



George J. Theus, Ph.D., FNACE, FASM, P.E.
Senior Consulting Engineer

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2009 – Present

Professional Analysis and Consulting, Inc.
Senior Consulting Engineer

Materials Engineering, Inc.
Senior Consulting Engineer

Metallurgical Engineering, Ltd.
President

Dr. Theus is currently president of Metallurgical Engineering Ltd. (MEL) and is associated with other engineering firms. He is a Senior Consulting Engineer with Professional Analysis and Consulting, Inc.

2006 – 2008

Dominion Engineering, Inc.
Principal Engineer

Dr. Theus was a Principal Engineer for Dominion Engineering, Inc. (DEI) in Reston, VA. He was a member of EPRI's Expert Panel on corrosion and material problems in nuclear power plants. He was responsible for all aspects of technical and project management of industrial and non-industrial projects as well as technical assistance to other engineers and managers. His work assignments included forensic investigations for industrial and commercial incidents as well as consultation and evaluation of utility power generation usually related to nuclear power plants. He interacted with personnel in the electrical utilities, the Electric Power Research Institute (EPRI), the Nuclear Regulatory Commission (NRC), the National Laboratories, as well as similar entities overseas.

1994 – 2006

Engineering Systems Inc., Aurora, IL
Vice President/Director, Materials and Applied Sciences Department,
2003-2006
Vice President, Boiler Machinery & Process Industries 2000-2002
Senior Project Consulting Engineer, 1999-2000
Director of Technology, 1995-1998
Senior Consultant, 1994-1995

Dr. Theus previously worked for Engineering Systems Inc. (ESI) of Aurora, IL. His most recent position was Vice President/Director of Materials and Applied Sciences. ESI is a professional engineering consulting firm. Dr. Theus supervised one of the company's major Profit Centers involved in projects requiring multi-discipline engineering

approaches to address issues in energy and heavy industry related products or processes. These included utility and industrial boilers, turbines, scrubbers, pressure vessels, petrochemical processes, natural gas transmission systems, alternate energy sources, safety, training, etc., as well as projects involving consumer products.

1972 – 1994

McDermott International, Inc. / Babcock & Wilcox Co.

**Aerospace Components Division, Mt. Vernon,
Indiana/Uniontown, OH**

Chief Engineer, ASRM Operations, 1989-1993

Babcock & Wilcox, Research and Development Division, Alliance, OH

Section Manager, Materials Performance Section, 1985-1989

Section Manager, Corrosion Technology Section, 1982-1985

Group Supervisor, Research and Development Division, Chemistry and Corrosion Group, 1973-1982

Kent State University

Adjunct Professor in the Engineering Technology Department, 1989-1990

Columbus Technical Institute

Instructor in the Engineering Technology School, 1971-1972

Ohio State University

Research Associate in the Metallurgical Engineering Department, 1967-1972

Ford Motor Company

Quality Assurance Specialist/Melting Floor & Line Foreman, 1964-1967

Dr. Theus worked for McDermott International Inc.'s Babcock & Wilcox (B&W) Company. For 17 years of those years Dr. Theus worked at B&W Co.'s Research and Development Division where he managed the Materials Performance and Corrosion Technology Sections. He was responsible for corporate and contract research as well as forensic engineering involving corrosion, materials characterization, water chemistry, chemical cleaning, preservation of nuclear and fossil power plant components. In addition, he was responsible for metal products for the petrochemical and chemical processing industries.

His technical expertise includes aqueous and non-aqueous corrosion, advanced electrochemical techniques, gaseous corrosion, heat treatment of metals, welding, materials testing, nondestructive testing, forging and machining development, production tubing (oil/gas) corrosion, mechanical metallurgy, fracture mechanics, metal fatigue, corrosion fatigue, and failure analysis.

While at the Research and Development Division, Dr. Theus worked for all of McDermott's/Babcock and Wilcox's manufacturing and engineering divisions. He is an internationally recognized materials expert in the nuclear power industry and was instrumental in the design and evolution of today's more reliable nuclear steam generators. In 2003, Dr. Theus was honored when he was named a Fellow by the National Association of Corrosion Engineers. In 2009, Dr. Theus was again honored to be the recipient of the ASM International Honorary Membership Award and the Alpha Sigma Mu lecturer. And in 2012, Dr. Theus was named a Fellow of ASM International.

