



Minerals, Critical Minerals, and the U.S. Economy

Committee on Critical Mineral Impacts of the U.S. Economy, Committee on Earth Resources, National Research Council

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*Biographical Sketches
of Committee
Members and Staff*

COMMITTEE MEMBERS

RODERICK G. EGGERT (*Chair*) is professor and director of the Division of Economics and Business at the Colorado School of Mines, where he has taught since 1986. He was editor of *Resources Policy*, an international journal of mineral economics and policy, from 1989 to 2006. Previously he taught at The Pennsylvania State University and held research appointments at Resources for the Future (Washington, D.C.) and the International Institute for Applied Systems Analysis (Austria). He has a B.A. in earth sciences from Dartmouth College, an M.S. in geochemistry and mineralogy from Pennsylvania State University, and a Ph.D. in mineral economics from Penn State. His research and teaching have focused on various aspects of mineral economics and public policy, including the economics of mineral exploration, mineral demand, mining and the environment, microeconomics of mineral markets, and most recently mining and sustainable development. He served for two terms on the Committee on Earth Resources of the National Research Council.

ANNS. CARPENTER was hired as president and chief operating officer for U.S. Gold Corporation in October 2005. From 2003 until 2005, Ms. Carpenter was an independent consultant in the mining industry, focusing

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on resource assessment, evaluations, and project development for properties in the United States, Mexico, and South America. From November 1997 to 2003, she was the vice president of exploration and business development for NCGI, a private mining company. With more than 26 years of experience in mineral development activities worldwide, her work focuses on resource calculations; engineering evaluations and studies; permitting requirements; and regulatory, legislative, and policy evaluations regarding mineral development here in the United States and overseas. She is president of the Northwest Mining Association; past president and current adviser of the Women's Mining Coalition; and foundation chairman and past officer of the Geological Society of Nevada. Ann is also an active member of the Society for Mining, Metallurgy, and Exploration (SME), Mining and Metallurgical Society of America (MMSA), and Prospectors and Developers Association of Canada (PDAC). She has testified before the U.S. Congress on matters regarding domestic mineral resource potential and development, permitting, mineral policy, and sustainable development. She earned her B.S. in geology from Montana State University in 1980, and completed advanced geologic studies at Mackay School of Mines in Reno, Nevada, from 1981 to 1983.

STEPHEN W. FREIMAN left the National Institute of Standards and Technology (NIST) in 2006 to start a consulting business (Freiman Consulting Inc.). He had been at NIST since 1978 (at that time called the National Bureau of Standards) where he worked primarily on the fracture of brittle materials. From 1992 to 2002, Dr. Freiman served as Chief of the Ceramics Division at NIST, and from 2002 to 2006 he served as deputy director of the Materials Science and Engineering Laboratory (MSEL). Dr. Freiman has published more than 150 papers focusing on the mechanical properties of brittle materials. He was the first chairman of the ASTM Subcommittee addressing brittle fracture and a past chair of the Versailles Project on Advanced Materials and Standards (VAMAS) steering committee. He is a fellow and a past president of the American Ceramic Society. Dr. Freiman graduated from the Georgia Institute of Technology with a

B.ChE. and an M.S. in metallurgy. After receiving a Ph.D. in materials science and engineering from the University of Florida in 1968, he worked at the IIT Research Institute and the Naval Research Laboratory.

THOMAS E. GRAEDEL (NAE) has been a professor of industrial ecology, chemical engineering, and geophysics at Yale University since 1997. From 1969 to 1984, Dr. Graedel was a member of the technical staff, and from 1984 to 1996, a distinguished member of the technical staff at AT&T Bell Laboratories. Dr. Graedel's research interests have included solar physics; chemical kinetic modeling of gases and droplets in Earth's atmosphere; corrosion of materials by atmospheric species; atmospheric change; and industrial ecology and sustainability science. He and his colleagues have assessed regional and global cycles for metals including copper, chromium, zinc, lead, and silver, determining the stocks available in different types of reservoirs and the related flows. Ongoing work treats a number of other metals, including iron, nickel, stainless steel, and tungsten. He is the author or coauthor of 13 books and more than 300 technical papers in various scientific journals. Dr. Graedel received his B.S. (chemical engineering) from Washington State University in 1960, his M.A. (physics) from Kent State University in 1964, and his M.S. and Ph.D. (astronomy) from the University of Michigan in 1967 and 1969, respectively.

TERENCE P. MCNULTY (NAE) has been president of T.P. McNulty and Associates, Inc., since 1989. His company's work for a global client base includes process engineering in base and precious metals, uranium, nonmetallic minerals, and industrial chemicals; direction of research programs; management consulting and strategic planning; project management; plant audits; and assistance in commercializing new technologies. From 1983 to 1988, he served as president and chief executive officer of Hazen Research, Inc., and from 1980 to 1983 he was vice president of technical operations for Kerr-McGee Chemical Corp. From 1960 to 1980 he was employed by the Anaconda Company. Dr. McNulty has two patents in copper metallurgy and 40 publications in the fields of (1) minerals pro-

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cessing and the extractive metallurgy of iron, copper, uranium, and precious metals; (2) process control; (3) energy conservation; (4) mineral industry trends; (5) waste treatment; (6) project management; and (7) technology development. He received his B.S. in chemical engineering in 1960 from Stanford University, his M.S. in metallurgical engineering in 1963 from the Montana School of Mines, and his D.Sc. in extractive metallurgy in 1966 from the Colorado School of Mines.

