Instrumentation and Controls

Task Working Group #6:
Digital I & C Licensing Process

DRAFT INTERIM STAFF GUIDANCE

Issue:

SRP Chapter 7 provides guidance to the NRC staff for review of I&C systems against the applicable regulatory criteria for nuclear reactor plant licenses and amendments to existing licenses. Digital systems used for I&C systems are somewhat unique in that the qualification of those systems, and the ultimate approval for use in safety-related systems is dependant not only on testing, but also on a high quality design process, which results in a considerable amount of documentation that must be reviewed by the staff. In light of this, the industry and vendors have requested clarification as to what documentation needs to be delivered to the staff for review, at which phase in the review this documentation is needed, which documentation needs to be on the docket, and which documentation does not need to be docketed, but needs to be available for staff review during the audit.

Staff Position:

This Interim Staff Guidance addresses the design and review of digital systems proposed for safety-related service in nuclear power plants. These guidelines address only selected digital aspects of such systems. Such systems are also subject to other licensing requirements germane to safety-related systems, such as requirements for separation, independence, electrical isolation, seismic qualification, Quality Requirements, etc., which are delineated in the Standard Review Plan, Appendix 7.1-A, Acceptance Criteria and Guidelines for Instrumentation and Control Systems Important to Safety.

This guidance specifically addresses the information needed by the NRC to see a clear path to the acceptance and review of the license amendment request. In general, this means all planning documentation must be available at the time of the submittal. The results of the life cycles tasks, such as final design, procedures, results of testing , and final configuration are not needed at the time of submittal, but are needed prior to the SER completion. As a practical matter, these documents should be submitted within 6 months after the acceptance review completion. Some limited documentation, which cannot be completed prior to final installation, such as results of installation test and the V & V report on installation testing, must be available for staff audit prior to start-up.

This guidance is intended to provide clarification and enhanced guidance in recognition of the inherent differences between digital systems that might be used in the future and analog / hardwired systems that have been used in the past. This guidance is based on staff requirement necessary to review a complex digital system upgrade (e.g., completer RTS/ESF digital upgrade) which would normally take about 18 months from acceptance of the LAR.

These guidelines do not modify or supersede existing regulatory requirements or guidance. These guidelines present means acceptable to the staff for meeting existing requirements. Alternative means of meeting existing requirements will be considered if requested and adequately documented and justified. A documented technical basis showing that the proposed alternative measures provide equivalent assurance of safe and correct

operation would be required.

Some of the provisions of this guidance may be interrelated, so acceptance of an alternative in one area may require that compensatory measures be taken in another. Thus acceptance of alternative provisions may require the imposition of other measures that would not otherwise be necessary for conformance to this guidance as-written. Such details must be addressed on a case-by-case basis.

In general, any failure to comply with any element of this guidance (expressed typically as "… should …") is to be considered to be a proposed alternative design as described above. In some cases the guidance itself addresses alternative measures, but in most cases it will be up to the applicant to identify, present, and justify them.

Systems accepted for review by the staff in the past that are not fully in accordance with this guidance were accepted on the basis of detailed case-by-case review: that prior acceptance is not rescinded or diminished by this guidance, nor does it serve as precedent for waiving the guidance provided herein. However, past precedent SER's will be considered in reviewing license application.

The extensive existing guidance (Regulatory Guides, SRP, etc. identified in column 2 of the attached table) on these subjects should also be taken into consideration in evaluating proposed digital systems. The provisions expressed herein are intended to supplement and clarify, not replace, the provisions of the existing guidance. The provisions of the existing guidance remain applicable even though many of those provisions are not addressed or referenced herein.

The purpose of Interim Staff Guidance is to clarify the licensing criteria the staff will use in confirming that a proposed design meets applicable requirements. Interim Staff Guidance will remain in effect until final guidance is developed and promulgated and the interim guidance has been explicitly rescinded. The staff intends to continue working with stakeholders in refining the interim guidance and in developing final guidance.

Rationale:

In general, there are a number of things the staff looks for in a high quality design process, such as configuration control, verification and validation activities, or testing of the product. In order to investigate these processes, a number of stages in each process must be examined by the staff.

First, the staff reviews what the vendor or licensee is planning to do in order to make a determination that these activities will result in a high quality design process. This is done by reviewing the various plans for the digital system development activities. For this reason, the planning documentation should be submitted at the time of the vendor submittal of a topical report of a licensee submittal or a license amendment request to the NRC. These plans must be docketed because they serve as part of the basis for the SER.

Second, the staff reviews the methods, e.g., procedures, used to implement the plans. These procedures need to be developed before the work is actually done, but may not be necessary until that phase of the lifecycle is reached. For this reason, the staff does not required that the procedures be submitted at the time of initial submittal, however for those activities which will occur quite early in the design lifecycle, the staff asks for preliminary procedures to be submitted, however, it need not be on the docket. The exact timing of when these procedures will vary depending on how far along in the lifecycle the project is, and for this reason, the exact time will vary. In general, the final version of these procedures need to be docketed, but

preliminary procedures used for initial review do not require docketing.

Third, the staff reviews these activities to verify they were done pursuant to the plans and procedures. In addition, the staff will review the training and qualifications of the personnel performing these activities. This portion of the review is done during the on-site audit, where the staff will have an opportunity to observe the activities, and talk to the personnel involved.

Forth and finally, the staff reviews the results for these activities to provide reasonable assurance that the goals were achieved. This is done by reviewing the documentation of the final results, such as test reports, V&V reports, problem reports, etc.

