

Regulatory Guide Number: 1.68.3, Revision 1

Title: Preoperational Testing of Instrument and Control Air Systems

Office/division/branch: NRR/DSS/SCPB
Technical Lead: David Nold

Staff Action Decided: Revise

1. What are the known technical or regulatory issues with the current version of the Regulatory Guide (RG)?

RG 1.68.3, "Preoperational Testing of Instrument and Control Air Systems," Revision 1 was published in September 2012. The RG provides methods and procedures acceptable to the NRC staff for the demonstration of the operability of the instrument and control air systems (ICAS) in a commercial light water nuclear power plant during its preoperational phase. Successful demonstration of ICAS operability is required by Appendix A, "General Design Criteria for Nuclear Power Plants," of Title 10 of the *Code of Federal Regulations*, Part 50, "Domestic Licensing of Production and Utilization Facilities" (10 CFR Part 50) which includes but not limited to:

- Criterion 1, "Quality Standards and Records;"
- Criterion 2, "Design Basis for Protection Against Natural Phenomena;"
- Criterion 5, "Sharing of Structures, Systems, and Components;"
- Criterion 13, "Instrumentation and Control;"
- Criterion 19, "Control Room;"
- Criterion 23, "Protection System Failure Modes;" and
- Criterion 55, "Reactor Coolant Pressure Boundary Penetrating Containment."

The RG also describes methods the NRC staff finds acceptable for the initial test program for ICAS systems, structures, and components (SSCs) in accordance with the regulations in 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants," Subpart B, "Standard Design Certifications," and Subpart C, "Combined Licenses."

RG 1.68 *Initial Test Programs for Water-Cooled Nuclear Power Plants* is unusual in that it contains three groups of systems having separate RGs (i.e., 1.68.X) instead of the guidance being fully contained in RG 1.68 with Appendices. Related RGs in this series include:

- 1.68.1 *Initial Test Program of Condensate and Feedwater Systems for Light-Water Reactors*
- 1.68.2 *Initial Startup Test Program to Demonstrate Remote Shutdown Capability for Water-Cooled Nuclear Power Plants*
- 1.68.3 *Preoperational Testing of Instrument and Control Air Systems*

RG 1.68.3, Revision 1 is outdated principally for **two** reasons:

Enclosure

(1) The RG should be Revised due to the following references being superseded:

- Reference 5, IAEA Safety Guide NS-G-2.9 *Commissioning for Nuclear Power Plants* was issued in 2003. IAEA Safety Standards Series No. SSG-28 *Commissioning for Nuclear Power Plants* Vienna, 2014 superseded *Safety Guide NS-G-2.9-2003*.

Staff review of IAEA Safety Standard SSG-28 when compared to IAEA NS-G-2.9 does not in itself establish an urgent technical need for revising RG 1.68.3, Revision 1.

- Reference 6, RG 1.68 *Initial Test Programs for Water-Cooled Nuclear Power Plants*, Revision 3. Revision 4 was issued June 2013 and expanded the RG by 17 pages. No specific details pertaining to preoperational testing of Instrument Air, Control Air or Compressed Air are contained in either Revision 3 or 4. Revision 4, does not require that section C.1 of RG 1.68.3 Revision 1 be reworded or expanded. RG 1.68 Revision 4 would have to be revised and expanded during its ten-year periodic review in 2023 to capture a "readers digest" version of the detailed technical information contained in RG 1.68.3 Revision 1 if RG 1.68.3 were to be Withdrawn.
- Reference 8 ANSI/ISA S7.3 R1981 *Quality Standard for Instrument Air* has been withdrawn and superseded by ISA 7.0.01 R1996. For reasons unknown, ANSI/ISA S7.3 (issued in 1981) was invoked in RG 1.68.3 Revision 1 instead ANSI/ISA 7.0.01 (issued in 1996). ANSI/ISA 7.0.01-1996 is 34 pages long versus the 8-page long ANSI/ISA S7.3-1981. ANSI/ISA 7.0.01-1996 incorporated the previous SP7 Subcommittee documents as follows:

- SP7.1 Pneumatic Control Circuit Pressure Test
- SP7.3 Air Quality Standards for Pneumatic Instruments
- SP7.3 Application and Tests for Quality Standards for Instrument Air
- SP7.4 Air Pressures for Pneumatic Controllers and Transmission Systems
- SP7.6 Pneumatic Control Circuit Transmission Distances
- ISA-RP7.1-1956 Pneumatic Control Circuit Pressure Test
- ISA-7.3-1975 (R1981) Quality Standard for Instrument Air
- ISA-7.4-1981 Air Pressures for Pneumatic Controllers, Transmitters and Transmission Systems
- ISA-RP7.7-1984 Producing Quality Instrument Air

(2) RG 1.68.3, Revision 1 does not reflect the past ten years of nuclear power industry operating experience (e.g., Generics Letters, Information Notices, Licensee Event Reports etc.).

