

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)

LONG ISLAND LIGHTING COMPANY)

(Shoreham Nuclear Power Station,)
Unit 1))

) Docket No. 50-322 O.L.
)
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)

STATEMENTS OF QUALIFICATIONS OF SUFFOLK COUNTY WITNESSES

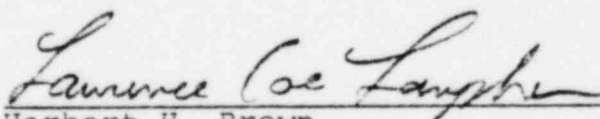
Each Suffolk County witness will testify in this proceeding on more than one contention. To avoid the necessity of separately attaching qualifications to each set of testimony, Suffolk County hereby submits the qualifications of the following witnesses:

Susan J. Harwood
Marc W. Goldsmith
Robert W. Capstick, Jr.
Dale G. Bridenbaugh
Richard B. Hubbard
Gregory C. Minor

Respectfully submitted,

DAVID J. GILMARTIN
Suffolk County Attorney
PATRICIA A. DEMPSEY
Assistant Suffolk County Attorney
Suffolk County Department of Law
Veterans Memorial Highway
Hauppauge, New York 11788

April 12, 1982



Herbert H. Brown
Lawrence Coe Lanpher
Karla J. Letsche
KIRKPATRICK, LOCKHART,
HILL, CHRISTOPHER & PHILLIPS
1900 M Street, N. W. - 8th floor
Washington, D. C. 20036

(202) 452-7000

Attorneys for Suffolk County



SUSAN J. HARWOOD

PROFESSIONAL BIOGRAPHY

CURRENT
POSITION

Research Engineer

EXPERTISE

Federal and State Regulation of Nuclear Facilities
Nuclear Power Plant Design and Safety
Public Policy Analysis
Energy Communications

EDUCATION

M.U.A. degree candidate in Energy Policy and Analysis
Boston University, Boston, MA

B.S. Nuclear Engineering with Distinction
University of Virginia School of Engineering and
Applied Science, Charlottesville, VA (May 1978)

EMPLOYMENT

1982 - Date	Research Engineer Energy Research Group.
1980 - 1982	Systems Analysis Engineer Boston Edison Company - Nuclear Engineering Department
1978 - 1980	Product Application Engineer Westinghouse Electric Corporation - Nuclear Commercial Operations Division

Energy Research Group, Inc.

400-1 Totten Pond Road, Waltham, Massachusetts 02154

(617) 890-1730

VITA

Susan Harwood received her B.S. degree in Nuclear Engineering from the University of Virginia School of Engineering and Applied Science in Charlottesville, VA in 1978. She completed her degree requirements with a B.S. thesis evaluating the LWR use of an alternate thorium fuel cycle, including core design, fuel cycle economics evaluation, and weapons proliferation assessment.

Upon graduation, Ms. Harwood joined Westinghouse Electric Corporation as a product application engineer in the Nuclear Commercial Operations Division. In this position from 1978 to 1980, Ms. Harwood advanced into lead responsibility for the technical marketing of numerous nuclear plant systems, including NSSS and auxiliary fluid systems, steam generators and S/G refurbishment activities, waste management systems, radiation exposure reduction programs, and various post-TMI backfit modifications. In this function, Ms. Harwood was responsible for the development of technical proposals, including the preparation of system descriptions and engineering design data, the review of costing and pricing schedules, and contract negotiations support. In addition, Ms. Harwood performed technical evaluations of existing product lines for sales optimization, and conducted market penetration studies for newly proposed products.

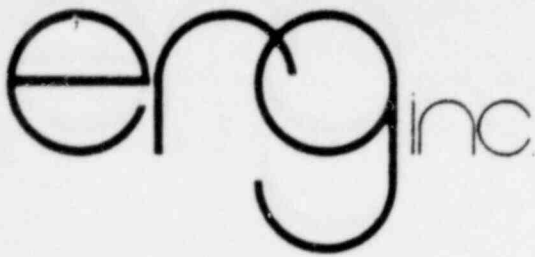
Following Westinghouse Electric Corporation, Ms. Harwood served as a systems analysis engineer in the Nuclear Engineering Department of Boston Edison Company. In this capacity, she was responsible for evaluating Pilgrim Nuclear Power Station (PNPS) plant systems for conformance to safety design bases, regulatory requirements and industry standards. Such responsibility included the evaluation of PNPS operational and administrative activities to ensure a safe plant operating environment through the review of design modifications, plant performance and organizational procedures. Also, Ms. Harwood was

responsible for the analysis of plant conditions and activities to determine if, and to what extent NRC reportability requirements were applicable, and the dissemination of information in compliance with federal requirements.

In addition to fulfilling her position as a systems analysis engineer, Ms. Harwood also represented Boston Edison Company as a spokesperson on various energy topics. She prepared and delivered numerous presentations to public interest groups, educational institutions, and the media regarding U.S. energy issues and industry activities. Such presentations were affiliated with both local Boston Edison programs and a national speaking and media tour on behalf of the Committee for Energy Awareness.

Currently at Energy Research Group, Inc., Ms. Harwood is responsible for the analysis of nuclear safety issues for Suffolk County related to Long Island Lighting Company's application for the Shoreham Nuclear Power Station (SNPS) operating license.

In this function, Ms. Harwood is responsible for the preparation and support of testimony to be presented before the NRC Atomic Safety and Licensing Board during SNPS operating license hearings.



MARC W. GOLDSMITH

PROFESSIONAL BIOGRAPHY

CURRENT
POSITION

President, Energy Research Group, Inc.

EXPERTISE

Federal and State Regulation of Power Plants
Nuclear Power Plant Design
Nuclear Waste Management
Alternate Energy Source Analysis
Fossil Power Plant Design and Operations

EDUCATION

Massachusetts Institute of Technology, Cambridge, MA

Degree of Nuclear Engineer, September 1972

M.S. in Nuclear Engineering, September 1972

State University of New York Maritime College, Fort
Schuyler, New York

Bachelor of Marine Nuclear Science, June 1968

Nuclear Safety Course, M.I.T., 1971

Exeter Institute, 1980

EMPLOYMENT

1974-Date Energy Research Group, Inc., President

1972-1975 United Engineers and Constructors, Inc. - Research
Engineering (Nuclear Analysis), Nuclear Licensing
Engineer.

Energy Research Group, Inc.

400-1 Totten Pond Road, Waltham, Massachusetts 02154

(617) 890-1730

Employment Continued

- 1971-1972 New England Coalition on Nuclear Pollution, Part Time Consultant on Nuclear Power Safety and Licensing (Full Time Graduate School).
- 1968-1970 U.S. Merchant Marine, Second and Third Assistant Engineer, Steam and Motor Vessels.

