Volume 5

RADIOACTIVE WASTE DISPOSAL
DECONTMATION AND DECOMMISSIONING
AGING ASSESSMENT AND LICENSE RENEWALS
GLOBAL ADVANCES IN NUCLEAR CODES & STANDARDS
MAJOR COMPONENT RELIABILITY

Editors
Atam S. Rao
GE Nuclear Energy

Romney B. Duffey
Brookhaven National Laboratory

David Elias
Commonwealth Edison
CONTENTS

RADIOACTIVE WASTE DISPOSAL

Spent Fuel and Nuclear Waste Processing
PC-MHR Spent Fuel: An Ideal Waste Form for Permanent Disposal
Matthew B. Richards, David Alberstein, and Anthony J. Neylan .......................... 1
Electrosorptive Technique to Deactivate Poorly Mineralized Liquid Radioactive Waste From NPP
Improvement of Cesium Leaching Resistance of Solidified Borate Wastes With Copper-Ferrocyanide-Vermiculite Adsorbent
Ching-Tsven Huang and Garry Wu ................................................................. 9
The Murmansk Low-Level Liquid Radioactive Waste Treatment Facility
Low-Waste Technology Developed for Complex Treatment of Navy Low Radioactive Effluents
R. A. Penzin, E. A. Beljakov, A. A. Schwedov, O. V. Evdokimov, and V. A. Zhdanov ................................................................. 17

Transportation and Characterization of Nuclear Waste
A Numerical Study of Transportation Casks Subjected to Puncture Loads
Jim Liu and Shen-Yi Luo ...................................................................................... 19
Fracture Mechanics Aspects in the Safe Design of Ductile Iron Shipping and Storage Containers
Manfred Sappok and Dieter Bounin ...................................................................... 27
Waste Characterization Using APSTNG Technology
Edgar A. Rhodes and Charles E. Dickerman ...................................................... 35
Highly Sensitive Methods of Determining the Concentrations of Uranium and Plutonium in Coolants and Liquid Radioactive Waste of Nuclear Reactors
Hot Cell Characterization of Failed Spent Fuel Rods
Kim-Fu Lin and Tsing-Tyan Yang ...................................................................... 49

Spent Fuel and High Level Waste Storage and Disposal
Experimental and Analytical Thermal Simulation Studies of Interim Dry Storage of Aluminium-Clad Spent Nuclear Fuel
Hector N. Guerrero, Davoud A. Eghbali, Mark D. Fowley, and Si Y. Lee .......... 59
Development and Application of a Quality Assurance System for Waste Repositories
Ingo Beckmerhagen and H. P. Berg ...................................................................... 67
Taipower's Radioactive Waste Management Program
Bruce Chung Cheng Lee ...................................................................................... 75
DECONTAMINATION AND DECOMMISSIONING

D&D of Reactors
- Decommissioning of Fort St. Vrain
  Vincent F. Likar .......................................................... 81
- The Trojan Large Component Removal Project
  Michael B. Lackey and Mary Lee Kelly ............................. 89
- Removal of the Yankee Pressure Vessel Diary of a Work in Progress
  Cedric L. Child .......................................................... 95
- Shoreham Decommissioning and License Termination: A Success Story
  M. Siva Kumar ........................................................... 101
- Decommissioning Situation and Research and Development for the Decommissioning of the Commercial Nuclear Power Station in Japan
  Tatsumi Yamamoto ....................................................... 107

D&D of Nonreactor Facilities
- Fluid-Based Radon Mitigation Technology Development for Decontamination and Decommissioning
  K. V. Liu, J. D. Gabor, R. E. Holtz, and K. C. Gross ........... 111
- Safe Shutdown of Defense Program Facilities at the Mound Plant, Miamisburg, Ohio
  Harold F. Anderson, Philip D. Bantz, and Don F. Luthy .......... 119
- Dresden Unit 1 Decommissioning Activities
  Richard O. Ralph ....................................................... 127
- Application of the Graded Management Approach to Battelle's Nuclear Project
  Cidney B. Voth ........................................................ 131

D&D Related Techniques and Technology
- The Verification Tests of Residual Radioactivity Measurement and Assessment Techniques for Buildings and Soil
  T. Onozawa, T. Ishikura, Yukio Yoshimura, M. Nakazawa, S. Makino, K. Urayama, and S. Kawasaki ......................... 137
- Experience With Electrodecontamination to Reduce the Surface Contaminated Metal at INER
- Electrokinetic Applications for Environmental Restoration, Waste Volume Reduction, and Contaminant Containment Systems
  Henry L. Lomasney and Christina A. Lomasney .................... 157
- Underwater Dismantling Thermal Cutting Tools Measurement of Secondary Wastes
  G. Pilot, J. P. Grandjean, and J. P. Dufayet ..................... 163