During his last years with B&W, Dr. Theus helped establish and operate the Aerospace Components Division from concept to a world class facility for producing rocket motor casings. As Chief Engineer, he managed the development, verification and testing programs for the Advanced Solid Rocket Motor (ASRM) project for the Space Shuttle Booster Rockets as well as providing sustained engineering and Corporate Design Review responsibilities for the entire ASRM project as it relates to manufacturing and performance of the ASRM casings. He also provided technical assistance to Babcock & Wilcox, Aerojet/Lockheed, and NASA's Marshall Space Flight Center management and technical professionals regarding the ASRM project.

ACADEMIC

B.S., Metallurgy, Case Institute of Technology, 1966
M.S., Metallurgical Engineering, Ohio State University, 1972
Ph.D., Metallurgical Engineering, Ohio State University, 1972
Management & Business Administration Short Courses

CONTINUING EDUCATION

Instructor for ASM International on "Material Issues in Nuclear Power Plants"

PROFESSIONAL ENGINEER LICENSES

State of Illinois, License No. 062-052117

AFFILIATIONS and HONORS

ASM International – For Outstanding Contributions to the Nuclear Energy Industry and the fields of Corrosion, Materials Engineering, Reliability and Failure Analysis

Fellow Award (2012)

Member of Electric Power Research Institute's (EPRI) Expert Panel on Materials Problems in Nuclear Power Systems

2006-2008

International Organizing Committee on Environmental Degradation of Materials in Nuclear Power Systems - Water Reactors Symposium

General Chairman (1989)
Technical Program Chairman (1987)
Technical Program Assistant Chairman (1985)

National Association of Corrosion Engineers (NACE)

Fellow Award Committee (2004-2006)
Fellow Award (2003)
T-2A Chairman (1983-1984)

American Society of Mechanical Engineers (ASME)

American Society of Materials - International (ASM)

Alpha Sigma Mu lecturer (2009)
Fellow Award (2012)

American Society for Testing and Materials (ASTM)

American Welding Society (AWS)

PATENTS

“End Point Determination for Chemical Cleaning Process,” Canadian Patent No. 1226332, September 1, 1987.

“High Temperature Reference Electrode,” Patent No. 4,290,872, September 12, 1981.

Patents Applied for:

“Stress Corrosion Cracking Improvement Using Plasma Re-melt.”

“Base and Weld Filler Composition for Improved Mechanical Properties and Weldability of High Strength - Low Alloy Steels.”

PUBLICATIONS & PRESENTATIONS

ASM International, Course Instructor, “Materials for Nuclear Power Plants”, North Charleston, SC (February 2013).

Illinois Institute of Technology, Lecture, “Nuclear Power Reactors: Past, Current, Near Future, Far Future.” (April, 2012).

ASM International, Course Instructor, “Materials for Nuclear Power Plants”, Materials Park, OH (February 2012).

“Generation IV Nuclear Reactors”. Advanced Materials & Processes, Jan. 2010, p. 26-29.

“Current Status of Nuclear Power Generation”, 2009 Alpha Sigma Mu Lecture at the Materials Science & Technology Conference, Pittsburg, PA (October, 2009).

EPRI Report: “Materials Reliability Program: Material Production and Installation Practices for Alloy 690 Replacement Components in Pressurized Water Reactors” (MPR-245), EPRI Report No. 1016608 (December, 2008).

EPRI Report: “Material Degradation Matrix – Appendix B – Materials Information Summaries”, (January, 2008).

EPRI Report: “Material Degradation Matrix – Revision 1” EPRI Report No. 1016486, May, 2008. (Contributor and Reviewer).

“Unique Cracking Observations in Super-heater Tubes,” Proceedings of Microscopy and Microanalysis 2005, Vol. 11, Supplement 2, Cambridge University Press, Cambridge U.K., (2005).

