

American National Standard Procedures for Periodic Inspection of Cobalt-60 and Cesium-137 Teletherapy Equipment

Secretariat for N44

Institute of Electrical and Electronics Engineers, Inc

Approved April 7, 1977
Reaffirmed August 7, 1984

American National Standards Institute

Published by

Institute of Electrical and Electronics Engineers, Inc
345 East 47th Street, New York, NY 10017

© Copyright 1978 by

The Institute of Electrical and Electronics Engineers, Inc

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher.

American National Standard

An American National Standard implies a consensus of those substantially concerned with its scope and provisions. An American National Standard is intended as a guide to aid the manufacturer, the consumer, and the general public. The existence of an American National Standard does not in any respect preclude anyone, whether he has approved the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard. American National Standards are subject to periodic review and users are cautioned to obtain the latest editions.

CAUTION NOTICE: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken to reaffirm, revise, or withdraw this standard no later than five years from the date of publication. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute.

Foreword

(This foreword is not a part of ANSI N449.1-1978, Procedures for Periodic Inspection of Cobalt-60 and Cesium-137 Teletherapy Equipment.)

These guidelines for inspection of teletherapy equipment are the product of Subcommittee N44.2, and its original draft of 1973 was written by Peter Vreeling. Priority for the attention of N44.2 on this subject of periodic inspection was suggested by the Bureau of Radiological Health (BRH) of the United States Department of Health, Education and Welfare. For those several early years of N44.2 the BRH was the sponsor of the subcommittee and some of the most productive work on this standard (ANSI N449.1-1978) was done at meetings in BRH headquarters. Urgency for promulgation of standards for periodic inspection of teletherapy apparatus was stimulated by a fatality occurring when a patient was crushed by a cobalt teletherapy whose deficiency might have been corrected by appropriate maintenance and inspection. It is a tribute to teletherapy apparatus, in general, that few serious accidents have been reported with such machines which became the "conventional radiotherapy devices" of the 1950's, 1960's and even the 1970's.

Complacency can follow decades of safe and dependable use of cobalt and cesium teletherapy machines, and this maintenance guide is designed to avoid accidents and inaccuracies of output.

When the BRH deemed it in conflict with their bureau to continue sponsorship of N44.2, the subcommittee on standards for radiotherapy equipment IEEE took on the task of continued sponsorship of N44.2, and the task of completion of this maintenance standard by obtaining final approval by formal balloting.

Members of N44.2 assisted Peter Vreeling in their numerous reviews and meetings, but the brunt of the work in developing N449.1 was borne by Peter Vreeling, himself. Consensus and suggestions of overlapping pertinent standards from other national and international agencies were supplied by members of the subcommittee.

N44.2 aimed its efforts toward supplying useful information on periodic inspections of teletherapy apparatus to users (physicians and physicists), manufacturers, and regulators (for example, BRH). During the multiple meetings and discussions on safety for teletherapy, the increase in numbers of linear accelerators was recognized, and the importance of promulgating standards for these complex devices was noted. But the relatively simpler job of establishing standards for cobalt teletherapy machines was elected because of the need for such a standard, and also to afford a prototype standard for subsequent promulgation of similarly needed guides for linear accelerators.

At the time it approved this standard, American National Standards Committee on Equipment and Materials for Medical Radiation Applications had the following personnel:

A. B Brill, MD, PhD, *Chair*
John Tagler, *Secretary*

American Association for the Advancement of Science	N. Suntharalingam, PhD
American Association of Obstetricians and Gynecologists	Charles L. Dunham, MD (<i>Alt</i>)
American Association of Physicists in Medicine	Clayton T. Beccham, MD
American Chiropractic Association	George C. Lewis, Jr, MD (<i>Alt</i>)
American Conference of Governmental Industrial Hygienists	Robert M. Quillin, MPH
American College of Physicians	Leonard Stanton, MS (<i>Alt</i>)
American College of Radiology	Joseph W. Howe, DC
Argonne Cancer Research Hospital	T. M. Goodrich, DC (<i>Alt</i>)
American Chemical Society	Gordon Lodde
American Dental Association	Jacqueline Messite, MD (<i>Alt</i>)
American Federation of Labor and Congress of Industrial Organizations	Henry N. Wagner, Jr, MD
Armed Forces Radiobiology Research Institute	Joseph F. Ross, MD (<i>Alt</i>)
American Insurance Association	S. Reid Warren, Jr, ScD
	Katherine A. Lathrop
	Paul V. Harper, MD (<i>Alt</i>)
	Ellis P. Steinberg, PhD
	Albert G. Richards
	Leonard M. Kraske, MD (<i>Alt</i>)
	George Taylor
	Jack Suarz (<i>Alt</i>)
	Lester A. Slaback, Jr
	John M. Arras (<i>Alt</i>)
	Leo G. Foxwell
	Harry W. Jacobson (<i>Alt</i>)

Atomic Industrial Forum, Inc	W. R. Konneker, PhD
American Medical Technologists.....	John M. Rhodes
	Thomas A. Pence (<i>Alt</i>)
American Nuclear Society	Herbert M. Parker, PhD
American Osteopathic Association	William E. Betts, Jr, PhD
	Robert R. Rosenbaum, MD (<i>Alt</i>)
American Osteopathic College of Radiology	M. Carmen Pettapiece, MD
	Robert R. Rosenbaum, MD (<i>Alt</i>)
American Pharmaceutical Association	William Briner
	Charles H. Barnstein, MD (<i>Alt</i>)
American Podiatry Association.....	Sidney B. Roth MD
American Public Health Association	Rodney Dean Ice, PhD
	Stanley J. Malsky, PhD (<i>Alt</i>)
American Roentgen Ray Society	Charles A. Bickham, Jr, MD
	Homer L. Twigg, Jr, MD (<i>Alt</i>)
American Radium Society	Morris J. Wizenberg, MD
American Society of Clinical Pathologists	Welby N. Tauxe, MD
American Society of Hospital Pharmacists.....	Barry M. Bowen
American Society of Mechanical Engineers.....	Allan B. Drosin
American Society for Quality Control	<i>Vacant</i>
American Society of Radiologic Technologists.....	John H. Tolan, RT
	Stephen Hiss, RT (<i>Alt</i>)
Association of State and Territorial Health Officers	Richard M. Fry
	Martin C. Wukasch (<i>Alt</i>)
American Veterinary Medical Association.....	Frank A. Todd, MPH, DBM
	Leo A. Whitehair, DBM, MS, PhD (<i>Alt</i>)
Brookhaven National Laboratory.....	H. Atkins, MD
	Ralph Fairchild, PhD (<i>Alt</i>)
Battelle-Northwest Memorial Institute (Nonvoting).....	Carlos E. Newton, Jr
	H. V. Larson (<i>Alt</i>)
Bureau of Radiological Health.....	Marshall S. Little
	Peter Paras, PhD (<i>Alt</i>)
College of American Pathologists.....	John R. Hansell, MD
	Wolfgang Hauser, MD (<i>Alt</i>)
Department of Defense — Office of the Surgeon.....	General David H. Wood
	Robert M. Quillin, MPH (<i>Alt</i>)
Electronic Industries Association.....	D. C. Fleckenstein
	L. M. Rundlett (<i>Alt</i>)
Food and Drug Administration	Earl L. Meyers, MD
Health Physics Society.....	John Hale, PhD (<i>Alt</i>)
Institute of Electrical and Electronic Engineers.....	Charles A. Burnham
The Metallurgical Society of AIME	J. Lawrence Katz, PhD
	Evan Greener, MD (<i>Alt</i>)
National Bureau of Standards	Robert Loevinger, PhD
	Elmer H. Eisenhower (<i>Alt</i>)
	Wilfrid B. Mann, PhD
National Cancer Institute	Robert W. Swain
National Council on Radiation Protection and Measurements	Herbert M. Parker, PhD
National Electrical Manufacturers Association	T. H. Rogers
	Joel Hixson (<i>Alt</i>)
National Formulary	Charles H. Barnstein, MD
	Elmer O. Krueger (<i>Alt</i>)
National Naval Medical Center.....	<i>Vacant</i>
Nuclear Regulatory Commission	Allen Brodsky, PhD
	Leo Wade, PhD
Naval Research Laboratory.....	Robert L. Flournoy
	Ronald B. Luersen (<i>Alt</i>)
Parenteral Drug Association	Robert Varney, MD
	Thomas H. Riggs (<i>Alt</i>)
Puerto Rico Nuclear Center	E. Theodore Agard, PhD
	A. E. Lanaro, MD (<i>Alt</i>)
Radiological Society of North America.....	Harold N. Schwinger, MD
	Norman Simon, MD (<i>Alt</i>)
Scientific Apparatus Makers Association.....	Robert A. Arrison, Jr
	J. B. Rickey (<i>Alt</i>)
Society of Nuclear Medicine	John U. Hidalgo, PhD
Southwest Research Institute	Edward E. Dean, MD
	H. Haskell Ziperman, MD (<i>Alt</i>)
The United States Pharmacopeia	Gordon E. Lindenblad, PhD
	E. James Potchen, MD (<i>Alt</i>)
Veterans Administration.....	John R. Boggs
	Chester B. Land (<i>Alt</i>)
	Gerald J. Hine, PhD

