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Dr. Robert E. Nickell provides engineering consulting services to private industry and government through Applied Science & Technology, a California C corporation located in San Diego, California. The corporate federal tax identification number is 94-2537938. Dr. Nickell has a Q clearance issued by the U. S. Department of Energy through a contractor, TechSource Incorporated, that is valid through September 30, 2014.

His current consulting activities include:

- **ENTERGY NUCLEAR NORTHEAST** – Technical expert through the law firm of Morgan, Lewis & Bockius LLP on environmental fatigue and embrittlement of reactor pressure vessel internals related to Atomic Safety and Licensing Board (ASLB) license renewal hearings on Indian Point Units 2 and 3 (through Iepson Consulting Enterprises, Inc.).
- **ELECTRIC POWER RESEARCH INSTITUTE** – Principal author of the inspection and evaluation guidelines (I&E Guidelines) for PWR reactor internals, working under the oversight of the EPRI MRP Assessment Issue Task Group, with continuing activity related to regulatory review and potential revision, and for utility implementation through a standardized template (through Anatech Corporation).
- **KOBE STEEL, LTD.** – Consultant on the design and operation of controlled detonation chambers for the destruction of chemical weapons, including projects at Port Kanda in Japan (World War II chemical weapons); Poelkapelle in Belgium (World War I chemical weapons); Tooele, Utah, in the United States (U.S. stockpile chemical weapons); and support for the design of additional controlled detonation systems in China (direct).
- **ALFRED P. SLOAN FOUNDATION** -- Consultant on two projects funded by the Alfred P. Sloan Foundation: (1) long-term operation of nuclear power plants; (2) accidental and terrorist risks associated with the use of medical, industrial, and academic nuclear radioactive materials (through J. W. Jones Consulting Engineers).
- **HOPPER ENGINEERING ASSOCIATES** – Consultant on sub-surface knife-edge corrosion of offshore oil and gas platforms in the Cook Inlet of Alaska, fatigue evaluation of platform structural elements due to cyclic ice loading and seawater corrosion crack growth acceleration effects and mitigation of seawater corrosion through cathodic protection (direct).

Recently completed consulting activities include (with completion date):

- **ELECTRIC POWER RESEARCH INSTITUTE** – Member, Expert Panel on aircraft impact for new nuclear power plants; nine years of involvement on technical peer review of EPRI nuclear power plant security projects, such as aircraft impact on plant structures housing nuclear fuel, explosive loading on

plant structures, and use of unconventional weaponry (rocket-propelled grenades) (July 2012).

- **NATIONAL NUCLEAR SECURITY ADMINISTRATION** – Served on the Independent Technical Review Team for the final design of the Uranium Processing Facility at Y-12 in Oak Ridge, responsible for Technology Readiness Level assessment (June 2012).
- **NUCLEAR ELECTRIC INSURANCE LIMITED** – Consultant in the area of post-tensioned concrete containment structural integrity to the law firm of Baker & McKenzie LLC on the insurance claim by Progress Energy, Inc. on the containment delamination at the Crystal River Unit 3 plant (January 2012).
- **STATE OF CALIFORNIA PUBLIC UTILITIES COMMISSION** – Consultant to the Independent Panel appointed by the Governor of California on the PG&E gas pipeline explosion in San Bruno, California, with particular expertise in structural integrity of electric-resistance-welded pipe and pressure ratings that include weld efficiency factors (August 2011).
- **NATIONAL NUCLEAR SECURITY ADMINISTRATION** – Consultant to Pacific Northwest National Laboratories (PNNL) on the Technology Maturity Evaluation (TME) of the Pit Disassembly and Conversion (PDC) project at the Savannah River site (August 2011).
- **LAWRENCE LIVERMORE NATIONAL LABORATORY** – Member of the Engineering Directorate Director's Review Committee (DRC), reviewing technical programs once every six months (November 2009).
- **SANDIA NATIONAL LABORATORIES** – Technical Review of the U. S. Army Explosive Destruction System (EDS) for non-stockpile chemical weapons and munitions (July 2009).
- **NATIONAL NUCLEAR SECURITY ADMINISTRATION** – Member of the Technical Independent Project Review (T-IPR) teams for the Pit Disassembly and Conversion Facility (PDCF) at Savannah River National Laboratory (SRNL) and for the Chemistry & Metallurgy Research Replacement (CMRR) nuclear facility at Los Alamos National Laboratory (LANL), with responsibility for mechanical systems and Technology Readiness Level assessment (February 2009).
- **NATIONAL NUCLEAR SECURITY ADMINISTRATION** – Served on the Independent Technical Review Team for the conceptual design of the Uranium Processing Facility at Y-12 in Oak Ridge (March 2007), and on the Independent Technical Review Team to evaluate the Y-12 steam replacement system (June 2007).
- **ELECTRIC POWER RESEARCH INSTITUTE** – Technical support to the EPRI Project Manager on technical issues related to nuclear power plant license renewal commitments to manage of age-related degradation during extended periods of plant operation, including reactor water environmental effects on fatigue life and thermal aging effects on cast austenitic stainless steel components (September 2006).

