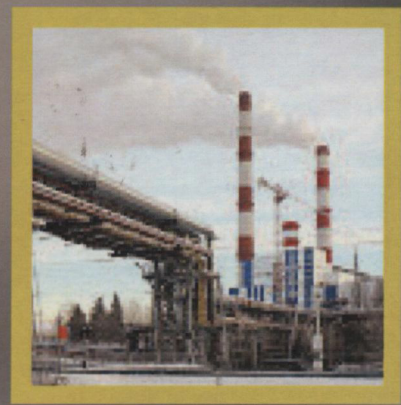


From the writers of
"Companion Guide to the ASME Boiler & Pressure Vessel Code"

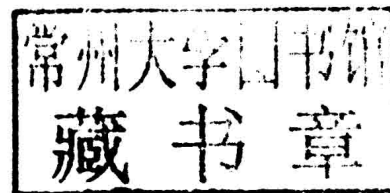
CONTINUING & CHANGING PRIORITIES OF
ASME BOILER &
PRESSURE VESSEL
CODES AND STANDARDS

K.R. RAO, EDITOR



● Fully updated, Versatile, and Expanded Edition ●

Continuing & Changing Priorities of ASME Boiler & Pressure Vessel Codes and Standards



EDITOR
K. R. RAO



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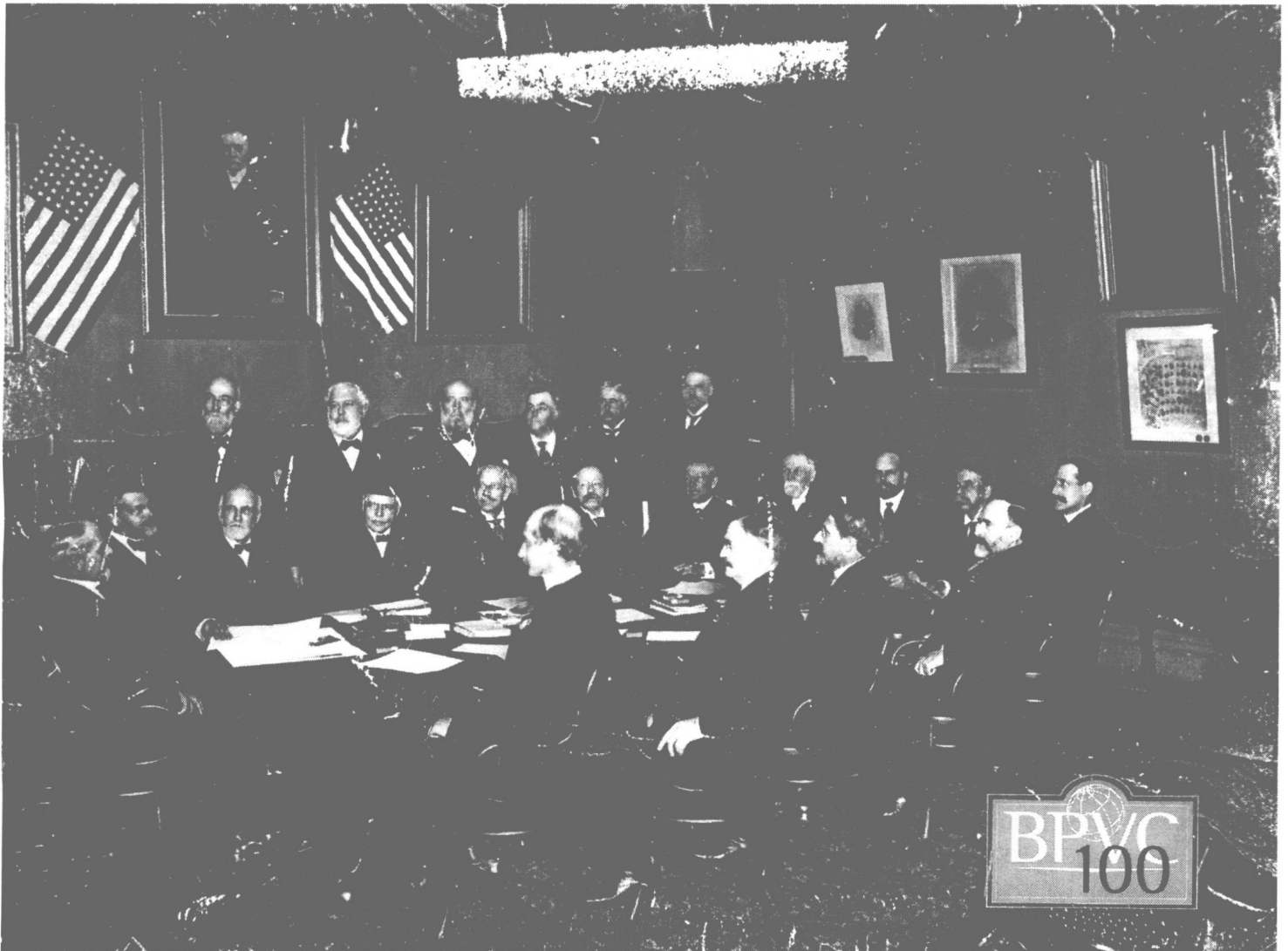
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DEDICATION

This book is dedicated to “one hundred years of boiler code activity” that started with the efforts of pioneers who are pictured below. Essentially their foresight and deliberative acumen resulted in the current boiler code activity that ensures safety, consensus and continuity of changes.

This book that captures continuing and changing priorities of the ASME Boiler Vessel Codes and Standards is mainly due to the efforts of over 1,000 ASME Boiler and Pressure Vessel Code

volunteers with the support of several dozen ASME staff. These volunteers meet and deliberate every three months for a period of one week. It is appropriate to recognize these volunteers and staff by dedicating this publication to these group of individuals whose efforts are reflected by the use of boiler and pressure vessel codes and standards around the globe so that “the sun never sets on the ASME Boiler Vessel Codes and Standards”.



■ 1914 ASME Code Council. Photo courtesy of ASME

(Source: “100 Years The ASME Boiler and Pressure Vessel Code”, by Gerry Eisenberg, p. 25, Winter, 2014 National Board Bulletin, National Board.org.)

ACKNOWLEDGEMENTS

It is befitting that this stand-alone publication of *Continuing and Changing Priorities of Boiler and Pressure Vessel (B&PV) Codes and Standards* by ASME Press would follow the 100th Anniversary of B&PV Codes and Standards which was recently celebrated at Hyatt Regency, Seattle from May 9th through May 15th 2014.

The use of ASME B&PV Codes and Standards and the scope and extent of the third edition of the “Companion Guide” had vastly increased, resulting in a “mammoth” 2,550 page book spread in three volumes. The editor in the Acknowledgements to the third edition paid tribute to the authors who had helped him since the first edition and whose expertise enriched the chapters they authored. Several of them were not merely contributors to the monumental effort, but were in several ways not only the stanchions of the chapters they authored, but also ardent advisors from the onset of this effort. The editor in the third edition acknowledged the efforts of those contributors, who participated from the very beginning and mentioned “. . . to them the editor salutes for their signal contribution, direction and continued support.”

This book has four distinct parts, the first being PART 1: CONTINUING PRIORITIES of B&PV CODES and STANDARDS. Several of the contributors such as C. Wesley Rowley, Late Marcus N. Bressler, David E. Olson, W. J. O’Donnell, Michael A. Porter, Stephen R. Gosselin, Frederick J. Moody, William J. Koves, Ronald S. Hafner, and Alan Murray befit the recognition for their effort as continuing contributors from the previous editions, “who had a remarkable influence on shaping this mammoth effort, few of them from the very beginning to this stage.” In this category of individuals editor places on record the unstinted support provided by Everett C. Rodabaugh, Anibal L. Taboas, Tony Williams, and Rafael G. Mora who had not contributed to this publication but whose efforts in the previous editions were updated in the current publication by the contributors who took over this onerous task. For this Part 1 of the book editor acknowledges the efforts of replacement contributors such as Richard Stevenson, Anthony W. Paulin Jr., Thomas C. Esselman and Harold E. Adkins who had agreed to revise the chapters requested of them. An additional chapter included in this book primarily because of the reputation of the contributors as much as the pressing need of the times has been authored by Chakrapani Basavaraju and Mohinder L. Nayyar to whom the editor expresses his appreciation.