CLAUSE	PAGE
1. Scope	1
2. Objective	1
3. General Considerations	1
4. Test Procedures	2
4.1 General	2
4.2 Source-condition Indicator	3
4.3 Door Interlock	3
4.4 Source Holder/Shutter Movement	3
4.5 Protective Source Housing, Beam-Off Leakage	3
4.6 Head Movement	5
4.7 Beam Orientation	5
4.8 Source Leakage	5
4.9 Central-Axis Indicator	5
4.10 Light-Radiation-Field Congruence	5
4.11 Isocenter Position	7
4.12 Source-Skin Distance (SSD)	10
4.13 Source Output	11
4.14 Timer	11
4.15 Stand and Stretcher	13
4.16 Manual Source/Shutter Return	14
4.17 Pneumatic System	14
4.18 Overhaul of Electrical, Mechanical, and Source Assemblies	14
5. Radiation Safety	14
6. Records	14
7. References	15

American National Standard Procedures for Periodic Inspection of Cobalt-60 and Cesium-137 Teletherapy Equipment

1. Scope

This guideline provides suggested procedures for the inspection of cobalt-60 and cesium-137 teletherapy equipment which may identify and quantify malfunctions or maladjustments of the safety and radiation defining components. This guideline is a companion document to ANSI N449-1974 [1], which specifies tests and suggested frequencies for the inspection and maintenance of teletherapy equipment.

2. Objective

The objective of the standard is to provide users of the teletherapy units with suggested procedures for performing the periodic inspection of their equipment as specified in ANSI N449-1974 [1]. Methods and equipment are listed for each procedure.

3. General Considerations

The procedures included in this document are not intended to be all-inclusive. Other procedures may be equally satisfactory. However, the procedures described here have been used successfully and will give results with sufficient accuracy to meet the recommended tolerances when performed by competent people with appropriate equipment. Appropriate equipment means equipment which is functioning properly and of relevant accuracy and reproducibility. Persons performing the test shall be competent in use of the test equipment, the teletherapy unit, and the procedures performed. A “qualified expert” as defined by the NCRP is acceptable in this regard.

NOTE — *Qualified Expert*: With reference to radiation protection, a person having the knowledge and training to measure ionizing radiation, to evaluate radiation safety techniques, and to advise regarding protection needs. With reference to the calibration of radiation therapy equipment, a person having, in addition to the above qualifications, training and experience of the clinical applications of radiation physics to radiation therapy [2].