U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

TABLE 7-1 REGULATORY REQUIREMENTS, ACCEPTANCE CRITERIA, AND GUIDELINES FOR INSTRUMENTATION AND CONTROL SYSTEMS IMPORTANT TO SAFETY

REVIEW RESPONSIBILITIES

Primary - Organization responsible for the review of instrumentation and controls

Secondary - None

Review Note: The revision numbers of Regulatory Guides (RG) and the years of endorsed industry standards referenced in Standard Review Plan (SRP) Chapter 7 are centrally maintained in SRP Section 7.1-T, "Regulatory Requirements, Acceptance Criteria, and Guidelines for Instrumentation and Control Systems Important to Safety," (Table 7-1). Therefore, the individual revision numbers of RGs (except RG 1.97) and years of endorsed industry standards are not shown in individual SRP sections or branch technical positions (BTPs). References to industry standards incorporated by reference into regulation (IEEE Std 279-1971 and IEEE Std 603-1991) and industry standards that are not endorsed by the agency do include the associated year in the SRP Chapter 7 sections or BTPs. See Table 7-1 to ensure that the appropriate RGs and endorsed industry standards are used for the review.

Revision 6 – August 2016

The SRP Table 7-1 identifies the regulatory requirements (denoted by “R”), and SRP acceptance criteria (denoted by “A”) and their applicability to the various sections of Chapter 7 of the safety analysis report (SAR).

Applicable requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, “Domestic Licensing of Production and Utilization Facilities,” 10 CFR Part 52, “Licenses, Certifications, and Approvals for Nuclear Power Plants.” 10 CFR Part 50, Appendix A, “General Design Criteria for Nuclear Power Plants,” 10 CFR 50.34(f)(2), 10 CFR 50.55a(h), “Protection and Safety Systems,” and 10 CFR 50.62, “Requirements for the reduction of risk from anticipated transients without scram (ATWS) events for light-water-cooled nuclear power plants,” establish the U.S. Nuclear Regulatory Commission (NRC) technical requirements for the instrumentation and control (I&C) systems important to safety. 10 CFR 50.55a(a)(2) incorporates by reference Institute of Electrical & Electronics Engineers (IEEE) Standard (Std) 603-1991, “IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations,” along with the correction sheet dated January 30, 1995, and IEEE Std 279-1971, “Criteria for Protection Systems for Nuclear Power Generating Stations.” 10 CFR 50.55a(h) requires compliance to IEEE Std 603-1991, along with the correction sheet dated January 30, 1995, or to IEEE Std 279-1971.

The SRP acceptance criteria for implementation of these requirements are provided in the current versions of RGs, the endorsed industry standards, SRP Chapter 7, and BTPs. These guidelines are not mandatory but set forth acceptable methods of implementing the regulatory requirements. The BTPs listed in SRP Table 7-1 are contained in SRP Appendix 7.1-A, “Acceptance Criteria and Guidelines for Instrumentation and Control Systems Important to Safety.” The BTPs are used when study of a particular design problem identified an acceptable solution. The guidance of BTPs is not mandatory. In all cases, the primary basis for acceptance of the design is conformance to the regulatory requirements.

Industry standards that are not endorsed by RGs, incorporated in regulations, referenced in BTPs, or that have not been previously used and accepted in the licensing process, must be reviewed before they can be accepted as a sole basis for approval of a design. They may be useful as guidance for identifying the subjects of importance to be considered in the review of the systems important to safety.