The draft staff guidance on each of these areas is provided in the attached tables. Consolidated lists of which documentation is needed in which phase of the review is also attached.

Guidance for Document Submittal

Organization of Tables:

TWG6 has determined that the licensing process addresses following different areas addressed by different sections of the standard review plan.

1. SRP Appendix 7.0-A - Review process for Digital I & C Systems

2. SRP Appendix 7.1-C - Guidance for Evaluation of Conformance to IEEE Std 603

3. SRP Appendix 7.1-D - Guidance for Evaluation of Conformance to IEEE Std 7-4.3.2

4. SRP Appendix 7.1-D - Cyber Security Requirements

5. SRP Chapter 18 - Human Factors Engineering

6. SRP BTP 7-14 - Software Program Plan

Table Overview:

Column one identifies the applicable SRP sections.

Column two lists the requirements, standards, regulatory guides.

Column three describe how these requirements are met in the submittal.

Column 4 describes documents which needs to be docketed prior to acceptance of the submittal for review. Delay in submission of these documents will result in non-acceptance of the review.

Column 5 may be submitted and reviewed after the acceptance review but are necessary to make the regulatory finding. If these documents are not submitted in a timely manner, the regulatory finding of acceptance or denial will be delayed.

Column 6 identifies those documents that are available for audit and not docketed at the

time of submittal or prior to SER.

Column 7 identifies those documents available for audit prior to operation.

References:

10 CFR 50
10 CFR 50 Appendix B
Ch.15 of SAR
EPRI TR-102323
EPRI TR-106439
EPRI TR-107330
GDC-20
GDC-24
Generic Letter 89-02
Generic Letter 91-05
IEC 12207.0
IEC 60880-2
IEC 61000
IEEE/EIA 12207.0-1996
IEEE Std. 1008
IEEE Std. 1012-1998
IEEE Std. 1028,
IEEE Std. 1042-1987
IEEE Std. 1050
IEEE Std. 1074
IEEE Std. 1228
IEEE Std. 1540-2001
IEEE Std. 308
IEEE Std. 323
IEEE Std. 344
IEEE Std. 352
IEEE Std. 379
IEEE Std. 384
IEEE Std. 420
IEEE Std. 494
IEEE Std. 577
IEEE Std. 603
IEEE Std. 7-4.3.2-2003
IEEE Std. 828 and 1042
IEEE Std. 828-1998
IEEE Std. 829
IEEE Std. 830
IEEE Std. C62.41
IEEE Std. C62.45
ISA S67.04
ISG on Communications
ISG on D3
ISG on Human Factors
ISG on Cyber Security
MIL-STD-461E
NUREG/CR 6101
NUREG/CR 6463
Regulatory Guide 1.100
Regulatory Guide 1.105
Regulatory Guide 1.152
Regulatory Guide 1.168
Regulatory Guide 1.169
Regulatory Guide 1.170
Regulatory Guide 1.171
Regulatory Guide 1.171
Regulatory Guide 1.172
Regulatory Guide 1.173
Regulatory Guide 1.180
Regulatory Guide 1.209
Regulatory Guide 1.22
Regulatory Guide 1.47
Regulatory Guide 1.53
Regulatory Guide 1.62
Regulatory Guide 1.75
SECY 93-087
SPR BTP 7-12
SPR BTP 7-17
SPR BTP 7-17
SPR BTP 7-21
SRP App 7.1-C
SRP App 7.1D.
SRP BTP 4,
SRP BTP 5
SRP BTP 6
SRP BTP 7-14
SRP BTP 7-17
SRP BTP 7-19
SRP BTP 7-2
SRP BTP 7-21
SRP BTP 7-6
SRP Section 7.1
SRP Section 7-6
SRP Section 7-9

SRP Appendix 7.0-A - Review process for Digital I&C Systems						
1	2	3	4	5	6	7
SRP Section	**Requirements & Standards (guidance)**	**Describe how met in submittal**	**Documents needed to be docketed prior to acceptance for review**	**Documents needed to be docketed within 6 months after acceptance (prior to SER)**	**Documents Available for Audit – non docketed (prior to SER)**	**Documents available for audit prior to operation**
3.A Adequacy of Design Criteria and Guidance	RG 1.152, IEEE Std. 7.4.3.2-2003, RG 1.168, 169, 170, 171, 172 and 173	Adequacy of design criteria and guidance applied to the proposed system		None	None	None
3.C Diversity and Defense in depth	Secy-93-087, SRP BTP 7-19 and ISG on D3	Adequacy of D3 in the proposed System	Final D3 Analysis	None	None	None
3.D Software Life Cycle Process Planning	See separate table for BTP 7-14					
3.E Functional Requirements	SRP Sections 7.1 and 7.9, SRP Appendix 7.1-C, and SRP BTP 7-17 and 7-21	EQ including EMI/RFI, Real-time deterministic performance, online and periodic test provisions, Communications independence, and Control of access	EMI, Temperature, Humidity, and Seismic testing plans	Testing procedures and EMI, Temperature, Humidity, and Seismic testing results	None	None