- **NATIONAL NUCLEAR SECURITY ADMINISTRATION** – Served on a six-member Secretary of Energy Advisory Board task force on nuclear weapons complex reorganization (October 2005).
- **DEPARTMENT OF HOMELAND SECURITY** – Risk assessment and risk management for potential terrorist attacks on nuclear power plant dry cask storage facilities, and radioactive material transportation (January 2006).
- **LOS ALAMOS NATIONAL LABORATORY** – Chair, Confinement and Safety Vessel Design Review Panel for DynEx Project; external review of codes and standards, such as the ASME Code, and the corresponding materials issues and design analysis, for confinement vessels used in the U. S. nuclear stockpile stewardship program of the U. S. Department of Energy (September 2007).
- **TUBERIA LAGUNA** – Technical assistance on the satisfaction of requirements imposed by Petroleus Mexicanos on suppliers of piping, in particular requirements for high-frequency-induction electric resistance welded (HFI ERW) piping (February 2006).
- **GENERAL ELECTRIC COMPANY** – External peer reviewer, through the law firm of Morgan, Lewis & Bockius LLP, on safety assessments for Tokyo Electric Power (TEPCO) BWR internals cracking issues (October 2002).
- **PACIFIC GAS & ELECTRIC COMPANY** – Humboldt Bay Power Plant nuclear fuel fragments investigation (February 2005); Review of technical specifications and dynamic structural analyses (e.g., seismic restraint system for the transfer cask) for the independent dry nuclear spent fuel storage system at the Diablo Canyon Nuclear Power Plant (May 2002).
- **U. S. DEPARTMENT OF ENERGY** – Vice Chair of external peer review panel arbitrating dispute between the U. S. Department of Energy and citizens of the State of Nevada with respect to mitigation of groundwater contamination at the Nevada Test Site (December 2001).
- **KOBE STEEL, LTD.** – Provide technical support for the arbitration of a dispute between Kobe Steel, Ltd. (supplier) and Formosa Petrochemical Company (user) related to pitting corrosion and stress corrosion cracking of refinery pressure vessels (March 2002).
- **GESELLSCHAFT FUR NUKLEAR-BEHALTER MBH** – Design and licensing technical assistance on the CASTOR X/32 spent fuel storage and transport cask Safety Analysis Reports, and the Kori KN-12 spent fuel transport cask, including material fracture toughness, welding, and inspection issues (June 2001).

Dr. Nickell received his B.S. (1963), M.S. (1964), and Ph.D. (1967) degrees in Engineering Science from the University of California, Berkeley. His early professional career was spent in the Bell System:

- First, at the Bell Telephone Laboratories, Whippany, New Jersey (1968-1971);

- Then, on an industrial sabbatical teaching assignment at Brown University, Providence, Rhode Island, as an Associate Professor of Engineering (1971-1973); and
- Finally, at the Sandia National Laboratories, Albuquerque, New Mexico (1973-1977).

During this ten-year period, Dr. Nickell conducted and supervised both fundamental and applied research for private industry and government sponsors, serving as Supervisor of Solid Mechanics at the Bell Telephone Laboratories and Supervisor of Design Technology at Sandia National Laboratories.

Since 1977, he has been a private engineering consultant, except for a four-year period (1980-1984) when he was a Project and Program Manager at the Electric Power Research Institute (EPRI), Palo Alto, California, and a three-year period (1992-1995) when he was Technical Director at SGI International, La Jolla, California.