AGING ASSESSMENT AND LICENSE RENEWALS

Assessment and Management of Aging, Degradation, and Damage
- The Effect of Aging on the PWR Chemical and Volume Control System
  Edward J. Grove and Richard J. Travis ............................ 173
- Effect of Long-Term Thermal Aging on the Material Properties of Austenitic Stainless Steel Welded Joints
  Masayuki Asano, Shigee Hattori, Isao Suzuki, Masayuki Oishi, Masakuni Koyama, Mamoru Akiyama, Tadatsune Okubo, and Yoshitsugu Mishima ......................... 183
- Materials Data Acquisition and Life Assessment for BWR Reactor Pressure Vessel
  Takahiko Kato, Yasushi Kanazawa, Isao Suzuki, Masakuni Koyama, Mamoru Akiyama, Tadatsune Okubo, and Yoshitsugu Mishima ......................... 189
A Commodity Approach to Aging Management Review of Supports for License Renewal
Caroline S. Schlaseman and Barry M. Tilden ...................................................... 197

Stress Corrosion Cracking of Irradiated Stainless Steels in Simulated PWR Primary Water
Isao Suzuki, Masakuni Koyama, Hiroshi Kanasaki, Hidehito Mimaki,
Mamoru Akiyama, Tadatsune Okubo, Yoshitsugu Mishima, and
Thomas R. Mager .......................................................... 205

Aging Effects on Failures

Ultrasonic Detection of Thermal Embrittlement of Duplex Stainless Steel
Shigeyuki Matsubara, Hiroshi Miyamoto, Kazuhiro Mukai, Jun Suetsugu,
Takuichi Imanaka, Masamitsu Kumada, Yasuo Kurozumi, and
Yukimitsu Okano .......................................................... 215

Detection of Defects and Evaluation of Material Deterioration Using Surface Wave Technique
Yoshikazu Yokono, Toshikazu Yoshihara, Jun Suetsugu, and
Takuichi Imanaka .......................................................... 225

In-Situ Optical Profilometry of CANDU Fuel Channels
Graham N. Jarvis, Eugene O. Cornblum, Miles G. Grabish, David L. Mader,
John C. Kuurstra, and Scott C. McNabb ...................................................... 235

Evaluation of the Effects of Irradiation on the Fracture Toughness of BWR Internal Components
Marcos L. Herrera, Jay P. Higgins, Isao Suzuki, Masakuni Koyama,
Shigeo Hattori, Masashi Andou, Noriyuki Chujo, Yasushi Kanazawa,
Mamoru Akiyama, Tadatsune Okubo, and Yoshitsugu Mishima ................. 245

Long Term Thermal Aging of Cast Duplex Stainless Steels
Isao Suzuki, Masakuni Koyama, Seiichi Kawaguchi, Hidehito Mimaki,
Mamoru Akiyama, Tadatsune Okubo, Yoshitsugu Mishima, and
Thomas R. Mager .......................................................... 253

License Extension and Regulatory Issues

Outline on Life Evaluation of Nuclear Power Plant Life Extension Technology Development
Masakuni Koyama, Masayuki Oishi, Isao Suzuki, Yasushi Kanazawa,
Noriyuki Chujo, Takahiko Kato, Kunio Enomoto, Hidehito Mimaki,
Hiroshi Kanasaki, Mamoru Akiyama, Tadatsune Okubo, and
Yoshitsugu Mishima .......................................................... 259

Qualified Life Extension of Safety Related Electrical Equipment
John M. Wheless .............................................................. 267

Plant Life Management for the First Stage Boiling Water Reactor
Ken-ichi Tezuka, Shin-ichi Kawamura, Masataka Aoki, and Tsuguo Mori ..... 271

Plant Critical Concept
Patrick J. O'Regan ........................................................... 277

The IAEA Activities on Nuclear Power Plant Life Management
B. Gueorguiev, L. M. Davies, and L. Ianko ............................................. 281

Assessment of Aging Effects

The Safety Evaluations of Age-Related-Degradation of BWR-4 Vessel Internals in Taiwan Nuclear Power Plant
Kuen Ting ................................................................. 289

