American Nuclear Society

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quality control for plate-type nium-aluminum fuel elements

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American National Standard Quality Control for Plate-Type Uranium-Aluminum Fuel Elements

Secretariat
American Nuclear Society

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Working Group ANS-15.2

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American National Standard

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Foreword

(This Foreword is not a part of American National Standard Quality Control for Plate-Type Uranium-Aluminum Fuel Elements, ANSI/ANS-15.2-1990.)

The American Nuclear Society Standards Committee established Subcommittee ANS-15 in the fall of 1970 with the task of preparing a standard for the operation of research reactors. In January 1972, this charter was expanded to the multiple tasks of preparing all standards for research reactors. To implement this enlarged responsibility, a number of Subcommittee work groups were established to develop standards for consideration and complementary action by Subcommittee ANS-15.

At the time of its development of the revision of the standard, Working Group ANS-15.2 had the following membership:

B. L. Corbett, Chairman, *Oak Ridge National Laboratory*
K. Bogacik, *Babcock & Wilcox*
R. W. Knight, *Oak Ridge National Laboratory*
L. K. Seymour, *EG&G Idaho*

In this process of creating standards against the background of established and varied practices in many operating facilities, it is important to consider:

a. It is not intended that the standard be used as a demand model for backfitting purposes.
b. It should be a vital aid for the new owner-agency.
c. It should be helpful for the facility undergoing change/modification.
d. Its thoughtful use by industry should ease the burden of regulatory agencies.

We affirm, further, that the use of any standard of performance, conduct or excellence is volitional. The decision to use a standard is a management matter, presumably on technical advisement. The institutionalizing of a standard can and almost must be conditional; i.e., high probability exists that some exception or addition will compromise the absolute, unconditional application of a document which was composed to cross lines of functional and material discipline.

It is a management function to ameliorate or mitigate conditional matters. It is not the function of a standard to attempt to accommodate the many different management systems. Neither is its function to preempt management prerogatives.

This standard is promulgated in the context of these considerations.

Subcommittee ANS-15, Operation of Research Reactors, had the following membership at the time of this standard:

W. J. Richards, Chairman, *U.S. Air Force*
L. C. Brinkerhoff, *U.S. Department of Energy*
W. J. Brynda, *Brookhaven National Laboratory*
B. L. Corbett, *Oak Ridge National Laboratory*
A. F. Di Meglio, *Nuclear Science Center*
J. P. Farrar, *University of Virginia*
D. E. Feltz, *Texas A&M University*
T. F. Luera, *Sandia National Laboratories*
G. W. Nelson, *University of Arizona*
R. C. Nelson, *U.S. Air Force*
D. P. Pruett, *Argonne National Laboratory-West*
T. M. Raby, *National Institute of Standards and Technology*
E. M. Roybal, *U.S. Department of Energy*
L. S. Rubenstein, *U.S. Nuclear Regulatory Commission*
T. R. Schmidt, *Sandia National Laboratory*
M. H. Voth, *Pennsylvania State University*
R. R. Walston, *U.S. Department of Energy*
W. L. Whittemore, *GA Technologies, Inc.*

Consensus Committee N17, Research Reactors, Reactor Physics, and Radiation Shielding, had the following membership at the time it reviewed and approved this standard:

R. S. Carter, Chairman
T. M. Raby, Secretary

S. H. Brown ..... Health Physics Society
A. Johnson (Alt.)
J. D. Buchanan ..... Individual
A. D. Callihan ..... Individual
R. E. Carter ..... Individual
R. S. Carter ..... American Nuclear Society
D. Cokinos ..... Brookhaven National Laboratory
A. De La Paz ..... Department of U.S. Army
D. Duffey ..... American Institute of Chemical Engineers
H. Goldstein ..... American Physical Society
P. B. Hemmig ..... U.S. Department of Energy
J. W. Lewellen (Alt.)
W. A. Holt ..... American Public Health Association
L. I. Kopp ..... Individual
J. E. Olhoeft ..... Individual
T. M. Raby ..... National Institute of Standards and Technology
W. J. Richards ..... U.S. Air Force
L. Rubenstein ..... U.S. Nuclear Regulatory Commission
A. Adams (Alt.)
M. M. Ter Pogossian ..... American College of Radiology
D. K. Trubey ..... Oak Ridge National Laboratory
A. Weitzberg ..... NUS Corporation
W. L. Whittemore ..... Individual

Contents

Quality Control for Plate-Type Uranium-Aluminum Fuel Elements

1. Scope and Purpose

1.1 Scope. This standard sets forth general requirements for the establishment and execution of a program designed to verify that the quality of plate-type uranium-aluminum fuel elements being purchased for research reactors conforms to the requirements of the contract and applicable technical documents, including specifications, standards, and drawings. The quality verification program prescribed herein comprises the elements of an inspection system, including planning, documentation, surveillance, inspection, testing, and certification. This document also includes elements of inspection control, test and measuring equipment, nonconforming items, and corrective actions. American National Standard Quality Assurance Program Requirements for Nuclear Facilities, ANSI/ASME NQA-1-1989 [1][1] for planning and executing the quality verification program and for testing equipment calibration requirements is recommended. A related document restricted to the production of low-enrichment uranium fuel elements is IAEA-TECDOC-467 (June 1988), "Standardization of Specifications and Inspection Procedures for LEU Plate-Type Research Reactor Fuels" [2].

1.2 Purpose. The purpose of this standard is to promote standardization of methods, procedures, and techniques that are used to verify the quality of the product. It is not the purpose of this standard to require manufacturing processes, quantities, dimensions, tolerances, materials, or material properties for the fuel elements; these requirements shall be included in the contract between purchaser and fuel-element supplier.

1.3 Application. It is intended that this standard be used in the nuclear industry to promote uniformity in the quality-verification program for acceptance of fuel elements consisting of flat or curved plates clad with aluminum containing fuel comprised of either uranium-aluminum alloy, U_3O_8-aluminum dispersion, UAl_x-aluminum dispersion or U_xSi_y-aluminum dispersion. The standard is applicable only to fuel elements in which the fuel plates are fastened to side plates for structural rigidity by mechanical means. Actual quality verification requirements to ensure compliance to specific product requirements must be included in the purchaser's product requirement.

It is recognized that in attempting to provide a uniform standard applicable to the full range of research reactors, certain sections of the document may be excessively restrictive to some reactor situations and correspondingly limited in scope for other situations; it is therefore intended that the purchaser will alter these portions or substitute specific requirements for these items in the purchase document.

1.4 Definitions

boron-10 equivalence. A ratio of the absorption cross section and atomic weight of uranium impurities expressed as an equivalent amount of Boron-10.

fuel core. The uranium-bearing region of each fuel plate. This may be aluminum-uranium alloy, a dispersion of U_3O_8 or UAl_x, or U_xSi_y in aluminum.

fuel element. The finished product described by the purchaser's product specification including fuel plates, support plates, end fittings, etc.

fuel plate. The fuel core complete with aluminum frame and cladding rolled or otherwise formed into an integral unit.

lot. The amount of material purchased or handled as a unit or traceable to a common step in fabrication. Material blended together to form a lot shall have the same chemical and physical characteristics.

mechanical assembly. The method used for fastening the fuel plates into side plates to form the fuel element (e.g., roll swaging). Welding, brazing, or other methods involving metallurgical bond are excluded.

[1]Numbers in brackets refer to corresponding numbers in Section 16, References.