

THE NATIONAL ACADEMIES

Advisers to the Nation on Science, Engineering, and Medicine

SCIENTIFIC AND TECHNICAL INPUT FOR THE REVISION OF THE WORLD BANK GROUP'S POLLUTION PREVENTION AND ABATEMENT HANDBOOK

Biographical Information

David Allen is the Melvin H. Gertz Regents Chair in Chemical Engineering and the Director of the Center for Energy and Environmental Resources at the University of Texas at Austin. His research interests lie in air quality and pollution prevention. He is the author of four books and over 150 papers in these areas. The quality of his research has been recognized by the National Science Foundation (through the Presidential Young Investigator Award), the AT&T Foundation (through an Industrial Ecology Fellowship), the American Institute of Chemical Engineers (through the Cecil Award for contributions to environmental engineering), and the State of Texas (through the Governor's Environmental Excellence Award). In addition, Dr. Allen is actively involved in developing Green Engineering educational materials for the chemical engineering curriculum. His most recent effort is a textbook on design of chemical processes and products, jointly developed with the U.S. EPA. Dr. Allen received his B.S. degree in Chemical Engineering, with distinction, from Cornell University in 1979. His M.S. and Ph.D. degrees in Chemical Engineering were awarded by the California Institute of Technology in 1981 and 1983. He has held faculty appointments at UCLA and the California Institute of Technology; he joined the University of Texas in 1995.

Richard Bissell joined the National Academies in June 1998 as Executive Director of the Policy Division, now the Policy and Global Affairs Division, and concurrently as Director of the Committee on Science, Engineering, and Public Policy (COSEPUP). Rich most recently headed the organizing secretariat of the World Commission on Dams, a joint initiative of the World Bank and the World Conservation Union. During 1994-1997, he was a founding member and chair of the Inspection Panel, an independent accountability mechanism established by the Executive Directors of the World Bank to ensure compliance with Bank policies by its management. During the years between 1986-1993, he was Assistant Administrator at the US Agency for International Development, first as head of the Bureau of Policy and Program Coordination, and later head of the Bureau of Research and Development. His B.A. is from Stanford, and his Ph.D. from the Fletcher School of Law and Diplomacy at Tufts University.

Colin Boocock, a French citizen, is a project manager with Knight Piésold and Co. Mr. Boocock has over 22 years of experience in the mining industry including geologic evaluations and managing multi-disciplinary environmental projects. He has worked on projects in Australo-Pacific Region, Europe, Russian Federation and Africa, with extensive experience of Francophone Africa. Mr. Boocock recent environmental work includes updates to the ESIs of Sadiola Hill and Yatela Gold Mines in Mali, and the ESIs for a cobalt mine in Cameroon and a gold mine in Chukotka (both in progress). He has also been actively involved in several mining-related projects funded by the World Bank or seeking World Bank/IFC funding or using IFC policies and guidelines as the template for the environmental and social program documentation. He was the environmental expert on the World Bank financed IMC Mackay and Schnellmann team that prepared the recently revised mining laws in Cameroon. He has prepared or supervised

the preparation of Environmental and Social Impact Assessments and Action Plans, as well as supporting component plans to the ESAP including Public Consultation and Disclosure Plans, Mine Closure and Reclamation Plans, Emergency Response and Contingency Plans, Waste Management Plans, and Community and Indigenous Peoples Development Plans. He has participated in numerous environmental evaluations including audits, impact assessments and data evaluations, and in establishing legal frameworks for environmental management in the mining industry. In addition, he has prepared environmental permitting documents to international lending institution standards and that have been passed by government regulatory authorities. He holds a B.S. in Geology and a M.S. in Geology and Environmental Management.

Tamara L. Dickinson is a senior program officer with the National Research Council's Board on Earth Sciences and Resources, responsible for managing the earth resources activities of the Board. She was awarded the National Academies 2002 Distinguished Service Award. She has served as program director for the Petrology and Geochemistry Program in the Division of Earth Sciences at the National Science Foundation. She has also served as discipline scientist for the Planetary Materials and Geochemistry Program at National Aeronautics and Space Administration (NASA) Headquarters. As a postdoctoral fellow at the NASA Johnson Space Center, she conducted experiments on the origin and evolution of lunar rocks and highly reduced igneous meteorites. She holds a Ph.D. and an M.S. in geology from the University of New Mexico and a B.A. in geology from the University of Northern Iowa.

