENTS FOR THE NCP REVIEWER TO CONSIDER

I agree in large part with the comments;, logic and reasoning provided by my staff expressing their concerns for the precedent that would be set by a bifurcated rule with differing requirements for new reactors. The problems that will likely emerge from the proposed bifurcation of rule requirements have been further described by staff in this non-concurrence. I also believe the restrictive positions taken in the wording for new reactors is contrary to agency policy and agency-industry consensus established in the Interim Staff Guidance, ISG-04, which was subsequently incorporated into industry standard IEEE 7.4.3.2. Of significance in this non-concurrence discussion is not only the inconsistency in regulatory treatment of new versus operating reactors, but also the perspective that the desire to simply and clearly restrict communications in the rule, through wording that is essentially a dictation of design, will likely produce even more regulatory uncertainty. This unintended consequence in the non-concurring staffs view, will emerge in the form of either the elimination of currently allowed appropriate engineering judgment, or the challenge of a regulatory review of a proposed alternative for which technical/regulatory review guidance may be lacking, or both. I agree with the non-concurrence statement: "A proposed rule based on system safety performance requirements, as they are now, applicable to both operating and new reactors should be implemented." That said, certain proposed changes related to consideration of the potential introduction of hazards (see clauses 50.55a(h)(5)(i) and (5)(ii)) are reasonable and I would have no objection to retaining them.

I did not see a logical nexus between the author 's discussion of NRO practices in degree of judgment allowed versus the wording in the current version of the rule, so I will not address those comments. I have listened to the perspectives and positions from all internal stakeholders on the concerns for this draft rule over the last two years. I have become convinced the rule as modified, injects inappropriate inconsistency of treatment between new and operating reactors.

My recommendations to the NCP Reviewer for this non-concurrence are consistent with my prior recommendations in the non-concurrence document by R. Stattel et al:

1. Direct action to delete the prescriptive clauses from Section 50.55a(h)(5)(iii) of the draft rule. This would eliminate regulatory bi-furcation and maintain a consistent approach for ensuring independence of l&C systems for both new and currently operating reactors."
2. Return this rule to its originally intended purpose, a clean, straightforward incorporation of the more recent IEEE standard by reference, with the exception that I believe it reasonable to retain the added hazards consideration conditions of Clauses 50.55a(h)(5) (i) and (5)(ii), applicable to both new and current operating reactors. The concerns that have spurred an interest in bifurcating the rule for new reactors should be instead factored into regulatory guidance, if differing treatment of communications independence can be justified for new reactor applicants.
3. An alternative would be for NRO staff to develop and gain Commission approval for a SECY paper that justifies their concern for new reactors, followed by separate rulemaking in 10OCFR52 to achieve their aims and address the circumstances they believe arc different than those faced in the review of operating reactor licensing actions relative to this standard.

☐ CONTINUED IN SECTION D

SIGNATURE: John C. Thorp

DATE: 4/16/2014

SEE SECTION E FOR IMPLEMENTATION GUIDANCE

NRC FORM 757
NRC MD 10.158
(7-2011)

U.S. NUCLEAR REGULATORY COMMISSION

NON-CONCURRENCE PROCESS

NCP TRACKING NUMBER: NCP 2014-003

TITLE OF SUBJECT DOCUMENT: Incorporation by Reference of Institute of Electrical and Electronics Engineers Standard 603-2009

ADAMS ACCESSION NO.: ML113191306

SECTION C - TO BE COMPLETED BY DOCUMENT SPONSOR

NAME: Patrick L. Hiland

TITLE: Division Director

PHONE NO.: (301) 415-3298

ORGANIZATION: Office of NRR, Division of Engineering

SUMMARY OF ISSUES

Document Sponsor's comments for NCP 2014-001, NCP 2014-003, and NCP 2014-004, are provided in a consolidated report, "Actions taken to address Non-concurrences NCP-2014-001, NCP-2014-003 and NCP 2014-004 to the Draft Rulemaking for incorporation by reference of IEEE Std. 603-2009." See attached.

ACTIONS TAKEN TO ADDRESS NON-CONCURRENCE

Document Sponsor's comments for NCP 2014-001, NCP 2014-003, and NCP 2014-004, are provided in a consolidated report, "Actions taken to address Non-concurrences NCP-2014-001, NCP-2014-003 and NCP 2014-004 to the Draft Rulemaking for incorporation by reference of IEEE Std. 603-2009." See attached.