While at Bell Telephone Laboratories, Dr. Nickell directed research and development activity on manufacturing problems of the Western Electric Company, and his staff provided specialty consulting services to Western Electric on structural design and analysis of both commercial and defense systems.

While at Brown University, he taught courses on soil mechanics, structural design, advanced structural dynamics, and finite element methods, while conducting research on residual stresses and deformations in welded structures, viscous fluid flow with free surfaces, nonlinear structural dynamics and buckling, forced convective/conductive heat transfer, and acoustic-structure interaction.

While at Sandia National Laboratories, he directed the management of projects on nuclear spent fuel transportation, ASME Code rules and related standards for elevated temperature reactor design, residual stresses in welded aerospace structures, inservice inspection of nuclear pressure vessels and components, seismic loading simulation using explosives and centrifugal accelerations, structural integrity of PWR component supports, and scale-model light-water-reactor severe accident experiments.

While at EPRI, Dr. Nickell managed research projects on repair welding of heavy-section steel vessels and components, residual stresses in BWR piping, fracture toughness of steam generator and reactor coolant pump support materials, aging of cast austenitic stainless steel components, simplified piping design, new design criteria for flexible piping systems, degradation and failure of bolted joints, and pressurized thermal shock of irradiated PWR reactor vessel weldments. As Program Manager, he directed the budget and technical management of research projects in the areas of structural integrity of nuclear power plant components, design and licensing of advanced light-water-cooled reactors, cleanup activities at Three Mile Island Unit 2, and high-temperature gas-cooled reactor (HTGR) research. The latter program involved the study of failure modes of dissimilar metal weldments and recrystallization of high-nickel alloy steam generator tubing materials. In addition, he provided support to the EPRI External Fuel Cycle Program in the areas of ductile cast iron and other alternative materials for spent fuel dry storage casks.

Dr. Nickell has been involved in various ASME Boiler and Pressure Vessel Code activities for the past thirty-nine years. He recently stepped down as the Chair, Task Group on Impulsively Loaded Vessels, reporting to the Subgroup on High Pressure

Vessels (SG HPV) of Section VIII of the ASME Code. He continues to be a member of the Task Group, and is also a member of the ASME Code Section III Subgroup NUPACK, which has developed rules for the construction of containment systems for nuclear spent fuel and high-level waste transport packagings, and is the past Chair of the Design Working Group of that body. He also serves on the ASME Code Section XI Special Working Group on Nuclear Plant Aging Management (NPAM) for commercial nuclear power plants. He was the Secretary of the Section XI Task Group of Reactor Pressure Vessels as Shipping Containers. He was the elected Chairman of the Consultants Service Meetings (CSMs) that developed criteria for the evaluation of brittle fracture for radioactive material transport packagings, under the auspices of the International Atomic Energy Agency (IAEA). Over the years he has taught short courses on the design of pressure vessels to ASME Code Section VIII, Division 1 and 2 rules, as well as short courses on ASME Code Section XI repairs and alterations to nuclear power plant components.

Dr. Nickell is a member of ASCE, ANS, and ASTM, and is a Fellow of the AAAS and ASME. He is a past Technical Editor of the ASME Transactions Journal of Pressure Vessel Technology, a past Chair of the Executive Committee of the ASME Pressure Vessel & Piping Division, a past member of the Accreditation Board on Engineering & Technology (ABET) mechanical engineering curriculum accreditation visitors lists (six visits in six years, from 1978-1984), a past member of the ASME National Nominating Committee, a past Chair of the ASME Transactions Board of Editors, a past Chair of the ASME Council on Engineering Budget Committee, a past Vice President and Chair of the Board on Communications of the ASME, and a past member of the Finance Committee of the Board of Governors of the ASME. He was elected and served as Governor of the ASME from 1992-1994, and served as Chair of its Committee on Program Review and as Chair of its Task Force on International Direction. He served as the Chair of the Board's Committee on Finance and Investment from 1994-1999, monitoring the ASME's annual budget of some \$ 70MM and its investment portfolio of some \$ 80MM. Dr. Nickell was nominated in June 1998 and elected in November 1998 to become the 118<sup>th</sup> President of ASME. He assumed that office in June 1999 and served until June 2000. He served as the Secretary and Treasurer of the Society, with a three-year term that ended in June 2004. He currently chairs the Trustees of the ASME Pension Plan.