SRP Appendix 7.0-A - Review process for Digital I&C Systems						
1	2	3	4	5	6	7
SRP Section	**Requirements & Standards (guidance)**	**Describe how met in submittal**	**Documents needed to be docketed prior to acceptance for review**	**Documents needed to be docketed within 6 months after acceptance (prior to SER)**	**Documents Available for Audit – non docketed (prior to SER)**	**Documents available for audit prior to operation**
3.F Audit of Software life cycle process implementation	See separate table for BTP 7-14					
3.G Audit of Software life cycle design outputs	See separate table for BTP 7-14					
3.H Acceptance of Commercial grade digital equipment	10CFR50 Appendix B, IEEE Std 7-4.3.2-2003, EPRI TR-106439 and EPRI NP-5652, GL 89-02 and 91-05	Preliminary (not docketed) report on acceptance of commercial grade dedication process	Final Commercial Grade Dedication Process Plans	Commercial Grade Dedication Procedures and final report on acceptance of commercial grade dedication	None	None

SRP Appendix 7.1-C – Guidance for Evaluation of Conformance to IEEE Std 603						
1	2	3	4	5	6	7
SRP Section	**Requirements & Standards (guidance)**	**Describe how met in submittal**	**Documents needed to be docketed prior to acceptance for review**	**Documents needed to be docketed within 6 months after acceptance (prior to SER)**	**Documents Available for Audit – non docketed (prior to SER)**	**Documents available for audit prior to operation (not needed for SER)**
4.0 Safety System Design Basis	GDC-20, SRP BTP 7-6	Summary Description of the Design Basis and analysis showing proposed design continues to meet Design Basis	Existing Plants- None New Plants - Design Basis Documentation	None	None	None
4.1 Identification of the Design Basis Events	SRP BTP -4, SRP BTP -5 IEEE 603 (needed for new plants)	Identification of the Design Basis Events				
4.4 Variables Monitored and Analytical Limit	IEEE 603 (needed for new plants)	Identification of Variables Monitored and Associated Analytical Limit				
4.5 Criteria for Manual Initiation	SRP BTP -6 IEEE 603 (needed for new plants)	Minimum Criteria for Manual Initiation and Control of Protective Actions				
4.6 Identification of the Minimum Sensors	IEEE 603 (needed for new plants)	Identification of the Minimum Number and Location of Sensors				

SRP Appendix 7.1-C – Guidance for Evaluation of Conformance to IEEE Std 603						
1	2	3	4	5	6	7
SRP Section	**Requirements & Standards (guidance)**	**Describe how met in submittal**	**Documents needed to be docketed prior to acceptance for review**	**Documents needed to be docketed within 6 months after acceptance (prior to SER)**	**Documents Available for Audit – non docketed (prior to SER)**	**Documents available for audit prior to operation (not needed for SER)**
4.7 Range of Conditions	IEEE 603 (needed for new plants)	Range of Transient and Steady-state Conditions				
4.8 Identification of Degradation Conditions	IEEE 603 (needed for new plants)	Identification of Conditions Having the Potential for Causing Functional Degradation of Safety System Performance				
4.9 Reliability of the Safety System Design	IEEE 603 (needed for new plants)	Identification of the Methods Used to Determine Reliability of the Safety System Design				
5.0 Safety System Criteria						
5.1 Single-Failure Criterion	Reg. Guide 1.53, IEEE 379, SECY 93-087, SRP BTP 7-19	"Single Failure Analysis" & basis at system block diagram level	Preliminary (not docketed) FMEA and final D3 analysis (see 3.C)	Final FMEA	None	None

SRP Appendix 7.1-C – Guidance for Evaluation of Conformance to IEEE Std 603						
1	2	3	4	5	6	7
SRP Section	**Requirements & Standards (guidance)**	**Describe how met in submittal**	**Documents needed to be docketed prior to acceptance for review**	**Documents needed to be docketed within 6 months after acceptance (prior to SER)**	**Documents Available for Audit – non docketed (prior to SER)**	**Documents available for audit prior to operation (not needed for SER)**
5.2 Completion of Protective Action	IEEE 603	Text & high-level logic diagrams	System description to block diagram level, detailed theory of operation description.	Final logic diagrams.	Final circuit schematics and code listings (needed for thread audit)	None
5.3 Quality	10 CFR 50 Appendix B, IEEE 7-4.3.2, SRP Appendix 7.1.D subsection 5.3	Describe QA Program applicable to the proposed digital system	Quality Assurance Plan for digital hardware and software	Quality Assurance Procedures for digital hardware and software	None	None
5.4 Equipment Qualification	Reg. Guide. 1.100, IEEE Std 344 Reg. Guide 1.209. IEEE-323 Reg. Guide 1.180, IEEE 1050 MIL – STD-461E IEC 61000 IEEE C62.41 IEEE C62.45 EPRI TR-102323	Describe program, and site specific bounding envelope, test plan	EMI, Temperature, Humidity, and Seismic testing plans	Qualification test procedures and summary of final EMI, Temperature, Humidity, and Seismic testing results	Individual completed test procedures / reports	None

SRP Appendix 7.1-C – Guidance for Evaluation of Conformance to IEEE Std 603						
1	2	3	4	5	6	7
SRP Section	**Requirements & Standards (guidance)**	**Describe how met in submittal**	**Documents needed to be docketed prior to acceptance for review**	**Documents needed to be docketed within 6 months after acceptance (prior to SER)**	**Documents Available for Audit – non docketed (prior to SER)**	**Documents available for audit prior to operation (not needed for SER)**
5.5 System Integrity	SRP BTP 7-2 and 7-14, IEEE 7-4.3.2	Description of the safety system design	System Requirements Specification and Design Analysis Report	V&V report on analysis of System Requirements Specification	Individual V&V Problem reports up to FAT	All Individual V&V Problem reports
5.6 Independence	Reg. Guide 1.75, IEEE 384	Description of the physical and electrical independence				
5.7 Capability for	Reg. Guide 1.22, Reg.	Description of the capability for test and calibration				
5.8 Information Displays	Reg. Guide 1.47 See also Section 5.14	Description of the Information displays				
5.9 Control of Access	See Cyber Security below					
5.10 Repair	SPR BTP 7-17	Describe how the system design facilitates repair.	System Requirements Specification and Design Analysis Report	V&V report on analysis of System Requirements Specification	Individual V&V Problem reports up to FAT	All Individual V&V Problem reports
5.11 Identification	IEEE 384, 420, and 494, RG 1.75, SRP BTP 7-14, SRP App. 7.1D.	Describe how components will be identified				
5.12 Auxiliary Features	N/A	Description of Auxiliary Features				