SIGNATURE--DOCUMENT SPONSOR: Patrick L Hiland — TITLE: Division Director

ORGANIZATION: NRR / DE — DATE: 8/6/2014

SIGNATURE--NCP REVIEWER: 6/22/15 JOHN W. LUBINSKI — TITLE: ACTING DIRECTOR

ORGANIZATION: NRR — DATE: 10/3/2014

NCP OUTCOME: SEE COVER PAGE

Non--Concurring Individual: ☐ CONCURS ☐ NON-CONCURS ☐ WITHDRAWS NON-CONCURRENCE (i.e., discontinues process)

AVAILABILTY OF NCP FORM

Non--Concurring Individual: ☐ WANTS NCP FORM PUBLIC ☐ WANTS NCP FORM NON-PUBLIC

☐ CONTINUED IN SECTION D

SEE SECTION E FOR IMPLEMENTATION GUIDANCE

Actions taken to address Non-concurrences NCP-2014-001, NCP-2014-003 and NCP 2014-004 to the Draft Rulemaking for incorporation by reference of IEEE Std. 603-2009

Background

As part of its role to ensure public health and safety, the U.S. Nuclear Regulatory Commission (NRC) routinely updates its regulations and guidance to ensure that the agency incorporates the current technology, maintains appropriate references, and improves regulatory efficiency and predictability. In January 2007, the NRC initiated a project to improve the regulatory efficiency and predictability of licensing digital Instrumentation and Control (I&C) safety systems in new and existing nuclear power plants. During a Commission meeting the previous November, the industry panel expressed concerns over the ability to license digital I&C safety systems and implement certain NRC policies regarding digital I&C. As a result, the Digital I&C project was initiated, and through this project, the NRC developed, over a five year period, seven I&C Interim Staff Guidance (ISG) documents to provide additional clarification for successful implementation of digital I&C systems. One of the long term goals of the project was to draft more permanent guidance that would incorporate the ISGs into existing NRC regulatory guidance. Most of the ISGs have been incorporated into NRC regulatory guides, however, ISG-04, digital system communications, has not been incorporated into the targeted regulatory guide (RG), RG 1.152, "Criteria for Use of Computers in Safety Systems of Nuclear Power Plants."

Shortly after its publication, the NRC began consideration of incorporating by reference the updated version of the Institute of Electrical and Electronics Engineers (IEEE) Standard 603-2009, "IEEE Standard Criteria for Safety Systems in Nuclear Power Generating Station (IEEE Std. 603-2009)." The applicable regulation that incorporates a previous version of this standard (IEEE Std. 603-1991) is 10 CFR 50.55a(h). IEEE Std. 603-1991 is a voluntary consensus standard that has been incorporated by reference into NRC regulations to establish functional and design requirements for safety systems for nuclear power plants since 1999. Previously, IEEE Standard 279-1971, "Criteria for Protection Systems for Nuclear Power Generating Stations," (IEEE Std. 279) was used. Incorporation by reference of IEEE Std. 603-2009 would be consistent with the provisions of the National Technology Transfer and Advancement Act of 1995, which encourages Federal regulatory agencies to consider adopting voluntary consensus standards as an alternative to de novo (from the beginning) agency development of standards.

In 2010, the NRC formed a working group including technical representatives from the Office of Nuclear Reactor Regulation (NRR), the Office of New Reactors (NRO), and the Office of Regulatory Research (RES), and representatives for the Office of the General Council and rulemaking project management. The working group reviewed IEEE Std. 603-2009 to determine its acceptability for incorporation by reference in the NRC regulations, and it concluded that, while the standard is technically adequate and consistent with the current NRC regulatory process, several conditions needed to be included to clarify and augment several acceptance criteria and the applicability of IEEE Std. 603-2009. During the evaluation of IEEE Std. 603-2009, the working group sought to develop practical solutions to ensure safety and address the various technical issues identified. The working group addressed a number of challenging technical issues and was able to arrive at a consensus position on most of these issues; however despite extensive working group efforts, it became clear by the summer of 2012 that the working group was having problems reaching a consensus on some of technical issues, the most challenging of which was digital system communication independence.