VITA Mr. Goldsmith received his BS degree in Marine Nuclear Science from the State University of New York Maritime College at Fort Schuyler in the Bronx, N.Y. in 1968.

In the summer of 1968, he worked as a Marine Engineer for Clipper Marine Lines prior to starting graduate school at M.I.T. in the fall. He alternated semesters at sea as both a second and third assistant engineer while working toward his Masters Degree and Degree of Nuclear Engineering. He earned his U.S. Coast Guard Second engineers license in January of 1970. His Engineers thesis design was a gas-cooled, fast breeder reactor core for ship propulsion - He was awarded both a Masters Degree in Nuclear Engineering and a Degree of Nuclear Engineer by M.I.T. in September 1972.

From 1970 to 1972, Mr. Goldsmith served as a Technical Consultant to the New England Coalition on Nuclear Power in Brattleboro, Vermont. He provided the nuclear engineering support in the operating license hearings on the Vermont Yankee Nuclear Power Station.

In the fall of 1972, he joined United Engineers and Constructors as a research analyst in the Advanced Systems Group. He performed nuclear safety analysis calculations on in-plant radiation transport and external pathways for both light-water-reactors and high-temperature gas-cooled reactors. In 1973, he was transferred to the Boston office as a nuclear plant licensing engineer. He was promoted to senior licensing engineer in 1974. Mr. Goldsmith was responsible for setting up all power plant licensing activity in the Boston office. He was directly

responsible for coordination of State and Federal permits and licenses - He has participated in a number of projects for utilities and electrical equipment manufacturers. He was involved with licensing both fossil and nuclear plants.

In 1975, he implemented a major state wide siting survey to identify new power plant locations for a major utility. Mr. Goldsmith organized and managed the interdisciplinary team of thirty engineers and scientists involved in the program effort.

Mr. Goldsmith founded ERG in May 1973, with three other co-incorporators as a Massachusetts-based energy technology company. In July 1975, Mr. Goldsmith became president of ERG, and started the full-time corporate operations. As president of ERG, he is currently responsible for the administrative direction and control of the company. He manages both corporate and client-specific projects including budget, scope, personnel, and schedule.

He has managed and contributed to numerous studies, evaluations, programs, and projects related to energy technology assessment, regulatory and environmental affairs and public policy.

In addition, Mr. Goldsmith has been actively involved in lecturing, debating and writing on energy policy. He has been called to testify before regulatory and legislative hearings on several occasions, and is the author of numerous technical and public papers. He is a registered professional engineer.

PUBLICATIONS

Technical Papers

Goldsmith, M.W. and Shants, F.W., "Dealing with Site Occupations: A Viewpoint and Practical Recommendations," Trans. Am. Nucl. Soc. 28 pgs. 680-681 (July, 1978).

Reports

Goldsmith, M.W., et. al., "Offshore Feasibility for Boston Edison", United Engineers & Constructors Inc., (October, 1973).

Bleiweis, A., et. al., "Evaluation of Power Generation Alternatives for Florida Power and Light Co., (November, 1973) Co-Author.

Goldsmith, M.W. and Forbes, I.A., "A Survey of Economic Costs of Nuclear Fuel Reprocessing", for the Congressional Research Service, Library of Congress (March, 1977).

Forbes, I.A., et. al., "New England Energy Alternatives: Technical and Economic Issues", subcontract to the MITRE Corporation for the U.S. Department of Energy (December, 1977).

Pilat, E.E., et. al., "Comparative Safety of Breeder Reactor Types", for the Congressional Research Service, Library of Congress (April, 1978).

Forbes, I.A., and Goldsmith, M.W. "Assessment of Allegations by the Union of Concerned Scientists with Regard to the Philippines Nuclear Power Plant", for Westinghouse International Projects Company (April, 1978).

Forbes, I.A., Goldsmith, M.W., Muckerheide, W.A., and Ladd, A.G., "Assessment of Alternate Technologies for Utility Baseload Generating Capacity in New England", for the New England Power Company (January, 1979). 1979 Shoreham Progress report.

Goldsmith, M.W., and Capstick, R.W., "Progress Report - 1979: Summary of Technical Assistance to the County of Suffolk, N.Y. Relating to the Safety of the Shoreham Nuclear Power Plant," Energy Research Group, Inc. (February 1980).

Forbes, I.A., Goldsmith, M.W., Muckerheide, W.A., Murphy, J.L., and Capstick, R.W., "Assessment of the Status of Commercial Nuclear Waste Storage Technology", Energy Research Group, for the Westinghouse Electric Corporation (May 1980).

Goldsmith, M.W., and Forbes, I.A., et. al., "Nuclear Waste Management: Technical and Sociopolitical Uncertainties", Energy Research Group, for the Electric Power Research Institute (February, 1980).

Goldsmith, M.W. and Capstick, R.W., "Technical Analysis and Evaluation of Safety Issues Concerning the Shoreham Nuclear Power Plant: 1980 Progress Report to the County of Suffolk, New York," Energy Research Group, Inc. (February 1981).

Public Papers:

"The Nuclear Debate: A Call to Reason," Energy Research Group, Inc. (June, 1974), (Co-Author).

"New Energy Sources: Dreams & Promises," Energy Research Group, Inc. (March, 1976), (Co-Author).

"The Nuclear Debate: A Call to Reason 2," Energy Research Group, Inc. (September, 1976), (Co-Author).

"Waste Management Directions: Planning For Resolution," with Murphy, J.L., Energy Research Group, Inc. (January, 1980).

Goldsmith, M.W., "Licensing and Regulation of Nuclear Power Plants," Nuclear Now, Philadelphia Electric Company Volume 1, No. 7 (October, 1980).

Murphy, J.L., and Goldsmith, M.W. - Addressing Public Concern in siting a region Low-Level-Radioactive Waste Facility - (February 1981).

Forbes, I.A., Goldsmith, M.W., Capstick, R.W., and Murphy, J.L., "Oil Use Replacement: The Electric Alternative," Energy Research Group, Inc. (November 1981).

TESTIMONY

Goldsmith, M.W. and Brown, G.J. - Testimony in Opposition to Nuclear Moratorium Bill, Committee on Natural Resources, Vermont House of Representatives, Montpelier, Vermont (January, 1975).

Goldsmith, M.W., Testimony in Opposition to Moratorium Bill, State Legislative Committee Wisconsin House of Representatives, Madison, Wisconsin (June, 1975).

Testimony, Massachusetts Legislative Committee on Nuclear Power (December, 1975).

Goldsmith, M.W., "Energy Production Wastes and a Perspective on Long Term Effects." Invited Testimony before the State of California Energy Resources Conservation & Development Commission at the Information Hearings on Nuclear Fuel Reprocessing & Waste Disposal, Sacramento, California (February, 1977).