SRP Appendix 7.1-C – Guidance for Evaluation of Conformance to IEEE Std 603						
1	2	3	4	5	6	7
SRP Section	**Requirements & Standards (guidance)**	**Describe how met in submittal**	**Documents needed to be docketed prior to acceptance for review**	**Documents needed to be docketed within 6 months after acceptance (prior to SER)**	**Documents Available for Audit – non docketed (prior to SER)**	**Documents available for audit prior to operation (not needed for SER)**
5.13 Multi-Unit Stations	IEEE 308 and 379	Description of the shared components between Multi Unit Stations				
5.14 Human Factors Considerations	See separate table below: Chapter 18, Human Factors					
5.15 Reliability	IEEE 352 and 577	Description of system reliability analysis	Preliminary (not docketed) FMEA	Final FMEA	None	None
6 Sense and Command Features – Functional and Design Requirements						
6.1 Automatic Control	SRP BTP 7-12 and 7-21	Description of Sense and Command Features	System Requirements Specifications; Hardware & Software Architecture Descriptions; and Design Analysis Report	None	Vendor Build Documentation	Site Installation Documentation
6.2 Manual Control	RG 1.62					
6.3 Interaction between the Sense and Command Features and Other Systems	GDC 24					

SRP Appendix 7.1-C – Guidance for Evaluation of Conformance to IEEE Std 603						
1	2	3	4	5	6	7
SRP Section	**Requirements & Standards (guidance)**	**Describe how met in submittal**	**Documents needed to be docketed prior to acceptance for review**	**Documents needed to be docketed within 6 months after acceptance (prior to SER)**	**Documents Available for Audit – non docketed (prior to SER)**	**Documents available for audit prior to operation (not needed for SER)**
6.4 Derivation of System Inputs	Ch.15 of SAR					
6.5 Capability for Testing and Calibration	SRP BTP 7-17					
6.6 Operating Bypasses	SRP 7-6					
6.7 Maintenance Bypass	SRP 7-6					
6.8 Set points	Reg. Guide 1.105 and ISA S67.04, SRP BTP 7-12	Description of the set point methodology	Draft Set point methodology	Final Set point methodology	Set point calculations	
7 Execute Features — Functional And Design Requirements						

SRP Appendix 7.1-C – Guidance for Evaluation of Conformance to IEEE Std 603						
1	2	3	4	5	6	7
SRP Section	**Requirements & Standards (guidance)**	**Describe how met in submittal**	**Documents needed to be docketed prior to acceptance for review**	**Documents needed to be docketed within 6 months after acceptance (prior to SER)**	**Documents Available for Audit – non docketed (prior to SER)**	**Documents available for audit prior to operation (not needed for SER)**
7.1 Automatic Control	SRP BTP 7-12 and 7-21	Description of the execute features	System Requirements Specifications; Hardware & Software Architecture Descriptions; and Design Analysis Report	None	Vendor Build Documentation	Site Installation Documentation
7.2 Manual Control	IEEE 308, RG 1.62		System Requirements Specifications; Hardware Descriptions; and Design Analysis Report	None	Vendor Build Documentation	Site Installation Documentation
7.3 Completion of Protective Action						
7.4 Operating Bypass						
7.5 Maintenance Bypass						

SRP Appendix 7.1-C – Guidance for Evaluation of Conformance to IEEE Std 603						
1	2	3	4	5	6	7
SRP Section	**Requirements & Standards (guidance)**	**Describe how met in submittal**	**Documents needed to be docketed prior to acceptance for review**	**Documents needed to be docketed within 6 months after acceptance (prior to SER)**	**Documents Available for Audit – non docketed (prior to SER)**	**Documents available for audit prior to operation (not needed for SER)**
8 Power Source Requirements	IEEE 308	Description of the Power Source Requirements	System Requirements Specifications; Hardware Descriptions; and Design Analysis Report	None	Vendor Build Documentation	Site Installation Documentation

SRP Appendix 7.1-D - Guidance for Evaluation of Conformance to IEEE Std 7-4.3.2						
1	2	3	4	5	6	7
SRP Section	**Requirements & Standards (guidance)**	**Describe how met in submittal**	**Documents needed to be docketed prior to acceptance for review**	**Documents needed to be docketed within 6 months after acceptance (prior to SER)**	**Documents Available for Audit – non docketed (prior to SER)**	**Documents available for audit prior to operation**
4.0 Safety System Design Basis	No requirements beyond those in SRP Appendix 7.1-C and IEEE 603					
5.0 Safety System Criteria						
5.1 Single-Failure Criterion	No requirements beyond those in SRP Appendix 7.1-C and IEEE 603					
5.2 Completion of Protective Action	SRP BTP 7.1-6 and 7.1-C	No requirements beyond those in SRP Appendix 7.1-C and IEEE 603	Safety Analysis	V&V Report on Safety Analysis	None	None