To assist the rulemaking working group in developing potential solutions in the area of independence, NRC senior management issued a memorandum on July 5, 2012 (Agencywide Document Access and Management System Accession No. ML12187A208), to encourage the working group to develop a common solution to provide a level of safety that meets the minimum needs of the various members of the working group and consistent with the NRC principles of good regulation. At the same time, the Senior Technical Advisors for this area in both NRR and NRO were tasked with developing potential "out-of-the-box" solutions to assist the rulemaking working group in developing a common solution.

By memorandum dated October 19, 2012 (ML12293A106), the Senior Technical Advisors provided their input to the working group and Senior Management. The working group used the recommendations provided to restart discussion on digital system independence and other issues and incorporated some of the Senior Technical Advisors' recommendations, such as the enhanced use of hazards analysis as part of the preliminary draft proposed rule text, however the primary recommendation to provide a graded approach to digital system independence requirements based on system architecture was not adopted. The working group continued to explore options that could resolve the differences of technical judgment between working group members on the topics of digital system communications, diversity requirements, and other issues based primarily on regulatory experience on recent digital system upgrades to operating reactors such as the Oconee reactor protection and engineer safeguards actuation system and new reactor reviews such as the AREVA U.S. Evolutionary Pressurized Reactor (EPR). The most recent evolution was the proposal to bifurcate the rule to have one requirement for digital system independence for new reactors and a different requirement for modifications and upgrades to I&C systems in operating reactor reviews. In the end, the rulemaking steering committee determined that sufficient consensus existed to move the preliminary draft proposed rule text to the concurrence process. As part of the concurrence process, three non-concurrences have been filed by eleven (11) individuals from the instrumentation and control branches in NRR and NRO including three (3) of the original five (5) working group members. The non-concurrences, which involved digital system communications, the adequacy of diversity requirements, the use of technology-specific language in the standard, and the need for enhanced hazards analysis, are summarized below.

Summary of Issues

Summary of Issues (NCP-2014-001)

The non-concurring staff objects to the inclusion of restrictions on data communications for the digital I&C safety systems for new reactors in the current version of the proposed rule to incorporate by reference IEEE Std. 603-2009. The non-concurring staff believes the proposed criterion for communication independence is contrary to fourteen years of regulatory precedent that has been successfully applied to operating nuclear power plants, and that no technical basis has been provided to demonstrate that current regulatory practices are either adverse to public health, safety, or security or to warrant the use of different regulatory requirements for the use of digital communications technology in new reactors. The proposed rule would institute a different set of regulations for new reactors that would not be applied to operating plants, which the non-concurring staff believes would promote inconsistencies between operating and new reactor plants and discourage the nuclear industry from using available technologies to enhance safety system performance. The non-concurring staff proposes to ensure safety of digital

communication through incorporation of IEEE Std. 603-2009 without the exception for independence and incorporation of IEEE 7-4.3.2-2010 (which has been updated to include ISG-4) in a revision of Reg. Guide 1.152.

Summary of Issues (NCP-2014-003)

The non-concurring staff objects to the inclusion of restrictions on data communications for the digital I&C safety systems for new reactors in the current version of the proposed rule to incorporate by reference IEEE Std. 603-2009. The non-concurring staff believes the proposed criteria for communication independence are intended to simplify the regulatory decision making process for new reactor I&C systems by prescriptively specifying the design of the applicant's I&C data communication architecture, thus reducing the need for staff judgment when applying the regulations. The non-concurring staff believes the opposite may turn out to be the case, because applicants will choose to request alternatives under 50.55a(z), making reviews more challenging and adding to regulatory uncertainty. The reviews, in this case, would need to be completed outside of established guidance and staff review plans. The non-concurring staff is also concerned that the prescriptive nature of the data communication clauses in the proposed rule is being used to supersede staff judgment, where use of the staff's reasoned judgment would better serve the goal of ensuring safety. The non-concurring staff proposes to ensure safety of digital communication through incorporation of IEEE 7-4.3.2-2010 in RG 1.152.