Three Mile Island (TMI) Action Plan requirements for I&C systems important to safety are imposed by 10 CFR 50.34(f), “Additional TMI-related requirements,” for applications pending as of February 16, 1982. For operating reactors that had approved construction permits prior to February 16, 1982, the TMI Action Plan requirements were imposed by orders that required conformance with NUREG-0718, “Licensing Requirements for Pending Applications for Construction Permits and Manufacturing License,” NUREG-0737, “Clarification of TMI Action Plan Requirements,” NUREG-0737, Supplement 1, “Clarification of TMI Action Plan Requirements - Requirements for Emergency Response Capability,” and NUREG-0694, “TMI-Related Requirements for New Operating Licenses.” Table 7.1 identifies both the 10 CFR and TMI Action Plan reference numbers for the TMI Action Plan requirements relevant to Chapter 7 of the SAR. The action plan references are given in brackets under the reference to the equivalent requirement of 10 CFR 50.34(f). SRP Appendix 7.1-A presents specific acceptance criteria for TMI Action Plan items. However, important context information is found in the concepts contained in the referenced reports.

Table 7-1. Regulatory Requirements (R) and SRP Acceptance Criteria (A) for Instrumentation and Control Systems Important to Safety

Criteria		Title or Subject	Applicability to SAR, Chapter 7								Remarks
			7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	
1. 10 CFR Parts 50 and 52											
a.	50.54(jj) and 50.55(i)	Quality Standards for Systems Important to Safety	R	R	R	R	R	R	R	R	
b.	50.55a(h)(2)	Protection Systems (IEEE Std 603-1991 or IEEE Std 279-1971)	R	R	*	*	*	*	*	**	See SRP Appendix 7.1-C or Appendix 7.1-B
c.	50.55a(h)(3)	Safety Systems (IEEE Std 603-1991)			†	†	†	*	*	**	See SRP Appendix 7.1-C
d.	50.34(f)(2)(v) [I.D.3]	Bypass and Inoperable Status Indication	R	R		R	R			**	See NUREGs -0718, -0737, -0737 Supplement 1, and -0694
e.	50.34(f)(2)(xi) [II.D.3]	Direct Indication of Relief and Safety Valve Position				R					See NUREGs -0718, -0737, -0737 Supplement 1, and -0694
f.	50.34(f)(2)(xii) [II.E.1.2]	Auxiliary Feedwater System Automatic Initiation and Flow Indication		R		R					Applies only to PWRs. See NUREGs -0718, -0737, and -0694
g.	50.34(f)(2)(xvii) [II.F.1]	Accident Monitoring Instrumentation				R					See NUREGs -0718, -0737 Supplement 1, and -0694
h.	50.34(f)(2)(xviii) [II.F.2]	Instrumentation for the Detection of Inadequate Core Cooling				R					See NUREG-0694

* The IEEE Std 603-1991 requirement to provide adequate separation between protection and control functions (Clauses 5.6.3 and 6.3.1) apply to all instrumentation and control systems. The requirements for display of bypass and inoperable status indication (Clause 5.8.3) also apply to information systems important to safety (SRP Section 7.5). Although not required by NRC regulations, for nonsafety systems, the other criteria of IEEE Std 603-1991 address considerations such as design bases, redundancy, independence, single failures, qualification, bypasses, status indication, and testing that are used as guidance, where appropriate, for systems addressed in these sections of the SRP.

** The data communication systems (DCS) addressed by SRP Section 7.9 are support systems for one or more of the systems addressed by SRP Section 7.2 through 7.8. Acceptance criteria for a specific DCS derive from the acceptance criteria for the systems supported by that DCS. The criteria marked as ** are likely to apply to the DCS in one or more possible DCS applications. SRP Section 7.9 provides more detailed guidance on the applicability of these criteria to specific DCS applications.

† The requirements of IEEE Std 603-1991 apply to the functions of these systems which are relied upon to remain functional during and following design basis events to ensure: (i) the integrity of the reactor coolant pressure boundary, (ii) the capability to shut down the reactor and maintain it in a safe shutdown condition, or (iii) the capability to prevent or mitigate the consequences of accidents that could result in potential off-site exposures comparable to the 10 CFR Part 100, “Reactor Site Criteria,” guidelines.

Table 7-1. Regulatory Requirements (R) and SRP Acceptance Criteria (A) for Instrumentation and Control Systems Important to Safety (Cont.)