Glenn Eurick is a manager at Environmental Issues Group, LLC. He has 27 years of experience with hard-rock mining management systems, issues management, advocacy & policy through legal, legislative, regulatory, educational, and community activities. He has combined experience in mine-site environmental & occupational health program development and management; environmental legislation and regulation development; community and governmental relations dialogue; operations environmental and occupational health program management; and environmental negotiations, issues analysis, legal and scientific interface, permit negotiations. From 1977 to 2002, Mr. Eurick has held various positions including an Environmental Engineer in power plant regulatory for Minnesota Power and Light Company; an Operations Environmental and Health Engineer for Anaconda Minerals; an Environmental and Occupational Health Coordinator for Barrick Resources (USA); an Environmental Affairs Coordinator for American Barrick Resources Corporation; and a Director of Environmental Relations for Barrick Gold Corporations. Mr. Eurick is affiliated with many mining associations. He is the recipient of the 1994 Environmental Engineering Alumni Recognition Award in Recognition of Professional Accomplishment and Support of the College from Montana College of Mineral Science and Technology. Mr. Eurick was awarded the 1997 Calvin K. Sudweeks Award for Outstanding Contributions in the Field of Water Quality in the State of Utah from Utah Division of Water Quality. He holds a B.S. in Environmental Engineering from Montana College of Mineral Science and Technology.

Arthur Fitzgerald is Chief Environmental Advisor at Export Development Canada (EDC—Canada's export credit agency). Mr. Fitzgerald is responsible for overseeing the application of EDC's Environmental Review Directive and other environmental review processes to projects that EDC may support. As well, he has recently assumed management of EDC's EnviroExports Programme that supports the export of Canada's environmental goods and services. Before joining EDC, he was one of two authors of the industry sector guidelines—Part III of the World Bank's Pollution Prevention and Abatement Handbook (PPAH) and provided other environmental consulting services to the International Finance Corporation/World Bank. As well, he has provided consulting services to PricewaterhouseCoopers as a policy and guidelines specialist in the development of China's new Cleaner Production Promotion Law. Mr.

FitzGerald's prior experience includes consulting to the United Nations Environment Programme, Assistant Vice President, Environmental Affairs at Nortel, and 16 years in environmental consulting. Mr. FitzGerald holds a B.Sc. in Chemical Engineering. He was a recipient of the U.S. Environmental Protection Agency's Stratospheric Ozone Protection Award and the United Nations Environment Programme's Citation of Excellence.

Joanne Fox-Przeworski is the Director of the new Center for Environmental Policy at Bard College in New York. At the Center, she is developing programs that seek to improve the quality of environmental policies by facilitating the use of the best available scientific knowledge in public and private decision-making. Dr. Fox-Przeworski is the former Director for North America of the United Nations Environment Programme. Prior to this position, she served twelve years at the Organisation for Economic Co-operation and Development in Paris as Advisor to the Deputy Secretary General and Co-ordinator for Sustainable Development. Previously she headed the newly created Environment Section of the OECD Development Assistance Committee (OECD members giving bilateral aid). From 1991-92 she also served as Special Assistant to the OECD Cabinet on the first joint meeting of Environment and Development Cooperation Ministers in preparation for the Earth Summit in Rio. She has conducted research on sustainable development, bilateral aid to developing countries, urban economic development, and urban policies relating to technological and sociodemographic change. In addition to publications and public presentations in the above areas, Dr. Fox-Przeworski has written articles and a book on the copper industry in Chile and a report on the status of human rights in Chile that appeared in the New York Review of Books. She also taught at colleges in Paris and St. Louis, Missouri. Dr. Fox-Przeworski was awarded an honorary doctorate in laws from Ripon College and received a doctorate from Washington University in St. Louis, a masters degree from Harvard University, and a bachelors degree with honors from Northwestern University.

Robert (Bob) Frosch is a theoretical physicist by education (AB, Columbia College '47 and Ph.D., Columbia University, '52). He conducted research in ocean acoustics at Columbia and later served as Director for Nuclear Test Detection, and Deputy Director of the Advanced Research Projects Agency (ARPA) in the Department of Defense, Assistant Secretary of the Navy for Research and Development (ASNR&D), Assistant Executive Director of the United Nations Environment Program, Associate Director for Applied Oceanography of the Woods Hole Oceanographic Institution (WHOI), Administrator of NASA, President of the American Association of Engineering Societies (AAES), and Vice President of General Motors Corporation (GM) in charge of Research Laboratories. Dr. Frosch retired from GM in 1993 before joining the Kennedy School of Government at Harvard University. He is a member of the National Academy of Engineering, the American Academy of Arts and Sciences, and a Foreign Member of the UK Royal Academy of Engineering.

