



Designation: E 482 – 89 (Reapproved 1996)

Standard Guide for Application of Neutron Transport Methods for Reactor Vessel Surveillance, E706 (IID)¹

This standard is issued under the fixed designation E 482; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 *Need for Neutronics Calculations*—An accurate calculation of the neutron fluence and fluence rate at several locations is essential for the analysis of integral dosimetry measurements and for predicting irradiation damage exposure parameter values in the pressure vessel. Exposure parameter values may be obtained directly from calculations or indirectly from calculations that are adjusted with dosimetry measurements; Guide E 944 and Practice E 853 define appropriate computational procedures.

1.2 *Methodology*—Neutronics calculations for application to reactor vessel surveillance encompass three essential areas: (1) validation of methods by comparison of calculations with dosimetry measurements in a benchmark experiment, (2) determination of the neutron source distribution in the reactor core, and (3) calculation of neutron fluence rate at the surveillance position and in the pressure vessel.

1.3 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

- E 170 Terminology Relating to Radiation Measurements and Dosimetry²
- E 560 Practice for Extrapolating Reactor Vessel Surveillance Dosimetry Results, E706(IC)²
- E 693 Practice for Characterizing Neutron Exposures in Iron and Low Alloy Steels in Terms of Displacements Per Atom (DPA), E706(ID)²
- E 706 Master Matrix for Light-Water Reactor Pressure Vessel Surveillance Standards, E706(0)²
- E 844 Guide for Sensor Set Design and Irradiation for Reactor Surveillance, E706(IIC)²

¹ This guide is under the jurisdiction of ASTM Committee E-10 on Nuclear Technology and Applications and is the direct responsibility of Subcommittee E10.05 on Nuclear Radiation Metrology.

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² *Annual Book of ASTM Standards*, Vol 12.02.

E 853 Practice for Analysis and Interpretation of Light-Water Reactor Surveillance Results, E706 (IA)²

E 944 Guide for Application of Neutron Spectrum Adjustment Methods in Reactor Surveillance, (IIA)²

E 1018 Guide for Application of ASTM Evaluated Cross Section Data File (ENDF/A), E706(IIB)²

E 706(IE) Damage Correlation for Reactor Vessel Surveillance³

E 706(IIIE) Benchmark Testing of Reactor Vessel Dosimetry³

2.2 Nuclear Regulatory Documents:⁴

NUREG/CR-1861 LWR Pressure Vessel Surveillance Dosimetry Improvement Program: PCA Experiments and Blind Test

NUREG/CR-3318 LWR Pressure Vessel Surveillance Dosimetry Improvement Program: PCA Experiments, Blind Test, and Physics-Dosimetry Support for the PSF Experiments

NUREG/CR-3319 LWR Pressure Vessel Surveillance Dosimetry Improvement Program: LWR Power Reactor Surveillance Physics-Dosimetry Data Base Compendium

NUREG/CR-5049 Pressure Vessel Fluence Analysis and Neutron Dosimetry

3. Significance and Use

3.1 General:

3.1.1 The methodology recommended in this guide specifies criteria for validating computational methods and outlines procedures applicable to pressure vessel related neutronics calculations for test and power reactors. The material presented herein is useful for validating computational methodology and for performing neutronics calculations that accompany reactor vessel surveillance dosimetry measurements (see Master Matrix E 706 and Practice E 853). Briefly, the overall methodology involves: (1) methods-validation calculations based on at least one well documented benchmark problem, and (2) neutronics calculations for the facility of interest. The neutronics calculations on the facility of interest and on the benchmark

³ For standards that are in the draft stage and have not received an ASTM designation, see Section 5, as well as, Figures 1 and 2 of Matrix E 706.

⁴ Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.