

C.11 Flaw Evaluation

In accordance with Title 10 of the Code of Federal Regulations (10 CFR) 50.55a(g), structural integrity must be maintained in conformance with American Society of Mechanical Engineers (ASME) Code Section XI for those parts of a system that are subject to ASME Code requirements. 10 CFR 50.55a(g)(4) requires, "Throughout the service life of a boiling or pressurized water-cooled nuclear power facility, components (including supports) which are classified as ASME Code Class 1, Class 2, and Class 3 must meet the requirements, except design and access provisions and preservice examination requirements, set forth in Section XI..."

ASME Section XI is generally written for preservice and inservice weld examinations and any identified flaws in welds. When examinations are performed and acceptance standards are not provided by components that are not addressed under ASME Section XI contain flaws, the construction code is to be used to establish acceptance criteria (i.e. determine disposition). ASME Section XI, Article IWA 3000 contains ~~the acceptance criteria for~~ standards and for ~~examination evaluation for~~ flaws found in welds. Sub-article IWA-3100(b) states "if acceptance standards for a particular component, Examination Category, or examination method are not specified in this Division [ASME Section XI, Division 30001], flaws that exceed the acceptance standards for materials and welds specified in the Section III Edition applicable to the construction of the component shall be evaluated to determine disposition." Therefore, if flaws are found in components for which ASME Section XI has no acceptance ~~standard~~criteria, then the Section III Edition construction code is to be used to establish the acceptance ~~standard~~criteria. Following the rules of Section XI ensures conformance with the original design and construction codes. ~~ASME Section XI is generally written for weld examinations and flaws in welds. When components that are not addressed under ASME Section XI contain flaws, the construction code is to be used to establish acceptance criteria (i.e. determine disposition).~~

The ASME Code contains ~~requirements rules~~ describing acceptable means of performing preservice and inservice inspection of inspecting welds and certain other locations in piping, vessels, and other pressure boundary components. For these preservice and inservice inspections tThe ASME Code also specifies acceptable flaw sizes based on the material type, location, and service of the system within which the flaw is discovered. If the flaw exceeds these specified acceptable flaw sizes, the ASME Code describes an alternate method by which a calculation may be performed to evaluate the acceptability of the flaw. However, while ASME Section XI does not specifically provide acceptance standards for conditions identified outside preservice or inservice inspections, its methods and standards may be applied when determined applicable.

~~Different ASME components can have different immediate operability determination outcomes depending on the Code Class of the component. If a component does not meet ASME Code requirements, it does not necessarily mean it is inoperable.~~ If an ASME Class 1 component does not meet ASME Code requirements, the requirements of an NRC endorsed ASME Code Case, or an NRC approved alternative then an immediate expectation of operability determination cannot exist and the component is inoperable the component should be considered inoperable. The basis for this statement is the need to assure the high degree of reliability required of ASME Class 1 components. However, When an ASME Class 2 or Class 3 component does not meet ASME Code requirements, the requirements of an NRC endorsed ASME Code Case, or an NRC approved alternative, then a licensee s-must make a determination of whether the degraded or non-conforming condition results in a TS--required feature or a TS-required support feature being inoperable. In order to determine the component is operable under an immediate operability determination, the degradation mechanism must be readily apparent. To be readily apparent, the degradation mechanism must be discernable from visual examination (such as external corrosion or wear), or substantial operating experience must exist with the identified degradation mechanism ~~on of~~ the system. In addition, detailed non-destructive examination data may be necessary to make determine a component is operable under an immediate operability

Comment [mas1]:
The operability determination outcome is not dependent on the Code Class. The timing may be affected (degree of urgency), but not the outcome.

Comment [mas2]:
Is this limited to ASME requirements for flaw acceptability? What is the purpose of this sentence?

Comment [mas3]:
Definition? Does this mean "component?"

Comment [mas4]:
Definition? Does this mean "component?"

~~determination a reasonable determination of immediated operability.~~ If detailed non-destructive examination is necessary and the examination cannot be completed within the time frame normally expected for an immediate operability determination, the component should be declared ~~not~~ **in**operable and the appropriate **TS** action statement entered. As outlined under defined terms, Section 3.9, Reasonable Expectation, there is no such thing as an indeterminate state of operability; an SSC is either operable or inoperable. Through-wall leakage and the methods to evaluate through-wall leakage are further addressed in section C.12.

The NRC staff accepts ASME Code Case **N-513-1**, "Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 piping Section XI, Division 1," as an acceptable alternative to the ASME Code requirements for evaluating the structural integrity for flaws identified in moderate-energy piping. Regulatory Guide (RG) 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1" endorses Code Case N-513-1 with the following conditions:

Comment [mas5]:
Recommend not limiting C.11 to a specific revision. Cite the revision approved in Reg Guide 1.147.

