

ASME PEER REVIEW PANEL MEMBERS
CARBON SEQUESTRATION PEER REVIEW
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John R. Benemann, Ph. D

Dr. Benemann is currently a consultant with Benneman Associates. He has worked in the area of biofuels, greenhouse gas abatement, and environmental biotechnologies for more than 30 years. Over the past decade, he has attended numerous international conferences and presented well over one hundred invited lectures on biofuels, biotechnology, greenhouse gas abatement, biogas production, biohydrogen, microalgae fuels production, and related topics. Dr. Benemann was instrumental in initiating several major research and development (R&D) programs in greenhouse gas abatement including the Coal-Biomass Co-Firing Program carried out by EPRI in the 1990s and, through the not-for-profit Institute of Environmental Management, which he founded, the Yolo County "Controlled Bioreactor Landfill" Project (1990 – present). And for the past five years, he has managed the International Network on Biofixation of CO₂ and Greenhouse Gas Abatement with Microalgae, which operates within the International Energy Agency Greenhouse Gas R&D Programme (Cheltenham, England). Dr. Benemann has pioneered the field of biological hydrogen (H₂) production and is an expert in the area of biofuels, from the fundamentals of photosynthetic efficiency, to production and utilization of biofuels using microalgae and other plants. Dr. Benemann earned a Bachelor's Degree in Chemistry and a doctorate in Biochemistry from the University of California, Berkeley.

Garry D. Brewer, Ph.D

Dr. Brewer is currently the Frederick K. Weyerhaeuser Professor of Resource Policy and Management for the Schools of Management and Forestry and Environmental Studies at Yale University. He returned to this chair in July 2001 after a ten-year hiatus. During those 10 years, Dr. Brewer had a series of other responsibilities including appointments as Professor of Environmental Policy and Management in Berkeley's Energy and Resources Group (ERG); Dean of the University of California's Extension; the King Carl XVI Gustaf Professor of Environmental Sciences at the Royal Institute of Technology in Stockholm (at the invitation and appointment of His Majesty, King Carl XVI Gustaf of Sweden); Professor of Business Administration in the University of Michigan Business School; and Professor of Resource Policy and Management in Michigan's School of Natural Resources and Environment. He is the author, coauthor, or editor of ten books and over 195 professional publications on a wide range of topics including contributions on organizational complexity and behavior, computer applications to social and national security problems, political and economic development, forecasting and strategic planning, and environmental management and resource matters. Dr. Brewer earned a Bachelor's degree in Mathematical Economics from the University of California, Berkeley, a Master of Science in Public Administration (development) at San Diego State University, and his Master of Philosophy and doctorate (with distinction) from Yale University.

John F. Clarke, Sc.D

Dr. Clarke is currently serving as Deputy Director of the Office of National Laboratories in the Science and Technology Directorate of the Department of Homeland Security (DHS) under an Intergovernmental Personnel Agreement. Before his DHS assignment, he was responsible for the macro-economic characterization and analysis of energy and environmental technologies within Joint Global Change Research Institute integrated assessment models and the Global Technology Strategy Project. In the latter capacity, Dr. Clarke managed the nuclear, bio-technology, and fusion energy strategic technology analysis projects. The focus of his research work is in the application of conditional choice theory to the market competition of energy technologies in macro-economic models. At the US Department of Energy (DOE), Dr. Clarke served as Executive Director of DOE Climate Activities and was DOE representative to the Intergovernmental Panel on Climate Change (IPCC). Prior to his government service, Dr. Clarke was the Director of the Fusion Energy Division at Oak Ridge National Laboratory. He received a Bachelor's Degree in physics and philosophy at Fordham University, and earned a Master of Science degree in plasma physics and a Doctor of Science degree in nuclear engineering at the Massachusetts Institute of Technology.

Robert M. Enick, Ph.D

Dr. Enick is currently Chairman and Bayer Professor of the Chemical and Petroleum Engineering Department of the University of Pittsburgh. He has been with the university since 1985 and is one of the 24 faculty fellows from the University of Pittsburgh, Carnegie Mellon University, and West Virginia University involved in the Department of Energy, National Energy Technology Laboratory (NETL), Oak Ridge Associated Universities Faculty Participation Program. Dr. Enick's recent project work under this program has included "Separation of Hydrogen (H₂) from Water-Gas Shift Gases using Palladium and Copper (PdCu) Membranes," "Investigation of Carbon Dioxide (CO₂)-Selective Polymeric Membranes," and "CO₂ and H₂ Membranes." In 2007, he was recognized as a National Energy Technology Laboratory (NETL) Institute for Advanced Energy Solutions (IAES) Faculty Fellow. Dr. Enick's areas of specialization are high-pressure phase behavior, supercritical fluid technology, CO₂-soluble compounds, and mathematical modeling of flow in porous media. His recent consulting projects included investigating high-pressure viscosity measurements of CO₂-soluble compounds. Dr. Enick is the author of a recently published book and many refereed journal papers. He earned a Bachelor's Degree in Chemical Engineering with Petroleum Option, Master's Degrees in both Petroleum Engineering and Chemical Engineering, and his doctorate in Chemical Engineering from the University of Pittsburgh.