Direct Testimony of the Energy Research Group, Inc. on the Adequacy of the Draft Environmental Statement ERDA-1536," before the ERDA Presiding Board in the matter of Idaho National Engineering Laboratory Waste Management Operations (February, 1977).

Invited Testimony on Radioactive Waste Disposal before New Hampshire House Committee on Science and Technology and Senate Committee on the Environment (March, 1977).

Testimony on Economics of Alternatives to Nuclear Power Generation, presented for Intervenor Local IBEW 25 on the Jamesport Nuclear Generating Station, units 1 & 2 at the Atomic Safety and Licensing Board Hearings (September, 1976 and January, 1977).

Testimony before the Atomic Safety & Licensing Board on Environmental Effects of Uranium Fuel Cycle S-3, Pacific Legal Foundation (September, 1977).

Testimony before the Energy Planning Board of the State of New York prepared on behalf of the New York State Council of Building and Construction Trades - AFL/CIO (September 20, 1979).

REGISTRATION Professional Engineer - California NU1304

MEMBERSHIPS American Nuclear Society, Northeast Section, Chairman
1975 - 1976,
Executive Committee 1975 - 1980
American Association for the Advancement of Science
International Association of Energy Economists
Materials Research Society

PROJECT EXPERIENCEEnergy Research Group, Inc., Waltham, Massachusetts

Founded the Energy Research Group, Inc. in May 1973, with three other co-incorporators as a Massachusetts based energy technology company. Organized and set up initial operations. As president of ERG, responsible for the administrative direction and control of projects. Management of both corporate and specific projects including budget, personnel, schedule and scope.

Examples of Project Experience

Westinghouse Electric Co., Pittsburgh, PA

Managed the evaluation of options for the disposition of the spent fuel generated at Turkey Point Units 3 & 4 under the contract between Westinghouse and Florida Power & Light with assistance and input from Bechtel National, Inc. and other divisions of Westinghouse. The study is to evaluate all potential existing and new off-site and on-site alternatives for the disposition of approximately 400 MTU of spent nuclear fuel discharged from the Turkey Point units. This effort was coordinated with Florida Power & Light's parallel evaluation, performed by its consultant EDS Nuclear, Inc. (In progress).

NELRAD, Concord, MA

Assisted in the formation and organization of a consortium of New England Low Level Radioactive Waste Generators (NELRAD). Prepared legislative, technical and communications materials including draft legislation, public information plan, strategic plan and communications materials.

Atomic Energy of Canada, Ltd., Ottawa, Canada

Prepared monthly report on nuclear waste management activities with primary emphasis on high-level waste disposal.

Philadelphia Electric Co., Philadelphia, PA

Authored a short paper on Licensing and Regulation of Nuclear Power Plants.

United Illuminating Co., New Haven, Conn.

Prepared and taught short course on nuclear power issues related to the development and use of nuclear power in Connecticut.

Suffolk County, Long Island, New York

Prepared and advised County Government on technical issues related to a Boiling Water Reactor Power Plant Operating License Intervention. This effort includes testimony and cross-examination on all aspects of plant operation.

Vermont Yankee Nuclear Power Corp., Rutland, VT

Prepared short paper on nuclear power plant decommissioning including issues related to NRC "As Low as Reasonably Achievable (ALARA)" requirements.

Mobil Oil Corporation, Denver, Colorado

Prepared and presented briefings on Three Mile Island accident to Mobil employees.

New England Power Co., Westboro, MA

Prepared study on alternate power generation sources for new generating capacity plan.

Westinghouse International Projects Co., Pittsburgh, PA

Analyzed nuclear safety issues raised with respect to the Philippines Nuclear Power Station.

Electric Power Research Institute, Palo Alto, CA

Managed and co-authored study of technical and sociopolitical Research and Development strategies for nuclear waste management. Study included risk assessment and accident analyses.

Congressional Research Service, Library of Congress,
Washington, DC

Prepared assessment of the status of safety research for a range of nuclear breeder designs.

MIT, Energy Laboratory, Cambridge, MA

Development of nuclear power regulatory issues for the M.I.T. Energy Lab Light-Water-Reactor Research Assessment Project.

Jersey Central Power Co., Oyster Creek, NJ

Prepared parts of Emergency Preparedness plan and presentation. Worked with local officials in addition to corporately responsible staff. Prepared black hat analysis of security plan and equipment.

Public Service of New Hampshire, Manchester, NH

Managed employee briefing program on energy and nuclear issues for all employees. On-going communications and legislative support.

PX Engineering Co., Woburn, MA

Co-venture for design and manufacture of high-density spent fuel racks. Performed reactor physics calculations and analyzed thermo-hydraulic efforts.

United Engineers & Constructors, Inc, Boston, Massachusetts

Eastern Utility

Organized planned, initiated and directed state-wide power generation siting survey for a major eastern utility. Efforts included scheduling, budgeting, client interface, staffing and organizing coordinating efforts for all phases of the study.

New York State Electric & Gas Corporation, Binghamton,
New York

Prepared and staffed licensing organization and coordinated preliminary inputs to the Somerset Nuclear Station. This included review, input of information, and publication of the Antitrust Review, the License Application, and the Preliminary Safety Analysis Report. Provided inputs to nuclear engineering design, industrial security requirements, and development of organizational structure for the project.

New York State Electric

Initiated state licensing efforts for an 800 Mwe coal plant in upstate New York. Began preparation of one of the first article 8 submissions to N.Y.S.

Boston Edison Company, Boston, Massachusetts

Prepared a report on offshore power plant feasibility including cost estimate, schedule evaluation, technical feasibility and regulatory licensing efforts.

Florida Power and Light Company, Miami, Florida

Researched and prepared sections of an assessment of nuclear offshore plants including Federal licensing with emphasis on AEC and ACRS and interaction with State Authorities. Technical feasibility of offshore plants, and cost estimates with comparison to land-based plants were also made.

Confidential Client

Prepared market survey analysis of major steam turbine market for both nuclear and fossil power generation stations for major manufacturer. Surveyed new market, repair and retrofit markets and compared product features.

Washington Public Power Service System, Richland,
Washington

Calculated wrote and coordinated Preliminary Safety Analysis Report inputs for Hanford Unit 1 Accident Analysis (PSAR) section, including coordination with NSSS vendor, client and internal project disciplines to assure technical accuracy.

Delmarva Power and Light Company Wilmington, Delaware

Prepared several (PSAR) sections for the 770 MWe High Temperature Gas-Cooled Reactor plants including conduct of operations, technical specifications, accident analysis.