The second part, PART 2: CHANGING PRIORITIES of B&PV CODES and STANDARDS, has chapters addressed by continuing contributors such as Marty Parece, Hardayal S. Mehta, William J. O’Donnell, Donald S. Griffin, P. T. Kuo, Glenn A. White and Ralph S. Hill III. Editor appreciates these contributors who continued from the previous editions to zealously provide

their best updates for the completion of this saga. Past contributions for the chapters in this part by Kaihwa R. Hsu, Timothy J. Griesbach, Pete Ricardella, Sidney A. Bernsen, Fredric A. Simonen, Kenneth R. Balkey, Raymond A. West, John T. Land and Masahiko Kaneda are appreciated. Replacement contributors Keith E. Schwab, Masanori Onozuka, William L. Server who agreed for updating chapters of this Part are immensely appreciated. It is worth highlighting the extra-mile that Hardayal Mehta took to update three of the chapters of this part. James Phillip Ellenberger is a new contributor whose write-up for a chapter in this part is appreciated.

To capture the lessons learned can be extremely challenging, especially if it covers familiar turf of the nuclear power generation. In PART 3: CHANGING PRIORITIES of B&PV CODES and STANDARDS: *Perspectives Lessons Learned* has additional chapters contributed by James C. Sowinski, David A. Osage, Gary Park, John F. Grubb, C. Wesley Rowley, Douglas A. Scarth, Chip H. Eskridge, Joseph F. Ball, Deepak Rao, Chakrapani Basavaraju and Jimmy E. Meyer. It is extremely gratifying to note the efforts of these contributors to unravel the gray areas of B&PV Codes and Standards.

The last part, PART 4: CHANGING PRIORITIES of B&PV CODES and STANDARDS – *Future Discussions*, was selected to address what is not exactly “within the box.” Such topics were covered by Jose N. Reyes, Daniel Ingersoll, Alexander W. Harkness, James A. Mahaffey, Brad Nelson, and Irving Zatz, whose notable contributions are thankfully acknowledged.

For any publication such as this which has no parallel, search for contributors can be painstaking. The editor acknowledges the advice of Chakrapani Basavaraju, Stephen Gosselin, Timothy Griesbach, Kunio Hasegawa, John T. Land, Hardayal Mehta, Jimmy Meyer, D. Keith Morton and Richard W. Swayne.

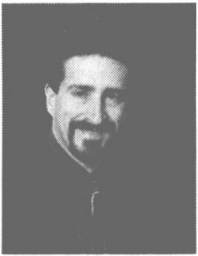
My thanks are especially to my wife, Indira Rao B.Sc. (Hons), M.Sc., M.S., Ph.D., for the sustained support in my editorial effort and participation in several chores at every stage of this book and her efforts are gratefully acknowledged. In addition, I appreciate her tolerating my working on it during several vacations.

The editor thanks the staff of ASME Technical Publications for their continued patience, undivided support and focused effort in aiming once again at this publication’s target of zero tolerance for errors and omissions. My personal appreciation as editor is to Ms. Mary Grace Stefanchik and Ms. Tara Collins Smith for their untiring efforts, even on business trips and vacations to keep the line of communication active in the publication of this book that was initiated on 8th February 2013.

Finally, the editor thanks all of you, readers and users of this *Continuing and Changing Priorities of B&PV Codes and Standards* and hopes it serves the purpose of this publication.

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Mr. Harold E. Adkins is a Senior Research Engineer in Fluid and Computational Engineering Group at Energy & Environment Directorate. He has BS & MS, Mechanical Engineering Degrees from University of Wyoming. Harold Adkins currently provides technical leadership and program management on US Nuclear Regulatory Commission and Department of Energy programs. In his capacity as the NRC Spent Fuel Assistance project manager, he leads a multi-discipline team of analysts responsible for performing advanced thermal-hydraulic and nonlinear structural evaluations of commercial spent nuclear fuel transport, transfer, and storage systems, both for normal and extra regulatory/vulnerability conditions. Harold has over 18 years of thermal-hydraulic and structural analytical experience and serves as a key computational, analytical, and experimental contributor in both fields. Harold serves as PNNL's liquid metal Magnetohydrodynamic (MHD) based Annular Linear Induction Pump technology expert with over 15 years of experience in this field and has provided support to NASA/JPL regarding the Jupiter Icy Moons Orbiter program (AKA, Project Prometheus). Harold also provided support to NASA's Fission Surface Power Program, regarding liquid metal pump analysis and design. Before transferring to his current group, he began his career at PNNL in 2000 when he joined the International Security and Nonproliferation group, providing engineering support to development programs for large caliber concept munitions, die casting technologies, and non-lethal acoustic technologies. Prior to coming to the Lab, Harold provided consulting services in the field of thermal hydraulics for Q-Metrics, Inc. out of Kirkland Washington, and Westinghouse Hanford Company in Richland.

BALKEY, KENNETH R.

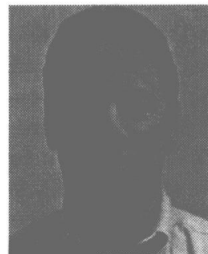


Kenneth R. Balkey is currently a Consulting Engineer in Nuclear Services, with Westinghouse Electric Company in Pittsburgh, PA with over 36 years of service in the nuclear power industry. Mr. Balkey provides consultation and advises technology developments related to Codes and Standards and critical asset protection initiatives. He performed and directed reliability and risk evaluations for nuclear and non-nuclear structures, systems and components over his lengthy career. He has produced more than 100 publications and documents relating to risk evaluations of the integrity of piping, vessels and structures,

and the performance of components using state-of-the-art probabilistic assessment techniques.

Mr. Balkey is vice chair, ASME Codes and Standards Board of Directors (June 2008 – June 2011), a member of the ASME Board on Nuclear Codes and Standards, past vice president, Nuclear Codes and Standards (June 2005 – June 2008), and past chair, ASME Board on Nuclear Codes and Standards (June 2005 – June 2008). Mr. Balkey also served as a senior technical advisor to the ASME Innovative Technologies Institute LLC, providing consultation on the development of guidance for Risk Analysis and Management for Critical Asset Protection (RAMCAP™) and working with the U.S. Department of Homeland Security. His honors include ASME's Dedicated Service Award (1991), the Bernard F. Langer Nuclear Codes and Standards Award (2002), the Melvin R. Green Codes and Standards Medal (2008), and several other awards from ASME, Westinghouse, and other institutions. Mr. Balkey earned B.S. and M.S. degrees in Mechanical Engineering at the University of Pittsburgh. Mr. Kenneth R. Balkey is a Registered Professional Engineer.

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Mr. Ball has worked for The National Board of Boiler & Pressure Vessels Inspectors for his 34 year career and is currently the Director of the Pressure Relief Department for the organization. He is responsible for department activities including acting as the ASME Designated Organization for all non-nuclear pressure relief Code stamps, management of the National Board capacity certification program, test laboratory oversight and the National Board's VR pressure relief valve repair program. He is a 26 year member of the ASME Subcommittee on Safety Valve requirements, and also sits on the PTC-25 committee, the Sub Group on Overpressure Protection for Section III, and the Section XI Committee on Nuclear Inservice Inspection. He has a B.S.E.E. from Purdue University and is a Registered Professional Engineer in the State of Ohio.

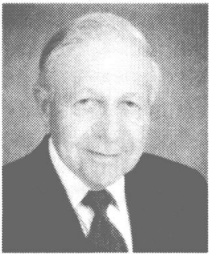
BASAVARAJU, CHAKRAPANI



Basavaraju received Ph.D. in Mechanical Engineering from Texas A&M University. He is a Registered Professional Engineer and an ASME fellow, a member of Design & Analysis Technical committee of PVP division, member of the ASME B&PV Code Section III Subgroup Design Working

Group Piping Design, Working Group Design Methodology, and Special Working Group on HDPE Piping. He published 22 technical papers. He was a contributing author to Chapter B4 and Appendix E2 of Piping Handbook, 7th Edition published by McGraw Hill Book publishing Company, N.Y. He was also a contributing author in updating Chapters 6 and 7 of ASME Companion Guide, 4th Edition published by the ASME, N.Y. He has over 30 years of experience. He is on the technical staff of Mechanical and Civil Engineering Branch of the Division of Engineering, Office of Nuclear Reactor Regulation (NRR) at the U.S. Nuclear Regulatory Commission (NRC).

