American Nuclear Society

WITHDRAWN
1996
ANSI/ANS-16.1-1986

measurement of the leachability of solidified low-level radioactive wastes by a short-term test procedure

an American National Standard

No longer being maintained as an American National Standard. This standard may contain outdated material or may have been superseded by another standard. Please contact the ANS Standards Administrator for details.

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

ANSI/ANS-16.1-1986

ANSI/ANS-16.1-1986

American National Standard Measurement of the Leachability of Solidified Low-Level Radioactive Wastes by a Short-Term Test Procedure

Secretariat
American Nuclear Society

Prepared by the
American Nuclear Society
Standards Committee
Working Group ANS-16.1

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

Approved April 14, 1986
by the
American National Standards Institute, Inc.

American National Standard

Designation of this document as an American National Standard attests that the principles of openness and due process have been followed in the approval procedure and that a consensus of those directly and materially affected by the standard has been achieved.

This standard was developed under the procedures of the Standards Committee of the American Nuclear Society; these procedures are accredited by the American National Standards Institute, Inc., as meeting the criteria for American National Standards. The consensus committee that approved the standard was balanced to assure that competent, concerned, and varied interests have had an opportunity to participate.

An American National Standard is intended to aid industry, consumers, governmental agencies, and general interest groups. Its use is entirely voluntary. The existence of an American National Standard, in and of itself, does not preclude anyone from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard.

By publication of this standard, the American Nuclear Society does not insure anyone utilizing the standard against liability allegedly arising from or after its use. The content of this standard reflects acceptable practice at the time of its approval and publication. Changes, if any, occurring through developments in the state of the art, may be considered at the time that the standard is subjected to periodic review. It may be reaffirmed, revised, or withdrawn at any time in accordance with established procedures. Users of this standard are cautioned to determine the validity of copies in their possession and to establish that they are of the latest issue.

The American Nuclear Society accepts no responsibility for interpretations of this standard made by any individual or by any ad hoc group of individuals. Requests for interpretation should be sent to the Standards Department at Society Headquarters. Action will be taken to provide appropriate response in accordance with established procedures that ensure consensus on the interpretation.

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

Published by

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

Printed in the United States of America

Foreword

(This Foreword is not a part of American National Standard for the Measurement of the Leachability of Solidified Low-Level Radioactive Wastes by a Short-Term Test Procedure, ANSI/ANS-16.1-1986.)

This standard provides a limited leach test procedure to measure the release of radionuclides from waste forms by leaching at ambient temperatures. It is intended for solidified low-level radioactive waste. The procedure permits accumulation of sufficient data for the determination of a material parameter in short times (days and months) using leach test specimens with simple shapes and finite dimensions. This parameter is used to characterize the leaching of a specific radioactive species from the waste form and is called the "Leachability Index" (L). Discussions of the interpretation and limitations of this Index are included.

This standard was drafted by Working Group ANS-16.1 of the American Nuclear Society Standards Committee which had the following membership at the time of its approval of this standard:

H. W. Godbee, Chairman, *Oak Ridge National Laboratory*
O. U. Anders, Secretary, *Dow Chemical Company*
E. L. Compere (retired), *Oak Ridge National Laboratory*
T. C. Johnson, *U.S. Nuclear Regulatory Commission*
J. E. Mendel, *Battelle Pacific Northwest Laboratory*
R. M. Neilson, Jr., *EG&G Idaho, Inc.*

Individuals who contributed to the development of this standard were:

T. S. Baer, *Bechtel National, Inc.*
J. R. Berreth, *Westinghouse Idaho Nuclear Co., Inc.*
M. L. Birch, *Duke Power Co.*
J. E. Carlson, *Chem-Nuclear Systems, Inc.*
D. E. Clark, *Battelle Columbus*
J. W. Doty, *Monsanto Research Corp.*
A. L. Dressen, *Envirosphere Company*
J. B. Duckworth, *Westinghouse Idaho Nuclear Co., Inc.*
J. L. Ellis, *Gilbert Associates, Inc.*
K. F. Flynn, *Argonne National Laboratory*
C. A. Gerber, *Niagara Mohawk Power Corp.*
T. M. Gilliam, *Oak Ridge National Laboratory*
P. J. Gillis, *TTI Engineering*
W. F. Holcomb, *U. S. Environmental Protection Agency*
A. H. Kibbey, *Oak Ridge National Laboratory*
N. P. Kirner, *State of Washington, Department of Social and Health Services*
M. J. Kupfer, *Rockwell Hanford Operations*
A. D. Miller, *Advanced Process Technology*
A. A. Moghissi, *Institute for Regulatory Science*
G. P. Motl, *NUS Corporation*
L. J. Riales, *Tennessee Valley Authority*
H. G. Shealy, *South Carolina Department of Health and Environmental Control*
R. T. Steen, *Impell Corporation*
D. L. Taylor, *Consultant*
R. F. Tucker, Jr., *Sargent & Lundy*
A. J. Weiss, *Brookhaven National Laboratory*
J. R. Wiley, *Savannah River Laboratory*