R. Larry Grayson is the Union Pacific/Rocky Mountain Energy Professor of Mining Engineering and Chair of the Department of Mining and Nuclear Engineering, School of Materials, Energy and Earth Resources at the University of Missouri-Rolla. He is also the Director of the Western U.S. Mining Safety and Health Training and Translation Center. He was formerly Dean of the College of Mineral and Energy Resources at West Virginia University and Chair of the West Virginia State Mine Inspectors' Examining Board (1991-1995). As the Bureau of Mines health and safety research functions were merged, he served as the first permanent Associate Director for the Office for Mine Safety and Health Research of the National Institute for Occupational Safety and Health, Centers for Disease Control (1997-2000). His research interests lie in mining health and safety, coal mining and coal bed methane, material flows accounting and analysis, sustainability, and other issues related to mine management and

operations. His industry background is in coal mining in Pennsylvania, where he began his career as a mine laborer and surveyor, working his way through various engineering and operations positions, including mine superintendent. He is a registered Professional Engineer in Missouri and Pennsylvania, and a certified mine examiner and mine foreman in Pennsylvania. Dr. Grayson has served on the Board of Directors (1999-2002) of the Society for Mining, Metallurgy, and Exploration (SME), is a member of the International Society of Mine Safety Professionals, and was chair of numerous committees and programs for SME. He chaired the recent NRC Committee on Material Flows Accounting of Natural Resources, Products, and Residuals. He holds a bachelors, masters, and doctoral degrees in Engineering of Mines from West Virginia University.

Murray Hitzman is the Charles Franklin Fogarty Professor of Economic Geology and Head of the Department of Geology and Geological Engineering at the Colorado School of Mines. Dr. Hitzman worked initially as a geophysicist for Phillips Petroleum Company. He began work in the mining industry with Anaconda in 1976 at the Yerington porphyry copper mine in Nevada and subsequently worked for Anaconda in Alaska from 1977 through 1982. From 1982 through 1993, Dr. Hitzman worked throughout the world for Chevron Resources Company. He initiated and managed base and precious metal exploration projects in Papua New Guinea, Brazil, Spain, Ireland, France, Germany, Italy, Tanzania, Canada, and the United States. In 1990 through 1993, Dr. Hitzman was manager of the Lisheen project guiding it through exploration and pre-feasibility, including engineering and environmental studies. In 1993, Dr. Hitzman was named Geological Society of America Congressional Fellow and served from September 1993 to August 1994 on the staff of U.S. Senator Joseph Lieberman (D-CT) working on natural resource and environmental issues. In 1994 Dr. Hitzman was named Executive Branch Fellow by the AAAS/Sloan Foundation in which he served as senior policy analyst in the White House Office of Science and Technology Policy until March 1996, specializing in natural resource, environmental, and geoscience issues. His current research interests include carbonate-hosted Zn-Pb deposits, the Zambian Copperbelt, iron oxide Cu-Au-U deposits, zinc oxide and silicate deposits, and the role of microbes in ore formation. He has authored over fifty technical and popular articles on ore deposits, mineral exploration, and geoscience policy. He was awarded the Society of Economic Geologists Silver Medal in 1999. Dr. Hitzman is a Director of Mansfield Minerals Ltd. (Vancouver). He received BA degrees in earth science and anthropology from Dartmouth College in 1976, an MS in geology from the University of Washington, Seattle in 1978, and a PhD from Stanford University in 1983.

Laura Holliday, is a senior program associate with the National Academies' Science and Technology for Sustainability (STS) Program. In this role, she has been active in the development and implementation of the STS program's portfolio of activities, including the Roundtable on Science and Technology for Sustainability and the Partnership "Strengthening Science-Based Decision-Making in Developing Countries." Previous Academies' projects she has been involved with include the Committee on Toxicological Effects of Methylmercury; the Standing Committee Agricultural Biotechnology, Health, and the Environment; and the Committee on Biological Threats to Agricultural Plants and Animals. Prior to her experience at the National Academies, Laura researched and translated German environmental regulations and technical documents for Argonne National Laboratory and worked as an intern the Salzburg Seminar in Austria. Laura graduated Magna Cum Laude and Phi Beta Kappa from Middlebury College with a B.A. in International Politics and French. She was a Max Kade Fellow at the Institute for Contemporary Germanic Studies at Indiana University and has an M.S. in Environmental Sciences and Policy from Johns Hopkins University. She speaks fluent German, French, and conversational Mandarin Chinese.

