

AN INTERNATIONAL CODE

# 2010 ASME Boiler & Pressure Vessel Code

2011a Addenda

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# XI RULES FOR INSERVICE INSPECTION OF NUCLEAR POWER PLANT COMPONENTS

ASME Boiler and Pressure Vessel Committee  
on Nuclear Inservice Inspection



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# NONMANDATORY APPENDIX A

## ANALYSIS OF FLAWS

### ARTICLE A-1000

#### INTRODUCTION

#### A-1100 SCOPE

This Appendix provides a procedure<sup>43</sup> for determining the acceptability of flaws that have been detected during inservice inspection (excluding preservice inspection) that exceed the allowable flaw indication standards of IWB-3500. The procedure is based upon the principles of linear elastic fracture mechanics. This procedure applies to ferritic materials 4 in. (100 mm) and greater in thickness with specified minimum yield strengths of 50.0 ksi (350 MPa) or less in components having simple geometries and stress distributions. The basic concepts of the procedure may be extended to other ferritic materials (including clad ferritic materials) and more complex geometries; however, they are not intended to apply to austenitic or high nickel alloys. For purposes of analysis, indications that exceed the standards of IWB-3500 are considered flaws. The following is a summary of the analytical procedure.

(a) Determine the actual flaw configuration from the measured flaw in accordance with IWA-3000.

(b) Characterize the flaw in accordance with IWB-3610.

(c) Using A-2000, resolve the actual flaw into a simple shape that can be analyzed.

(d) Determine the stresses at the location of the observed flaw for normal (including upset), emergency, and faulted conditions.

(e) Calculate stress intensity factors for each condition using the methods outlined in A-3000.

(f) Using the methods outlined in A-4000, determine the necessary material properties, including the effects of irradiation if applicable.

(g) Using the analytical procedures described in A-5000, determine the following critical flaw parameters:

$a_f$  = expected end-of-life flaw size

$a_c$  = minimum critical flaw size for normal conditions

$a_i$  = minimum critical initiation flaw size for emergency and faulted conditions

(h) Using the critical flaw parameters  $a_f$ ,  $a_c$ , and  $a_i$ , apply the flaw evaluation criteria of IWB-3600 to determine whether the observed flaw is acceptable for continued service.