Inspection of Thermal Aging of Primary Piping Systems in Nuclear Power Plants With SQUID Magnetometer
Yoshihiro Isobe, K. Aoki, and F. Nakayasu ............................................. 295
Evaluation of Material Degradation of Light Water Reactor Structure Using a Miniaturized Specimen Sampled From Actual Components
Shinobu Okido, Akihiko Hirano, and Makoto Hayashi ................................................................. 301
Reactor Pressure Vessel Annealing: Effective Mitigation Method
Milan Brumovsky and Jiri Brynda .................................................................................................. 307
Reconstitution Technique for Surveillance Programmes
Milan Brumovsky and Petr Novosad .............................................................................................. 313

GLOBAL ADVANCES IN NUCLEAR CODES AND STANDARDS
From "Compliance-Based" to "Performance-Based" Quality: A Trend in and Evolution of U.S. Quality Standards
Douglas A. Brown and H. Stephen Taylor ......................................................................................... 317
Inter-Society Research Committee
Mamoru Akiyama and Masahisa Higuchi ......................................................................................... 325
French Nuclear Codes and Operating Feedback
C. Faidy .............................................................................................................................................. 329
NPP Structures Strength: Russian Strength Regulations and ASME Code
V. M. Filatov and E. Y. Rivkin .......................................................................................................... 337

MAJOR COMPONENT RELIABILITY
Steam Generator Reliability
Investigation of the Causes of Steam Generator Tube Leakage at Ohi-2
Tomoya Matsunaga, Takuya Kitera, and Toshio Kodama ............................................................... 345
Depth Sizing Technology of Ultrasonic Testing in Steam Generator Tubes
Yasuyuki Nagata, Yutaka Harada, Ryuji Murakami, Yasutada Kishi, Noel Dubé, Gilles Rousseau, and Tomoya Matsunaga ........................................................................................................ 351
Circumferential Cracks in PWR Steam Generator Tubes
Jeffrey A. Gorman and Allan R. McIlree ......................................................................................... 355
Probability of Detection for ODSCC at Tube Support Plates
Peter S. Jackson and Michael Sears .................................................................................................. 361
Application of the ATHOS3 Code for Steam Generator Thermal Hydraulics and Fouling Analysis
Govinda S. Srikantiah and P. R. Chappidi ......................................................................................... 373
Steam Generator Tube Vibration Measurement System and Application
Seiichi Uwagawa, Takaya Kusakabe, and Tomomichi Nakamura .................................................... 391
A Transient Thermal Hydraulic Simulation of a Steam Generator Feedwater Header
Nicholas J. Wyman and Richard Klamer ............................................................................................ 397
Materials Integrity Under Elevated pH Control of RCS Water for Reduction of Radiation Source
N. Ogawa, Tsuyoshi Kohno, M. Yamada, Y. Arimoto, S. Okamoto, and T. Tsuruta ......................................... 403
Estimating Structural Failure Frequency of Degraded Steam Generator Tubes
Susan A. Chavez, Phillip G. Ellison, Corwin L. Atwood, and James L. Jones ..................................... 411
Steam Generator Waterlancing at Darlington NGS: System Development and Initial Field Application
Dave Seppala, Jim Malaugh, Eric Kisel, and Frank Kamler .............................................................. 427
Bruce A Nuclear Division: Steam Generator Life Management Program
Ian B. Trotman ..................................................................................................................................... 435
Identification of Potential Fouling Regions in Steam Generators Using ATHOSBWl
Shufen Jiang, Richard G. Klamer, and William G. Schneider ............................................................ 443
Study on the IGA/SCC Behavior of Alloy 600 and 690 SG Tubing Materials in High Temperature Solutions


Reliability of Reactor Vessels and Internals
Life Prediction of Boiling Water Reactor Internals

Peter L. Andresen, F. Peter Ford, J. Patrick Higgins, Isao Suzuki,
Masakuni Koyama, Mamoru Akiyama, Yoshitsugu Mishima, Tadatsune Okubo,
Shigeo Hattori, Hideo Anzai, Noriyuki Chujo, and Yasushi Kanazawa .......... 461

Boiling Water Reactor Core Shroud Repair
H. William McCurdy and Nicholas J. Marrone ........................................ 475

Estimating Residual Life of Alloy 600 RPV Penetrations

E. Stephen Hunt, Glenn A. White, Raj Pathania, Melvin Arey, and
David E. Whitaker ................................................................. 481

The Results and Analysis of Irradiation Experiments Conducted on
Reactor Vessel Plate and Weld Materials
Eric C. Biemiller, Robert G. Carter, and Stan T. Rosinski .................... 489

Author Index .................................................................................. 509