American Nuclear Society

verification and validation of non-safety-related scientific and engineering computer programs for the nuclear industry

an American National Standard

REAFFIRMED

September 26, 2016

ANSI/ANS-10.4-2008; R2016

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This standard does not necessarily reflect recent industry initiatives for risk informed decision-making or a graded approach to quality assurance. Users should consider the use of these industry initiatives in the application of this standard.

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Verification and Validation of Non-Safety-Related Scientific and Engineering Computer Programs for the Nuclear Industry

Secretariat
American Nuclear Society

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American National Standard

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Comments on this standard are encouraged and should be sent to Society Headquarters.

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Foreword

(This Foreword is not a part of American National Standard "Verification and Validation of Non-Safety-Related Scientific and Engineering Computer Programs for the Nuclear Industry," ANSI/ANS-10.4-2008.)

The purpose of this standard is to provide guidelines for the verification and validation (V&V) of non-safety-related scientific and engineering computer programs developed for nuclear industry applications. The standard does not recommend a specific approach to program development but does recommend that V&V activities be carried out in parallel with program development. For a specific project, the project sponsor should determine the level of the V&V effort to be applied. The standard complements the following ANS-10 standards relating to computer program development:

ANSI/ANS-10.3-1995, "Guidelines for the Documentation of Computer Programs" (withdrawn);

ANSI/ANS-10.5-2006, "Accommodating User Needs in Scientific and Engineering Computer Software Development";

ANSI/ANS-10.2-2000, "Portability of Scientific and Engineering Software."

In addition, an effort has been made to maintain consistency in terminology and concepts with various software standards being developed under the sponsorship of the Institute of Electrical and Electronics Engineers, Inc., and to identify areas of disagreement.

Compliance with this standard does not substitute for compliance with regulatory requirements. For example, any analysis that requires a 10 CFR Part 50 Appendix B quality assurance program would still require one whether or not it conforms with this standard.

Charles R. Martin was the working group chair for much of the development of this standard. His contributions are gratefully acknowledged.

This standard has been written by Working Group ANS-10.4 of the American Nuclear Society's Standards Committee. The membership of this group during the preparation of the final drafts consisted of the following:

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Contents

Verification and Validation of Non-Safety-Related Scientific and Engineering Computer Programs for the Nuclear Industry

1 Scope and objective

1.1 Scope

This standard provides guidelines for the verification and validation (V&V) of non-safety-related scientific and engineering computer programs developed for use by the nuclear industry. The scope is restricted to research and other non-safety-related, noncritical applications.

1.2 Objective

The objective of this standard is to identify activities that will improve the reliability of scientific and engineering computer programs and reduce the risk of incorrect application.

1.3 Guidance for applying this standard

The intent of this standard is to present a comprehensive set of V&V activities. These activities should be performed in parallel with the program development process. Sections 5 through 10 address the situation in which V&V is carried out in parallel with program development. Section 11 describes V&V activities that may be applied a posteriori to an existing program where V&V parallel to program development was not performed.

Since performing the complete set of V&V activities for a project may be impractical, the level of the V&V effort to be applied and whether it is to be carried out in parallel or a posteriori should be determined by the project sponsor based on such factors as the size; complexity; regulatory requirements; and American National Standards Institute/American Nuclear Society ANSI/ANS-10.5-2006, "Accommodating User Needs in Scientific and Engineering Computer Software Development," intended use of the program.

Application of this standard is expected to provide material for use in a quality assurance program. This standard does not recommend a particular approach toward quality assurance. Questions about frequency of reviews or audits, resolution of discrepancies, or responsibility for configuration control are not within the scope of this standard.

2 Definitions

In the context of this standard, the following definitions apply.

non-safety-related: Software whose failure would not create a hazard to a facility, worker, or member of the general public.

validation: (a) The process of testing a computer program and evaluating the results to ensure compliance with specified requirements. (b) The demonstration that the verified computer program (and by inference the mathematical model) are an adequate representation of the physical phenomena.

verification: The process of evaluating the products of a software development activity to provide assurance that they meet the requirements defined for them.

Verification and validation is abbreviated throughout the standard as V&V. In addition, reference is made to the following software development, maintenance, or V&V products:

- statement of problem;
- management plan;
- requirements specification;
- design specification;
- program documentation (user's manual, technical manual, etc.);
- source code;
- integrated program;
- installation package;
- test plan;
- V&V plan;
- V&V report.

These products are briefly described in Secs. 4 through 10.