“Boiler Failures,” Boiler & Machinery Insurance Association of Chicago (February 4, 2004).

“Residual Stress Measurements of Welded Cylinders for the Advanced Solid Rocket Motor (ASRM),” AMS/TMS Meeting, Indianapolis, IN (September 1997).

“Investigation & Solutions of Heat Exchanger Corrosion Problems in a Corn Starch Wet Milling Plant,” AMS/TMS Meeting, Cincinnati, OH (October 1996).

“Corrosion Problems in Boilers: Root Causes & Remedial Measures,” AMS/TMS Meeting, Cleveland, OH (October 1995).

“Heat Treatment Optimization Studies of ASRM Casing Steel,” presented at the 27th Joint Propulsion Conference and Exhibit, Sacramento, CA (June 1991).

“Selection of a Weld Joint Configuration for Plasma And Welding of HP-9NI-4Co-0.30C ASRM Casing Steel,” presented at the 27th Joint Propulsion Conference and Exhibit, Sacramento, CA (June 1991).

“Fracture Toughness Correlation Studies of HP-9NI-4Co-0.30C ASRM Casing Steel,” presented at the 27th Joint Propulsion Conference and Exhibit, Sacramento, CA (June 1991).

“Quantification of the Effects of Crack-Tip Constraint In Fracture Testing of Structural Steels,” 26th National Symposium on Fracture Mechanics. (1993).

“Stress Corrosion Cracking of Alloys 600 and 690 in 400°C Steam at 35kPa Partial Pressure

Hydrogen,” Corrosion/88, St. Louis, MO (March 1988).

“Materials Degradation in Water Reactors,” 1988 JAIF International Conference on Water Chemistry in Nuclear Power Plants - Operational Experience and New Technologies for Management, Tokyo, Japan (April 1988)

“Remedial Measures for Stress Corrosion Cracking of Alloy 600 Steam Generator Tubing,” Third International Symposium: Degradation of Materials in Nuclear Power Systems - Water Reactors, Traverse City, MI (September 1987).

“The Role of Sulfur in Corrosion of Nuclear Steam Generators,” Third International Symposium: Degradation of Materials in Nuclear Power Systems - Water Reactors, Traverse City, MI (September 1987).

“Predicting Caustic IGA in Nuclear Steam Generator Tubing,” Third International Symposium: Degradation of Materials in Nuclear Power Systems - Water Reactors, Traverse City, MI (September 1987).

“The Effect of Shot Peening on Transition SCC of Alloy 600 Steam Generator Tubing,” National Association of Corrosion Engineers, Corrosion 87, San Francisco, CA (March 1987).

“The Effect of Steam Generator Tube Temperature on the Stress Corrosion Cracking of Alloy 600,” Water Chemistry and Materials Performance Conference, Toronto, Canada (October 1986).

“Corrosion of Steam Generator Tubing,” Second International Topical Meeting on Nuclear Power Plant Thermal Hydraulics and Operations, Tokyo, Japan (April 1986).

“Use of Pourbaix Diagrams to Infer Local Pitting Conditions and Laboratory Evaluation of Steam Generator Tubes from the Millstone Point Unit-2 Nuclear Power Plant,” Second International Symposium: Degradation of Materials in Nuclear Power Systems - Water Reactors, Monterey, CA (September 1985).

“Stress Corrosion Cracking of Alloy A-286 Bolt Material in Simulated PWR Reactor Environments,” Second International Symposium: Degradation of Materials in Nuclear Power Systems - Water Reactors, Monterey, CA (September 1985).

“Fire-Side Corrosion in Low NO_x Combustion Systems,” 1985 Joint Symposium on Stationary Combustion NO_x Control, Boston, MA (May 1985).

“Chemical Cleaning Endpoint Determination Using Electrochemical Techniques,” National Association of Corrosion Engineers, Corrosion/85 (March 1985).

“Corrosion in Steam Generating Systems,” *Corrosion in Power Generating Equipment*, Ed. By M.O. Speidel and A. Atrens, Plenum Press, New York and London, (1984), p. 185.