Dr. Nickell was elected to the National Academy of Engineering in 2007. In addition, he was the 1972 recipient of the Office of Naval Research/American Institute of Aeronautics and Astronautics (ONR/AIAA) Naval Structural Mechanics Award, and was appointed by U.S. Secretary of Energy Hazel Rollins O'Leary to the National Coal Council for 1993-1995, with a reappointment for the periods 1995-1997 and 1997-1999. He was selected to present the Robert D. Wylie Memorial Lecture at the Ninth International Conference on Pressure Vessel Technology in April 2000. He has authored or co-authored more than 100 papers in refereed journals.

## SELECTED PUBLICATIONS

1. *Stability of Laminated Orthotropic Shells* (with R. L. Taylor), in: **Developments in Mechanics, Vol. 3** (ed. by T. C. Huang and M. W. Johnson, Jr.), John Wiley & Sons, New York, pp. 115-127 (1965).

2. *Application of the Finite Element Method to Heat Conduction Analysis* (with E. L. Wilson), **Nuclear Engineering and Design**, Vol. 4, No. 3, pp. 276-286 (1966).
3. *Creep of a Cracked Reinforced Beam* (with J. L. Sackman), in: **Proceedings ASCE, Journal of the Structural Division**, Vol. 94, No. ST1, pp. 283-308 (1968).
4. *Variational Principles for Linear Coupled Thermoelasticity* (with J. L. Sackman), **Quarterly Journal of Applied Mathematics**, Vol. 26, No. 1, pp. 11-26 (1968).
5. *Approximate Solutions in Linear, Coupled Thermoelasticity* (with J. L. Sackman), **Transactions ASME, Series E, Journal of Applied Mechanics**, Vol. 35, No. 2, pp. 255-266 (1968).
6. *On the Stability of Approximation Operators in Problems of Structural Dynamics*, **International Journal of Solids and Structures**, Vol. 7, pp. 301-319 (1971).
7. *Thermal Shock Resistant Zirconia Nozzles for Continuous Copper Casting* (with R. E. Jaeger), in: **Materials Science Research**, Vol. 5 (ed. by W. W. Kriegel), Plenum Press, pp. 163-184 (1971).
8. *Integration Operators for Transient Structural Response* (with R. S. Dunham and D. C. Stickler), **Computers and Structures**, Vol. 2, pp. 1-15 (1972).
9. *Reentry Thermal Analysis of Variable Thickness Spherical Vehicles* (with J. C. Dunn), in: **Progress in Astronautics and Aeronautics-- Fundamentals of Spacecraft Thermal Design**, Vol. 29 (ed. by J. W. Lucas), M.I.T. Press, pp. 319-331 (1972).
10. *Direct Integration Methods in Structural Dynamics*, **Proceedings ASCE, Journal of the Engineering Mechanics Division**, Vol. 99, No. EM2, pp. 303-317 (April 1973).
11. *The Solution of Viscous Incompressible Jet and Free-Surface Flows Using Finite-Element Methods* (with R. I. Tanner and B. Caswell), **Journal of Fluid Mechanics**, Vol. 65, Part 1, pp. 189-206 (1974).
12. *Thermal and Mechanical Analysis of Welded Structures* (with H. D. Hibbitt), **Nuclear Engineering and Design**, Vol. 32, No. 1, pp. 110-120 (April 1975).
13. *Nonlinear Dynamics by Mode Superposition*, **Computer Methods in Applied Mechanics and Engineering**, Vol. 7, No. 1, pp. 107-129 (January 1976).
14. *Finite Element Methods for the Solution of Some Incompressible, Non-Newtonian Fluid Mechanics Problems with Free Surfaces* (with R. I. Tanner and R. W. Bilger), **Computer Methods in Applied Mechanics and Engineering**, Vol. 6, No. 2, pp. 155-174 (September 1975).
15. *Applications of the Finite Element Method in Solid Mechanics, Fluid Mechanics, and Heat Transfer*, in: **Developments in Mechanics**, Vol. 8, **Proceedings of the 14<sup>th</sup> Midwestern Mechanics Conference**, University of Oklahoma, pp. 599-626 (March 24-26, 1975).
16. *Free and Forced Convective-Diffusion Solutions by Finite Element Methods* (with D. K. Gartling), in: **Proceedings**, 2nd International Symposium on Finite Elements in Flow Problems, Santa Margherita Ligure, Italy, pp. 595-605 (June 1976).

