

March 22, 2001

MEMORANDUM TO: Jack R. Strosnider, Jr., Director  
Division of Engineering  
Office of Nuclear Reactor Regulation

FROM: Michael E. Mayfield, Director /s/  
Division of Engineering Technology  
Office of Nuclear Regulatory Research

SUBJECT: REVISED TRANSMITTAL OF NUREG/GR-0019 "SOFTWARE  
ENGINEERING MEASURES FOR PREDICTING SOFTWARE  
RELIABILITY IN SAFETY CRITICAL DIGITAL SYSTEMS"

This memorandum supercedes the memorandum, dated December 19, 2000, transmitting NUREG/GR-0019 "Software Engineering Measures for Predicting Software Reliability in Safety Critical Digital Systems." NUREG/GR-0019 is the University of Maryland's final report evaluating the current state-of-the-art of quantitative measures/metrics for software engineering and proposing a new paradigm for using a set of software engineering measures from which the potential reliability of a digital I&C systems can be predicted.

This work was conducted to meet, in part, an NRR user need that was later included as request number 2000-5 of the consolidated NRR user need letter on instrumentation and control issues, dated March 17, 2000. This letter requests RES to "review existing methods, tools, and models used for assessing qualitative and quantitative reliability of software-bases systems." The objective of this work was to provide quantitative tools for assessing the reliability, quality and other functional characteristics of software used in digital I&C systems if supported by the current state-of-the-art software engineering practice or to provide a review of the current state-of-the-art if a useable assessment tool was not yet available.

The research presented in NUREG/GR-0019, assesses the state-of-the-art in software engineering measures for predicting software reliability and other software functional characteristics. The conclusion reached as part of this research is that the state-of-the-art is presently not able to assess these functional characteristics sufficiently well for regulatory proposes. Nevertheless, this NUREG provides information which can be used by the NRC and the licensees as a means of evaluating the relative merits of measurement indicators in the software development process. The NUREG also proposes a method for using a set of software engineering measures that has the potential for providing information on functional characteristics that would advance the current state-of-the-art.

The next step in this research, as defined in Section 3.3.1 of the Draft NRC Research Plan for Digital Instrumentation and Control, is to validate the software measures and method proposed in the NUREG in a software development setting to determine if the method can be of practical use. If the next phase of this work indicates that the new software engineering measures can be effectively utilized to assess software characteristics, then guidance which can be incorporated into SRP Chapter 7 will be identified and discussed with NRR staff. A determination will be made at that time to see if significant improvement in regulatory effectiveness, efficiency and realism can be achieved to warrant the effort.

If you have any questions, please call me (415-5678) or Steve Arndt (415-6502) of my staff. Steve is Team Leader for the Instrumentation and Controls Team in the Engineering Research Applications Branch.

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