BERNSEN, SIDNEY A.



Dr. Bernsen, earned his B.S.M.E. in 1950, M.S.M.E. in 1951, and Ph.D. in 1953, from Purdue University. He has been involved in nuclear power activities for over 50 years, initially at Argonne National Laboratory and subsequently with Bechtel Corporation. At Bechtel he held a variety of positions including Chief Nuclear Engineer and Manager of Quality Assurance for Bechtel Power Corporation.

Since retirement from Bechtel, after more than 30 years, he has provided consulting services and has remained active in ASME Nuclear Codes and Standards. Dr. Bernsen served as the initial Chair of the ASME Committee on Nuclear Quality Assurance (NQA) and is now an honorary member of the NQA committee.

Dr. Bernsen, was a founding member of the ASME Board on Nuclear Codes and Standards (BNCS) and has continuously served on BNCS since its inception. He was the initial Chair of the ASME Committee on Nuclear Risk Management and completed his second term in 2004. During his tenure, the committee completed and published the first issue of this Standard in April 2002 and the first addendum was published in December 2003. Through his long career, including extensive involvement in licensing and safety, as well as his work in coordinating the development and approval of the Nuclear Risk Management Standard, he has obtained valuable insight into nuclear risk related activities and how they are being and may be applied in the future to ASME Codes and Standards. Dr. Bernsen, an ASME Fellow, has been involved in Codes and Standards for over 35 years.

BRESSLER, MARCUS N.



Mr. Bressler is President of M. N. BRESSLER, PE, INC., an engineering consulting firm founded in 1977, specializing in codes and standards, quality assurance, design, fabrication, inspection and failure analysis for the piping, power, petroleum and chemical industries. He has over 54 years of experience. He joined TVA in 1971 as Principal Engineer and

was promoted in 1979 to Senior Engineering Specialist, Codes Standards and Materials. He took early retirement in 1988 to open up a private consulting practice. His previous experience was with

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Mr. Bressler began his activities in Codes, Standards and Materials in 1960. He has been a member of the ASME B&PV Standards Committee since 1979 to 2009, and is now a member of the Technical Oversight Management Committee. He is a member and past Vice Chair of the Committee on Nuclear Certification. He is a member of the Standards Committees on Materials and on Nuclear Power, the subgroup on Design (SCIII), the special working group on Editing and Review (SC III), the Boards on Nuclear Codes and Standards and on Conformity Assessment. He is the Chair of the Honors and Awards Committee (BNCS). Mr. Bressler is a member of the ASTM Committees A-01 and B-02 and many of their subcommittees.

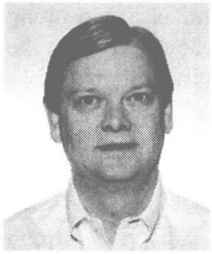
Mr. Bressler holds a BME degree from Cornell University (1952) and an MSME degree from Case Institute of Technology (1960). In 1989 he received a Certificate of Achievement from Cornell University for having pursued a course that, under today's requirements, would have resulted in a Master of Engineering degree. He was awarded the ASME Century Medallion (1980), and became a Fellow of ASME in 1983. He is now a Life Fellow. He received the 1992 ASME Bernard F. Langer Nuclear Codes and Standards Award, and is the 1996 recipient of the ASME J. Hall Taylor Medal. He received the 2001 ASME Dedicated Service Award. He is a Registered Professional Engineer in the State of Tennessee (Retired).

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Dr. Chang is a registered professional engineer and received his Ph.D. in applied mechanics from the Department of Mechanical Engineering, University of California, Berkeley. Through his technical and management career at Westinghouse, he has been involved in the design, analysis, and construction of nuclear power plant systems, structures and components, and development for more than 34 years. Dr. Chang is a renowned professional in the field of fatigue design, structural dynamics, and aging managing for ASME Class 1 components, and authored over twenty-five technical papers and professional presentations. He is a key participant in the development of the new review and audit process for aging management reviews (AMRs) and aging management programs (AMPs) for license renewal applications (LRAs) at USNRC and conducted several training on the subject. Dr. Chang retired as a branch chief of License Renewal Division responsible for performing on-site audits and reviews for the new LRAs. In that capacity he was also a staff member planning for the guidance documents update, involving industry participation, for more efficient preparation and review of LRAs.

ASME Section Code development for more than 34 years. Dr. Chang is a renowned professional in the field of fatigue design, structural dynamics, and aging managing for ASME Class 1 components, and authored over twenty-five technical papers and professional presentations. He is a key participant in the development of the new review and audit process for aging management reviews (AMRs) and aging management programs (AMPs) for license renewal applications (LRAs) at USNRC and conducted several training on the subject. Dr. Chang retired as a branch chief of License Renewal Division responsible for performing on-site audits and reviews for the new LRAs. In that capacity he was also a staff member planning for the guidance documents update, involving industry participation, for more efficient preparation and review of LRAs.

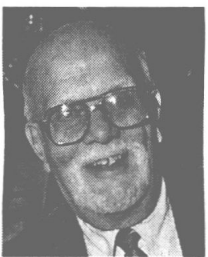
DEBOO, GUY H.

24 years in nuclear power generation, DeBoo has worked on major nuclear design projects including design, inspection and testing phases.

Mr. DeBoo's recent experience includes fatigue, crack growth, flaw stability analyses and operability for power plant components. He supervised functionality and operability evaluations of systems and components to address unanticipated operating events or conditions, which do not meet inspection or test requirements. Mr. DeBoo provides engineering direction for design and operability evaluations of pressure vessels, piping and components and provides technical responses to NRC.

He is a Member ASME B&PV Code Section XI, Secretary, WG Flaw Evaluation, and WG Pipe Flaw Evaluations. Guy is a PE (Illinois), Member of National Society of Professional Engineers.

His industry participation includes PVRC Technical Committee on Piping Systems; publications include "Position Paper on Nuclear Plant Pipe Supports," WRC Bulletin 353, May 1990, and a Tutorial on "An Integrated Approach to Address Engineering of Operating Nuclear Power Plants Functionality and Operability Criteria," 1994, ASME PV&P Conference.

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Mr. Ellenberger's management responsibilities include Co-Manager Engineering Products Clow Corporation, Westmont IL; GM Chisolm Boyd and White, Chicago IL, GM Continental Filters, Louisville KY, GM Summitt Tool, Clearwater FL.

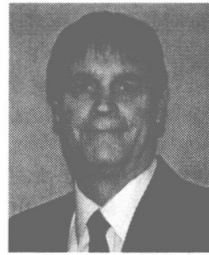
Mr. Ellenberger was a Consulting Structural Engineer for residential constructions in Texas and various industries.

Mr. Ellenberger's professional qualifications include ASME, B16 Vice-Chair Subcommittee C, Member Subcommittee F. He is a member of ASME committees B31, B31.3 Design, B31 MDC, B31.12 and B31 Fabrication. He is ISO Convener of Working Group 10; Member of MSS, Chair Committee 113, previously Coordinating Committee-Chair and is currently a Board Member.

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Guy DeBoo has a B.S. Mechanical Engineering from Northwestern University, 1976 and M.S. Mechanical Engineering from University of Illinois, 1986. His professional experience from 1995 to present is as Senior Staff Engineer, Commonwealth Edison, Senior Staff Engineer with Exelon Nuclear and with Sargent & Lundy Engineers 1976 to 1995. During his

Calculations and several technical papers. He is an educator, having taught High School Physics, Pipeline Stress Analysis. He participated at several Technical Seminars in US, UA Emirates and Mexico. His other interests and activities include being Chairman County Historical Commission, TX and Chaired Committee for School District, IA.

