

NRC Staff Position on Code Case N-940 in RG 1.87, Rev. 3

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NRC public meeting on Code Case N-940

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Background and Purpose

- RG 1.87, Rev. 3 (ML25176A084) was published in August 2025
- The RG contains:
 - NRC staff endorsement of the 2023 edition of Section III, Division 5 (III-5) of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (BPVC)
 - NRC staff endorsement of select Code Cases, including N-940
- The purpose of this meeting is to discuss the staff's conditions on Code Case (CC) N-940 and new proposals from the CC N-940 authors related to these conditions

Code Case N-940: Overview

Title: Alternate Rules for Nondestructive Examination (NDE) and Testing of Items Commensurate with their Contribution to Safety or Risk

Background:

- During its development, industry indicated in public meetings particular interest in applying N-940 for non-safety related with special treatment (NSRST) SSCs under NEI 18-04/LMP (RG 1.233)
- N-940 has been generally described as using ASME Section III design methods combined with NDE and testing from industrial codes and standards (C&S)
- "Industrial codes and standards" generally refer to C&S commonly used in the non-nuclear industry (e.g., ASME Section VIII, ASME B31)

Scope:

- This CC applies alternate NDE and testing to valves, piping, and piping supports.

What is NSRST under LMP?

- NSRST is a middle tier of safety importance in LMP
 - Between safety-related (SR) and non-safety related with no special treatment (NST)
- NSRST SSCs are defined as safety-significant based on
 - Performing risk-significant functions OR
 - Performing functions needed for defense in depth
- Special treatments are defined as
 - those requirements that provide “increased assurance beyond normal industrial practices” that SSCs perform their design-basis functions.
- Generally, industrial C&S are understood to represent “normal industrial practices”

NRC Condition on Scope of N-940

- The term “items commensurate with their contribution to safety or risk” is vague and needs clarification on which SSCs are appropriate to use N-940
 - “The alternate requirements in these sections should not be applied to safety-related SSCs but may be appropriate for ... NSRST under RG 1.233 (Ref. 20). The justification for use of alternate requirements in these sections as a special treatment to achieve the reliability and capability targets specified for the NSRST SSC is subject to NRC review and approval. The NRC may review classification of NSRST SSCs in accordance with the approved methodology in RG 1.233.”
- Condition conveys the staff’s openness to applying N-940 to NSRST SSCs, while providing the staff flexibility to confirm these rules are appropriate based on the risk significance and reliability and capability targets of the NSRST SSCs for a specific design

Other N-940 Conditions

- NRC staff included six conditions on specific provisions in CC N-940 along with a footnote:
 - Alternative approaches to those specified in conditions 1-CC-N-940 through 6-CC-N-940 may be proposed with justification subject to NRC review and approval. Justification should be based on the ability to meet the reliability and capability targets for the SSC. The justification can also include consideration of performance monitoring approaches, such as surveillance methods, in-service inspection, and continuous monitoring. Continuous monitoring of an SSC's ability to perform its function, such as online monitoring for cracking, pressure, temperature, or chemistry changes to indicate a leak or loss of boundary integrity, could bolster such a justification.

Other N-940 Conditions

- Code conditions represent what staff believe are generically acceptable approaches absent information about a specific reactor technology and design
 - Intended to provide baseline of certainty to industry to support efficient licensing
- Conditions do not restrict alternative approaches
 - Alternative approaches need to be justified by a designer, subject to NRC review and approval as indicated in the footnote (discussed on the previous slide).

N-940 Conditions in RG 1.87

- 1-CC-N-940: UT exams should be encoded (recorded for later review)
 - Allows review after inspection by other qualified NDE personnel
 - Permits future examination results to be compared to original UT examination results
 - Consistent with ASME B31.1 and Code Case N-831-1
- 3-CC-N-940: Progressive sampling should not be used above 750°F
 - Consistent with ASME B31.1
- Revision 1 of CC N-940 (ASME Record 25-1351) generally incorporates these conditions into the updated CC.

N-940 Conditions in RG 1.87

- 2-CC-N-940: UT should be qualified to Intermediate Rigor
 - Requires limited performance demonstration
 - Consistent with B31.1 requirements to demonstrate UT performance
- 5-CC-N-940: moderate energy piping definition needs NRC approval
 - Needed to ensure the definition of moderate energy piping is appropriately considered for each technology
- The staff's understanding is that these conditions are not the primary areas of interest for discussion from industry.

