American Nuclear Society

design objectives for and monitoring of systems controlling research reactor effluents

an American National Standard

published by the
American Nuclear Society
555 North Kensington Avenue
La Grange Park, Illinois 60525 USA

ANSI/ANS-15.12-1977
(N647)

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American National Standard
Design Objectives for and Monitoring of Systems Controlling Research Reactor Effluents

Secretariat
American Nuclear Society

Prepared by the
American Nuclear Society
Standards Committee
Working Group ANS-15.12

Published by the
American Nuclear Society
555 North Kensington Avenue
La Grange Park, Illinois 60525 USA

Approved April 19, 1977
by the
American National Standards Institute, Inc.

American National Standard

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Published by

American Nuclear Society
555 North Kensington Avenue, La Grange Park, Illinois 60525 USA

Price: $15.00

Printed in the United States of America

Foreword

(This Foreword is not part of American National Standard Design Objectives for and Monitoring of Systems Controlling Research Reactor Effluents, ANS-15.12-1977).

The ANS Standards Secretariat 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 Working Groups have been established to develop standards for consideration and complementary action by Subcommittee ANS-15.

Working Group ANS-15.9 was formed in June of 1973 to begin development of this proposed Standard. Draft three was sent to approximately 80 research reactor facilities for comment in December, 1973. At the April, 1974 meeting of Subcommittee ANS-15, Working Groups 15.5 and 15.9 were combined and designated Working Group 15.12 which carried on the work. Draft six of this Standard was approved by ANS-15 in the fall of 1974 and was balloted by American National Standards Committee N17 in early 1975.

In preparing this Standard, the intent has been to specify objectives, which, if achieved, will give the following results:

a. The concentration of radioactivity in research reactor effluents, and the resulting doses to persons not occupationally involved, will be a small percentage of the maximums recommended by the National Council on Radiation Protection and Measurements (NCRP). In specifying these objectives, references are made to Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation," as the most accessible and comprehensive listing of concentrations based on NCRP recommendations.

b. Doses of those not occupationally involved will be a small percentage of natural background.

c. A level of activity in effluents which is as low as reasonably achievable without seriously restricting the operation of existing reactors (if the standard were to be applied to them) or discouraging the development of new research facilities. It is hoped that achievement of these objectives will relieve the majority of research reactor operators from the burden of individual cost benefit analyses, particularly those with minimal resources. It is recognized that the wide variety of reactors to which the description "research reactor" is applied makes it inevitable that some cannot meet the specified objectives, and may at some point be required to perform a cost-benefit analysis. It is believed that, in general, such cases will involve an organization with adequate resources to do the analysis.

The definition of research reactor in the standard is one which is somewhat arbitrary, but which is believed necessary to restrict the range of reactors covered by the standard to manageable proportions. Subcommittee ANS-15 is reexamining the definition of research reactors used in its standards.

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

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 com-

promise 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, and in the context of a family of related research reactor standards, a Work Group and an actively participating Subcommittee in an atmosphere of direct exchange of ideas across multi-discipline and multi-system boundaries.

This Standard was developed by Working Group ANS-15.12 of the American Nuclear Society Standards Committee which had the participation of the following members during the major portion of the groups activity:

George C. Geisler (Director), *Pennsylvania State University*
Harold W. Berk, *University of Virginia*
Richard Neff, *Texas A&M*
Robert Schemel, *U.S. Nuclear Regulatory Commission*

The family of standards and task assignments include:

ANS-15.1 (N378): Development of Technical Specifications
ANS-15.2 (N398): Quality Verification for Plate-Type U-A1 Fuel Elements
ANS-15.3 (N399): Records and Reports
ANS-14.5 (N380): Selection and Training of Personnel
ANS-15.6 (N401): Review of Experiments
ANS-15.7 (N379): Site Evaluation
ANS-15.8 (N402): Quality Assurance Program Requirements
ANS-15.10 (N550): Decommissioning
ANS-15.11 (N628): Radiological Control
ANS-15.12 (N647): Design Criteria for Systems Controlling Effluents . . .
ANS-15.14 (N700): Physical Security
ANS-15.15 (N701): Core Protective Systems
ANS-15.16 (N17.2): Emergency Planning

The membership of Subcommittee ANS-15 at the time of their approval of this Standard was:

Don F. Hanlen, Chairman, *Brown & Root, Inc.*
Mayhue A. Bell, *U.S. Energy Research and Development Administration*
James R. Bohannon, *North Carolina State University*
Lloyd Bonzon, *Sandia Laboratory*
James A. Cox, *Oak Ridge National Laboratory*
Richard Curtis, *U.S. Nuclear Regulatory Commission*
Monte V. Davis, *Georgia Institute of Technology*
A. C. Ellingson, *Sandia Laboratory*
Thomas P. Flood, *U.S. Nuclear Regulatory Commission*
George Geisler, *Pennsylvania State University*
Pat Kraker, *U.S. Geologic Survey*
J. Lawrence Meem, *University of Virginia*
Tawfik M. Raby, *U.S. National Bureau of Standards*
Wade J. Richards, *Lawrence Livermore Laboratories*
Robert Schemel, *U.S. Nuclear Regulatory Commission*
Robert R. Walston, *U.S. Nuclear Regulatory Commission*
William L. Whittemore, *Gulf General Atomic*

The American National Standards Committee N17, Research Reactors, Reactor Physics, and Radiation Shielding, had the following membership at the time it reviewed and approved this Standard:

W. L. Whittemore, Chairman
R. S. Carter, Secretary

Organization Represented	*Name of Representative*
American College of Radiology	Michel M. TerPogossian
American Institute of Chemical Engineers	Richard Duffy
American Nuclear Society	W. L. Whittemore
American Physical Society	W. W. Havens, Jr.
	Herbert Goldstein (Alt)
American Public Health Association	Charles G. Amato
	William A. Holt (Alt)
American Society of Mechanical Engineers	Roy A. Axford
American Society of Radiologic Technologists	John H. Tolan
Health Physics Society	Charles A. Willis
Institute of Electrical & Electronics Engineers	H. A. Thomas
National Bureau of Standards	R. S. Carter
	Tawfik M. Raby (Alt)
National Council on Radiation Protection & Measurement	Arthur B. Chilton
U.S. Nuclear Regulatory Commission	Karl R. Goller
	Robert J. Schemel (Alt)
U.S. Energy Research & Development Administration	Phillip B. Hemmig
	John W. Lewellen (Alt)
Individual Members	J. E. Olhoeft
	Alfred M. Perry
	E. A. Warman

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Design Objectives for and Monitoring of Systems Controlling Research Reactor Effluents

1. Scope

This Standard establishes design objectives for systems controlling the release of radioactive materials from research reactors during normal operation. It also defines acceptable monitoring techniques. The basic objectives are listed below.

2. Definitions

location of concern. In this Standard, the term "location of concern" is used to identify a point at which an objective for dose or concentration is specified. It is the point in an unrestricted area where the maximum dose or concentration exists. Appropriate and conservative occupancy factors may be used in estimating average doses in areas which are not continuously occupied.

research reactor. A research reactor is one used for scientific, engineering, or training purposes which operates at:

(1) A thermal power level of 1 megawatt or less; or

(2) A thermal power level between 1 and 10 megawatts and does not contain:

(a) A flow loop through the core in which fueled experiments are conducted, or

(b) A liquid or unclad fuel loading, or

(c) An experimental facility in the core in excess of 16 inches^2 or 103.2 cm^2.

concentration (above background) averaged over one year. This term is employed several times in this Standard and is intended to be used in defining a relatively continuous rate of release (during normal operation) while allowing reasonable variations above and below the objective. Such variations shall be limited to 10 times the objective averaged over one day.

3. Noble Gas Effluents

3.1 Design Objectives. One of the design objectives specified below shall be applied:

(1) The annual dose equivalent (above background) shall be less than 10 millirem at the location of concern

(2) The concentration, averaged over one year at the location of concern, shall be less than 2% of those specified in Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation," Appendix B, Table II, Column 1.* [1][1]

3.2 Monitoring. Three methods of monitoring are acceptable:

(1) The actual dose at the location of concern may be measured using integrating dosimeters, providing adequate consideration is given to background measurements and calibration.

(2) The concentration at some point in the release path may be measured, and realistic dispersion factors used to calculate the concentration at the location of concern.

(3) Measurement of actual concentration at the location of concern may be used.

4. Gaseous or Airborne Radioactive Materials (other than noble gases)

4.1 Design Objectives. The concentration (above background) averaged over one year at the location of concern, shall be less than 2% of 10 CFR, Part 20, Appendix B, Table II, Column 1. [1]

4.2 Monitoring

(1) The concentration at some point in the release path may be measured and realistic dispersion factors and deposition velocity used to calculate the concentration at the location of concern.

(2) Measurement of actual concentration and deposition at the location of concern may be used.

5. Liquid Effluents

*April 30, 1975

[1]Numbers in brackets refers to corresponding number in Section 6, References.