17. *A Finite Element Convergence Study for Accelerating Flow Problems* (with D. K. Gartling and R. I. Tanner), **International Journal of Numerical Methods in Engineering**, Vol. 11, pp. 1155-1174 (1977).
18. *Spectral Decomposition in Advection-Diffusion Analysis by Finite Element Methods* (with D. K. Gartling and G. Strang), **Computer Methods in Applied Mechanics and Engineering**, Vol. 17/18, pp. 561-580 (1979).
19. *Applications of Fatigue and Fracture Tolerant Design Concepts in the Nuclear Power Industry* (with R. L. Jones, T. U. Marston, S. W. Tagart, and D. M. Norris), in: **Design of Fatigue and Fracture Resistant Structures, ASTM STP 761**, (ed. By P. R. Abelkis and C. M. Hudson), ASTM, pp. 28-46 (1982).
20. *Large Deformation Inelastic Analysis of Impact of Shipping Casks* (with C. M. Charman and R. M. Grenier), **Computer Methods in Applied Mechanics and Engineering**, Vol. 33, pp. 759-784 (1982).
21. *Design of Radioactive Material Shipping Packaging for Low-Velocity Puncture Resistance* (with R. A. May), **Nuclear Engineering and Design**, Vol. 74, No. 2, pp. 223-232 (February 1982).
22. *Simple Mixing Model for Pressurized Thermal Shock Applications* (with B. Chexal, J. Chao, and T. Griesbach), **Nuclear Engineering and Design**, Vol. 74, No. 2, pp. 193-197 (February 1982).
23. *Buckling Design Analysis for Impact Evaluation* (with R. Sauve and W. Teper), **Transactions ASME, Journal of Pressure Vessel Technology**, Vol. 107, No. 2, pp. 165-171 (May 1985).
24. *Static and Dynamic Analysis of Flaw Stability in Piping Systems* (with D. F. Quinones and D. M. Norris), **ASME Transactions, Journal of Pressure Vessel Technology**, Vol. 112, No. 3, pp. 204-212 (August 1990).
25. *Low Velocity Impact of Missiles on Reinforced Concrete Structures* (with Y. R. Rashid and I. R. Kirkchubasche), **ASME Transactions, Journal of Pressure Vessel Technology**, Vol. 113, No. 2, pp. 127-132 (May 1991).
26. *Evaluation of Flawed Piping Under Dynamic Loading* (with D. F. Quinones and J. Gilman), **Nuclear Engineering and Design**, Volume 142, pp. 77-87 (1993).
27. *Fracture Mode Evaluation of Flawed Piping Under Dynamic Loading* (with D. F. Quinones), in: **Fracture Mechanics: Twenty-Fourth Symposium, ASTM STP 1207** (ed. by J. D. Landes, D. E. McCabe, and J. A. M. Boulet) ASTM, Philadelphia, pp. 652-671 (1994).
28. *Determination of Lower-Bound Fracture Toughness for Heavy-Section Ductile Cast Iron (DCI) and Estimations by Small Specimen Tests* (with T. Arai, T. Saegusa, G. Yagawa, and N. Urabe), in: **Fracture Mechanics: Twenty-Fourth Symposium, ASTM STP 1207** (ed. by J. D. Landes, D. E. McCabe, and J. A. M. Boulet), ASTM, Philadelphia, pp. 355-368 (1994).
29. *Generic License Renewal Issues Summary*, **EPRI TR-107521**, Electric Power Research Institute, Palo Alto, CA (April 1998).

