

Name: Mark A. Gray
Title: Principal Engineer, Primary Systems Design and Repair

EXPERIENCE

Mark A. Gray has over 30 years of experience with Westinghouse. His principal activities include the evaluation of structural integrity issues of primary system piping and components. This includes the development of plant life extension and monitoring programs and analysis. He has participated in the development and application of transient and fatigue monitoring algorithms and software for the WESTEMS™ Transient and Fatigue Monitoring System. He has also participated in cooperative efforts with vendors outside Westinghouse in the development of transient and fatigue monitoring systems.

Mr. Gray has been involved in life extension and license renewal activities at Westinghouse since participating in the first Plant Life Extension pilot study for the Surry Unit 1 nuclear power plant. He co-authored the Westinghouse Owners Group Generic Technical Report on Aging Management for Pressurizers. He also contributed to a similar report covering Reactor Coolant System Piping, and represented Westinghouse before the NRC in their review of the generic reports. He has contributed to development of transient and fatigue monitoring programs for a number of plants, including Comanche Peak, V. C. Summer, Vogtle, Callaway, Wolf Creek, South Texas, Indian Point, Beaver Valley, Beznau, Salem, Harris, D. C. Cook, H. B. Robinson, and Fort Calhoun. These activities have included overall program development, as well as reduction and interpretation of plant historical records and monitoring data for the establishment of baseline fatigue estimates, justification of 40 year transients for 60 years, and identification of improvements to fatigue management programs. He has also performed and directed evaluations of the effects of reactor water environment on fatigue of reactor components for a number of plants, including Harris, H. B. Robinson, D. C. Cook, Beaver Valley, Beznau, and Salem.

Mr. Gray has extensive experience performing ASME Code evaluations, and in evaluating actual plant transients, including surge line stratification (NRC Bulletin 88-11), thermal stratification and cycling (NRC Bulletin 88-08), and pressurizer insurge/outsurge. He successfully led the Westinghouse Owners Group program on Mitigation and Evaluation of Pressurizer Insurge and Outsurge Transients. He has also led plant specific activities for evaluation of pressurizer insurge/outsurge transients for Beaver Valley, V. C. Summer, Salem, Comanche Peak, Surry, North Anna, Byron, Braidwood, Harris, H. B. Robinson, and D. C. Cook.

His experience includes directing and performing analyses of plant systems and components subjected to various loading conditions, to satisfy ANSI and ASME Code requirements. For a number of years, he was lead engineer for fatigue analysis and fatigue related issues affecting class 1 piping and related systems in Westinghouse plants. He was responsible for all design fatigue evaluations of class 1 piping systems and components, as well as evaluation of reported non-design transients for their effects on design requirements. Mr. Gray has had extensive experience in application of finite element analysis, transfer function, and other techniques to evaluate heat transfer, stress and fatigue of components and structures subjected to complex thermal and mechanical loading conditions. He has also developed a working knowledge of power plant fluid systems design bases and operational conformance. He is currently involved in fatigue analysis applications in new plant design.

At Westinghouse, Mr. Gray has developed a substantial understanding of ASME Code requirements, background, and interpretation. He has participated in Pressure Vessel Research Council activities addressing Cyclic Life and Environmental Effects in nuclear plant applications, industry activities of the Materials Reliability Program Issues Task Group on Fatigue, and similar activities as part of the ASME Boiler & Pressure Vessel Code committees. He has performed and directed numerous evaluations of the impact of reactor water environment on fatigue of piping and components in license renewal applications.

EDUCATION B.S.M.E., University of Pittsburgh, 1981

PROFESSIONAL AFFILIATIONS Registered Professional Engineer, Commonwealth of Pennsylvania
Member, American Society of Mechanical Engineers
Member, ASME Code Section III Working Group Piping Design
Member, EPRI/ASME Environmentally Assisted Fatigue Expert Panel

PUBLICATIONS "Finite Element Analysis of Piping Trunnions for Fatigue Loadings", M. A. Gray and D. H. Roarty, ASME Publication PVP-Vol. 120, June 1987.

"Evaluation of Thermal Stratification in PWR Pressurizers", M. A. Gray and E. L. Cranford, ASME Publication PVP-Vol. 388, August, 1999.

"Fatigue Aging Management Reconciliation of 40-Year Transients for 60-Year Application", E. L. Cranford, M. A. Gray, L. E. Sheffield, *Transactions, SMiRT 16*, Washington D. C., August 2001.

"Reduced Life Cycle Costs and Improved Analysis Accuracy Utilizing WESTEMS Integrated Modeling Methods", E. L. Cranford, M. A. Gray, R. Kabir, PVP2002-1325, ASME PVP 2002.

"Advanced Methods for Monitoring Operating Transient and Fatigue Cycles", M. A. Gray and E. L. Cranford, Second International Conference on Fatigue of Reactor Components, EPRI/OECD NEA/CSNI/USNRC, July 2002.

"Analysis Continuity Considerations and Methods Used in Fatigue Monitoring", E. L. Cranford and M. A. Gray, PVP2003-1783, ASME 2003.

"Life Cycle Management of PWR Pressurizer", K. K. Dwivedy, N. J. Shah, M. A. Gray, *Transactions, SMiRT 17*, Prague, CR, August 2003.

"Predicting Steam Generator Auxiliary Feedwater Nozzle Thermal Stratification Transients and Fatigue Effects in Complex Systems," E. L. Cranford, M. A. Gray, S. Sahgal, PVP2005-71403, ASME 2005.

"Application of Environmental Fatigue Penalty Factors and Implications for Design Analyses," M. A. Gray, E. L. Cranford, P. R. Donavin, PVP2006-ICPT11-93982, ASME 2006.

"Simulation of a PWR Residual Heat Removal System for Component Fatigue Monitoring," E. L. Cranford, M. A. Gray, *Transactions, SMiRT 19*, Toronto, Ontario, August 2007.

"Simulation of Reactor Pressure Vessel Internals Thermal Stress Due to Internal Heat Generation and Environmental Boundary Conditions Using Stress Transfer Functions," M. A. Gray, E. L. Cranford, C. B. Gilmore, S. G. Guillot, C. Y. Yang, PVP2008-61394, ASME 2008.

"Evaluation of Improved Methods for Plant Data Validation in Automated Fatigue Monitoring," E. L. Cranford, M. A. Gray, J. L. Shychuck, H. Haegeli, B. Blokker, PVP2009-77826, ASME 2009.

“Strain Rate Calculation Approach in Environmental Fatigue Evaluations,” M. A. Gray, M. C. Salac, D. H. Roarty, E. L. Cranford, PVP2010-25947, ASME 2010.

“Method for Selecting Stress States for Use in an NB-3200 Fatigue Analysis,” T. L. Meikle, E. L. Cranford, M. A. Gray, PVP2010-25891, ASME 2010.

“Simulation and Evaluation of Thermal Stratification in a Sloped Surge Nozzle Correlated with Plant Measurements,” T. L. Meikle, E. D. Johnson, M. A. Gray, N. L. Glunt, J. D. Burr, PVP2011-57700, ASME 2011.

In addition, Mr. Gray has authored or co-authored numerous Westinghouse "WCAP" reports.