- a. Specific safety factors in paragraph 4.0 of ASME Code Case N-513-1 must be satisfied, and
- b. ASME Code Case N-513-1 may not be applied to:
 - (1) components other than pipe and tubing,
 - (2) leakage through a gasket,
 - (3) threaded connections employing nonstructural seal welds for leakage prevention (through-seal weld leakage is not a structural flaw, but thread integrity must be maintained), and
 - (4) degraded socket welds.

In addition, the NRC issued Generic Letter (GL) 90-05, "Guidance for Performing Temporary Non-Code Repair of ASME Code Class 1, 2, and 3 Piping," which permits licensees to consider either the "through-wall flaw" or the "wall thinning" flaw evaluation approach when assessing the structural integrity of moderate-energy piping with identified through-wall

flaws. If the flaw is found acceptable by the “through-wall flaw” approach, a temporary non-code repair may be made following NRC staff review and approval of the evaluation. If the flaw is found acceptable by the “wall thinning” approach, immediate repair of the flaw is not required; but the licensee should comply with the guideline for flaw repair and monitoring.

Comment [mas6]:
What compensatory measures can a licensee take in the interim? This appears to be a constraint that NRC does not apply to non-Code situations. We seem to be mixing compliance with operability.

The NRC staff ~~considers that accepts~~ the ASME Code, GL 90-05, ASME Code Case N-513-1, and any other applicable NRC-approved ASME Code Case ~~, provide acceptable criteria for for conclusively concluding establishing~~ that a TS-required ~~operating~~ ASME Code Class 2 or 3 piping system that contains a through-wall flaw has adequate structural integrity and is, therefore ~~in a degraded but~~, operable ~~but degraded condition~~. ASME Code Cases which describe methods, criteria, or requirements different from the ASME Code referenced in 10 CFR 50.55a cannot be used to evaluate the acceptability of a flaw without prior NRC review and approval unless the ASME Code Cases are endorsed in RG 1.147.

Therefore, ~~the table below summarizes the methods available to licensees which are acceptable to the NRC staff for evaluating structural integrity of to evaluate the structural integrity of~~ flaws found in boiling or pressurized water-cooled nuclear power facility ~~on~~, components (including supports) ~~which are~~ classified as ASME Code Class 1, Class 2, and Class 3 ~~components, the following table outlines the available methods.~~

Methods Available to Evaluate Structural Integrity

Pipe Class/Energy	ASME Code Section XI/ Construction Code	NRC Approved Alternative <u>or RG 1.147 Code Case</u>	CC N-513-1	GL 90-05
Class 1/HE	X	X		
Class 2/HE	X	X		
Class 2/ME	X	X	X	
Class 3/HE	X	X		X
Class 3/ME	X	X	X	X

Comment [mas8]:
Recommend not limiting C.11 to a specific revision. Cite the revision approved in Reg Guide 1.147.

Comment [mas7]:
Is this limited to 10CFR50.55a relief requests and alternatives?

Once a flaw is determined to be unacceptable, regardless of whether the degraded component is degraded but operable ~~but degraded~~, or inoperable, the component must be restored to meet ASME Code requirements, requirements of an NRC endorsed ASME Code Case, or an NRC approved alternative. If this involves physical changes to the components, it must be completed in accordance with ASME Section XI, IWA-4000. Completion is expected by the next outage, or at least the next refueling outage, or prior to return to service if identified while the component was out of service.

Comment [mas9]:
If a component meets all the provisions of CC 513, it complies with the Code. However, one can meet portions of CC 513 as a basis for "operable but degraded."

C.12 Operational Leakage From ASME Code Class 1, 2, and 3 Components

Leakage from the reactor coolant system is limited to specified values in the TSs depending on whether the leakage is from identified, unidentified, or specified sources such as the steam generator tubes or reactor coolant system pressure isolation valves. If the leakage exceeds TS limits, the limiting condition for operation (LCO) must be declared not met and the applicable TS conditions must be entered. For identified reactor coolant system leakage within the TS limits ~~of the TS~~, the licensee should make an immediate operability determination ~~determine operability~~ for the degraded component (i.e., the leaking component) and include in the determination the effects of the leakage on other components and materials.

The regulations require that the structural integrity of ASME Code Class 1, 2, and 3 components be maintained in accordance with the ASME Code. In the case of specific types of degradation, other regulatory requirements must also be met. If a leak is discovered in a Class 1, 2, or 3 component in the conduct of an inservice inspection, maintenance activity, or facility operation, any final corrective measures to repair or replace the leaking component must be performed in accordance with IWA-4000 of Section XI to return the condition to full conformance. Alternately, relief from compliance conformance with ASME Code requirements may be requested from the NRC.