Enclosure

NRC Information Notices were issued subsequently to the Draft Revision DG-1268 (i.e., dated March 2012) for RG 1.68.3. The lessons learned as contained in these Information Notices are to be evaluated for inclusion in the next revision of RG 1.68.3:

- 2012-16, *Preconditioning of Pressure Switches Before Surveillance Testing*; (ADAMS# ML120170120)
- 2012-25, *Performance Issues with Seismic Instrumentation and Associated Systems for Operating Reactors*; (ADAMS# ML121590444)
- 2013-12, *Improperly Sloped Instrument Sensing Lines*; (ADAMS# ML13136A362)
- 2016-05, *Operating Experience Regarding Complications from a Loss of Instrument Air*; (ADAMS# ML16028A308)
- 2018-04, *Operating Experience Regarding Failure of Operators to Trip the Plant When Experiencing Unstable Conditions*; (ADAMS# ML17269A262)
- 2021-01, *Lessons Learned from U.S. Nuclear Regulatory Commission Inspections of Design-Basis Capability of Power-Operated Valves at Nuclear Power Plants*; (ADAMS# ML21061A265)

In summary, RG 1.68.3, Revision 1 needs to be revised for **two reasons**:

- (1) to capture the guidance of the SP7 Subcommittee documents as contained in ANSI/ISA 7.0.01-1996; and
- (2) to reflect post 2012 industry operating experience, with respect to ICAS preoperational testing.

RG 1.68.3, Revision 1 offers significant guidance beyond the “Auxiliary and Miscellaneous Systems” test guidance contained in RG 1.68, Appendix A, *Initial Test Program*. Therefore, RG 1.68.3 should remain separate from RG 1.68 and should be revised to support the staff’s anticipated reviews of near-term SMR design certification applications (e.g., BWRX-300).

2. What is the impact on internal and external stakeholders of not updating the RG for the known issues, in terms of anticipated numbers of licensing and inspection activities over the next several years?

For the existing U.S. fleet of operating light-water power reactors, the staff concludes that there would be no impact with the withdrawal of the RG, since the RG’s purpose is to provide methods and procedures acceptable to the NRC staff for the demonstration of the operability of the instrument and control air systems (ICAS) in a commercial nuclear power plant during its preoperational phase.

For Vogtle nuclear plants 3 and 4 currently undergoing construction and startup testing activities per the regulations in 10 CFR Part 52, the impact of not maintaining or revising RG 1.68.3 Revision 1 will be non-existent since the DCD invokes RG 1.68.3 Revision 0 as a license basis for these plants. The DCD ITAAC Section 2.3.15 “Compressed and Instrument Air System” contains no clear tie (i.e., reference) to RG 1.68.3, Revision 0.

Enclosure

NuScale *Design Certification Application* Tier 2 Table 1.9.2 “Conformance with Regulatory Guides” states that the Design “Partially Conforms” to RG 1.68.3 Revision 1 with the comment “This guidance is applicable except for site-specific aspects, including test performance and records retention, which are the responsibility of the COL applicant or licensee.” Tier 2 Chapter 14.2.7 “Test Programs Conformance Regulatory Guides” lists RG 1.68.3, Revision 1. Service Air System Test #16; Instrument Air System Test #17; and Control Room Habitability System Test #18 (i.e., compressed breathable air) are relevant to the guidance contained in RG 1.68.3, Revision 1.

Other expected SMR pre-application activities of near-term relevance that could invoke RG 1.68.3, Revision 1 would be the Design Certification of the BWRX-300.

Limited impact is anticipated if RG 1.68.3, Revision 1 is not updated. The impact on operating reactors is non-existent because the scope of this RG is pre-operational testing of the instrument and control air systems. Post-maintenance testing has been adequately established through other guidance and requirements. In summary, the pre-operational test program guidance in RG 1.68.3 is out-of-date but nonetheless adequate for the in progress LWR pre-operational licensing activities.

3. What is an estimate of the level of effort needed to address identified issues in terms of full-time equivalent (FTE) and contractor resources?

<0.4FTE for Revision (*which includes the Sunk Cost of completing this 10-year periodic review assessment*)

4. Based on the answers to the questions above, what is the staff action for this guide (Reviewed with no issues identified, reviewed with issues identified for future consideration, Revise, or Withdraw)?

Revise.

5. Provide a conceptual plan and timeframe to address the issues identified during the review.

Revise RG 1.68.3 Revision 1 to address/resolve the two principal reasons for being outdated as identified in the answer to Question 1. The target date for completion of this revision should be established as the end of NRC fiscal year 2022-2023 to support the staff review of additional SMR Design Certification Applications (e.g., BWRX-300).

REFERENCES

1. Regulatory Guide 1.68 “Initial Test Programs for Water-Cooled Nuclear Power Plants,” Revision 4, June 2013 (ADAMS Accession No. ML13051A027)

NOTE: This review was conducted in September 2022 and reflects the staff’s plans as of that date. These plans are tentative and subject to change.