SRP Appendix 7.1-D - Guidance for Evaluation of Conformance to IEEE Std 7-4.3.2						
1	2	3	4	5	6	7
SRP Section	**Requirements & Standards (guidance)**	**Describe how met in submittal**	**Documents needed to be docketed prior to acceptance for review**	**Documents needed to be docketed within 6 months after acceptance (prior to SER)**	**Documents Available for Audit – non docketed (prior to SER)**	**Documents available for audit prior to operation**
5.3 Quality	See separate table below: BTP 7-14: Software Program Plan, 10 CFR App. B, IEEE 603, 1012, 828, 1042, and 1540, IEC 12207.0 and 60880-2, SRP BTP 7.1-6 and 7-14, RG 1.152, 1.168, and 1.169, EPRI TR-106439 and TR-107330	Software lifecycle documentation	See Table on SRP BTP 7-14: Software Program Plan			
5.3.1 Software development	See Table on SRP BTP 7-14: Software Program Plan					
5.3.2 Software tools	IEEE 7-4.3.2 section 5.3.2	Description of Software Tool Verification Program	Software Tool Verification Program	Software Tool Analysis Report	None	None
5.3.3 Verification and validation	IEEE Std 1012-1998	See Table on SRP BTP 7-14: Software Program Plan				

SRP Appendix 7.1-D - Guidance for Evaluation of Conformance to IEEE Std 7-4.3.2						
1	2	3	4	5	6	7
SRP Section	**Requirements & Standards (guidance)**	**Describe how met in submittal**	**Documents needed to be docketed prior to acceptance for review**	**Documents needed to be docketed within 6 months after acceptance (prior to SER)**	**Documents Available for Audit – non docketed (prior to SER)**	**Documents available for audit prior to operation**
5.3.4 Independent V&V requirements	IEEE Std 1012-1998	See Table on SRP BTP 7-14: Software Program Plan				
5.3.5 Software configuration management	IEEE Std 1042-1987 IEEE Std 828-1998	See Table on SRP BTP 7-14: Software Program Plan				
5.3.6 Software project risk management	IEEE/EIA 12207.0-1996 IEEE Std 1540-2001	Description of Software Project Risk Management Program	Software Project Risk Management Program	Software Project Risk Management Report	None	None
5.4 Equipment Qualification	See Sections 5.4.1 and 5.4.2 below					

SRP Appendix 7.1-D - Guidance for Evaluation of Conformance to IEEE Std 7-4.3.2						
1	2	3	4	5	6	7
SRP Section	**Requirements & Standards (guidance)**	**Describe how met in submittal**	**Documents needed to be docketed prior to acceptance for review**	**Documents needed to be docketed within 6 months after acceptance (prior to SER)**	**Documents Available for Audit – non docketed (prior to SER)**	**Documents available for audit prior to operation**
5.4.1 Computer System Testing	Reg. Guide 1.170, IEEE 829, and Reg. Guide 1.171, IEEE 1008	Description of Test program	Test Plan	Test procedures; Final Test Reports; V&V report on Test plans and Procedures; and Summary of Test Results (Including FAT) Installation Test Plans and procedures.	Completed test procedure reports (Including FAT)	SAT Test Reports; Installation Test Reports, V&V Report on Installation Test
5.4.2 Qualification of Existing Commercial Computer	10 CFR 50 App. B, SRP App 7.1-C and BTP 14, EPRI TR-106439 and TR-107330	Summary description of the plans to qualify commercial computer equipment	Commercial Grade Dedication Plans	Final Commercial Grade Dedication Procedures; COTS Dedication Report; V&V Analysis of COTS Dedication Program	Completed test procedure reports	None

SRP Appendix 7.1-D - Guidance for Evaluation of Conformance to IEEE Std 7-4.3.2						
1	2	3	4	5	6	7
SRP Section	**Requirements & Standards (guidance)**	**Describe how met in submittal**	**Documents needed to be docketed prior to acceptance for review**	**Documents needed to be docketed within 6 months after acceptance (prior to SER)**	**Documents Available for Audit – non docketed (prior to SER)**	**Documents available for audit prior to operation**
5.5 System Integrity	IEEE 603, SRP App. 7.1-C	Description of the Design for computer integrity, test and calibration; and Fault detection and self-diagnostics	Design Report on computer integrity, test and calibration; and Fault detection and self-diagnostics	V&V reports on System Requirements Specifications;	Detailed system and hardware drawings, schematics, and software code listings.	None
5.6 Independence	IEEE 603; GDC 24; SRP 7-9 and App 7.1-C; ISG on Communications	Describe the communications independence	Description of system in sufficient detail to determine compliance with the ISG on Communications	None	Detailed system and hardware drawings, schematics, and software code listings.	None
5.7 Capability for Test and Calibration	No requirements beyond those in SRP Appendix 7.1-C and IEEE 603					
5.8 Information Displays	No requirements beyond those in SRP Appendix 7.1-C and IEEE 603					
5.9 Control of Access	See Cyber Security below					
5.10 Repair	No requirements beyond those in SRP Appendix 7.1-C and IEEE 603					