Criteria		Title or Subject	Applicability to SAR, Chapter 7								Remarks
			7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	
i.	50.34(f)(2)(xiv) [II.E.4.2]	Containment Isolation Systems		R							See NUREG-0737
j.	50.34(f)(2)(xix) [II.F.3]	Instruments for Monitoring Plant Conditions Following Core Damage				R					See NUREG-0718
k.	50.34(f)(2)(xx) [II.G.1]	Power for Pressurizer Level Indication and Controls for Pressurizer Relief and Block Valves			R	R					Applies only to PWRs. See NUREG-0737
l.	50.34(f)(2)(xxii) [II.K.2.9]	Failure Mode and Effect Analysis of Integrated Control System						R			Applies only to B&W plants. See NUREGs -0718, -0737, and -0694
m.	50.34(f)(2) (xxii) [II.K.2.10]	Anticipatory Trip on Loss of Main Feedwater or Turbine Trip	R								Applies only to B&W plants. See NUREGs -0737 and -0694
n.	50.34(f)(2)(xxiv) [II.K.3.23]	Central Reactor Vessel Water Level Recording				R					Applies only to BWRs. See NUREG-0718
o.	50.62	Requirements for Reduction of Risk from Anticipated Transients without Scram							R	**	
p.	52.47(b)(1)	Inspections, Tests, Analyses, and Acceptance Criteria for Standard Design Certification	R	R	R	R	R	R	R	R	
q.	52.80(a)	Inspections, Tests, Analyses, and Acceptance Criteria for Combined Licensee Applications	R	R	R	R	R	R	R	R	
2. 10 CFR Part 50, Appendix A, General Design Criteria											
a.	General Design Criterion (GDC) 1	Quality Standards and Records	R	R	R	R	R	R	R	R	
b.	GDC 2	Design Bases for Protection Against Natural Phenomena	R	R	R	R	R			**	
c.	GDC 4	Environmental and Dynamic Effects Design Bases	R	R	R	R	R			**	

Table 7-1. Regulatory Requirements (R) and SRP Acceptance Criteria (A) for Instrumentation and Control Systems Important to Safety (Cont.)

Criteria		Title or Subject	Applicability to SAR, Chapter 7								Remarks
			7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	
d.	GDC 10	Reactor Design	R	R			R	R			
e.	GDC 13	Instrumentation and Control	R	R	R	R	R	R	R	**	
f.	GDC 15	Reactor Coolant System Design	R	R			R	R			
g.	GDC 16	Containment Design		R			R				
h.	GDC 19	Control Room	R	R	R	R	R	R	R	**	
i.	GDC 20	Protection System Functions	R	R							
j.	GDC 21	Protection Systems Reliability and Testability	R	R						**	
k.	GDC 22	Protection System Independence	R	R						**	
l.	GDC 23	Protection System Failure Modes	R	R						**	
m.	GDC 24	Separation of Protection and Control Systems	R	R	R	R	R	R	R	R	
n.	GDC 25	Protection System Requirements for Reactivity Control Malfunctions	R				R				
o.	GDC 28	Reactivity Limits					R	R			
p.	GDC 29	Protection Against Anticipated Operational Occurrences	R	R				R		**	
q.	GDC 33	Reactor Coolant Makeup		R			R				
r.	GDC 34	Residual Heat Removal		R	R		R				
s.	GDC 35	Emergency Core Cooling		R	R		R				
t.	GDC 38	Containment Heat Removal		R	R		R				
u.	GDC 41	Containment Atmosphere Cleanup		R			R				
v.	GDC 44	Cooling Water		R			R	R			

Table 7-1. Regulatory Requirements (R) and SRP Acceptance Criteria (A) for Instrumentation and Control Systems Important to Safety (Cont.)