Puerto Rico Water Resources Authority, Puerto Rico

Involved in the dose calculation for the new Aguirre Site. This included calculation of annual accident doses for the new location. Operated and assisted in the modification of the LOCAPOBJ code, used for LOCA accident analysis.

New England Coalition on Nuclear Pollution, Brattleboro, Vermont

Consultant on Nuclear Power (Part time during full-time graduate study).

Prepared technical background for legal use in power plant intervention, including participation in ASLB Hearing. Preparation included alternatives to the nuclear station, purchased power and fossil fueled generating stations including the environmental effects.

U.S. Merchant Marine

Served as a second and third assistant engineer on numerous U.S. freighters and tankers. Duties included operations, maintenance and repair and shift (watch) supervision.



ROBERT W. CAPSTICK

PROFESSIONAL BIOGRAPHY

CURRENT
POSITION

Research Analyst

EXPERTISE

Public Policy Analysis
Risk Assessment and Safety Analysis
Science and Intergovernmental Relations
Technical Research

EDUCATION

M.P.A., (Public Administration)
Suffolk University Graduate School of Management

Massachusetts Legislative Staff Fellowship Program,
University of Massachusetts Graduate School of Politics

A.B., Physics; Political Science (Cum Laude)
Boston College

EMPLOYMENT

1979 - Date	Research Analyst Energy Research Group, Inc.
1978 - 1979	Assistant Director Science Resource Office, Massachusetts Legislature
1976 - 1978	Research Coordinator Science Resource Office, Massachusetts Legislature

Energy Research Group, Inc.

400-1 Totten Pond Road, Waltham, Massachusetts 02154

(617) 890-1730

VITA

Mr. Capstick received his A.B. degree (Cum Laude) in Physics and Political Science from Boston College, and his Masters degree in Public Administration from Suffolk University. He has also done graduate work in both Physics and Political Science. Prior to joining Energy Research Group, Inc. he worked for the Science Resource Office of the Massachusetts Legislature.

At the Science Resource Office, Mr. Capstick was responsible for directing research and preparing information on a broad range of scientific and technical issues for members, committees and staff of the Massachusetts Legislature. His responsibilities included serving as coordinator and liaison with academic institutions, professional organizations, research and development firms, and State and Federal agencies. His work in energy for the Legislature included directing research evaluating institutional and technological requirements of alternate energy systems, comparative energy supply and consumption patterns, liquefied energy gas safety, potential for coal development in New England, and nuclear fission and fusion.

At ERG, Mr. Capstick is responsible for conducting research in technical and public policy areas. These areas include alternate energy source assessment, risk assessment and safety analysis, energy policy, and regulatory/licensing analysis.

PUBLICATIONS
AND REPORTS

Bolt, R.H., and Capstick, R.W., "Some Scientific Information about Laetrile and Cancer," for the Joint Legislative Committee on Health Care, Science Resource Office, Massachusetts Legislature, Boston, MA (August 1977).

"Report of the Special Committee Relative to Safety Regarding Transportation, Storage and Siting of Storage Facilities of Liquefied Natural Gas and Other Liquefied Energy Gases," (as Director of Research for the Special Committee), Massachusetts Legislature, Boston, MA (December 29, 1978).

Capstick, R.W., "Risk Assessment and the Legislative Decision-Making Process: The Massachusetts Legislature and the Liquefied Natural Gas (LNG) Issue," paper submitted in partial fulfillment of degree program for Master of Public Administration, Suffolk University Graduate School of Management, Boston, MA (May 1, 1979).

Capstick, R.W., Jr., "Concepts and Public Perceptions of Risk in Contemporary Society," Energy Research Group, Inc., Waltham, MA (October 1979).

Goldsmith, M.W., and Capstick, R.W., "Progress Report - 1979: Summary of Technical Assistance to the County of Suffolk, N.Y. Relating to the Safety of the Shoreham Nuclear Power Plant," Energy Research Group, Inc. (February 1980).

Goldsmith, M.W., Forbes, I.A., Murphy, J.L., Capstick, R.W., Kearns, K.D., Muckerheide, W.A., "Nuclear Waste Management: Technical and Sociopolitical Uncertainties," Energy Research Group, Inc. for the Electric Power Research Institute (February, 1980).

Forbes, I.A., Goldsmith, M.W., Muckerheide, W.A., Murphy, J.L. and Capstick, R.W., "Assessment of the Status of Commercial Nuclear Waste Storage Technology," Energy Research Group, Inc. for the Westinghouse Electric Corporation (May, 1980).

Comparative Assessment of Hydroelectric Pumped Storage for Potential Contribution to the Nation's Energy Supply; Section III, Alternatives to Hydroelectric Pumped Storage, Energy Research Group, Inc. subcontract to Dames and Moore for the U.S. Army Corps of Engineers (January 1981).

Goldsmith, M.W. and Capstick, R.W., "Technical Analysis and Evaluation of Safety Issues Concerning the Shoreham Nuclear Power Plant: 1980 Progress Report to the County of Suffolk, New York," Energy Research Group, Inc. (February 1981).

Forbes, I.A., Goldsmith, M.W., Capstick, R.W. and Murphy, J.L., "Oil Use Replacement: The Electric Alternative," Energy Research Group, Inc. (November 1981).

MEMBERSHIPS

Massachusetts Engineers Council
American Association for the Advancement of Science
International Association of Energy Economists
Society for Risk Analysis

PROJECT
EXPERIENCETechnical Analysis and Evaluation of Nuclear Power
Plant Safety.

Provided technical assistance to a government client
intervening in the operating license proceedings
before the Atomic Safety and Licensing Board.

Assessment of the Status of Commercial Nuclear Waste
Storage Technology.

Assisted in a technical and institutional assessment
of the status of commercial nuclear waste storage
technology for a corporate client.

Technical and Economic Assessment of Alternative
Energy Sources.

Assisted in the preparation of testimony providing a
technical and economic assessment of alternative
energy sources for a New England utility group before
a State siting agency.

Technical and Sociopolitical Analysis of Nuclear Waste
Management.

Assisted in a study of technical and sociopolitical
uncertainties concerning nuclear waste management for
the Electric Power Research Institute.

Technical Assessment of Alternative Energy Sources to
Hydroelectric Pumped Storage.

Assisted in an assessment and comparative analysis of
current and future energy supply alternatives to
pumped hydro under a subcontract for the U.S. Army
Corps of Engineers.

Technical Assistance to Legal Counsel.

Participated in providing technical assistance to a utility's legal counsel for cross examination of witnesses before a state public utility company.

Analysis of Risk Assessment Related to Public Decision-making.

Performed an analysis of the concepts and public perceptions of risk in contemporary society for a corporate client. Published paper on research.