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Mr. Eskridge has over 30 years of experience in the petrochemical and power industries. He is currently a Technology Manager for Mechanical Equipment and Piping Systems for the Jacobs Engineering Group. He earned his BSChE from the University of Kentucky and MSChE from the University of Tennessee and is licensed as a Professional Engineer in the Mechanical, Chemical, Metallurgical and Environmental disciplines in Kentucky. He is the Chairman of the ASME B31.3 Process Piping Code's Subgroup on Fabrication, Examination, and Testing, a Member of B31 Materials Technical Committee, a Member of API's Pressure Relief Systems Committee, and a Governor appointee to the Kentucky Boiler/Pressure Vessel Safety Board. Chip spent 15 years with Bechtel Corp in the Refinery/Chemical and Power Divisions, 5 years with Olin Corp, and has been with Jacobs since 2001. He has published numerous articles in his field.

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Thomas Esselman is a Principal in LPI, Inc., an engineering consulting company that is headquartered in New York City. He has worked in a wide variety of engineering disciplines, including component and structure performance, aging, stress analysis, dynamics, seismic design and analysis, mechanical design, thermo-hydraulics, materials, materials degradation, and failure analysis. Dr. Esselman was the Founder and previous President of Altran Corporation. Altran Corporation was an engineering consulting firm founded in 1986. Dr. Esselman was previously with Westinghouse Electric Corporation where he held the position of Manager, Engineering Mechanics.

Dr. Esselman was Vice Chairman and Technical Program Representative for Codes and Standards for the Pressure Vessel and Piping Division of the American Society of Mechanical Engineers (ASME) and a member of the Pressure Vessel Research Council, Technical Committee on Piping Systems. He is the Chairman of the Advisory Board for the Great Lakes Energy Institute at Case Western Reserve University.

Dr. Esselman was a Lecturer in the School of Engineering and Applied Science at Harvard University. He is also a Research Affiliate at MIT.

He has a Ph.D. in Engineering from Case Western Reserve University and an MBA from the University of Pittsburgh. Dr. Esselman has authored or co-authored more than seventy publications.

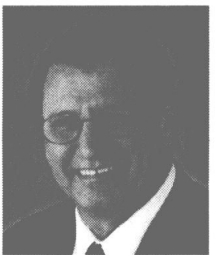
GORMAN, JEFFREY A.



Jeff Gorman has been working on materials issues related to nuclear power since 1959, when he was assigned to Naval Reactors. He studied civil engineering at Cornell before working for Naval Reactors. After leaving the Navy, he did graduate work in engineering science, with emphasis on materials science, at CalTech. Since 1968 he has worked as a consulting engineer in the civilian nuclear power program, with most of his work involving materials, corrosion, stress analysis and fracture mechanics.

In 1980, Dr. Gorman was a co-founder of Dominion Engineering, Inc., and is still actively working for the company. A significant part of his consulting work has been for EPRI. His work for EPRI has included preparation of many workshop proceedings involving PWR steam generator technology, preparation of topical reports on materials and corrosion issues, and assisting in revision of water chemistry guidelines. He has also worked extensively for utilities and other industrial organizations on materials and corrosion issues, such as evaluation of the causes of failures of pressure vessels and piping, and developing predictions of the probable rate of failure of PWR steam generator tubes. Dr. Gorman is a registered professional engineer and is a member of AMS, NACE and ANS.

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Steve Gosselin is the Director for the Western Regional office of LPI, Inc. with over 34 years commercial nuclear power industry experience. Since joining LPI (Lucius Pitkin), and before that at Pacific Northwest National Laboratory (PNNL) and Electric Power Research Institute (EPRI), his work has focused primarily on fitness-for-service, structural integrity, safety, and reliability of pressure vessels and piping components. He has made significant contributions in the areas of fatigue and flaw tolerance methodologies for nuclear pressure vessel and piping components, environmental fatigue computational methods, fatigue crack flaw detection probability, on-line fatigue monitoring, and the development and application of physics-based degradation models model for vessel and piping component risk-informed and reliability integrity management programs.

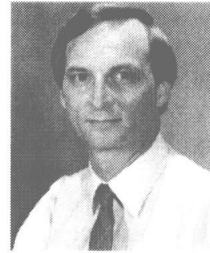
Mr. Gosselin's computational expertise is complemented by over 13 years experience in system engineering and mechanical design analyses at Westinghouse and Combustion Engineering PWR commercial nuclear power plants and 8 years operating experience on U.S. Navy SIC, S5W, and S3G submarine nuclear power plant designs.

Mr. Gosselin is an ASME Fellow and a member of several the American Society of Mechanical Engineers Codes and Standards Committees including: Subgroup Fatigue Strength (SCIII), Working Group Environmental Fatigue Evaluation Methods (SCIII), and Working Group on Operating Plant Criteria (SCXI), Working Group Piping (SCXI), and Special Working Group RIM (SCXI).

Mr. Gosselin has a B.S. degree in Mechanical Engineering from the California State Polytechnic University (1980) and a M.S. degree in Mechanical Engineering from the University of

North Carolina at Charlotte (1998). He is a licensed professional engineer in California. Mr. Gosselin has published over 50 papers, articles, and reports in the open literature and is a consulting expert to the International Atomic Energy Agency (IAEA) in the areas of plant life extension, design reconciliation and risk-informed inservice inspection.

GRIESBACH, TIMOTHY J.

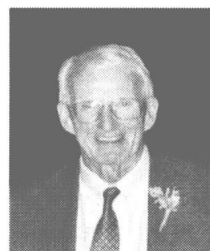


Timothy J. Griesbach earned a B.S. in 1972 and M.S. in 1974 in Metallurgy and Materials Science from Case Western Reserve University in Cleveland, Ohio. He is currently an Associate with Structural Integrity Associates (SI) in San Jose, California. Before joining Structural Integrity Associates, Mr. Griesbach was the Director of Technical Services for ATI Consulting. Mr. Griesbach was a Project Manager with the Electric Power Research Institute (EPRI) from 1982 to 1993 where he managed programs on reactor vessel integrity, research on neutron irradiation embrittlement, vessel material toughness properties, fracture mechanics methods, and management of reactor vessel integrity issues including pressurized thermal shock. From 1977 to 1982 he was a Principal Engineer at Combustion Engineering responsible for evaluating the response of nuclear systems and components to severe loading conditions using advanced finite element techniques. From 1974 to 1977 Mr. Griesbach was a Materials Engineer with Pratt & Whitney Aircraft where he was a member of a select research team developing a unique process to produce diffusion bonded jet turbine blades.

Mr. Griesbach is a member of ASME and the American Nuclear Society, and he has been a member of Section XI since 1989. He is chairman of the Working Group on Operating Criteria whose charter is to develop and maintain the Code criteria for whose pressure vs. temperature limits, operating plant fatigue assessment, and related operating plant issues. He is also a member of the Working Group on Flaw Evaluation and Subgroup on Evaluation Standards.

Mr. Griesbach specializes in evaluation of aging degradation mechanisms for nuclear components, including developing databases and modeling predictions on irradiated materials behavior. He has taught courses on managing the integrity of reactor pressure vessels for extended vessel life, and he has written numerous technical papers on these topics.

GRIFFIN, DONALD S.



Dr. Don Griffin has 30 years of experience in the structural design, development, and evaluation of nuclear reactor systems. At Westinghouse he developed computer-oriented methods of analysis, structural design criteria, and design procedures for naval, PWR, and fast breeder reactors. He has directed structural analysis of static and dynamic systems including effects of fatigue, fracture, thermal shock, seismic, fluid-solid interactions, and non linear and creep response of materials. He has personal expertise in buckling and instability, inelastic analysis, and elevated-temperature structural design. Current ASME Boiler and Pressure

Vessel Code activities include development of design limits for high-temperature and creep buckling, and participation in the Subgroup for Elevated-Temperature Design. Responsible for presentation and resolution of elevated-temperature structural design issues raised during NRC licensing review of CRBRP.

