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operation of fast pulse reactors

an American National Standard

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American National Standard

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Foreword

(This foreword is not part of American National Standard "Operation of Fast Pulse Reactors," ANSI/ANS-14.1-2004.

Nuclear devices designed and operated for purposes of research and as sources of sharp, intense pulses of fission-produced radiation have functioned successfully for more than 40 years. In the usual operation, superprompt criticality is established in a mass of unmoderated fissile metal, radiation is produced, and the nuclear reaction is immediately terminated by characteristics inherent in the fissile material itself. These devices have come to be known as fast pulse reactors. This standard provides direction in the use of such specialties so that the risk of damage to personnel and equipment can be controlled. It was prepared by individuals having extensive and intimate experience in the operation of this type of reactor.

At the time of the initial publication in 1975, the membership of Subcommittee 14 was as follows:

A. De La Paz (Chair), *White Sands Missile Range*

L. M. Bonson, *Sandia National Laboratories*
K. Elliott, *Albuquerque Operations Office, U.S. Atomic Energy Commission*
L. P. Holland, *Oak Ridge National Laboratory*
A. H. Kazi, *Aberdeen Pulse Radiation Facility*
R. L. Long, *University of New Mexico*
J. M. Reuscher, *Sandia National Laboratories*
T. F. Wimett, *Los Alamos Scientific Laboratory*

In 2000, a working group was reestablished to review and update the standard. The standard had been reaffirmed in 1982, 1989, and 2000. The standard needed to be updated to reflect changes in procedures and to reference associated standards. The members of Working Group 14.1 producing the revised standard are as follows:

T. R. Schmidt (Chair), *Sandia National Laboratories*

R. E. Anderson, *Los Alamos National Laboratory*
J. W. Bryson, *Sandia National Laboratories*
M. J. Burger, *Sandia National Laboratories*
A. De La Paz, *Vista Technologies*
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M. Mendonca, *U.S. Nuclear Regulatory Commission*
D. M. Minnema, *National Nuclear Security Administration*
G. A. Schlapper, *National Nuclear Security Administration*

This standard was processed and approved for submittal to ANSI by the American Nuclear Society's Research Reactors, Reactor Physics, Radiation Shielding & Computational Methods (N17) Committee on ANSI/ANS-14.1-2004, "Operation of Fast Pulse Reactors." Committee approval of the standard does not necessarily imply that all committee members voted for its approval. At the time it approved this standard, the N17 committee had the following members:

T. M. Raby (Chair), *National Institute of Standards and Technology*
A. Weitzberg (Vice-Chair), *Scientech, Inc.*

R. E. Carter, *Individual*
D. Cokinos, *Brookhaven National Laboratory*
B. Dodd, *Health Physics Society*
W. A. Holt, *American Public Health Association*
W. C. Hopkins, *Individual*
L. I. Kopp, *Individual*

L. B. Marsh, *U.S. Nuclear Regulatory Commission*
(Alt. A. Adams, *U.S. Nuclear Regulatory Commission*)
J. F. Miller, *Institute of Electrical and Electronics Engineers, Inc.*
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S. H. Weiss, *National Institute of Standards and Technology*
(Alt. T. J. Myers, *National Institute of Standards and Technology*)
W. L. Whittemore, *General Atomics*

Contents

Operation of Fast Pulse Reactors

1 Scope

This standard is for those involved in the design, operation, and review of fast pulse reactors. It has been formulated in general terms to be applicable to all current fast pulse reactors. This standard does not apply to periodically pulsed reactors or booster assemblies.

2 Definitions

2.1 Limitations

The definitions given below are restrictive for the purposes of this standard. Other specialized terms are defined in the *Glossary of Terms in Nuclear Science and Technology*, [1][1)] or have definitions accepted by usage.

2.2 Shall, should, may

The word "shall" is used to denote a requirement; the word "should" is used to denote a recommendation; and the word "may" is used to denote permission, neither a requirement nor a recommendation. To conform with this standard, all operations shall be performed in accordance with its requirements, but not necessarily with its recommendations.

2.3 Glossary of terms

control elements: Those reactor fuel or neutron reflection components whose movement increases or decreases the reactivity of the reactor. Included are control rods, pulse rod, safety block, and reflectors or equivalent.

fast pulse reactor (also referred to as fast burst reactor): An essentially unmoderated assembly of fissionable material designed to produce short-duration, high-intensity pulses of fission radiation. Also, it may be operated at a steady-state power level.

interlock: A switch, relay, or hardware/software combination that locks in a priority of events or that locks out a particular event.

neutron decay interval: The interval of time in the pulse production cycle of the reactor during which a subcritical configuration is attained to allow for decay of delayed neutron precursors.

reactor area: A region in the vicinity of the reactor where personnel shall not be present during a reactor operation.

reactor operating staff: Those personnel, including reactor supervisor and reactor operator personnel, certified in accordance with procedures established by management to carry out operation of the reactor.

reactor operator: An individual certified to manipulate the controls of a reactor.

reactor shutdown: The condition where, as a minimum, the safety block or equivalent is in its minimum reactivity position.

reactor supervisor: See senior reactor operator.

safety block: The control element having a reactivity worth such that its movement is the primary mechanical means of shutting down the operation.

safety device: A mechanism or system designed to move a control element to reduce the reactivity of a fast pulse reactor.

scram: The act of shutting down a reactor suddenly by operation of the reactor safety devices.

senior reactor operator: An individual certified to direct the activities of reactor operators. Such an individual is also a reactor operator.

3 Administrative practices

3.1 Line organization

Management shall assign responsibility and commensurate authority for safe operation of the reactor unambiguously and singularly through the line organization.

[1)] Numbers in brackets refer to corresponding numbers in Section 8, "References."