Summary of Issues (NCP-2014-004)

The non-concurring staff objects to the currently proposed rulemaking because it fails to adequately address several technical issues that the staff and licensees face when designing and evaluating new I&C systems. The non-concurring staff believes that additional steps must be taken in order to ensure the regulations remain current, precise and comprehensive enough to provide reasonable assurance of safety. The non-concurring staff believes that including by reference IEEE Std. 603-2009, that includes some technology-specific language, will lead applicants and licensees to design new I&C systems for licensing considerations rather than optimizing system safety and could result in unintended consequences for both the staff and industry. Additionally, the non-concurring staff believes that adding technology specific requirements in the proposed regulation that previously applied to all I&C safety systems places additional regulatory burden on licensees and causes delays in new system designs and implementation that may result in hampering, rather than enhancing overall plant safety. Additionally, the non-concurring staff asserts that such requirements may add to regulatory uncertainty causing licensees and applicants to forego updating I&C safety systems and instead opt for maintaining obsolete systems.

The non-concurring staff believes that new technology and the level of complexity of current and future I&C systems may contribute to common cause failures that are not addressed in the proposed rule and could defeat system diversity. Additionally, the non-concurring staff believes that embedded digital devices that are now being used in sensors as well as final actuation devices are not adequately addressed in the proposed rule, and that system complexity is also not sufficiently addressed. This staff member is concerned that since there is no requirement for systems' hazards analysis to be conducted for these devices (sensors, priority modules and final actuation devices), there is a greater likelihood of common cause failures that have the potential to defeat systems diversity, because these devices contain new failure modes that impact new I&C system designs in unexpected and unanticipated ways.

The non-concurring staff proposes re-examining the issues cited above and developing rule language that proactively addresses the greater range of safety concerns as outlined in the non-concurrence. To counter or eliminate these concerns, the non-concurring staff recommends that the staff develop a two tiered strategy that would first allow generic safety system requirements, applicable to all systems of a given type, such as IEEE Std. 603-1991, and then would develop additional upper tier and lower tier "application-specific" standards for those systems that utilize a specific technology. Further, the non-concurring staff recommends rulemaking that would revise the current diversity requirements, to require all I&C safety systems to incorporate a minimum of two separate, diverse paths from sensor output to final actuation device for all I&C safety system functions (trip and ESF functions) whose failure to actuate, or whose actuation when system conditions do not require it, would cause the plant to exceed design limits. The non-concurring staff's recommendation would be to also add additional hazards analysis requirements to support a better understanding of system operational capabilities and failure mechanisms. The diversity requirements and the analysis of the I&C safety systems would have to include all components from sensor to final actuation device to ensure the level of review is commensurate with the technology utilized for the given device, including the final actuation devices.

Actions taken to address each of the issues and rationale for resolution of non-concurrences

In non-concurrence NCP-2014-001 and 2014-003, the non-concurring staff proposes to ensure the safety of digital communication through incorporation of IEEE Std.603-2009 without exception to the criteria for independence, and incorporation of IEEE 7-4.3.2-2010 in a revision of Reg. Guide 1.152. While I agree with the non-concurring staff that to add more prescriptive requirements for data communication for new reactors is a significant change to past regulatory precedent that has been successfully applied to current and new reactors, I believe that the proposed rule text can be successfully implemented. The draft proposed rule text for digital communication in new reactors provides regulations that will ensure safety while providing greater predictability in the licensing process. Additionally, as pointed out by the non-concurring staff, I understand that the proposed rule text would preclude some future digital safety system designs that may in fact be as safe, or safer, than those outlined in the rule forcing an applicant to request and justify an alternative. I believe that the added regulatory predictability for both the staff and the applicants outweighs the associated uncertainty necessarily caused by applicants pursuing this path as delineated in Title 10 of *The Code of Federal* Regulations (10 CFR) 50.55a(z) rather than the new requirements for digital communications provided in 10CFR 50.55a(h)(5)(iii)(D).

This may add to the uncertainty associated with new reactor I&C reviews but the NRC staff has reviewed digital systems based on the less prescriptive requirements associated with IEEE Std. 603-1991 for many years and can do so in the future, so I believe that the increased licensing certainty of the new rule outweighs this argument. To help mitigate this concern, as part of implementing changes associated with the new rule, the staff will consider enhancing standard review plan (NUREG-0800) Chapter 7 guidance to provide to support this possibility. Although, as pointed out in the non-concurrence, the proposed restrictions on digital communications may affect the opportunity to use some of the features of advanced communication technologies to improve safety for new reactors, it has been the experience of the Office of New Reactors that the need to request an alternative to the incorporated standard and additional requirements is

less of a burden than that experienced by other members of the working group working primarily in the Office of Nuclear Reactor Regulation.