Subcommittee ANS-16, Isotopes and Radiation, had the following membership at the time of its approval of this standard:

R. L. Heath, Chairman, *EG&G Idaho, Inc.*
O. U. Anders, *Dow Chemical Company*
B. Kahn, *Georgia Institute of Technology*
S. Kaplan, *University of California*
J. E. McLaughlin, *U. S. Department of Energy*
I. L. Morgan, *Scientific Measurement System*

American National Standards Committee N48, Radioactive Waste Management, which reviewed and approved this standard, had the following membership:

L. C. Oyen, Chairman
M. D. Weber, Secretary

Organization Represented	*Representative*
Allied General Nuclear Services	W. L. Godfrey
American Nuclear Insurers	R. Sanacore
American Nuclear Society	L. C. Oyen
Argonne National Laboratory	P. F. Gustafson
Dames & Moore	O. Oztunali
Edison Electric Institute	R. E. Stanford
Health Physics Society	J. S. Corbett
	B. V. Roberts (Alt.)
Manufacturers Chemists Association	C. J. Francis
Oak Ridge National Laboratory	E. J. Frederick
Rockwell Hanford Company	C. Tominey
Tennessee Valley Authority	D. L. Michlink
U.S. Department of Energy	V. Trice
	R. Cooperstein (Alt.)
U.S. Nuclear Regulatory Commission	K. S. Kim
Individual Members	J. Hall
	J. H. Roecker
	R. J. Stouky
	D. Wenzel

Contents

Measurement of the Leachability of Solidified Low-Level Radioactive Wastes by a Short-Term Test Procedure

1. Introduction

The characteristics of radioactive wastes (radwastes) from the nuclear industry are dependent on many diverse factors, most of which do not lend themselves to simple definition and standardization. However, in this standard, low-level wastes are considered to be those radioactive wastes which are defined as low-level in Title 10, Code of Federal Regulations, Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste" [1][1]. In general, Section 61.2 of Part 61 defines low-level wastes as those containing source, special nuclear, or by-product material that are not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or uranium or thorium tailings and waste. Low-level radioactive waste accrues in the form of combustible, noncombustible, compactible, and noncompactible solids (cloth, metal, paper, wood, etc.), liquids (evaporator bottoms, decontamination solutions, etc.), slurries (filter sludges, ion-exchange resins, etc.) and powders (incinerator ash, salts, etc.). The present effort addresses itself to but one facet of the overall issue: low level, non-selfheating, radioactive fluids (liquids, slurries, and free flowing powders).

An accepted method for managing these liquids, slurries, and powders is solidification, packaging, and subsequent shipment for disposal by shallow-land burial. Solidification can restrict dispersal during handling and transportation and can provide a non-changing volume during the residence time of the waste in the burial trench.

1.1 Need. At present, generators of low-level radioactive wastes (e.g., nuclear power plants, laboratories, and hospitals) need a common basis for evaluating the alternatives for packaging, handling, storing, and shipping their radioactive wastes. Vendors of solidification systems need a common basis for evaluating the leachability of the waste forms made by their solidification processes. Burial ground operators need leaching information to improve the efficiency of their handling, disposal, and site maintenance operations.

1.2 Purpose. The quantification of the leaching characteristics of solidified wastes requires a standardized, practical method to measure the ability of the solids to impede the release of radioisotopes when water comes in contact with them. The purpose of this standard is to establish such a test, define a material parameter, and provide a mathematical procedure for calculating a "Leachability Index" value for the test data collected over the time period of the test.

This standard is intended to serve as a basis for indexing radionuclide release from solidified low-level radioactive waste forms in a short-term (3-month) test under controlled conditions in a well defined leachant. It is not intended to serve as a definition of the long-term (several hundred to thousands of years) leaching behavior of these forms at conditions representing actual disposal conditions.

Under such leaching conditions, mechanisms other than diffusion (e.g., chemical reaction, surface layers and films, cracking, etc.) are important considerations. Also, the interplay of retardation mechanisms (filtration, ion exchange, coprecipitation, etc.) and enhancement mechanisms (chelation, desorption, dissolution, etc.) for radionuclide migration are important considerations.

1.3 Scope. This standard provides a uniform procedure to measure and index the release of radionuclides from waste forms as a result of leaching in demineralized water for three months. The results cannot be interpreted to apply to any specific environmental situation except through correlative studies of actual disposal site conditions.

[1]Numbers in brackets refer to corresponding numbers in Section 4, References.