Nuclear Waste Management-Periodic Update of Technical and Institutional Developments.

Assisted in the design and continuing preparation of a monthly memorandum for several clients, reporting on and assessing recent developments pertaining to nuclear waste management issues.

Technical and Policy Assessment of United States Electrical Energy Policy.

Performed an evaluation and analysis of U.S. Electrical Energy Policy (including evaluation of consumption patterns, demand, environmental and economic factors and alternate source comparisons) for a corporate client for inclusion in a U.S. Congressional briefing document.

Technical Analysis of Nuclear Decommissioning Issues.

Performed an evaluation of nuclear power plant decommissioning issues, including technical status, regulatory base, and costs, for a New England utility.

Legislation: Research and Evaluation.

Conducted research and evaluation of numerous pieces of federal and state legislation pertaining to energy and nuclear waste for a corporate client. Also assisted in drafting state legislation.

Licensing and Regulation of Nuclear Power Plants.

Assisted in the preparation of a paper providing an overview of nuclear power plant licensing and regulation for an East Coast utility client.

Three Mile Island Briefing Books.

Developed and wrote a section of a briefing book on the TMI accident and related issues discussing public risk and radiation for a corporate client.

New Energy Source Assessment.

Researched, drafted and edited a public position paper for publication evaluating and describing new energy source technologies and U.S. energy use and supply issues.

Electric Power Substitution for Oil Use.

Co-authored a public position paper discussing the potential for replacement of oil use with electric power in the United States.

Alternatives for the Disposition of Turkey Point Spent Fuel.

Detailed technical assessment of all potentially feasible alternatives for on-site storage or off-site domestic or foreign disposition of Turkey Point spent fuel.

March 1982

PROFESSIONAL QUALIFICATIONS OF DALE G. BRIDENBAUGH

DALE G. BRIDENBAUGH
1723 Hamilton Avenue
Suite K
San Jose, CA 95125
(408) 266-2716

EXPERIENCE:

1976 - PRESENT

President - MHB Technical Associates, San Jose, California.
Co-founder and partner of technical consulting firm. Specialists in energy consulting to governmental and other groups interested in evaluation of nuclear plant safety and licensing. Consultant in this capacity to state agencies in California, New York, Illinois, New Jersey, Pennsylvania, Oklahoma and Minnesota and to the Norwegian Nuclear Power Committee, Swedish Nuclear Inspectorate, and various other organizations and environmental groups. Performed extensive safety analysis for Swedish Energy Commission and contributed to the Union of Concerned Scientist's Review of WASH-1400. Consultant to the U.S. NRC - LWR Safety Improvement Program, performed Cost Analysis of Spent Fuel Disposal for the Natural Resources Defense Council, and contributed to the Department of Energy LWR Safety Improvement Program for Sandia Laboratories. Served as expert witness in NRC and state utility commission hearings.

1976 - (FEBRUARY - AUGUST)

Consultant, Project Survival, Palo Alto, California.

Volunteer work on Nuclear Safeguards Initiative campaigns in California, Oregon, Washington, Arizona, and Colorado. Numerous presentations on nuclear power and alternative energy options to civic, government, and college groups. Also resource person for public service presentations on radio and television.

1973 - 1976

Manager, Performance Evaluation and Improvement, General Electric Company - Nuclear Energy Division, San Jose, California.

Managed seventeen technical and seven clerical personnel with responsibility for establishment and management of systems to monitor and measure Boiling Water Reactor equipment and system operational performance. Integrated General Electric resources in customer plant modifications, coordinated correction of causes of forced outages and of efforts to improve reliability and performance of BWR systems.

1973 - 1976 (Contd)

Responsible for development of Division Master Performance Improvement Plan as well as for numerous Staff special assignments on long-range studies. Was on special assignment for the management of two different ad hoc projects formed to resolve unique technical problems.

1972 - 1973

Manager, Product Service, General Electric Company - Nuclear Energy Division, San Jose, California.

Managed group of twenty-one technical and four clerical personnel. Prime responsibility was to direct interface and liaison personnel involved in corrective actions required under contract warranties. Also in charge of refueling and service planning, performance analysis, and service communication functions supporting all completed commercial nuclear power reactors supplied by General Electric, both domestic and overseas (Spain, Germany, Italy, Japan, India, and Switzerland).

1968 - 1972

Manager, Product Service, General Electric Company - Nuclear Energy Division, San Jose, California.

Managed sixteen technical and six clerical personnel with the responsibility for all customer contact, planning and execution of work required after the customer acceptance of department-supplied plants and/or equipment. This included quotation, sale and delivery of spare and renewal parts. Sales volume of parts increased from \$1,000,000 in 1968 to over \$3,000,000 in 1972.

1966 - 1968

Manager, Complaint and Warranty Service, General Electric Company - Nuclear Energy Division, San Jose, California.

Managed group of six persons with the responsibility for customer contacts, planning and execution of work required after customer acceptance of department-supplied plants and/or equipment--both domestic and overseas.

1963 - 1966

Field Engineering Supervisor, General Electric Company, Installation and Service Engineering Department, Los Angeles, California.

Supervised approximately eight field representatives with responsibility for General Electric steam and gas turbine installation and maintenance work in Southern California, Arizona, and Southern Nevada. During this period was responsible for the installation of eight different central station steam turbine generator units, plus much maintenance activity. Work included customer contact, preparation of quotations, and contract negotiations.

1956 - 1963

Field Engineer, General Electric Company, Installation and Service Engineering Department, Chicago, Illinois.

Supervised installation and maintenance of steam turbines of all sizes. Supervised crews of from ten to more than one hundred men, depending on the job. Worked primarily with large utilities but had significant work with steel, petroleum and other process industries. Had four years of experience at construction, startup, trouble-shooting and refueling of the first large-scale commercial nuclear power unit.

1955 - 1956

Engineering Training Program, General Electric Company, Erie, Pennsylvania, and Schenectady, New York.

Training assignments in plant facilities design and in steam turbine testing at two General Electric Factory locations.

1953 - 1955

United States Army - Ordnance School, Aberdeen, Maryland.

Instructor - Heavy Artillery Repair. Taught classroom and shop disassembly of artillery pieces.

1953

Engineering Training Program, General Electric Company, Evendale, Ohio.

Training assignment with Aircraft Gas Turbine Department.

EDUCATION & AFFILIATIONS:

BSME - 1953, South Dakota School of Mines and Technology, Rapid City, South Dakota, Upper $\frac{1}{4}$ of class.

Professional Nuclear Engineer - California. Certificate No. 0973.

Member - American Nuclear Society.

Various Company Training Courses during career including Professional Business Management, Kepner Tregoe Decision Making, Effective Presentation, and numerous technical seminars.