The non-concurring staff points to the Commission's direction in staff requirement memorandums (SRM)-M061108, which established the Digital I&C Steering Committee and the Digital I&C Project in 2007. This effort was a proactive effort by the NRC to work with the industry to provide additional guidance associated with how licensees and applicants could meet NRC requirements for digital systems and reduce licensing uncertainty associated with the use of these systems. As part of this effort, as pointed out by the non-concurring staff, the NRC developed ISG-04 (ML083310185), which established acceptable methods for incorporating communication features into digital systems. The staff used this guidance to license digital I&C systems portions of which would not be permitted for new reactors under the provisions of the proposed 10 CFR 50.55a(h)(5)(iii)(D). The non-concurring staff pointed out that to implement this provision of the proposed draft rule will be a significant change to the direction set in the ISG and by inference the SRM. However, as discussed in SECY-09-0061, the staff always planned to update the final guidance after the "staff gains experience with the use of the ISGs through current reviews" and "the SRP, regulatory guides, and other regulatory guidance will be revised to incorporate the ISGs and **lessons learned** (emphasis added)." The experience that new reactor reviewers have had regarding this area has led me to believe that the added regulatory certainty associated with the proposed draft rule language is a lesson learned in this area and is a valid reason for adding this additional regulatory requirement for new reactors.

However, because the non-concurrence packages make reasonable assertions regarding the possible negative impact of the proposed draft rulemaking on safety and regulatory predictability, the rulemaking package has been modified to elicit input from the public to better inform the agency regarding several of the issues raised. The following questions have been added to the "Specific Request for Comments" section of the rulemaking package:

> 1) Will the proposed bifurcation of the independence requirements (50.55a(h)(5)) provide more regulatory certainty for new and current reactor I&C designs? Are there better ways to achieve independence with regulatory certainty? What additional guidance is necessary to implement the proposed criteria?
>
> 2) How likely is it that applicants and licensees will use the alternative process (as provided in the 50.55a(z) associated with the new requirements for "independence" (IEEE Std. 603-2009, section 5.6)? In what respects would alternatives be sought and what would be the basis for seeking the alternatives? Will the proposed rule language act to limit different design solutions to address independence?
>
> 3) Will the added requirements and restrictions on digital communications independence discourage the nuclear industry from using available technologies to enhance safety system performance or replace aging and obsolete safety systems?
>
> 4) Will different requirements for digital system independence for new and current reactors lead to inconsistencies between reactor designs that will impact safety or the ability of the NRC to effectively carry out inspections or regulatory reviews? Will this difference between new and operating reactor I&C review criteria improve regulatory certainty?

Also as part of the public comment process, the NRC will proactively engage the public by holding one or more public workshops to discuss the proposed rule and provide opportunities for all stakeholders to discuss and comment on these and other parts of the proposed rule text. The public workshop(s) will use these and other questions associated with the proposed changes to the rule to discuss the rulemaking and the issues discussed in the non-concurrences as part of the public comment process.

In non-concurrence NCP-2014-004, the non-concurring staff proposes to not go forward with the proposed rulemaking and rethink a number of technical issues before moving forward with a new rulemaking package. The non-concurring staff objects to the currently proposed rulemaking because it fails to adequately address several technical issues that the staff and licensees face when designing and evaluating new I&C systems. While I agree with the non-concurring staff that there are a number of technical issues that have not been fully resolved by this proposed draft rulemaking, I am not persuaded that the rulemaking should be abandoned at this point.