30. *Evaluation of Neutron Irradiation Embrittlement for PWR Stainless Steel Internal Component Supports* (with M. A. Rinckel and W. Pavinich), **EPRI TR-112718**, Electric Power Research Institute, Pal Alto, CA (1999).
31. *Evaluation of Thermal Embrittlement for Cast Austenitic Stainless Steels* (with M. A. Rinckel), **EPRI TR-106092**, Electric Power Research Institute, Pal Alto, CA (September 1997); Revision 1 (December 2000).
32. *An Approach for Evaluating the Effects of Reactor Water Environments on Fatigue Life* (with D. A. Gerber and G. L. Stevens), **Proceedings, First International Conference on Fatigue in Reactor Components**, Napa, California (July-August 2000).
33. *Summary of Generic License Renewal Technical Issues, Revision 1*, **EPRI Report 1000866**, Electric Power Research Institute, Palo Alto, CA (June 2001).
34. *Materials Reliability Program (MRP): Evaluation of Fatigue Data Including Reactor Water Environmental Effects* (with W. A. Van Der Sluys and S. Yukawa), **EPRI Report 1003079 (MRP-49)**, Electric Power Research Institute, Palo Alto, CA, and U. S. Department of Energy, Washington, DC (2001).
35. *Evaluation of Proposed Revisions to ASME Code Fatigue Analysis to Account for Environmental Effects Using Structural Fatigue Test Results* (with W. A. Van Der Sluys), **Proceedings, Second International Conference on Fatigue of Reactor Components**, Snowbird, Utah (July 29-31, 2002).
36. *Evaluation of Fatigue Data Including Reactor Water Environmental Effects* (with S. T. Rosinski, W. A. Van Der Sluys, and S. Yukawa), **Proceedings, 5<sup>th</sup> International Symposium on Contribution of Materials Investigations to Improve Safety and Performance of LWRs**, Fontevraud Royal Abbey, France (September 2002).
37. *Technical Justification for ASME Code Section XI Crack Detection by Visual Examination* (with Y. R. Rashid), **Proceedings, 9<sup>th</sup> International Conference on Nuclear Engineering**, Nice, France (April 2003).
38. *ASME Boiler & Pressure Vessel Code Requirements for Prevention of Brittle Fracture*, in: **ASME Transactions, Journal of Pressure Vessel Technology**, Vol. **125**, No. **2**, pp. 121-130, May 2003.
39. *Consideration of Environmental Fatigue in the ASME Code for Carbon and Low-Alloy Steel Components* (with S. T. Rosinski and A. F. Deardorff), **Proceedings, ASME Pressure Vessels and Piping Conference**, Cleveland, Ohio (July 2003).
40. *Environmental Fatigue Testing of Stainless Steel Pipe Bends in Flowing, Simulated PWR Primary Water at 240°C*, (with R. Kilian and J. Hickling), **Proceedings, Third International Conference on Fatigue of Reactor Components**, Seville, Spain (October 3-6, 2004).
41. *Materials Reliability Program: Framework and Strategies for Managing Aging Effects in PWR Internals* (with T. J. Griesbach), **EPRI Report 1008203 (MRP-134)**, Electric Power Research Institute, Palo Alto, CA (June 2005).
42. *Spent Nuclear Fuel Transportation Risk Assessment Methodology for Homeland Security* (with G. A. Teagarden and K. T. Canavan), **Paper ICONE14-89855**,



**Proceedings**, ICONE14 International Conference on Nuclear Engineering, Miami, FL (July 2006).

43. *Plant Support Engineering: Nuclear Plant License Renewal Commitments: Utility Implementation Guidance* (with N. Wilmshurst, T. Taylor, R. King, and W. Server), **EPRI Report 1013477**, Electric Power Research Institute, Palo Alto, CA (November 2006).
44. *ASME Code Rules for Vessels Subject to Detonation Loads and Their Application to the DA VINCH Chemical Weapons Destruction System,*” **Proceedings**, 10<sup>th</sup> International Chemical Weapons Demilitarization Conference, Brussels, Belgium (May 2007).
45. *Materials Reliability Program: Fracture Toughness Evaluation of Highly Irradiated PWR Stainless Steel Internal Components* (with H. Xu, K. Yoon, and W. Pavinich), **EPRI Report 1016106 (MRP-210)**, Electric Power Research Institute, Palo Alto, CA (December 2007).
46. *Analysis of the Dynamic Response of a Controlled Detonation Chamber* (with B. Simoens, M. H. Lefebvre, F. Minami, and J. K. Asahina), **ASME Transactions, Journal of Pressure Vessel Technology**, Vol. 133, No. 5, pp. 051209-1 to 051209-7 (October 2011).