HONORS & AWARDS:

Sigma Tau - Honorary Engineering Fraternity.

General Managers Award, General Electric Company.

PERSONAL DATA:

Born November 20, 1931, Miller, South Dakota.

Married, three children

6'2", 190 lbs., health - excellent

Honorable discharge from United States Army

Hobbies: Skiing, hiking, work with Cub and Boy Scout Groups.

PUBLICATIONS & TESTIMONY:

1. Operating and Maintenance Experience, presented at Twelfth Annual Seminar for Electric Utility Executives, Pebble Beach, California, October 1972, published in General Electric NEDC-10697, December 1972.
2. Maintenance and In-Service Inspection, presented at IAEA Symposium on Experience From Operating and Fueling of Nuclear Power Plants, Bridenbaugh, Lloyd & Turner, Vienna, Austria, October, 1973.
3. Operating and Maintenance Experience, presented at Thirteenth Annual Seminar for Electric Utility Executives, Pebble Beach, California, November, 1973, published in General Electric NEDO-20222, January. 1974.
4. Improving Plant Availability, presented at Thirteenth Annual Seminar for Electric Utility Executives, Pebble Beach, California, November 1973, published in General Electric NEDO-20222, January, 1974.
5. Application of Plant Outage Experience to-Improve Plant Performance, Bridenbaugh and Burdsall, American Power Conference, Chicago, Illinois, April 14, 1974.
6. Nuclear Valve Testing Cuts Cost, Time, Electrical World, October, 15, 1974.
7. The Risks of Nuclear Power Reactors: A Review of the NRC Reactor Safety Study WASH-1400, Kendall, Hubbard, Minor & Bridenbaugh, et al, for the Union of Concerned Scientists, August, 1977.

8. Swedish Reactor Safety Study: Barsebäck Risk Assessment, MHB Technical Associates, January, 1978. (Published by the Swedish Department of Industry as Document DsI 1978:1)
9. Testimony of D.G. Bridenbaugh, R.B. Hubbard, G.C. Minor to the California State Assembly Committee on Resources, Land Use, and Energy, March 8, 1976.
10. Testimony of D.G. Bridenbaugh, R.B. Hubbard, and G.C. Minor before the United States Congress, Joint Committee on Atomic Energy, February 18, 1976, Washington, DC (Published by the Union of Concerned Scientists, Cambridge, Massachusetts.)
11. Testimony by D.G. Bridenbaugh before the California Energy Commission, entitled, Initiation of Catastrophic Accidents at Diablo Canyon, Hearings on Emergency Planning, Avila Beach, California, November 4, 1976.
12. Testimony by D.G. Bridenbaugh before the U.S. Nuclear Regulatory Commission, subject: Diablo Canyon Nuclear Plant Performance, Atomic Safety and Licensing Board Hearings, December, 1976.
13. Testimony by D.G. Bridenbaugh before the California Energy Commission, subject: Interim Spent Fuel Storage Considerations, March 10, 1977.
14. Testimony by D.G. Bridenbaugh before the New York State Public Service Commission Siting Board Hearings concerning the Jamesport Nuclear Power Station, subject: Effect of Technical and Safety Deficiencies on Nuclear Plant Cost and Reliability, April, 1977.
15. Testimony by D.G. Bridenbaugh before the California State Energy Commission, subject: Decommissioning of Pressurized Water Reactors, Sundesert Nuclear Plant Hearings, June 9, 1977.
16. Testimony by D.G. Bridenbaugh before the California State Energy Commission, subject: Economic Relationships of Decommissioning, Sundesert Nuclear Plant, for the Natural Resources Defense Council, July 15, 1977.
17. Testimony by D.G. Bridenbaugh before the Vermont State Board of Health, subject: Operation of Vermont Yankee Nuclear Plant and Its Impact on Public Health and Safety, October 6, 1977.
18. Testimony by D.G. Bridenbaugh before the U.S. Nuclear Regulatory Commission, Atomic Safety and Licensing Board, subject: Deficiencies in Safety Evaluation of Non-Seismic Issues, Lack of a Definitive Finding of Safety, Diablo Canyon Nuclear Units October 18, 1977, Avila Beach, California.

19. Testimony by D.G. Bridenbaugh before the Norwegian Commission on Nuclear Power, subject: Reactor Safety/Risk, October 26, 1977.
20. Testimony by D.G. Bridenbaugh before the Louisiana State Legislature Committee on Natural Resources, subject: Nuclear Power Plant Deficiencies Impacting on Safety & Reliability, Baton Rouge, Louisiana, February 13, 1978.
21. Spent Fuel Disposal Costs, report prepared by D.G. Bridenbaugh for the Natural Resources Defense Council (NRDC), August 31, 1978.
22. Testimony by D.G. Bridenbaugh, G.C. Minor, and R.B. Hubbard before the Atomic Safety and Licensing Board, in the matter of the Black Fox Nuclear Power Station Construction Permit Hearings, September 25, 1978, Tulsa, Oklahoma.
23. Testimony of D.G. Bridenbaugh and R.B. Hubbard before the Louisiana Public Service Commission, Nuclear Plant and Power Generation Costs, November 19, 1978, Baton Rouge, Louisiana.
24. Testimony by D.G. Bridenbaugh before the City Council and Electric Utility Commission of Austin, Texas, Design, Construction, and Operating Experience of Nuclear Generating Facilities, December 5, 1978, Austin, Texas.
25. Testimony by D.G. Bridenbaugh for the Commonwealth of Massachusetts, Department of Public Utilities, Impact of Unresolved Safety Issues, Generic Deficiencies, and Three Mile Island-Initiated Modifications on Power Generation Cost at the Proposed Pilgrim-2 Nuclear Plant, June 8, 1979.
26. Improving the Safety of LWR Power Plants, MHB Technical Associates, prepared for U.S. Dept. of Energy, Sandia Laboratories, September 28, 1979.
27. BWR Pipe and Nozzle Cracks, MHB Technical Associates, for the Swedish Nuclear Power Inspectorate (SKI), October, 1979.
28. Testimony of D.G. Bridenbaugh and G.C. Minor before the Atomic Safety and Licensing Board, in the matter of Sacramento Municipal Utility District, Rancho Seco Nuclear Generating Station following TMI-2 accident, subject: Operator Training and Human Factors Engineering, for the California Energy Commission, February 11, 1980.
29. Italian Reactor Safety Study: Caorso Risk Assessment, MHB Technical Associates, for Friends of the Earth, Italy, March, 1980.
30. Decontamination of Krypton-85 from Three Mile Island Nuclear Plant, H. Kendall, R. Pollard, & D.G. Bridenbaugh, et al, The Union of Concerned Scientists, delivered to the Governor of Pennsylvania, May 15, 1980.