Key relevant experience of Dr. Griffin includes Support of integrity evaluation of the CRBRP Containment Vessel during NRC licensing review; Responsibility for evaluation of Hanford N Reactor pressure tube integrity and pressure tube rupture propagation; Provided structures, seismic, and materials input to the Westinghouse Independent Safety Review of Savannah River Production Reactors; and In-depth review of the Loss of Coolant Accident Design Basis for the Savannah River Production Reactors – Leak Before Break Report.

Dr. Griffin is a Fellow of ASME, past Associate Editor of the Journal of Applied Mechanics, past Chairman of the ASME Pressure Vessel and Piping Division, a recipient of the ASME PVP Medal, and author of 26 publications in applied mechanics, computer methods, and elevated-temperature design. He has been an active contributor to the ASME Boiler and Pressure Vessel Code, Section III, Subsection NH for elevated-temperature nuclear applications. Griffin earned his BME, Cornell University (1952), MS (1953) and PhD (1959), at Stanford University.

GRUBB, JOHN F.

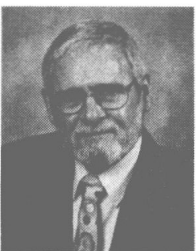


Dr. Grubb received his B.S. from Lehigh University, M.S. and Ph.D. from Rensselaer Polytechnic Institute. He has over 30 years' experience with corrosion-resistant alloys. His primary areas of expertise are in materials environmental resistance, behavior and applications. He is the author of more than 50 papers as well as several handbook chapters. Dr. Grubb is

currently employed by ATI Allegheny Ludlum. He is co-inventor of several patented corrosion-resistant alloys.

Dr. Grubb has been active with the ASME Boiler and Pressure Vessel Committees since 2001 and is the current chairman of the ASME Sub-Group on Physical Properties for Section II as well as chairman of the ASME Sub-Group on Materials for Section VIII. He is also an active member of the Sub-Groups on External Pressure, Ferrous Specifications, and Non-Ferrous Alloys (all BPV II). Dr. Grubb is a Fellow of ASM International (the former American Society for Metals) and recipient of the Pittsburgh Chapter's Edgar C. Bain Award. He is active in ASTM where he serves as a subcommittee officer.

HAFNER, RONALD S.



Ronald S. Hafner has almost 50 years of experience in a variety of disciplines ranging from radar systems and nuclear instrumentation, to non-destructive testing using gamma-ray sources and electronic devices, to nuclear reactor- and tritium facility-operations, to regulatory issues associated with Department of Energy facilities and the transportation, storage, and disposal of

radioactive materials. After a seven-and-a-half year enlistment in the U.S. Air Force, he went to work at Sandia National Laboratories, in Livermore, CA, in 1974, where he specialized in tritium operations and tritium health physics. While at Sandia, he went back to school and earned his Bachelor of Science Degree from California State University, Hayward, CA, in 1983, with a major in Physical Sciences and a minor in Physics. In 1987, he moved to Lawrence Livermore National Laboratory where, for the first four years, he worked in tritium operations and tritium facility management. In 1991, he moved to the Mechanical Engineering Division, where he has been part of an engineering consulting group since that time.

His ASME activities started in 1993, with the Operations, Applications, and Components (OAC) Technical Committee of the ASME's Pressure Vessels & Piping Division (PVPD). Since that time, he has been involved with the development of more than 100 PVPD Conference sessions on the Transportation, Storage, and Disposal of Radioactive Materials. He is a past Chair of the OAC Technical Committee, and a past Chair of the ASME's Pressure Vessels & Piping Division. He is currently a member of the Senate of Past Division Chairs of the ASME's PVPD.

HARKNESS, ALEXANDER W.



Alexander W. Harkness is a Consulting Engineer and Design Lead for the Small Modular Reactor (SMR) development program with more than 23 years of nuclear industry experience covering areas of engineering, plant design, marketing, component design and analysis. In addition to his role with the SMR Program, Mr. Harkness also

serves as chair of the company's Technical Leader Review Committee, which oversees development and placement of fellow and consulting engineers and scientists for Westinghouse technical leader positions.

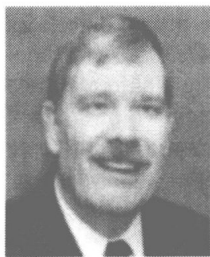
Prior to working on the development of the Westinghouse SMR, Mr. Harkness was a Fellow Engineer in Westinghouse's New Plants Engineering department, which is responsible for the deployment of the AP1000® plant. In this capacity he was responsible for the resolution of technical issues identified during the final stages of design.

Mr. Harkness spent the first 18 years of his career with Westinghouse as an engineer in the Nuclear Services Business Area. During this time, he designed, analyzed, procured and installed replacement nuclear plant components. Many of these components were replaced due to issues associated with aging; however towards the end of his experience in Nuclear Services he worked on the development of a new product, reactor vessel head upgrades which improved the plant's efficiency by reducing the length of the plant's refueling outages. Mr. Harkness was the technical lead for more than two dozen reactor vessel head upgrade projects.

Mr. Harkness is currently a member of the ASME Special Working Group on Reliability and Integrity Management (RIM) Program.

Alex is a graduate of the University of Pittsburgh and Carnegie Mellon University with a bachelor's and master's degree in Mechanical Engineering respectively.

HILL III, RALPH S.



Ralph S. Hill III, PMP, is a Consulting Engineer with Westinghouse Electric Company in Pittsburgh, PA. He has over 35 years of technical and management experience including more than eighteen years in planning, engineering design, construction, and modification for the nuclear power industry and fourteen years providing strategic planning, system engineering, risk

management, process evaluation, and project management consulting services to the U.S. Department of Energy in spent nuclear fuel, radioactive waste management, and nuclear materials disposition-related projects.

At the time of this writing, Mr. Hill is Chairman of the BPV Committee on Construction of Nuclear Facility Components (III) and ASME Vice President Elect Nuclear Codes and Standards where he serves as Chairman of the Risk Management Task Group. Mr. Hill is actively involved in bringing risk-informed probabilistic design methods into the ASME Code and initiatives to support both advanced and next-generation nuclear reactors.

HSU, KAIHWA ROBERT



Kaihwa Robert Hsu earned a B.S. in Civil Engineering from Chung Yuan Christian College, and an M.S. from University of South Carolina. He has thirty years experience applying engineering principles, developing computer codes of corrosion erosion monitoring system, fatigue cycle monitoring system, fatigue crack growth, and fracture mechanics evaluation for nuclear industry.

From 1981 until 2003, he worked in Westinghouse and has been involved in the areas of stress analysis, fatigue, fracture mechanics, leak before break, residual stress, primary water stress corrosion crack, and ASME Code related analyses pertaining to PWR. Mr. Hsu is currently a senior engineer with U.S. Nuclear Regulatory Commission (NRC). He is a key member in the development of the review and audit process improvement for aging management reviews. He is an audit team leader for license renewal application, responsible for metal fatigue time-limited aging analyses (TLAA) and aging management programs (AMPs) audit and review.

Publications of Kaihwa Robert Hsu are in the Proceedings of ASME Pressure Vessels and Piping Conference, the Proceedings of 10th Environmental Degradation Conference, and the Proceedings of 8th International Conference of Nuclear Engineering.

HUNT, STEPHEN

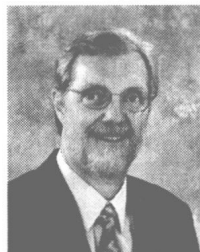


Since receiving his BSME from Purdue University in 1995, Steve Hunt has been involved in equipment design, stress analysis and root cause failure analysis of mechanical equipment primarily for the commercial nuclear power and offshore oil industries. This work has included commercial and research nuclear power plants, fossil power plants, floating and fixed off-

shore oil/gas production facilities, deep diving submersibles, large optical telescopes, tower cranes, paper mills, and chemical plants.