John R. Kitchin, Ph.D

Dr. Kitchen currently holds the positions both of Assistant Professor, Department of Chemical Engineering and Courtesy Assistant Professor, Department of Materials Science and Engineering at Carnegie Mellon University (CMU) in Pittsburgh, Pennsylvania. Prior to this he was an Alexander von Humboldt Postdoctoral Research Fellow at the Fritz Haber Institut in Berlin, Germany. Dr. Kitchen's main areas for research include discovering new electrocatalytic materials for proton exchange membrane (PEM) hydrogen fuel cell cathodes and methanol reduction anodes; preparing and characterizing alloy electrocatalysts for use in fuel cell electrocatalyst applications; and achieving *ab initio*, multiscale modeling of alloy surfaces. He has co-authored numerous publications related to his research including two recent papers, one entitled "*Trends in the chemical properties of early transition metal carbide surfaces: A density functional study*" and the other entitled "*Trends in the exchange current for hydrogen evolution.*" Dr. Kitchen earned a Bachelor of Science degree in Chemistry (summa cum laude) at North Carolina State University and then went on to gain his Master of Science degree in Materials Science and Engineering and his doctorate in Chemical Engineering from the University of Delaware.

Charles A. Miller, Ph.D, P.E.

Dr. Miller is a senior project engineer with the US Environmental Protection Agency (EPA), National Risk Management Research Laboratory (NRMRL) in Research Triangle Park, North Carolina. In over 16 years at NRMRL, his key technical activities have included Characterization of Particulate Matter from Combustion Sources, which involves evaluating particle size distributions and size-specific trace element concentrations in particulate from the combustion of fuel oil, pulverized coal, and diesel exhaust; Assessment of Science Needs for Accountability-Based Air Quality Management, where he was the lead author of the Emissions chapter of the NARSTO Assessment – NARSTO is a public/private partnership dedicated to improving air quality in North America; and Assessment of Air Emissions Inventories, where he was the lead author of the Recommendations chapter for NARSTO Emission Inventory Assessment. Dr. Miller is currently the NRMRL representative for EPA Office of Research and Development (ORD) Laboratory Research Plan Development, a member of the National Exposure Research Laboratory (NERL) Air Research Implementation Steering Committee, and on the scientific and technical advisory and review committees for New York State Energy Research and Development Authority and the California Air Resources Board. Among many awards and honors, he was awarded the EPA Gold Medal for Exceptional Service for his role on the International NO_x Control Reburn Team in 2001. Dr. Miller earned both his Bachelor of Science and Master of Science degrees in Mechanical Engineering from the University of Arizona, and his doctorate in Mechanical Engineering from North Carolina State University. He is also a registered Professional Engineer in North Carolina.

Bruce Reynolds, MSChE

Mr. Reynolds is currently Department Manager, Fossil Energy Technology for Idaho National Laboratory (INL). The Fossil Energy Technology Department has responsibility for all aspects of oil and natural gas exploration and production, crude refining and utilization technologies, development of compressed natural gas fueling stations, natural gas liquefaction technologies, alternate fueled vehicles, synthetic liquid fuel production, coal, hydrogen, carbon dioxide sequestration, and methane hydrates. Mr. Reynolds has management responsibility for INL's participation in the Big Sky Regional CO₂ Sequestration project. He is a technical advisor to the Center for Advanced Engineering Studies and the Center for Space Nuclear Fuel at INL, and on the board of directors for The Energy Systems Technology and Education Center (ESTEC) at Idaho State University. Prior to joining INL, Mr. Reynolds was a Program Manager for six years with Battelle Pacific Northwest National Laboratory (PNNL). At PNNL, he was point of contact for the "Refinery of the Future" Initiative in the Strategic Alliance with the Mexican Petroleum Institute (IMP) and the National Autonomous University of Mexico (UNAM). Mr. Reynolds received a Bachelor of Science degree in Chemical Engineering with Honors from the University of Nebraska and earned a Master of Science in Chemical Engineering from Massachusetts Institute of Technology.

David C. Thomas, Ph.D

Dr. Thomas is currently a Senior Technical Advisor with Advanced Resources International providing consulting services to industry and government on CO₂ mitigation technology and policy related issues. He is also a consultant to the CO₂ Capture Project (CCP), a multi-national, multi-company CO₂ mitigation research program, where he has organized and managed the CCP's communications with the US Department of Energy (DOE) and is the Chief Editor of CCP's technology results volumes published in January 2005 by Elsevier Science. Prior to this, Dr. Thomas worked for BP Amoco Corporation for 24 years including as Manager, CO₂ Mitigation Technology, Green Operations. In this position, he led an international team responsible for a CO₂ mitigation program worldwide, led development of a group-wide technology strategy for Green Operations technology and implementation through a balanced program of technology sharing through step-change technologies, and had oversight and budgetary responsibility for CO₂ mitigation technology including the CO₂ Capture Project – a major joint industry project bringing together nine international energy companies and three governments to address greenhouse gas reduction. Dr. Thomas received a Bachelor of Science degree in Chemistry from Baker University and earned a Master of Science in Inorganic Chemistry from The University of Akron. He also earned a doctorate in Physical Chemistry from The University of Oklahoma.

Raymond L. Zahradnik, Ph.D

Dr. Zahradnik is a consultant and partner in Appalachian-Pacific LLC. Prior to working as a private consultant, he worked for Occidental Petroleum Corporation for 14 years first as Director of Energy Research, then as President of Occidental Oil Shale, Inc. In the latter capacity, Dr. Zahradnik oversaw all of Occidental's oil shale activities including a large field-test facility and a commercial venture involving a leasehold property from the US Department of the Interior (DOI). He also worked for various branches of the Federal Government including the National Science Foundation and DOI mostly involved in energy subjects. And Dr. Zahradnik was acting head of the Office of Coal Research and Director of the Coal Conversion and Utilization Department at the Energy Research and Development Administration (ERDA). Previous to this, he was Professor of Chemical Engineering at Carnegie-Mellon University for 6 years. Dr. Zahradnik earned his Bachelor of Science degree in Chemical Engineering, Master of Science in Chemical Engineering, and doctorate in the same field from Carnegie-Mellon University.