The operational leakage TS LCO does not permit any reactor coolant pressure boundary leakage. Upon discovery of leakage from a Class 1 pressure boundary component (pipe wall, valve body, pump casing, etc.), the licensee must declare the component inoperable. Upon discovery of leakage from a TS-required Class 2 or Class 3 component, the component is evaluated in an immediate determination of operability followed by a prompt determination if additional or supporting analysis is needed to support a reasonable expectation of operability. In performing the immediate determination, the degradation mechanism would have to be readily apparent to support a determination of operable. To be readily apparent, the degradation mechanism must be discernable from visual inspection (such as external corrosion or wear) or substantial operating

experience must exist with the degradation mechanism on the system. In addition, detailed non-destructive examination data may be necessary to ~~make a support an immediate expectation of operability determination~~reasonable determination of immediate operability. If detailed non-destructive examination is necessary and the examination cannot be completed within the time frame normally expected for an immediate operability determination, the component should be declared ~~not~~inoperable and the appropriate TS conditions action statement entered. As outlined under defined terms, Section 3.9, Reasonable Expectation, there is no such thing as an indeterminate state of operability; an SSC is either operable or inoperable. GL 90-05 provides guidance for the evaluation of Class 3 piping and ASME Code Case N-513-1 provides guidance for the evaluation of Class 2 and Class 3 moderate energy piping.

As noted above, upon discovery of leakage from a TS-required Class 2 or a Class 3 pressure boundary component, the licensee must immediately evaluate the operability of the component, followed by a prompt determination of operability to fully characterize the flaw. In performing the subsequent prompt operability determination, the licensee must evaluate the structural integrity of the leaking component using the actual geometry of the through-wall flaw characterized or bounded with volumetric examination methods. It may be possible to use visual methods to determine the exterior dimension(s) and orientation of a through-wall flaw in a leaking component. However, even though the outside surface breaking dimension of a through-wall flaw is small, the length and extent of the flaw inside the component wall may be quite long and potentially outside the limits established by the ASME Code. To evaluate the structural integrity of the leaking component, the licensee may use the criteria in Section XI of the ASME Code or any applicable ASME Code Case approved in NRC RG 1.147. The licensee may evaluate the structural integrity of Class 3 piping by evaluating the flaw using the criteria of paragraph C.3.a of Enclosure 1 to GL 90-05. If the flaw meets the GL 90-05 criteria, the piping is degraded but operable. ~~until relief from the applicable ASME Code requirement or requirements is obtained from the NRC and a temporary non-Code repair is made.~~

Comment [mas10]:
Ensure consistent with Table.

Comment [mas11]:
Need follow-up discussion on why relief request is needed if piping is degraded but operable, and licensee intends to restore full conformance. Is this meant to be authorization for the repair (i.e., final corrective action)? Only need relief if there is a "delta" between your final CA and the Code or the Regulations.

Alternatively, the licensee can evaluate the structural integrity of leaking Class 2 or Class 3 moderate-energy piping using the criteria of ASME Code Case N-513-1, as discussed in section C.11, "Flaw Evaluation." If the flaw in the leaking component has adequate structural integrity in accordance with criteria identified to be acceptable to the NRC staff ~~as discussed~~, the piping can be deemed degraded but operable and continued temporary service of the degraded piping components is permitted. Components with these flaws must be restored to ASME Code requirements through repair/replacement or meet requirements acceptable to the NRC, as approved in a relief request or ASME Code Case approved under RG 1.147 prior to the completion of the next scheduled outage.

Comment [mas12]:
Ensure consistent with Table.

Comment [mas13]:
Documented?

If the licensee decides to control the leakage by mechanical clamping means, the requirements of ASME Code Case 523-2, "Mechanical Clamping Devices for Class 2 and 3 Piping Section XI, Division 1," may be followed, because the NRC staff endorses this Code Case in RG 1.147. This Code Case applies to structural integrity of Class 2 and 3 piping which is 6 inches (nominal pipe size) and smaller and shall not be used on piping larger than 2 inches (nominal pipe size) when the nominal operating temperature or pressure exceeds 200°F or 275 psig. These and other applicable ASME Code Cases which have been determined to be acceptable for licensee use without a request or authorization from the NRC are listed in RG 1.147. These ASME Code Cases do not apply to Class 1 pressure boundary components.

Comment [mas14]:
1. 523 is for structural clamps
2. This implies that a licensee cannot execute compensatory measures without prior NRC approval (??).

The NRC has no specific guidance or generically approved alternatives for temporary repair of flaws (through-wall or non-through-wall) in Class 1, 2, or 3 high-energy system components, or for Class 2 or 3 moderate-energy system pressure boundary components other than piping. Therefore, all such flaws in these components must be repaired in accordance with ASME Code requirements, or relief from ASME Code requirements must be requested of and approval obtained from the NRC.

Comment [mas15]:
Does "other than piping" also apply to Class 1/2/3 HE?