Alex Indorf is a Program Coordinator in the Environmental and Social Development Department at the International Finance Corporation (IFC). Prior to his appointment at IFC in June 2004, he was an environmental consultant for 15 years dedicated to the assessment of environmental liabilities for multinational corporations in the United States, Latin America, and Europe. In his consulting role, he acted as liaison between corporations, local experts, and government agencies in the implementation of pollution prevention and control requirements. His international experience includes management environmental, health and safety (EH&S) compliance assessments, management systems audits, environmental impacts studies, and contamination assessments in a wide range of industry sectors, including: chemicals and durable goods manufacturing; waste management; mining; off-shore, and on-shore, oil and gas exploration; geothermal, hydroelectric, and thermal power; telecommunications; and textiles. Mr. Indorf has a working knowledge of EH&S regulatory requirements in Argentina, Bolivia, Brazil, Chile, Costa Rica, Colombia, Dominican Republic, El Salvador, Guyana, Jamaica, Mexico, Venezuela, and Portugal. He has assisted US, Canadian, and Norwegian services and technology providers in the marketing of their products and services in the US and Latin America. Between 1997 and 2001, he was based as a consultant in his home city of Caracas, Venezuela, and in San Jose, Costa Rica. He holds a Bachelor's Degree in Environmental Science and Master's Degree in Technology Assessment and Risk Management from Clark University. His Master's research centered on the occupational hazards and vulnerability of recycling workers (scavengers) laboring at the largest, mixed waste landfill in Venezuela.

Dee Miller is the program assistant for the Science & Technology for Sustainability Program (STS) and the Committee on Science, Engineering, and Public Policy (COSEPUP) at The National Academies. Prior to joining The National Academies, she was a research assistant for the NSF Nanoscale Science and Engineering Center at Rensselaer Polytechnic Institute in which she considered strategies for managing the many radical innovations of nanotechnology and researched socioeconomic implications of nanotechnology. In 2002, she worked on a project under Rensselaer's Ecological Economics, Values, and Policy Program in which she compared ISO-14000 certified and non-ISO-14000 certified companies environmental, health, and safety programs of some the top companies in the healthcare industry and modified some of the programs for better implementation. Her current interests include nanotechnology, science and technology policy, environmental policy, sustainable development, international relations, and R&D and technological change. In 2002, she received a B.S. in Science and Technology Studies with a minor in Management from Rensselaer Polytechnic Institute.

G. Edward Schuh is a Regents Professor and Orville and Jane Freeman Professor of International Trade and Investment Policy in the Humphrey Institute of Public Affairs, and Director of the Orville and Jane Freeman Center for International Economic Policy in the University of Minnesota. He has contributed internationally as an educator, researcher, administrator, adviser, consultant, and author in the fields of economic development, international trade and exchange rate theory, and agricultural policy. His work has involved extensive international involvement, with emphasis on Latin America, Sub Saharan Africa, and the Middle East. He is the author or co-author of six books, has edited another six books, and has over 150 scientific and technical papers to his credit. Schuh holds a Bachelor's degree in agricultural education from Purdue University, a masters of science degree in agricultural economics from Michigan State University, and a master of arts and a Ph.D. degree in economics from the University of Chicago. He has held academic appointments at Purdue University, at the University of Minnesota as department head, and ten years as Dean of the Humphrey Institute of Public Affairs. He has served in public roles as Senior Staff Economist on the President's Council of Economic Advisors in the Ford Administration, as Deputy Under Secretary of Agriculture in the Carter Administration, and as Director of Agricultural and Rural Development in the World

Bank. He is currently on the Board of Trustees of the International Potato Center, headquartered in Lima, Peru, and on the Board of Trustees of the Sasakawa Africa Association. Schuh is a Fellow of the American Agricultural Economics Association, a Fellow of the American Association for the Advancement of Science, a Fellow of the American Academy of Arts and Science, and a Legendary Member of the Brazilian Society of Agricultural and Rural Sociology.