“Computer-Calculated Potential - pH Diagrams to 300°C - Applications to Corrosion in Power Generating Equipment,” *Equilibrium Diagrams Localized Corrosion*, Ed. By R.P. Frankenthal and J. Kruger, Electrochemical Society, NJ (1984) p 95.

“Pipe Cracking in Pressurized Water Reactors with Low-Pressure Borated Water Systems,” Final Report for EPRI Project 1841-1, EPRI NP-3320 (December 1983).

“Failure Analysis of Primary Manway Studs Removed from Two PWR Plants,” Topical Conference on Ferritic Alloys for Use in Nuclear Energy Technologies, Snowbird, UT (June 1983). Published by the Metallurgical Society of AIME.

“Stress Corrosion Cracking of Alloy 600 and Alloy 690 in All Volatile Treated Water at Elevated Temperatures,” Final Report for EPRI Project S192-2, EPRI NP-3061 (May 1983).

“Chemistry of Corrosion Producing Salts in LWR Systems,” Final Report for EPRI Research Project 1167-2 (February 1983).

“OTSG Tube Failures: Upper Tubesheet Corrosion Tests,” Final Report for EPRI Research Project S165-1, EPRI NP-1790 (December 1982).

“Stress Corrosion Cracking Test of Monel 400 Steam Generator Tubing,” NACE Corrosion/82, Houston, TX, (March 1982).

“Chemistry of Corrosion Producing Salts in Light Water Reactors,” Final Report for EPRI Research Project 967-1, EPRI NP-2298 (March 1982).

“Stress Corrosion Cracking Tests of Alloy 600,” EPRI's Workshop on U-Bend Tube Cracking in Steam Generators. EPRI WS-80-136 Proceedings (June 1981).

“Materials Model Boiler Tests for the Babcock & Wilcox Once Through Steam Generators,” Presented at American Nuclear Society International Conference on Materials Performance in Nuclear Steam Generators, St. Petersburg, FL, October 1980. *Nuclear Technology*, Volume 55 (1981), p. 422.

“Electrochemical Behavior of Iron in Fused Salts,” Symposium on Progress in Electrochemical Testing, San Francisco, CA, (May 1979). Sponsored by the Electrochemical Society.

“Stress Corrosion Cracking Tests on Stabilized Alloy 800,” NACE Corrosion/79, Atlanta, GA, (March 1979).

“Constant Strain Rate Technique: Applications to Caustic Stress Corrosion Cracking Studies,” presented to ASTM Symposium, Toronto, Canada, May 2-3, 1977. Published in *Stress Corrosion Cracking - The Slow Strain Rate Technique*, ASTM Special Technical Publication 665, Philadelphia, PA (January 1979), p. 81.

“Review of Stress Corrosion Cracking and Hydrogen Embrittlement in Austenitic Fe-Cr-Ni Alloys,” Symposium Volume: International Conference on Stress Corrosion Cracking and Hydrogen Embrittlement of Iron-Base Alloys, Firminy, France (1978).

“Relationship Between Intergranular Corrosion and Caustic Stress Corrosion Cracking of Alloy 600,” NACE Corrosion/76, Houston, TX (March 1976). *Corrosion* 33 (1977), p. 20.

“Effect of Microstructure on Stress Corrosion Cracking of Alloy 600 in High Purity Water,”

presented at NACE Corrosion/76, Houston, Texas, March 1976. *Corrosion* 33 (1977), p. 26.

“Caustic Stress Corrosion Cracking of Inconel 600, Incoloy 800 and Type 304 Stainless Steel,” presented at American Nuclear Society International Conference on Materials for Nuclear Steam Generators, Gatlinburg, Tennessee, September 1975, and *Nuclear Technology*, Volume 28 (1976), p. 388.

“Fluoride-Induced Intergranular Stress Corrosion Cracking of Sensitized Stainless Steel,” *Corrosion Problems in Energy Conversion and Generation*, The Electrochemical Society, Princeton, NJ (1974).

“Electrochemical Studies of Metals in Fused Sodium Hydroxide,” Ph.D. Thesis, Ohio State University (1972).