SRP Appendix 7.1-D - Guidance for Evaluation of Conformance to IEEE Std 7-4.3.2						
1	2	3	4	5	6	7
SRP Section	**Requirements & Standards (guidance)**	**Describe how met in submittal**	**Documents needed to be docketed prior to acceptance for review**	**Documents needed to be docketed within 6 months after acceptance (prior to SER)**	**Documents Available for Audit – non docketed (prior to SER)**	**Documents available for audit prior to operation**
5.11 Identification	IEEE 7-4.3.2, Section 5.11	Description of the Hardware, Firmware and Software Identification Methods	System Requirements Specifications; Hardware Description System Requirements Specifications; Hardware Description	Final design description	Detailed System & Hardware drawings and schematics, code listings, Vendor Build Documentation	None
5.12 Auxiliary Features	No requirements beyond those in SRP Appendix 7.1-C and IEEE 603					
5.13 Multi-Unit Stations	No requirements beyond those in SRP Appendix 7.1-C and IEEE 603					
5.14 Human Factors Considerations	No requirements beyond those in SRP Appendix 7.1-C and IEEE 603	See separate table below: Chapter 18, Human Factors				
5.15 Reliability	IEEE 7-4.3.2, Section 5-15	If reliability goals are Required, the method of meeting the goals, include the software	Preliminary (non-docketed) FMEA and Reliability Analysis	Final FMEA and Reliability Analysis	None	None

SRP Appendix 7.1-D - Guidance for Evaluation of Conformance to IEEE Std 7-4.3.2						
1	2	3	4	5	6	7
SRP Section	**Requirements & Standards (guidance)**	**Describe how met in submittal**	**Documents needed to be docketed prior to acceptance for review**	**Documents needed to be docketed within 6 months after acceptance (prior to SER)**	**Documents Available for Audit – non docketed (prior to SER)**	**Documents available for audit prior to operation**
6 Sense and Command Features	No requirements beyond those in SRP Appendix 7.1-C and IEEE 603					
7 Execute Features	No requirements beyond those in SRP Appendix 7.1-C and IEEE 603					
8 Power Source Requirements	No requirements beyond those in SRP Appendix 7.1-C and IEEE 603					

Cyber Security Requirements (Completion of this table is assigned to TWG-1 on Cyber Security)						
1	2	3	4	5	6	7
SRP Section	**Requirements & Standards (guidance)**	**Describe how met in submittal**	**Documents needed to be docketed prior to acceptance for review**	**Documents needed to be docketed within 6 months after acceptance (prior to SER)**	**Documents Available for Audit – non docketed (prior to SER)**	**Documents available for audit prior to operation**
C.I.7.C-2 Cyber Security Requirements						
Concepts Phase	RG 1.152, Regulatory Positions 2.1 through 2.9 Alternately use NEI 04-04 as revised and ISG on Cyber Security IEEE 603	Stand alone submittal; Sensitive information – withhold from public disclosure pursuant to §2.390. Incorporate by reference pursuant to §50.32 Address developer actions as well as licensee's Address Reg. Guide 1.152 on how you have or will meet the Reg. Guide.	Cyber Security Programmatic Documents - Plans and procedures	V&V Report on cyber security aspect of software and system design.	None	None
Requirements Phase						
Design Phase						
Implementation Phase						
Test Phase						
Installation, Checkout, and Acceptance Testing						
Operation						
Maintenance						
Retirement						

Chapter 18 – Human Factors Engineering (Completion of this table is assigned to TWG-4 on Human Factors)						
1	2	3	4	5	6	7
NUREG 0711 Section	**Requirements & Standards (guidance)**	**Describe how met in submittal**	**Documents needed to be docketed prior to acceptance for review**	**Documents needed to be docketed within 6 months after acceptance (prior to SER)**	**Documents Available for Audit – non docketed (prior to SER)**	**Documents available for audit prior to operation**
HFE Program Management	IEEE Std 1023, 1988, NUREG-0711 and ISG	Summary description	HFE program plan	V&V Report on HFE program Plan	Details to support plan summary, e.g., quals of team members, tracking system	None
Operating Experience Review		Summary description of significant safety findings	Operating Experience Review Plan	Operating Experience Review Report	Operating Experience Tracking Items	None
Functional Requirements Analysis		Summary description of significant changes from past practice	FRA and FA document	None	FRA Results Report	Plan for updating FRA / FA
Task Analysis		Task Analysis	Task Analysis Plan	Summary Report on Task Analysis Results	Design inputs derived from task analysis	Task analysis documentation
Staffing & Qualifications		Define minimum operational staffing	Staffing plan	Final justification of operating staffing	Changes to staffing plan	None
Human Reliability Analysis		Human Reliability Analysis	Integration of Human Reliability Analysis into plant design	Human Reliability Analysis Results	Design inputs derived from HRA analysis	Completed HRA Reports and Documents

Chapter 18 – Human Factors Engineering (Completion of this table is assigned to TWG-4 on Human Factors)						
1	2	3	4	5	6	7
NUREG 0711 Section	**Requirements & Standards (guidance)**	**Describe how met in submittal**	**Documents needed to be docketed prior to acceptance for review**	**Documents needed to be docketed within 6 months after acceptance (prior to SER)**	**Documents Available for Audit – non docketed (prior to SER)**	**Documents available for audit prior to operation**
Human-System Interface Design			Conceptual Design Plan	Final Design Summary Description	HF Design Input / Requirements documentation	prototyping / Test results final description
Procedure Development	SRP Chapter 13		GTGs / EPGs	Generic EOPs on PSTGs	V&V Results report	Final approved procedures
Training Program Development	SRP Chapter 13		Training program planning documentation	Training program manuals and schedule	Course materials Assessment Plan	None
Human Factors V&V	IEEE Std 1023, 1988, NUREG-0711		V&V Planing documentation	Final V&V Reports, summary	Individual V&V Problem reports	V&V Results / Resolutions
Design Implementation	IEEE 603		System Requirements Specifications; Hardware Description System Requirements Specifications; and Hardware Description	None	None	None