Criteria		Title or Subject	Applicability to SAR, Chapter 7								Remarks
			7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	
3. Staff Requirements Memoranda (SRM)											
a.	SRM to SECY 93-087 II.Q	Defense Against Common-Mode Failures in Digital Instrumentation and Control Systems	A	A				A	A	**	See BTP 7-19
b.	SRM to SECY 93-087 II.T	Control Room Annunciator (Alarm) Reliability				A				**	Applies only to advanced light water reactors
4. Regulatory Guides											
a.	RG 1.22, Revision 0, 02/1972, Reviewed 08/2012	Periodic Testing of Protection System Actuation Functions	A	A					A	**	See BTP 7-8
b.	RG 1.28, Revision 4, 06/2010	Quality Assurance Program Criteria (Design And Construction)									See BTP 7-14; See Part I and Part II requirements in NQA-1-2008 and the NQA-1a-2009 Addenda
b.	RG 1.47, Revision 1, 02/2010	Bypassed and Inoperable Status Indication for Nuclear Power Plant Safety System	A	A		A	A			**	
c.	RG 1.53, Revision 2, 11/2003, Reviewed 10/2011	Application of the Single-Failure Criterion to Safety Systems	A	A	A	A	A			**	See IEEE Std 379-2000
d.	RG 1.62, Revision 1, 06/2010	Manual Initiation of Protection Actions	A	A					A		
e.	RG 1.70, Revision 3, 11/1978 Reviewed 04/2009	Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants	A	A	A	A	A	A			
f.	RG 1.75, Revision 3, 02/2005	Independence of Electrical Safety Systems	A	A	A	A	A	A	A	A	See IEEE Std 384-1992

Table 7-1. Regulatory Requirements (R) and SRP Acceptance Criteria (A) for Instrumentation and Control Systems Important to Safety (Cont.)

	Criteria	Title or Subject	Applicability to SAR, Chapter 7								Remarks
			7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	
g.	RG 1.97, Revision 2, 12/1980, Revision 3, 05/1983, Revision 4, 06/2006	Instrumentation for Light Water Cooled Nuclear Power Plants to Assess Plant Conditions During and Following an Accident and Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants				A					Revision 2: ANSI/ANS 4.5-1980 Revision 3: ANSI/ANS 4.5-1980 Revision 4: IEEE Std 497™-2002 and BTP 7-10
h.	RG 1.100, Revision 3, 09/2009	Seismic Qualification of Electric and Mechanical Equipment for Nuclear Power Plants									See IEEE Std 344-2004 and ASME QME-1-2007
i.	RG 1.105, Revision 3, 12/1999	Setpoints for Safety-Related Instrumentation	A	A	A	A	A	A	A	A	See ISA-S67.04-1994 Part I and BTP 7-12
j.	RG 1.118, Revision 3, 04/1995, Reviewed 08/2012	Periodic Testing of Electric Power and Protection Systems	A	A	A	A	A		A	**	See ANSI/IEEE Std 338-1987
k.	RG 1.151, Revision 1, 07/2010	Instrument Sensing Lines	A	A	A	A	A	A	A		See ANSI/ISA-67.02.01-1999 and IEEE Std 622-1987
l.	RG 1.152, Revision 3, 07/2011	Criteria for Use of Computers in Safety Systems of Nuclear Power Plants	A	A	A	A	A	A	A	A	See IEEE Std 7-4.3.2-2003 and Appendix 7.1-D
m.	RG 1.168, Revision 2, 07/2013	Verification, Validation, Reviews and Audits for Digital Computer Software Used in Safety Systems of Nuclear Power Plants	A	A	A	A	A	A	A	A	See IEEE Std 1012-2004 and IEEE Std 1028-2008
n.	RG 1.169, Revision 1, 07/2013	Configuration Management Plans for Digital Computer Software Used in Safety Systems of Nuclear Power Plants	A	A	A	A	A	A	A	A	See IEEE Std 828-2005
o.	RG 1.170, Revision 1, 07/2013	Software Test Documentation for Digital Computer Software Used in Safety Systems of Nuclear Power Plants	A	A	A	A	A	A	A	A	See IEEE Std 829-2008
p.	RG 1.171, Revision 1, 07/2013	Software Unit Testing for Digital Computer Software Used in Safety Systems of Nuclear Power Plants	A	A	A	A	A	A	A	A	See ANSI/IEEE Std 1008-1987 (Reaffirmed 2002)

Table 7-1. Regulatory Requirements (R) and SRP Acceptance Criteria (A) for Instrumentation and Control Systems Important to Safety (Cont.)