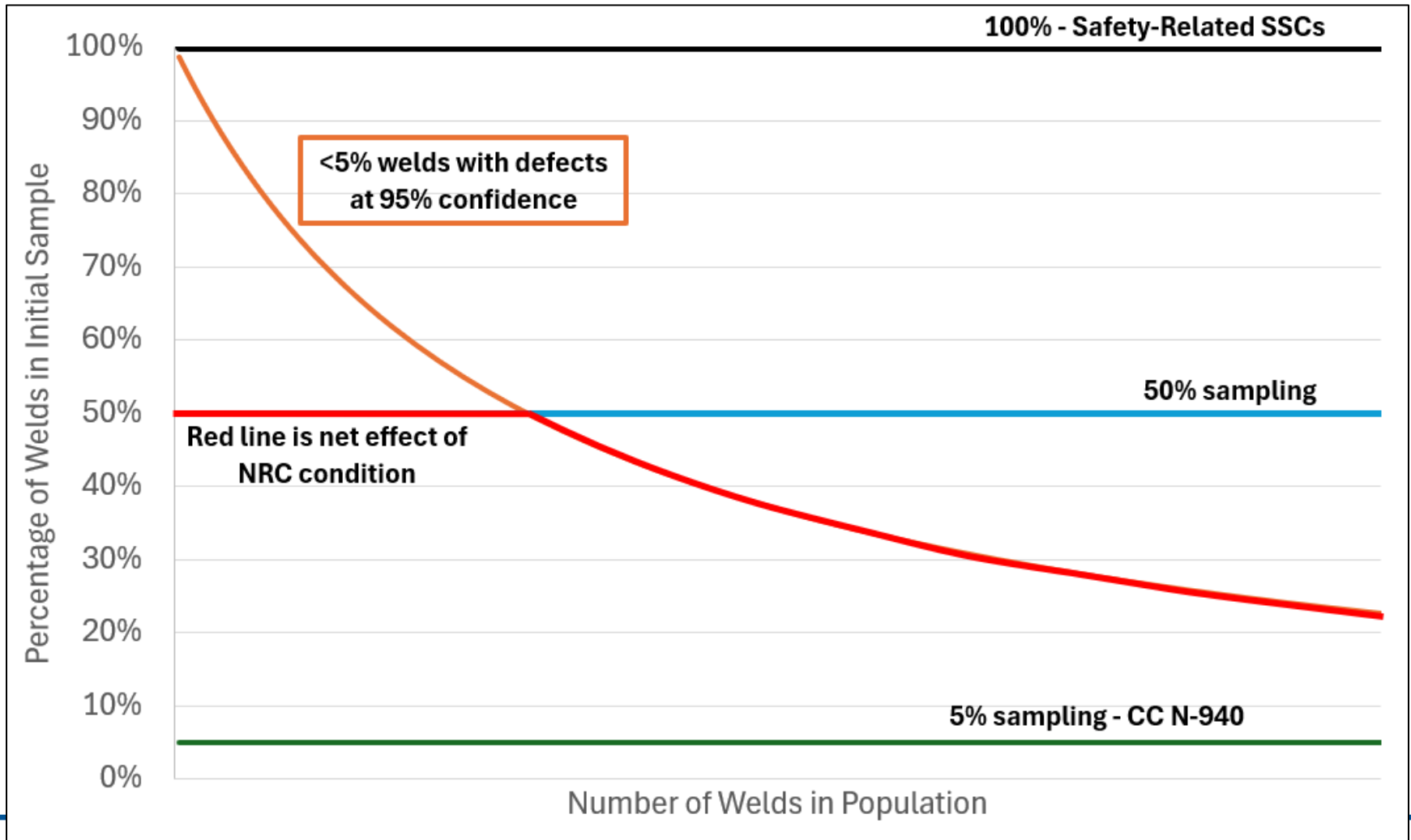
N-940 Condition on Sampling

- CC N-940 requires at least 5% random sampling volumetric (RT or UT) examinations for moderate energy piping
- 4-CC-N-940: For applications of progressive sampling ... the initial sample size should be one of the following:
 - (1) a population justified statistically to provide 95% confidence that 5% or fewer of the welds contain defects, or
 - (2) a lesser initial sample justified as an alternative approach as described in footnote 6 below, or
 - (3) for instances where a designer does not prefer to use the statistical justification in (1) or develop an alternative approach in (2), 50% random sampling is acceptable.

Basis for Condition on Sampling

- Commercial piping codes (e.g., B31.1 and B31.3) most analogous to nuclear service vary between 5% and 100% sampling
 - Given this variance and without specific information about the SSC to which the Code Case may be applied, staff cannot conclude that a 5% sample is generically appropriate.
- Position (1) is intended to provide a baseline on inspection sampling to provide reasonable confidence of performance
 - Meaningfully lowers from the 100% inspection required for SR SSCs under regular ASME BPVC Section III rules and under commercial codes in certain situations.
- Position (2) provides explicit clarity that a CC user may propose what it believes to be an appropriate sample percentage based on the specific design and service condition of the SSC
- Position (3) provides a simpler approach that does not require additional analysis or justification and is more likely to be applied in cases where there are fewer welds to inspect
 - Consistent with a graded approach, NRC staff finds 50% random sampling to be an acceptable approach based on the generally lower safety significance of NSRST SSCs relative to SR SSCs.

Effect of NRC Condition



N-940 Condition on Leak Testing

- 6-CC-N-940: Nonmandatory Appendix D should be implemented consistent with paragraph 137.7.1 from ASME BPVC B31.1:
 - 137.7.1 When specified by the owner, an initial service test and examination is acceptable when other types of tests are not practical or when leak tightness is demonstrable due to the nature of the service. One example is piping where shutoff valves are not available for isolating a line and where temporary closures are impractical. Others may be systems where during the course of checking out of pumps, compressors, or other equipment, ample opportunity is afforded for examination for leakage prior to full scale operation.
- In particular, an initial service leak test shall be used only “when other types of tests are not practical or when leak tightness is demonstrable due to the nature of the service.”

Conclusion

- NRC staff have reviewed and endorsed the use of CC N-940 in RG 1.87, Rev. 3 subject to several conditions.
- The staff is open to new information that may be relevant to updating positions on safety issues, including C&S development.
- The staff continues to enable the safe use of new technologies by ensuring appropriate rigor is provided in the design, construction, and operation of passive mechanical SSCs commensurate with their safety significance.