Chapter 18 – Human Factors Engineering (Completion of this table is assigned to TWG-4 on Human Factors)						
1	2	3	4	5	6	7
NUREG 0711 Section	**Requirements & Standards (guidance)**	**Describe how met in submittal**	**Documents needed to be docketed prior to acceptance for review**	**Documents needed to be docketed within 6 months after acceptance (prior to SER)**	**Documents Available for Audit – non docketed (prior to SER)**	**Documents available for audit prior to operation**
Human Performance Monitoring	IEEE Std 1023, 1988, NUREG-0711	None	None	None	None	None

SRP BTP 7-14: Software Program Plan						
1	2	3	4	5	6	7
SRP Section	**Requirements & Standards (guidance)**	**Describe how met in submittal**	**Documents needed to be docketed prior to acceptance for review**	**Documents needed to be docketed within 6 months after acceptance (prior to SER)**	**Documents Available for Audit – non docketed (prior to SER)**	**Documents available for audit prior to operation**
Software Management Plan	RG 1.173 and 1.152, IEEE Std 1074 NUREG/CR 6101 IEEE Std 7-4.3.2, BTP 7-14 Reg. Guide 1.172, IEEE 830 Reg. Guide 1.168, IEEE 1012 Reg. Guide 1.169, IEEE 828 and 1042	Summary description of overall software life cycle process Summary description of Plans, plus hardware & software architecture	Software Management Plan Software Requirements Specification Software Design Specification	Software Management implementing procedures V&V report on the System build documents Operations manuals	Code listings	None
Software Development Plan	RG 1.173, RG 1.152, IEEE Std 1074 NUREG/CR 6101 and 6463, IEEE Std 7-4.3.2, BTP 7-14		Software Development Plan; Hardware & software architecture	V&V report on the Installation configuration tables	Individual V&V Problem reports up to FAT	All Individual V&V Problem reports
Software QA Plan	10 CFR 50, App. B, IEEE 1074, RG 1.173, NUREG/CR 6101		Software QA Plan / Procedures	V&V report on the Software QA Plan	Individual V&V Problem reports up to FAT	All Individual V&V Problem reports

SRP BTP 7-14: Software Program Plan						
1	2	3	4	5	6	7
SRP Section	**Requirements & Standards (guidance)**	**Describe how met in submittal**	**Documents needed to be docketed prior to acceptance for review**	**Documents needed to be docketed within 6 months after acceptance (prior to SER)**	**Documents Available for Audit – non docketed (prior to SER)**	**Documents available for audit prior to operation**
Software Integration Plan	RG 1.173, IEEE Std 1074 NUREG/CR 6101		Software Integration Plan	V&V Report on Software Integration Plan Final configuration tables	Final Software Integration Report; Individual V&V Problem reports up to FAT	All Individual V&V Problem reports
Software Installation Plan	RG 1.173, IEEE Std 1074 and 1012, NUREG/CR 6101		Software Installation Plan	V&V report on the Installation Plan, Installation Procedures, Final configuration lists	Individual V&V Problem reports up to FAT	Final Installation Report
Software Maintenance Plan	RG 1.152, IEEE 7-4.3.2, NUREG/CR 6101		Software Maintenance Plan	V&V report on the Maintenance Plan	Individual V&V Problem reports up to FAT, Maintenance manuals	All Individual V&V Problem reports
Software Training Plan	IEEE 1074, NUREG/CR 6101		Software Training Plan	V&V report on the Training Plan	Individual V&V Problem reports up to FAT; and Training manuals & course material	All Individual V&V Problem reports

SRP BTP 7-14: Software Program Plan						
1	2	3	4	5	6	7
SRP Section	**Requirements & Standards (guidance)**	**Describe how met in submittal**	**Documents needed to be docketed prior to acceptance for review**	**Documents needed to be docketed within 6 months after acceptance (prior to SER)**	**Documents Available for Audit – non docketed (prior to SER)**	**Documents available for audit prior to operation**
Software Operations Plan	RG 1.152		Software Operations Plan	V&V report on the Operations Plan; Operations Manual	Operations procedures Individual V&V Problem reports up to FAT	All Individual V&V Problem reports
Software Safety Plan	NUREG/CR 6101, RG 1.173, IEEE-1228		Software Safety Plan	V&V report on the Software Safety Plan	Individual V&V Problem reports up to FAT	All Individual V&V Problem reports

SRP BTP 7-14: Software Program Plan						
1	2	3	4	5	6	7
SRP Section	**Requirements & Standards (guidance)**	**Describe how met in submittal**	**Documents needed to be docketed prior to acceptance for review**	**Documents needed to be docketed within 6 months after acceptance (prior to SER)**	**Documents Available for Audit – non docketed (prior to SER)**	**Documents available for audit prior to operation**
Software V&V Plan	RGs 1.152, 1.168, 1.170 and 1.171, IEEE 7-4.3.2, 829, 1012, 1008, and 1028, NUREG/CR 6101		Software V&V Plan and procedures	V&V Requirements Analysis Report V&V Design Analysis Report V&V Implementation Analysis & Test Report V&V Integration Analysis & Test Report V&V Validation & Test Report V&V Change Report	Individual V&V Problem reports up to FAT	All Individual V&V Problem reports