## **Nuclear Power Plant License Renewal Support Activity**

**ELECTRIC POWER RESEARCH INSTITUTE** – Dr. Nickell was the Technical Editor for ten License Renewal Industry Reports (IRs), prepared by contractors under joint funding by EPRI and the U.S. Department of Energy and submitted to the U. S. Nuclear Regulatory Commission for review and approval during the very early days of license renewal from 1989 to 1993. The ten IRs are listed below.

[1]. *PWR Reactor Pressure Vessel License Renewal Industry Report*, Revision 1, September 1992, and PWR Reactor Pressure Vessel IR: Response to NRC Staff Comments, September 10, 1992, EPRI Report No. TR-103837.

[2]. *BWR Reactor Pressure Vessel License Renewal Industry Report*, Revision 1, August 1992, and BWR Reactor Pressure Vessel IR: Response to NRC Staff Comments, September 16, 1992, EPRI Report No. TR-103836.

[3]. *PWR Reactor Coolant System License Renewal Industry Report*, Revision 1, May 1992, and PWR Reactor Coolant System IR: Response to NRC Staff Comments, May 28, 1992, EPRI Report No. TR-103844.

[4]. *BWR Primary Coolant Pressure Boundary License Renewal Industry Report*, Revision 1, April 1992, and BWR Primary Coolant Pressure Boundary IR: Response to NRC Staff Comments, May 15, 1992, EPRI Report No. TR-103843.

[5]. *PWR Reactor Pressure Vessel Internals License Renewal Industry Report*, Revision 1, December 1992, and PWR Reactor Pressure Vessel Internals IR: Response to NRC Staff Comments, December 23, 1992, EPRI Report No. TR-103838.

[6]. *BWR Reactor Pressure Vessel Internals License Renewal Industry Report*, Revision 1, June 1992, and BWR Reactor Pressure Vessel Internals IR: Response to NRC Staff Comments, June 11, 1992, EPRI Report No. TR-103839.

[7]. *PWR Containment License Renewal Industry Report*, Revision 1, September 1991, and PWR Containment IR: Response to NRC Staff Comments, August 28, 1991, EPRI Report No. TR-103835.

[8]. *BWR Containment License Renewal Industry Report*, Revision 1, December 1991, and BWR Containment IR: Response to NRC Staff Comments, December 20, 1991, EPRI Report No. TR-103840.

[9]. *Class I Structures License Renewal Industry Report*, Revision 1, December 1991, and Class I Structures IR: Response to NRC Staff Comments, December 20, 1991, EPRI Report No. TR-103842.

[10]. *Low-Voltage, Environmentally-Qualified Cables License Renewal Industry Report*, Revision 1, March 1993, and Low-Voltage, Environmentally-Qualified Cables IR: Response to NRC Staff Comments, April 7, 1993, EPRI Report No. TR-103841.

In addition to the ten License Renewal Industry Reports, Dr. Nickell has been involved with numerous individual utility license renewal applications, as shown below.

- **STRUCTURAL INTEGRITY ASSOCIATES, INC.** – Provided technical support for license renewal technical issues for the Florida Power & Light St.

Lucie license renewal application and the Progress Energy H. B. Robinson license renewal application.

- **SOUTHERN NUCLEAR OPERATING COMPANY** – Provided technical support for the Hatch license renewal application, with primary emphasis on the review of aging management evaluations reviews.
- **ELECTRIC POWER RESEARCH INSTITUTE** – Provided technical support to the Nuclear Energy Institute's License Renewal Working Group in the reviews of the initial Generic Aging Lessons Learned (GALL) report and its subsequent revisions, bringing to bear the history of EPRI technical issue resolution experience.
- **FLORIDA POWER & LIGHT** – Provided technical support for the Turkey Point license renewal application, with primary emphasis on the adaptation of the early versions of what is now EPRI Report 1010639, Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools, currently up to Revision 4, January 2006. At the time, the Mechanical Tools needed to be adapted from B&W plant applications to Westinghouse plant applications.
- **WESTINGHOUSE ELECTRIC CORPORATION** – Reviewer of Westinghouse aging management evaluations for reactor pressure vessels, containments, reactor coolant system components, pressurizers, and many other systems, structures, and components during the period from in 1996 and 1997.