Alexander Shakow earned a bachelor's degree with honors from Swarthmore College (1958) and a doctorate from the London School of Economics (1962). Mr. Shakow began his career in 1963 with five years as a Peace Corps staff member, including serving as Director of the Indonesia program and head of the Office of Volunteer Training in Washington. Shakow joined USAID in 1968 as Indonesia Office Director and over his fourteen years there held a number of other senior positions, culminating in his appointment in 1977 as Assistant Administrator for Program and Policy. In the latter position he was involved in the creation of Appropriate Technology International, which later became EnterpriseWorks Worldwide, on whose Board he now sits. Mr. Shakow joined the World Bank in 1981 where he worked in various policy-related positions before becoming Strategic Planning Director in 1987 and Director of External Affairs from 1990 to 1994. He was subsequently elected Executive Secretary of the Development Committee, the ministerial level forum that advises the World Bank and International Monetary Fund on critical development policy issues. He held that position for seven years and also served as acting Vice-President and Corporate Secretary of the Bank. From 1989 to 1995 he was Chairman of the Board of Science and Technology for International Development (BOSTID) of the NAS. He was the co-chair of the World Bank-NGO Committee for seven years, and for twelve years he was a member of the Board of Governors of the Institute of Development Studies, Sussex, England, where he remains an Honorary Governor. He retired from the Bank in 2002.

Don Sherk is a veteran international development economist specializing in multilateral development banks. Dr. Sherk has broad, senior-level experience as a development bank executive director and international civil servant, as well as a distinguished record as a diplomat and negotiator with experience in nearly 50 developing countries. Most recently he served as a senior advisor to the African Development Bank, where he was previously U.S. executive director. He also served as U.S. alternate director at the Asian Development Bank, vice president of multilateral and corporate client services at Development Alternatives, Inc., and principal advisor on multilateral assistance policies at the Organization for Economic Cooperation and Development (OECD). He has been a member of various advisory and evaluative bodies, including the Eminent Persons Panel on World Bank-African Development Bank Synergy, the Knox Commission (which evaluates the African Development Bank's portfolio quality), the Bretton Woods Committee private sector advisory group, and the International Financial Institutions Advisory Commission ("Meltzer Commission") of the U.S. House of Representatives. Dr. Sherk is a seasoned public speaker, panel participant, and expert witness before U.S. Congress, and a well-published author on international development. He holds a B.A., an M.A., and a Ph.D. in economics from the University of Iowa. He also studied at the Australian National University as a Fulbright Fellow and taught economics at Boston College and Simmons College.

Kirk Smith is Professor of Environmental Health Sciences and holds the Maxwell Endowed Chair in Public Health at the University of California, Berkeley. He is also founder and coordinator of the campus-wide Masters Program in Health, Environment, and Development. Previously, he was founder and head of the Energy Program of the East-West Center in Honolulu, where he still holds appointment as Senior Fellow in Environment and Health after moving to Berkeley in 1995. His research work focuses on environmental and health issues in developing

countries, particularly those related to health-damaging and climate-changing air pollution, and includes ongoing field projects in India, China, Nepal, Mexico, and Guatemala. He serves on a number of national and international scientific advisory and editorial boards and has published over 200 scientific articles and 7 books. He holds bachelors, masters, and doctoral degrees from UC Berkeley and, in 1997, was elected member of the US National Academy of Sciences, one of the highest honors awarded to US scientists by their peers.

Alvaro Umana is currently Leader of the Energy and Environment Group of the United Nations Development Programme (UNDP). As Costa Rica's first Minister of Environment from 1986-1990, under President Oscar Arias, Dr. Umaña was internationally recognized for his path breaking contribution to conservation. He created the National Biodiversity Institute (INBIO) and developed a Masters-level specialization in natural resources and sustainable development at INCAE, one of Latin America's top schools of business and management. Dr. Umaña was founding member and chairman (1997-1998) of the World Bank Inspection Panel, an innovative mechanism for transparency and accountability in international organizations. He has served on the Board of the Rockefeller Foundation, the Arias Foundation for Peace and Human Progress, the UNESCO Executive Council, the World Resources Institute and the Stockholm Environment Institute. He is a member of the Jury of the prestigious Goldman Environmental Prize. Dr. Umaña holds a Ph.D. in Environmental Engineering and Science and a Masters in Economics from Stanford University (1979).