31. Decontamination of Krypton-85 from Three Mile Island Nuclear Plant, H. Kendall, R. Pollard, & D.G. Bridenbaugh, et al, The Union of Concerned Scientists, delivered to the Governor of Pennsylvania, May 15, 1980.
32. Testimony by D.G. Bridenbaugh before the New Jersey Board of Public Utilities, on behalf of New Jersey Public Advocate's Office, Division of Rate Counsel, Analysis of 1979 Salem-1 Refueling Outage, August, 1980.
33. Minnesota Nuclear Plants Gaseous Emissions Study, MHB Technical Associates, for Minnesota Pollution Control Agency, September, 1980.
34. Position Statement, Proposed Rulemaking on the Storage and Disposal of Nuclear Waste, Joint Cross-Statement of Position of the New England Coalition on Nuclear Pollution and the Natural Resources Defense Council, September, 1980.
35. Testimony by D.G. Bridenbaugh and Gregory C. Minor, before the New York State Public Service Commission, In the Matter of Long Island Lighting Company Temporary Rate Case, prepared for the Shoreham Opponents Coalition, September 22, 1980, Shoreham Nuclear Plant Construction Schedule.
36. Supplemental Testimony by D.G. Bridenbaugh before the New Jersey Board of Public Utilities, on behalf of New Jersey Public Advocate's Office, Division of Rate Counsel, Analysis of 1979 Salem-1 Refueling Outage, December, 1980.'
37. Testimony by D.G. Bridenbaugh and Gregory C. Minor, before the New Jersey Board of Public Utilities, on behalf of New Jersey Department of the Public Advocate, Division of Rate Counsel, Oyster Creek 1980 Refueling Outage Investigation, February, 1981.
38. Economic Assessment: Ownership Interest in Palo Verde Nuclear Station, MHB Technical Associates, for The City of Riverside, September 11, 1981.
39. Testimony of D.G. Bridenbaugh before the Public Utilities Commission of Ohio, in the matter of the Regulation of the Electric Fuel Component Contained Within the Rate Schedules of the Toledo Edison Company and Related Matters, subject: Davis-Besse Nuclear Power Station 1980-81 Outage Review, October, 1981.
40. Supplemental Testimony of D.G. Bridenbaugh before the Public Utilities Commission of Ohio, in the matter of the Regulation of the Electric Fuel Component Contained within the Rate Schedules of the Toledo Edison Company and Related Matters, subject: Davis-Besse Nuclear Power Station 1980-81 Outage Review, November, 1981.

41. Systems Interaction and Single Failure Criterion, Phase 2 Report, MHB Technical Associates for the Swedish Nuclear Power Inspectorate (SKI), January, 1982.
42. Testimony of D.G. Bridenbaugh and Gregory C. Minor on behalf of Governor Edmund G. Brown Jr., before the Atomic Safety and Licensing Board, regarding Contention 10, Pressurizer Heaters, January 11, 1982.
43. Testimony of D.G. Bridenbaugh and Gregory C. Minor on behalf of Governor Edmund G. Brown, Jr. before the Atomic Safety and Licensing Board, regarding Contention 12, Block and Pilot Operated Relief Valves, January 11, 1982.

PROFESSIONAL QUALIFICATIONS OF RICHARD B. HUBBARD

RICHARD B. HUBBARD
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Suite K
San Jose, California 95125
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EXPERIENCE:

9/76 - PRESENT

Vice-President - MHB Technical Associates, San Jose, California.
Founder, and Vice-President of technical consulting firm. Specialists in independent energy assessments for government agencies, particularly technical and economic evaluation of nuclear power facilities. Consultant in this capacity to Oklahoma and Illinois Attorney Generals, Minnesota Pollution Control Agency, German Ministry for Research and Technology, Governor of Colorado, Swedish Energy Commission, Swedish Nuclear Inspectorate, and the U.S. Department of Energy. Also provided studies and testimony for various public interest groups including the Center for Law in the Public Interest, Los Angeles; Public Law Utility Group, Baton Rouge, Louisiana; Friends of the Earth (FOE), Italy; and the Union of Concerned Scientists, Cambridge, Massachusetts. Provided testimony to the U.S. Senate/House Joint Committee on Atomic Energy, the U.S. House Committee on Interior and Insular Affairs, the California Assembly, Land Use, and Energy Committee, the Advisory Committee on Reactor Safeguards, and the Atomic Safety and Licensing Board. Performed comprehensive risk analysis of the accident probabilities and consequences at the Barseback Nuclear Plant for the Swedish Energy Commission and edited, as well as contributed to, the Union of Concerned Scientist's technical review of the NRC's Reactor Safety Study (WASH-1400).

2/76 - 9/76

Consultant, Protect Survival, Palo Alto, California.
Volunteer work on Nuclear Safeguards Initiative campaigns in California, Oregon, Washington, Arizona, and Colorado. Numerous presentations on nuclear power and alternative energy options to civic, government, and college groups. Also resource person for public service presentations on radio and television.

5/75 - 1/76

Manager - Quality Assurance Section, Nuclear Energy Control and Instrumentation Department, General Electric Company, San Jose, California.

Report to the Department General Manager. Develop and implement quality plans, programs, methods, and equipment which assure that products produced by the Department meet quality requirements as defined in NRC regulation 10 CFR 50, Appendix 3, ASME Boiler and Pressure Vessel Code, customer contracts, and GE Corporate policies and procedures. Product areas include radiation sensors, reactor vessel internals, fuel handling and servicing tools, nuclear plant control and protection instrumentation systems, and nuclear steam supply and Balance of Plant control room panels. Responsible for approximately 45 exempt personnel, 22 non-exempt personnel, and 129 hourly personnel with an expense budget of nearly 4 million dollars and equipment investment budget of approximately 1.2 million dollars.

11/71 - 5/75

Manager - Quality Assurance Subsection, Manufacturing Section of Atomic Power Equipment Department, General Electric Company, San Jose, California.

Report to the Manager of Manufacturing. Same functional and product responsibilities as in Engagement #1, except at a lower organizational report level. Developed a quality system which received NRC certification in 1975. The system was also successfully surveyed for ASME "N" and "NPT" symbol authorization in 1972 and 1975, plus ASME "U" and "S" symbol authorizations in 1975. Responsible for from 23 to 39 exempt personnel, 7 to 14 non-exempt personnel, and 53 to 97 hourly personnel.

3/70 - 11/71

Manager - Application Engineering Subsection, Nuclear Instrumentation Department, General Electric Company, San Jose, California. Responsible for the post order technical interface with architect engineers and power plant owners to define and schedule the instrumentation and control systems for the Nuclear Steam Supply and Balance of Plant portion of nuclear power generating stations. Responsibilities included preparation of the plant instrument list with approximate location, review of interface drawings to define functional design requirements, and release of functional requirements for detailed equipment designs. Personnel supervised included 17 engineers and 5 non-exempt personnel.