SRP BTP 7-14: Software Program Plan						
1	2	3	4	5	6	7
SRP Section	**Requirements & Standards (guidance)**	**Describe how met in submittal**	**Documents needed to be docketed prior to acceptance for review**	**Documents needed to be docketed within 6 months after acceptance (prior to SER)**	**Documents Available for Audit – non docketed (prior to SER)**	**Documents available for audit prior to operation**
Software CM Plan	RG 1.152 and 1.173, IEEE Std 7-4.3.2, 828, and 1074, Reg. Guide 1.169, NUREG/CR 6101		Software CM Plan	V&V report on the Initial CM Report, Final System Configuration Documentation,	Individual V&V Problem reports up to FAT Configuration Management Reports	None
Software Test Plan	Reg. Guide 1.170, IEEE 829 Reg. Guide 1.171, IEEE 1008		Software Test Plan	V&v Report on Software Test Plan Software Test Procedures (unit and integration test)	Individual completed test procedures.	None

Consolidated List of Documents Required for Acceptance Review
In Accordance with Column 4 in Tables in TWG 6 ISG
Documents Needed to Be Docketed Prior to Acceptance for Review

1. Commercial Grade Dedication Plans
2. D3 Analysis
3. Description of system in sufficient detail to determine compliance with the ISG on Communications
4. Design Analysis Report
5. Design Report on computer integrity, test and calibration; and Fault detection and self-diagnostics
6. Detailed theory of operation description.
7. Draft Set point methodology
8. EMI, Temperature, Humidity, and Seismic testing plans
9. Software QA Plan / Procedures
10. System description to block diagram level
11. Hardware & Software Architecture Descriptions
12. Preliminary FMEA (non-docketed)
13. Quality Assurance Plan for digital hardware and software
14. Reliability Analysis
15. Safety Analysis
16. System Requirements Specification
17. Test Plan
18. Software Life Cycle Documentation
    a. Software CM Plan
    b. Software Design Specification
    c. Software Development Plan;
    d. Software Installation Plan
    e. Software Integration Plan
    f. Software Maintenance Plan
    g. Software Management Plan
    h. Software Operations Plan
    I. Software Project Risk Management Program
    j. Software Requirements Specification
    k. Software Safety Plan
    l. Software Test Plan
    m. Software Tool Verification Program
    n. Software Training Plan
    o. Software V&V Plan and procedures

Consolidated List of Documents Required for System Review
In Accordance with Column 5 in Tables in TWG 6 ISG
Documents Needed to Be Docketed Within Six Months after Acceptance

1. Commercial Grade Dedication Report
2. Commercial Grade Dedication Procedures
3. Design Analysis Report
4. Final configuration lists
5. Final configuration tables
6. Final design description
7. Final FMEA
8. Final logic diagrams.
9. Final Reliability Analysis
10. Final Report on acceptance of commercial grade dedication
11. Final Set point methodology
12. Final System Configuration Documentation,
13. Final Test Reports;
14. Installation Test Plans and procedures.
15. Operations manuals
16. Qualification test procedures
17. Quality Assurance Procedures for digital hardware and software
18. Summary of final EMI, Temperature, Humidity, and Seismic testing results
19. Summary of Test Results (Including FAT)
20. Test procedures;
21. Testing procedures and EMI, Temperature, Humidity, and Seismic testing results
22. Software Life Cycle Documentation
    a. Software Management implementing procedures
    b. Software Project Risk Management Report
    c. Software Test Procedures (unit and integration test)
    d. Software Tool Analysis Report
23. V&V Reports
    a. V&V Analysis of COTS Dedication Program
    b. V&V Change Report
    c. V&V Design Analysis Report
    d. V&V Implementation Analysis & Test Report
    e. V&V Integration Analysis & Test Report
    f. V&V Report on the Installation Procedures
    g. V&V Report on the Installation configuration tables
    h. V&V Report on the Installation Plan
    I. V&V Report on the System build documents
    j. V&V Report on the Training Plan
    k. V&V Report on the Operations Plan;
    l. V&V Report on the Initial CM Report
    m. V&V Report on the Software Safety Plan
    n. V&V Report on analysis of System Requirements Specification
    o. V&V Report on the Software QA Plan
    p. V&V Report on the Maintenance Plan
    q. V&V Report on Test plans and Procedures
    r. V&V Report on Software Integration Plan

s. V&V Report on Safety Analysis
t. V&V Report on Software Test Plan
u. V&V reports on System Requirements Specifications;
v. V&V Requirements Analysis Report
w. V&V Validation & Test Report

Consolidated List of Documents Required for Audit
In Accordance with Column 6 in Tables in TWG 6 ISG
Documents Available for Audit – non docketed

1. Completed test procedure / reports (Including FAT)
2. Configuration Management Reports
3. Detailed system and hardware drawings
4. Detailed System & Hardware drawings
5. Final circuit schematics
5. Final Software Integration Report;
7. Individual completed test procedures / reports
8. Individual V&V Problem reports up to FAT
9. Maintenance manuals
10. Operations procedures
11. Set point calculations
12. Software code listings.
13. Training manuals & course material
14. Vendor Build Documentation

Consolidated List of Documents Required for Audit
In Accordance with Column 7 in Tables in TWG 6 ISG
Documents available for audit prior to operation

1. All Individual V&V Problem reports
2. Final Installation Report
3. Final Test Reports;
4. Installation Test Reports
5. Site Acceptance Test Reports
6. Site Installation Documentation
7. Completed Test procedures;
8. Summary of Test Results (Including FAT)
9. V&V report on Test plans and Procedures
10. V&V Report on Installation Test