In 1980, Steve Hunt was a co-founder of Dominion Engineering, Inc., and he is currently a Principal Officer. A significant part of Mr. Hunt's recent consulting work has been for the Electric Power Research Institute (EPRI). Major areas of effort have included primary water stress corrosion cracking (PWSCC) of Alloy 600 material, boric acid corrosion, leakage reduction technology, and life cycle management. Publications for EPRI have included many documents related to Alloy 600 PWSCC, the *Boric Acid Corrosion Guidebook*, and most of the Sealing Technology and Plant Leakage Reduction Series reports. Mr. Hunt also works extensively for electric utilities in the areas of Alloy 600 PWSCC failure analysis and strategic planning, life cycle management, and root cause failure analysis. Mr. Hunt also provides technical consulting in the areas of offshore oil production facilities, high pressure sealing technology, large diameter bearings, and pressure vessel failure analysis. Mr. Hunt has authored several hundred reports for a wide range of clients and holds several patents. Mr. Hunt is a registered professional engineer and is a member of ASME and IEEE.

INGERSOLL, DANIEL T.

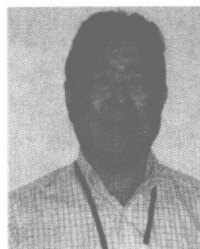


Dr. Daniel Ingersoll is Director of the Office of Research Collaborations for NuScale Power. He joined NuScale in January 2012 to coordinate and develop R&D partnerships between NuScale and universities, laboratories and industry. Prior to joining NuScale, he was Senior Program Manager in the Small Modular Reactors R&D Office at Oak Ridge National Laboratory where

he served as National Technical Director for the U.S. Department of Energy's Small Modular Reactor program. During his 34 years at ORNL, he led several ORNL research groups conducting radiation transport modeling, reactor shielding experiments and reactor physics analysis in support of advanced reactor development, advanced medical therapies, and defense applications.

Dr. Ingersoll received a BS degree in Physics from Miami University in 1973 and a PhD in Nuclear Engineering from the University of Illinois in 1977. He is a Fellow of the American Nuclear Society and former chairman of the ANS Radiation Protection and Shielding Division.

KANEDA, MASAHIKO



Masahiko Kaneda is Senior Vice President of Mitsubishi Nuclear Energy Systems, Inc. He has more than thirty years of experience in development and management of nuclear power plant design in Japan. Mr. Kaneda received a B.S. in Mechanical Engineering from Seikei Univ. in Tokyo, Japan in 1978. From September 2006 to March 2008, he was employed by MHI in Tokyo, Japan as

the General Manager of Advanced Pressurized Water Reactor Promoting Department, Nuclear Energy Systems Headquarters. He directed all aspects of the APWR Promoting Department's operations to control activities such as Design Certification of US-APWR, Luminant Project and Potential Customer Engineering. From October 2005 to August 2006, he was employed by MHI in Hyogo, Japan as the General Manager of the Water Reactor Engineering

Department, Nuclear Energy Systems Engineering Center, Nuclear Energy Systems Headquarters.

Under the direction of Mr. Kaneda, The Water Reactor Engineering Department got involved in the conceptual and basic design of the entire nuclear power plant facility, and consisted of various sections specialized in the system design, layout design, structural and seismic design, electrical design, instrumentation and control design, turbine system design, and water reactor engineering. In this position, Mr. Kaneda directed the entire operations of the Water Reactor Engineering Department and he established the department's annual operational goals, and planned the budget and resources needed for the achievement of annual operation goals.

Thus, Mr. Masahiko Kaneda has nearly three decades of experience related to plant design for nuclear power plants such as Japanese prototype FBR, Monju and many commercial PWRs in Japan. He is not only a specialist for plant layout design but seismic design as well. Currently, as the General Manager of APWR Promoting Department, Nuclear Energy Systems Headquarters in Mitsubishi Heavy Industries, LTD Japan, he is responsible for the promotion of US-APWR.

KOVES, WILLIAM J.



William Koves, Ph.D., P.E., ASME Life Fellow, retired as a Senior Engineering Fellow, distinguished technologist from UOP, a high technology company that develops and licenses process and related equipment technology in the petrochemical, process and related industries.

Dr. Koves has 40 years of experience in the design, analysis and troubleshooting of equipment and structures including air-craft, nuclear reactors, and petrochemical equipment. His specialties include stress analysis, fracture, elevated temperature design, heat transfer, stability, vibration, fatigue, fluid mechanics, and mechanics of granular solids.

Dr. Koves is author of numerous publications in the field and holder of 27 US and 3 European patents. He is the recipient of numerous awards from ASME and UOP including the B31 Forever Medal and the ASME Dedicated Service Award. He has been very involved with numerous ASME and PVRC committees including, Past Chair of ASME B31.3 Process Piping Committee, Past Chair of ASME B31 Mechanical Design Committee, Member of the B31 Standards Committee, Member of ASME Boiler and Pressure Vessel Subcommittee on Design Analysis, Elevated Temperature Design, Special Working Group on Design of Bolted Flange Joints and member of the Post Construction Standards Committee and Subcommittee on Repair.

Dr. Koves was Vice-Chair of the Pressure Vessel Research Council (PVRC), Member of PVRC Committee on Piping and Nozzles, Chair of PVRC Committee on Elevated Temperature Design, Chair of PVRC Subcommittee on Shell Intersections, and Past the Chair of the Post Construction Flaw Evaluation Committee and Member of the Main and Executive committees.

KUO, PAO-TSIN



Dr. Kuo earned an engineering diploma from Taipei Institute of Technology, a MS from North Dakota State University and a PhD from Rice University. He is a Registered Professional Engineer in the State of Maryland. He has been an executive consultant to the regulatory bodies and utilities worldwide for more than five years after his retirement from the US

Nuclear Regulatory Commission in 2008. Prior to his retirement, he served as the Director of License Renewal Division, responsible for guidance development and licensing activities of the license renewal program as well as environmental reviews of applications for license renewal and early site permits.

Dr. Kuo was a former member of the ASME Section XI Special Working Group on Plant Life Extension. He was also a former member of the ASME Section III Working Group of Piping Design as well as Task Group on Dynamic Stress Limit. Internationally, he was the Chairman of Working Group I, General Long Term Operation Framework, IAEA Extra Budgetary Program on Safety aspects of Long Term Operation of Water Moderated Reactors.

LAND, JOHN T.

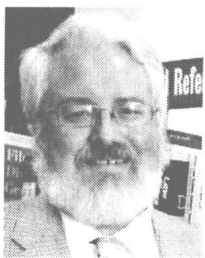


John T. Land, P.E., has been involved in the design, analyses and manufacturing of Westinghouse's PWR nuclear primary equipment products for almost thirty years. His product design experience includes reactor internals, steam generators, pressurizers, valves, and heat exchangers. Mr. Land also contributed to the design and development of the AP600 and AP1000 MWe Advanced Power Plants,

the Westinghouse/Mitsubishi APWR 4500 MWt Reactor Internals, and many of the currently operating Westinghouse PWR domestic and international reactor internals components. In addition, he has directed and reviewed the design and analysis efforts of engineers from Italy (FIAT and ANSALDO), Spain (ENSA), Czech Republic, and Japan (MHI) on several collaborative Westinghouse international efforts. His experience included five years with Westinghouse as a stress analyst on nuclear valves in support of the Navy's Nuclear Reactor Program. Prior to working for Westinghouse, Mr. Land spent eleven years with the General Electric Company on the design and development of Cruise Fan and XV-5A Vertical Take-Off and Landing aircraft propulsion systems. He also holds eleven patents from General Electric, and Westinghouse. Mr. Land received his BS in Mechanical Engineering from Drexel University and his MS in Applied Mechanics from the University of Cincinnati.

Over the past thirty years, John has been active in ASME B&PV Code work. Mr. Land is currently member of the Working Group Core Support Structures and participates in the rule making and maintenance of Sub-Section NG. John is also a member of Sub-Group Design that oversees Section III and Section VIII Design Rules.

MAHAFFEY, JAMES A.



Dr. James Mahaffey holds a bachelor of science degree in physics and master of science and doctorate degrees in nuclear engineering from the Georgia Institute of Technology. As a senior research scientist, during his 25-year career at the Georgia Tech Research Institute (GTRI) he directed or worked on projects for the U.S. Defense Nuclear Agency, the U.S.