Criteria		Title or Subject	Applicability to SAR, Chapter 7								Remarks
			7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	
q.	RG 1.172, Revision 1, 07/2013	Software Requirements Specifications for Digital Computer Software Used in Safety Systems of Nuclear Power Plants	A	A	A	A	A	A	A	A	See IEEE Std 830-1998
r.	RG 1.173, Revision 1, 07/2013	Developing Software Life Cycle Processes for Digital Computer Software Used in Safety Systems of Nuclear Power Plants	A	A	A	A	A	A	A	A	See IEEE Std 1074-2006
s.	RG 1.174, Revision 2, 05/2011	An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis									See BTP 7-12 for applicability
t.	RG 1.177, Revision 1, 05/2011	An Approach for Plant-Specific Risk-Informed Decision Making: Technical Specifications									See BTP 7-12 for applicability
u.	RG 1.180, Revision 1, 10/2003, Reviewed 06/2011	Guidelines for Evaluating Electromagnetic and Radio- Frequency Interference in Safety-Related Instrumentation and Control Systems	A	A	A	A	A	A	A	A	IEEE Std 1050-1996, MIL-STD-461E-1999, Series IEC 61000-3, Series IEC 61000-4, Series IEC 61000-6, IEEE Std C62.41-1991 (reaffirmed in 1995), IEEE Std C62.45-1992 (reaffirmed in 1997), and EPRI TR-102323-1996
v.	RG 1.189, Revision 2, 10/2009	Fire Protection for Operating Nuclear Power Plants			A						
w.	RG 1.200, Revision 2, 03/2009	An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities									See BTP 7-12 for applicability
x.	RG 1.204, 11/2005, Reviewed 12/2011	Guidelines for Lightning Protection of Nuclear Power Plants	A	A	A	A	A	A	A	A	See IEEE Std 665-1995 (reaffirmed 2001), IEEE Std 666-1991 (reaffirmed 1996), IEEE Std 1050-1996, and IEEE Std C62.23-1995 (reaffirmed 2001)

Table 7-1. Regulatory Requirements (R) and SRP Acceptance Criteria (A) for Instrumentation and Control Systems Important to Safety (Cont.)

Criteria		Title or Subject	Applicability to SAR, Chapter 7								Remarks
			7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	
y.	RG 1.206, 2007	Combined License Applications for Nuclear Power Plants (LWR Edition)	A	A	A	A	A	A	A	A	COL applications
z.	RG 1.209, 03/2007, Reviewed 06/2013	Guidelines for Environmental Qualification of Safety-Related Computer-Based Instrumentation and Control Systems in Nuclear Power Plants	A	A	A	A	A	A	A	A	See IEEE Std 323-2003
5. Branch Technical Positions (BTP)											
a.	BTP 7-1	Guidance on Isolation of Low-Pressure Systems from the High-Pressure Reactor Coolant System					A				
b.	BTP 7-2	Guidance on Requirements on Motor-Operated Valves in the Emergency Core Cooling System Accumulator Lines					A				
c.	BTP 7-3	Guidance on Protection System Trip Point Changes for Operation with Reactor Coolant Pumps Out of Service	A	A							
d.	BTP 7-4	Guidance on Design Criteria for Auxiliary Feedwater Systems		A							
e.	BTP 7-6	Guidance on Design of Instrumentation and Controls Provided to Accomplish Changeover from Injection to Recirculation Mode		A							
f.	BTP 7-5	Guidance on Spurious Withdrawals of Single Control Rods in Pressurized Water Reactors	A				A	A			
g.	BTP 7-7	Not used									
h.	BTP 7-8	Guidance on Application of RG 1.22	A	A						**	
i.	BTP 7-9	Guidance on Requirements for Reactor Protection System Anticipatory Trips	A								

Table 7-1. Regulatory Requirements (R) and SRP Acceptance Criteria (A) for Instrumentation and Control Systems Important to Safety (Cont.)