One of the non-concurring staff concerns is that by referencing, IEEE Std. 603-2009, that includes some technology-specific language, will lead to applicants and licensees to design new I&C systems for ease of licensing rather than optimizing system safety and thus result in unintended consequences for both the staff and industry. Although there has been some inclusion of technology-specific language in IEEE Std. 603-2009, I believe it will not have a significant impact on current I&C designs or the designs that the NRC will review for the next several years. In discussions with members of the IEEE Standards organization, I am informed that the Nuclear Power Engineering Council is already reviewing a proposal for the next revision of IEEE Std. 603 that is to be completed in 2018 or 2019. I am also informed that the current plan for revision to the standard includes removal of the technology specific language as part of the next revision. Based on this information and likelihood that the NRC will review this new revision of the standard, I have determined not to revise the draft proposed rule text to address this issue at this time. The non-concurring staff also believes that adding technology specific requirements in the proposed regulation that previously applied to all I&C safety systems places additional regulatory burden on licensees and causes delays in new system designs and implementation. I do not believe the level of added technology specific requirements will result in this effect but will carefully review public comments in this area to ensure we have not underestimated this concern.

The non-concurring staff believes that new technology and the level of complexity of current and future I&C systems may contribute to common cause failures that are not addressed in the draft proposed rule and could defeat system diversity. Additionally, the non-concurring staff believes that embedded digital devices are not sufficiently addressed nor is the need for systems' hazards analysis. The staff is moving forward with a Regulatory Information Summary (RIS) on embedded digital devices that will partially address the concerns raised by the non-concurring staff. This RIS will highlight to the licensees and applicants the need to address embedded digital devices and adequately review their potential failure modes. The agency is also moving to more proactively address the identified need to better address digital system hazards analysis. In addition to the sections in the proposed draft rule text associated with hazards analysis (50.55a(h)(5)(i) and (ii)), the NRC's efforts include ongoing research into this area being conducted in the Office of Nuclear Regulatory Research (RES) and its contractors. To date, this effort has informed NRO's development of the Design Specific Review Standard for mPower and will be used to inform the next revision of the Standard Review Plan (NUREG-

0800) Chapter 7. Therefore, although I agree that these issues are of concern, I believe the current efforts underway within the agency will adequately address the non-concurring staff's issues with embedded digital devices and hazards analysis.

With respect to the non-concurring staff's concern that new technology and the level of complexity of current and future I&C system may contribute to areas that are not addressed in the draft proposed rule text associated with common cause failures, I agree. The current position on digital system common cause failures was provided in a Commission Paper (SECY 93-087) and the Commission's staff requirements memorandum responding to that Commission Paper (SECY 93-087) and represents the technical and regulatory thinking on the subject at that time. Because of the significant changes to the technology since that time, including the expanded use of Field Programmable Gate Array (FPGA) and similar technologies, new methods and tools, and significant operational experience associated with the use of digital systems in nuclear power plants and other fields, the assumptions provided in SECY 93-087 are outdated and likely in need of reevaluation. Therefore, I have removed the diversity requirement from the rulemaking text (50.55a(h)(6)) and plan to provide the commission a paper proposing a new rulemaking effort (already prioritized as NRR-40) that will look at a number of issues including some discussed by the non-concurring staff, such as the sufficiency of overall system level diversity. Issues would include the changes to the state of the art in digital system technology since the Commission policy on digital system diversity was established in SECY 93-087 such as FPGAs, the need to incorporate diverse paths from sensor output to final actuation device for all I&C safety system functions (trip and ESF functions) and the emergence of embedded digital devices in nuclear power plant I&C channels from smart sensors to final actuation devices.

Finally, the non-concurring staff recommends that the staff develop a two tiered strategy that allows generic safety system requirements, that applies to all systems of a given type, such as IEEE Std. 603-1991, then develop additional upper tier and lower tier "application-specific" standards for those systems that utilize a specific technology, similar to the strategy used by the International Electrotechnical Commission (IEC) standards. The NRC is familiar with the IEC standards and has a representative on the IEC standards committees that develop the IEC-61513 series of standards discussed in non-concurrence NCP-2014-004. Although I appreciate the non-concurring staff's perspective on this structure and understand the potential benefit, I do not believe that it is practical at this time to completely revise the NRC's structure to parallel the IEC structure. However, because I agree that there is merit to this line of argument; NRR is currently preparing a User Need Request for RES to prepare a regulatory guide that would address FPGAs and similar Hardware Description Languages based technology. If successful, this regulatory guide would serve as a second tier guidance document parallel to RG 1.152 for software based systems under IEEE Std. 603-2009. In this way, the NRC would move to a structure that would, at least partially, parallel the IEC structure in which IEC-61513 serves as the higher level standard and IEC-60880 and IEC-62566 serve as the lower tier standards as proposed by the non-concurring staff.