DREW A. MEYER is the former vice president, Marketing & Transportation Services, Vulcan Materials Company, from which he retired in March 2007. At Vulcan, he was responsible for the Marketing, Market Research, Marketing Support Services, Transportation Sales, and Support Services Departments, and he led economic forecasting and analysis for the Construction Materials Group. Mr. Meyer has spent more than 38 years with Vulcan Materials Company during which time he has worked at the corporate, group, and division levels both domestically and overseas. Mr. Meyer has been an active participant in serving the construction aggregates industry through its associations and was elected to honorary life membership in the National Stone, Sand & Gravel Association (NSSGA) in January 2004. Prior to its merger with NSSGA, he served in a number of leadership positions in the National Aggregates Association including treasurer and vice chairman. In 2003, *Aggregate Manager Magazine* selected Drew as the AGGMAN Professional of the Year for 2002. He is a past chairman of SME's Construction Materials and Aggregates Committee, a recipient of the President's Citation for Outstanding Leadership and Service to SME in 2003, a member of the SME Board of Directors, and vice president of the SME Foundation. In addition to SME, Mr. Meyer is a member of the American Marketing Association and the National Association of Business Economists; he is on the Board of Directors of the Minerals Information Institute. He has authored and coauthored articles and made numerous presentations on subjects related to the stone industry and to the extraction, processing, and consumption of magnetic metals from municipal solid waste. He is a graduate of The Pennsylvania State University with B.S. and M.S. degrees in mineral economics.

BRIJ M. MOUDGIL (NAE) is a distinguished professor and alumni professor of materials science and engineering, and director of the Particle Engineering Research Center at the University of Florida (UF), Gainesville. Dr. Moudgil also serves as the director of the UF Mineral Resources Research Center. Prior to joining the University of Florida faculty in 1981, Dr. Moudgil was associated with the Occidental Research Corporation in California as a research engineer. He was a visiting research fellow at E.I. DuPont de Nemours & Co. in Wilmington, Delaware, in 1988-1989. His current research interests include nanoparticulate processing and separation technology for enhanced performance in mineral, chemical, microelectronics, pharmaceuticals, advanced materials, and resource recovery and waste disposal applications. Dr. Moudgil is a member of several professional societies (AIChE, SME, ACS, ACerS, MRS, TAPPI). He is currently serving as president of the SME. He has published more than 200 technical papers, has been awarded 14 patents, and has edited 9 books. He received his undergraduate training in metallurgy at the Indian Institute of Science, Bangalore. He continued his graduate studies at Columbia University, New York, and received M.S. and Eng.Sc.D. degrees in mineral engineering-interfacial phenomena applied to particulate processing.

MARY M. POULTON is professor and department head at the Department of Mining and Geological Engineering, University of Arizona, where she has been a faculty member since 1990. Her research interests include neural networks, geosensing and geophysics, mineral exploration and production, resource characterization, and water and energy resources exploration. She has published numerous papers in refereed journals and books, and has edited a book on geophysical data processing. In addition to her service at the university, Dr. Poulton has worked in consulting capacity for Neural Optimization Applied Hydrology, LLC, in the area of water and energy optimization, environmental impacts, and water security. She received her B.S. (1984), M.S. (1987), and Ph.D. (1989) in geological engineering from the University of Arizona.

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LEONARD J. SURGES has been director general, Industry Analysis and Business Development, at Natural Resources Canada since 2005 where he is responsible for a policy branch within the Minerals and Metals Sector, including commodity and market analysis for metals and nonmetallic minerals, and international cooperation, trade, and investment relations. From 2002 to 2005, he was director of sustainable development and product policy at Noranda Inc./Falconbridge Limited; he was employed from 1992 to 2002 with Noranda Inc. with responsibility for environmental policy and management. An assignment from 1990 to 1992 with Environment Canada as a mining and smelting senior engineer was preceded by 11 years with Brunswick Mining and Smelting Corporation Limited. Membership in professional societies includes the Association of Professional Engineers of New Brunswick; the Canadian Institute of Mining, Metallurgy and Petroleum, and The Minerals, Metals and Materials Society. His professional career has overlapped with military service in the Canadian Forces where he most recently served with the Royal New Brunswick Regiment (North Shore) and held appointments as company commander and deputy commanding officer with the rank of major. He received his bachelor of applied science (B.A.Sc.) degree in metallurgical engineering from the University of British Columbia in 1979.

NRC STAFF

ELIZABETH A. EIDE, senior program officer, is a geologist with specialization in isotope geochronology applied to crustal processes, including oil and gas exploration. Prior to joining the National Research Council, she worked for 12 years at the Geological Survey of Norway where she constructed and managed an $^{40}\text{Ar}/^{39}\text{Ar}$ geochronology laboratory and managed personnel, budget, and research matters as team leader-researcher for two departments. She received her Ph.D. in geology from Stanford University and a B.A. in geology from Franklin and Marshall College.

NICHOLAS D. ROGERS is a research associate with the Board on Earth Sciences and Resources, National Research Council. He received a

B.A. in history, with a focus on the history of science and early American history, from Western Connecticut State University in 2004. He began working for the National Academies in 2006 and has primarily supported the Board on Earth Sciences and Resources on earth resource issues.