National Ground Intelligence Center, the U.S. Air Force Air Logistics Center, Georgia Power Company, and other government and private industrial organizations, in such areas as nuclear power, non-linear analysis, digital systems design, and cold fusion.

His first funded project at GTRI in 1980 was for the U.S. Nuclear Regulatory Commission and involved the design of a hardened computer system for the Loss of Fluid Test (LOFT) reactor at the Idaho National Energy Laboratory. The final report for this project, *Reactor Safety System Design Using Hardened Computers*, was published as NUREG/CR-2118. This document supplemented a new regulation, NUREG-0696, *Functional Criteria for Emergency Response Facilities*, for use in the design and full implementation of computer systems for the two GE reactors at Georgia Power's Plant E.I. Hatch Nuclear Power Station. Dr. Mahaffey was director and chief engineer for this multi-million dollar, multi-year project. Later work included foreign technology exploitation and theoretical work with non-linear analysis of potential fires in aircraft accidents affecting on-board nuclear devices. His work at Georgia Tech led to two patents and over 30 published reports, articles, and refereed papers. He has delivered invited lectures in Germany, Ireland, and Australia and taught physics at Georgia Tech as a shared appointment with GTRI.

He served as Head of Advanced Research at Nanoventions Inc. in Roswell, Georgia, working in digital nano-optics and entangled-state photon communication systems. He also worked as Director of Technology for AIR2, Maryland, developing acoustic and K-band radar equipment to evaluate power-transmission cross-arms from a stand-off position.

Dr. Mahaffey's first book trade book, *ATOMIC AWAKENING: A New Look at the History and Future of Nuclear Power*, (Pegasus Books, New York, July 2009) has received wide critical acclaim. His six-book reference set for high schools and colleges on nuclear power was published by Facts On File. His second trade book, *ATOMIC ACCIDENTS: A History of Nuclear Meltdowns and Disasters from the Ozark Mountains to Fukushima*, (Pegasus Books, New York, 2014) is also proving popular, giving detailed descriptions and analyses of nuclear mistakes over the past 120 years. He was Contributing Editor to the Mercedes-Benz magazine, *The Star*, and his articles were included in the book *Mercedes-Benz Technical Companion*, Bentley Publishers, Cambridge, MA, 2005. He has written technical articles for *Optics and Photonics News*, Washington, DC, and the *NAWCC Bulletin*, Columbia, PA.

MEHTA, HARDAYAL S.

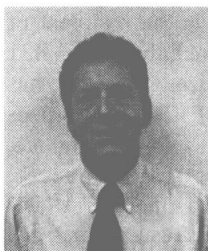


Dr. Mehta received his B.S. in Mechanical Engineering from Jodhpur University (India), M.S. and Ph.D. from University of California, Berkeley. He was elected an ASME Fellow in 1999 and is a Registered Professional Engineer in the State of California.

Dr. Mehta has been with GE Nuclear Division (now, GE-Hitachi Nuclear Energy) since 1978 and currently holds the position of Chief Consulting Engineer. He has over 40 years of experience in the areas of stress analysis, linear-elastic and elastic-plastic fracture mechanics, residual stress evaluation, and ASME Code related analyses pertaining to BWR components. He has also participated as principal investigator or project-manager for several BWRVIP, BWROG and EPRI sponsored programs at GE, including the Large Diameter Piping Crack Assessment, IHSI, Carbon Steel Environmental Fatigue Rules, RPV Upper Shelf margin Assessment and Shroud Integrity Assessment. He is the author/coauthor of over 50 ASME Journal/Volume papers. Prior to joining GE, he was with Impell Corporation where he directed various piping and structural analyses.

For more than 25 years, Dr. Mehta has been an active member of the Section XI Subgroup on Evaluation Standards and associated working task groups. He is also a member of Section III Working Group on Core Support Structures. He also has been active for many years in ASME's PVP Division as a member of the Material & Fabrication and Codes & Standards Committees and as conference volume editor and session developer. His professional participation also included several committees of the PVRC, specially the Steering Committee on Cyclic Life and Environmental Effects in Nuclear Applications. He had a key role in the development of environmental fatigue initiation rules that are currently under consideration for adoption by various ASME Code Groups.

MEYER, JIMMY E.



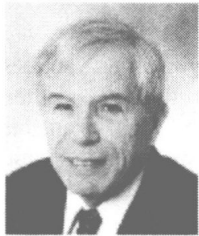
Jimmy Meyer has over 35 years of experience in refining petrochemical, chemical, power generation and industrial facilities. He is a principal engineer at Louis Perry and Associates, a full service engineering and architectural firm in Wadsworth Ohio. Jim is experienced in overall project coordination/management, pressure equipment, piping design, analysis, specifications, support design, mechanical system requirements and documentation requirements. Particular areas of technical competence include ASME piping and pressure vessel codes, stress analysis, and field troubleshooting piping system support, vibration and expansion problems.

Mr. Meyer is a member of ASME and has been involved in the ASME B31.1 and ASME B31.3 Section committees for over 30 years. He is currently Chair of the ASME B31.3 Process Piping

Section Committee, Chair of the ASME B31 Standards Committee and serves on the ASME Board on Pressure Technology Codes and Standards. Jim has also served as Chair of ASME B31.1 Power Piping Code Section Committee.

Past projects and work experience has involved major oil refineries, petrochemical plants, fossil, nuclear, solar and alternative energy generation as well as cryogenic and vacuum test facilities.

MOODY, FREDERICK J.



Ph.D., M.S., B.S., Mechanical Engineering (Stanford, Stanford, U. of Colorado) Consulting Engineer, Thermal-Hydraulics, GE Nuclear Energy, 41 years with emphasis on fluid mechanics, thermodynamics, heat transfer, and coupled fluid-structure interaction, pertaining to reactor and containment technology. Adjunct Professor,

Thermosciences, San Jose State University, 28 years, Instructor, GE Advanced Engineering Programs. Instructor for ASME Continuing Education courses. Invited courses, lectures in U.S. universities and national labs, Rome, Israel, Holland, Japan, India, Germany, Spain, and Taiwan on unsteady thermofluid behavior. National Academy of Engineering, 2001, Induction into Silicon Valley Engineers Hall of Fame, 2000, ASME PV&PD Award (1999), ASME Fellow (1981); George Westinghouse Gold Medal Award (1980), and Alfred Noble Award for technical paper (1967). Has been Committee chair and co-chair, ASME Fluids Engineering Division, PV&P Division and Associate Editor of ASME Journals.

Participated on NRC-appointed peer review groups, and ongoing consulting assignments with several NRC studies and panels. Publications include *Introduction to Unsteady Thermofluid Mechanics*, Wiley, and *The Thermal-Hydraulics of a Boiling Water Nuclear Reactor*, ANS (co-author), and more than 50 publications in technical journals, and symposium volumes.

MORA, RAFAEL G.



Mr. Rafael Mora is a graduate in Civil Engineering from the University of La Gran Colombia, and holds a Master of Business Administration, UNET-UFPS, Venezuela-Colombia. He is a registered professional engineer in Canada.

Mr. Mora has been working for the pipeline industry for over seventeen years that include pipeline operating; integrity consulting and in-line inspection service companies. He recently joined the National Energy Board as a Technical Leader, Engineering within the Compliance Planning and Analysis Team.

Mr. Mora is currently also a professor in the Pipeline Engineering Master Degree program at the University of Calgary. He has taught courses in pipeline integrity extensively within North and South America and has authored a number of technical papers on this subject.

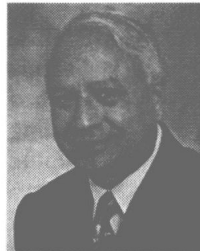
MURRAY, ALAN



Dr. Alan Murray recently retired from the position of Chief Engineer and Chief Safety Officer of the National Energy Board in Calgary, Alberta, Canada. He is an Adjunct Professor in the Mechanical Engineering Department of the Schulich School of Engineering at the University of Calgary and instructs a number of pipeline related professional courses throughout the world.