Criteria		Title or Subject	Applicability to SAR, Chapter 7								Remarks
			7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	
j.	BTP 7-10	Guidance on Application of RG 1.97				A					
k.	BTP 7-11	Guidance on Application and Qualification of Isolation Devices	A	A	A	A	A	A	A	**	
l.	BTP 7-12	Guidance on Establishing and Maintaining Instrument Setpoints	A	A	A	A	A	A	A	A	
m.	BTP 7-13	Guidance on Cross-Calibration of Protection System Resistance Temperature Detectors	A	A	A	A					
n.	BTP 7-14	Guidance on Software Reviews for Digital Computer-Based Instrumentation and Control Systems	A	A	A	A	A	A	A	A	
o.	BTP 7-15	Not used									
p.	BTP 7-16	Not used									
q.	BTP 7-17	Guidance on Self-Test and Surveillance Test Provisions	A	A	A	A	A	A	A	A	
r.	BTP 7-18	Guidance on Use of Programmable Logic Controllers in Digital Computer-Based Instrumentation and Control Systems	A	A	A	A	A	A	A	A	
s.	BTP 7-19	Guidance on Evaluation of Diversity and Defense-in-Depth in Digital Computer-Based Instrumentation and Control Systems	A	A				A	A	A	
t.	BTP 7-20	Not used									
u.	BTP 7-21	Guidance on Digital Computer Real-Time Performance	A	A	A	A	A	A	A	A	

PAPERWORK REDUCTION ACT STATEMENT

The information collections contained in the Standard Review Plan are covered by the requirements of 10 CFR 50, 10 CFR 52 and 10 CFR 100, and were approved by the Office of Management and Budget, approval number 3150-0011, 3150-0151, and 3150-0093.

PUBLIC PROTECTION NOTIFICATION

The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement unless the requesting document displays a currently valid OMB control number.

SRP Table 7-1
Description of Changes

SRP Table 7-1, "Regulatory Requirements, Acceptance Criteria, and Guidelines for Instrumentation and Control Systems Important to Safety"

This SRP Section affirms the technical accuracy and adequacy of the guidance previously provided in SRP Table 7-1, Revision 5, dated March 2007. See ADAMS Accession No. ML070460342.

The main purpose of this update is to incorporate the revised software Regulatory Guides and the associated endorsed standards. For organizational purposes, the revision number of each Regulatory Guide and year of each endorsed standard is now listed in one place, Table 7-1. As a result, revisions of Regulatory Guides and years of endorsed standards were removed from other SRP Chapter 7 sections, as applicable. For standards that are incorporated by reference into regulation (IEEE Std 279-1971 and IEEE Std 603-1991) and standards that have not been endorsed by the agency, the associated revision number or year is still included in other SRP Chapter 7 sections, as applicable.

The footnote on page T-7-1-2 referring to Part 50 licensing requirements for plants not listed in 10 CFR 50.34(f), "Additional TMI-related requirements," was deleted. Part of 10 CFR was reorganized due to a rulemaking in the fall of 2014. Quality requirement discussions in the former 10 CFR 50.55a(a)(1) were moved to 10 CFR 50.54(jj) and 10 CFR 50.55(i). The incorporation by reference language in the former 10 CFR 50.55a(h)(1) was moved to 10 CFR 50.55a(a)(2). There were no changes either to 10 CFR 50.55a(h)(2) or 10 CFR 50.55a(h)(3).

Additional changes were editorial.