Alan is a graduate of The Queen's University of Belfast, Northern Ireland in Civil Engineering (Ph.D.) and Mechanical Engineering and has spent most of his career in Design and Development activities mostly in heavy engineering-shipbuilding, pressure vessels and pipelines. He has held a number of senior management positions with a major North American pipeline company and was founding chair of the ASME Pipeline Systems Division in 2000. He is the coauthor of the very successful ASME books *Pipeline Design and Construction: - A Practical Approach*, and *Pipeline Integrity Assurance*, and has published 60 papers on a variety of engineering topics. Alan has been active in the ASME since 1982, editing the Proceedings of the Pipeline Symposium of the Offshore Mechanics and Arctic Engineering conference (1993–2000) and chaired the ASME International Pipeline Conference in 2000 and 2002. He is a Fellow of ASME and has twice been a recipient of the Society's Distinguished Service Award. He is a registered Professional Engineer in Alberta and is a Chartered Member of the Institution of Mechanical Engineers in the United Kingdom.

NAYYAR, MOHINDER L.



Mohinder L. Nayyar, P.E. is an ASME Life Fellow and an internationally recognized specialist in the area of piping, valves, materials, and codes and standards.

As a member of the ASME Council on Standards and Certification, Member of Board on Nuclear Codes and Standards, Vice Chair of the ASME Board on Pressure Technology Codes and Standards,

member, chair and vice chair of several national and international level code committees, Mr. Nayyar has made invaluable contributions to codes and standards resulting in publication of new standards, new rules and the resolution of numerous technical issues. Mr. Nayyar has been awarded the ASME's highest award, Melvin R. Green Medal for his outstanding contributions to codes and standards. He is the recipient of 2013 ASME B31 Forever Medal for Excellence in Piping, a lifetime achievement award.

He has 46 years of design engineering experience on more than 100 domestic and international mega fossil and nuclear power and other projects. He has worked as Systems Design Engineer for Nuclear steam supply systems (NSSS) both on pressurized and boiling water reactor power plants; performed flexibility analysis of ASME III, Class 1, 2, and 3 systems; developed and updated Bechtel's standards, specifications, and guides; chaired inservice inspection (ISI) Task Force of Bechtel; developed and updated Bechtel ISI Manual; supervised Piping and Valve Engineering

work on 19 nuclear power plants; worked as Project Engineer to study and evaluate ISI and IST (Inservice Testing) Programs for Nine Miles Nuclear Power Plant; and served as Operations Coordinator at Turkey Point Nuclear Power Plant. In addition, Mr. Nayyar has provided technical guidance and resolved technical issues on operating nuclear power plants and assisted more than 30 Steam Generator Replacement Projects in achieving successful completion and satisfying Owner and regulatory agencies requirements.

As Senior Principal Engineer, prior to retiring from Bechtel at the end of 2011, he has been providing engineering advice and code interpretations to senior management and day-to-day guidance to all business lines of the BECHTEL Corporation, a global design and construction company. He has initiated and implemented numerous innovative ideas to improve working process and quality; developed and conducted training programs for clients and others; published articles on valves, authored the "Pipeline" article for the 7th Edition of Science and Technology Encyclopedia, and he is the author and Editor-in-Chief of *The Piping Handbook*, Sixth and Seventh Editions, (1992 and 1999), published by McGraw-Hill. He is also the author of the first edition of the *Piping Data Book* (2002), published by McGraw-Hill.

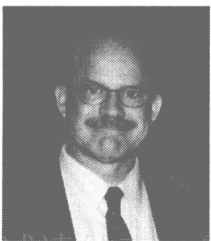
Mr. Nayyar has played key leadership roles in planning and programming Bechtel efforts for successfully passing ASME Surveys to obtain ASME Certificate of Accreditation and N-Certificates of Authorization and for their periodic renewals in compliance with ASME BPV Code Section III.

Mr. Nayyar has initiated, developed, and conducted numerous training programs on various topics covered by ASME BPV Code Section III, Section XI, and US NRC regulations for training new and experienced Client and Bechtel engineers working on nuclear power plant projects. These training programs have been videotaped and were/are being used to train engineers at jobsites and other locations within and outside the United States.

Mr. Nayyar has served as Chairman of the ASME B31, Standards Committee on Pressure Piping Code and he is currently serving as the inaugural Chair of the newly established ASME Standards Committee on Nonmetallic Pressure Piping Systems. He has served as Chair of ASME B31.1, Power Piping Code Committee, B16 Committee on Flanges, ASME B16 Materials Technical Committee, ASME B31 Materials Technical Committee and several other committees. He has also served as Vice Chairman, ISO TC5/SC 10, Subcommittee on Metallic Flanges and their Joints, ASME B16 Standards Committee, and also a Member of ISO/TC/153, USA Technical Advisory Group, ASME B&PV Section II Standards Committee on Materials.

Mr. Nayyar has been the recipient of several awards at Bechtel, ASME leadership awards, ASME Dedicated Service Awards and other honors including "MASTER OF POWER PIPING" Award in 2009 for his accomplishments, and he is listed in "Marquis Who's who in America and the World" since 1995.

NELSON, BRAD



Brad Nelson is the chief engineer for the US ITER Project. His group provides engineering support to US ITER, and he interfaces with partner laboratories and the ITER International Organization. He has more than 35 years of experience in the design and analysis of experimental fusion energy research facilities and components

and has contributed to the engineering design of several facilities and devices, including the Advanced Toroidal Facility, Large Coil Test Facility, National Spherical Torus Experiment, National Compact Stellarator Experiment, and Quasi-Poloidal Stellarator. He was involved in both the ITER Conceptual Design Activity and the Engineering Design Activity in the areas of design integration, vacuum vessel design, blanket and shield design, and the vacuum vessel R&D program. Brad, who is a registered professional engineer, received bachelor of science and master of science degrees in mechanical engineering from the University of Missouri.

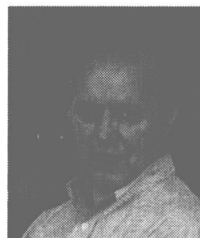
O'DONNELL, WILLIAM J.



Bill O'Donnell has Engineering Degrees from Carnegie Mellon University and the University of Pittsburgh. He began his career at Westinghouse Research and Bettis where he became an Advisory Engineer. In 1970 Bill founded O'Donnell and Associates, an engineering consulting firm specializing in design and analysis of structures and components. The firm has

done extensive work in the evaluation of structural integrity, including corrosion fatigue, flaw sensitivity, crack propagation, creep rupture and brittle fracture. Dr. O'Donnell has published 96 papers in engineering mechanics, elastic-plastic fracture mechanics, strain limits and damage evaluation methods. He is Chairman of the Subgroup on Fatigue Strength and a Member of the Subcommittee on Design of the ASME Code. He has patents on mechanical processes and devices used in plants worldwide. He is recognized expert in Failure Causation Analyses. Dr. O'Donnell has given invited lectures at many R&D laboratories, design firms and universities. He is a registered Professional Engineer. He received the National Pi Tau Sigma Gold Medal Award "For Outstanding Achievement in Mechanical Engineering" and the ASME Award for "Best Conference Technical Paper" in 1973 and 1988. The Pittsburgh Section of ASME named Bill "Engineer of the Year." (1988) He was awarded the ASME PVP Medal (1994) and received the University of Pittsburgh ME Department's Distinguished Alumni Award (1996) and Carnegie Mellon University's 2004 Distinguished Achievement Award for distinguished service and accomplishments in any field of human endeavor. He is a Fellow of the ASME and is listed in the Engineers Joint Council "Engineers of Distinction," Marquis "Who's Who in Science and Engineering" and "Who's Who in the World."

OLSON, DAVID E.



Mr. Olson is the current and long standing Chairman of the ASME Operation and Maintenance Subgroup on Piping Systems, the group responsible for writing the OM-3 standard on piping vibration. He has published over 20 papers on vibration and piping dynamics, testing and design and has also given numerous training seminars on these topics. Mr. Olson has been involved

in solving piping and rotating equipment vibration problems at over 50 nuclear and fossil power plants. He has managed the design and successful implementation of preoperational and initial startup piping test programs at BWR and PWR plants.