12/69 - 3/70

Chairman - Equipment Room Task Force, Nuclear Instrumentation Department, General Electric Company, San Jose, California.
Responsible for a special task force reporting to the Department General Manager to define methods to improve the quality and reduce the installation time and cost of nuclear power plant control rooms. Study resulted in the conception of a factory-fabricated control room consisting of signal conditioning and operator control panels mounted on modular floor sections which are completely assembled in the factory and thoroughly tested for proper operation of interacting devices. Personnel supervised included 10 exempt personnel.

12/65 - 12/69

Manager - Proposal Engineering Subsection, Nuclear Instrumentation Department, General Electric Company, San Jose, California.
Responsible for the application of instrumentation systems for nuclear power reactors during the proposal and pre-order period. Responsible for technical review of bid specifications, preparation of technical bid clarifications and exceptions, definition of material list for cost estimating, and the "as sold" review of contracts prior to turnover to Application Engineering. Personnel supervised varied from 2 to 9 engineers.

8/64 - 12/65

Sales Engineer, Nuclear Electronics Business Section of Atomic Power Equipment Department, General Electric Company, San Jose, California.
Responsible for the bid review, contract negotiation, and sale of instrumentation systems and components for nuclear power plants, test reactors, and radiation hot cells. Also responsible for industrial sales of radiation sensing systems for measurement of chemical properties, level, and density.

10/61 - 8/64

Application Engineer, Low Voltage Switchgear Department, General Electric Company, Philadelphia, Pennsylvania.
Responsible for the application and design of advanced diode and silicon-controlled rectifier constant voltage DC power systems and variable voltage DC power systems for industrial applications. Designed, followed manufacturing and personally tested an advanced SCR power supply for product introduction at the Iron and Steel Show. Project Engineer for a DC power system for an aluminum pot line sold to Anaconda beginning at the 161KV switchyard and encompassing all the equipment to convert the power to 700 volts DC at 160,000 amperes.

GE Rotational Training Program

Four 3-month assignments on the GE Rotational Training Program for college technical graduates as follows:

- a. Installation and Service Eng. - Detroit, Michigan.
Installation and startup testing of the world's largest automated hot strip steel mill.
- b. Tester - Industry Control - Roanoke, Virginia.
Factory testing of control panels for control of steel, paper, pulp, and utility mills and power plants.
- c. Engineer - Light Military Electronics - Johnson City, New York.
Design of ground support equipment for testing the auto pilots on the F-105.
- d. Sales Engineer - Morrison, Illinois.
Sale of appliance controls including range timers and refrigerator cold controls.

EDUCATION:

Bachelor of Science Electrical Engineering, University of Arizona, 1960.

Master of Business Administration, University of Santa Clara, 1969.

PROFESSIONAL AFFILIATION:

Registered Quality Engineer, License No. QU805, State of California.

Member of Subcommittee 8 of the Nuclear Power Engineering Committee of the IEEE Power Engineering Society responsible for the preparation and revision of the following 3 national Q.A. Standards:

- a. IEEE 498 (ANSI N45.2.16): Requirements for the Calibration and Control of Measuring and Test Equipment used in the Construction and Maintenance of Nuclear Power Generating Stations.

PROFESSIONAL AFFILIATION: (Contd)

- b. IEEE 336 (ANSI N45.2.4): Installation, Inspection, and Testing Requirements for Class 1E Instrumentation and Electric Equipment at Nuclear Power Generating Stations.
- c. IEEE 467: Quality Assurance Program Requirements for the Design and Manufacture of Class 1E Instrumentation and Electric Equipment for Nuclear Power Generating Stations.

I am currently a member of the IEEE Ad Hoc Committee which recommended the issues to be addressed in the development of a standard relating to the selection and utilization of replacement parts for Class 1E equipment during the construction and operation phase. I am also a member of the work group which will prepare this proposed standard.

PERSONAL DATA:

Birth Date: 7/08/37
Married; three children
Health: Excellent

PUBLICATIONS AND TESTIMONY:

- 1. In-Core System Provides Continuous Flux Map of Reactor Cores, R.B. Hubbard and C.E. Foreman, Power, November, 1967.
- 2. Quality Assurance: Providing It. Proving It, R.B. Hubbard, Power, May, 1972.
- 3. Testimony of R.B. Hubbard, D.G. Bridenbaugh, and G.C. Minor before the United States Congress, Joint Committee on Atomic Energy, February 18, 1976, Washington, DC. (Published by the Union of Concerned Scientists, Cambridge, Massachusetts.) Excerpts from testimony published in Quote Without Comment, Chemtech, May, 1976.
- 4. Testimony of R.B. Hubbard, D.G. Bridenbaugh, and G.C. Minor to the California State Assembly Committee on Resources, Land Use, and Energy, Sacramento, California, March 8, 1976.
- 5. Testimony of R. B. Hubbard and G.C. Minor before California State Senate Committee on Public Utilities, Transit, and Energy Sacramento, California, March 23, 1976.
- 6. Testimony of R.B. Hubbard and G.C. Minor, Judicial Hearings Regarding Grafenrheinfeld Nuclear Plant, March 16 & 17, 1977, Wurtzburg, Germany.

PUBLICATIONS AND TESTIMONY: (Contd)

7. Testimony of R.B. Hubbard to United States House of Representatives, Subcommittee on Energy and the Environment, June 30, 1977, Washington, DC, entitled, Effectiveness of NRC Regulations - Modifications to Diablo Canyon Nuclear Units.
8. Testimony of R.B. Hubbard to the Advisory Committee on Reactor Safeguards, August 12, 1977, Washington, DC, entitled, Risk Uncertainty Due to Deficiencies in Diablo Canyon Quality Assurance Program and Failure to Implement Current NRC Practices.
9. The Risks of Nuclear Power Reactors: A Review of the NRC Reactor Safety Study WASH-1400, Kendall, et al, edited by R.B. Hubbard and G.C. Minor for the Union of Concerned Scientists, August, 1977.
10. Swedish Reactor Safety Study: Barsebäck Risk Assessment, MHB Technical Associates, January 1978 (Published by Swedish Department of Industry as Document DSI 1978:1).
11. Testimony of R.B. Hubbard before the Energy Facility Siting Council, March 31, 1978, in the matter of Pebble Springs Nuclear Power Plant, Risk Assessment: Pebble Springs Nuclear Plant, Portland, Oregon.
12. Presentation by R.B. Hubbard before the Federal Ministry for Research and Technology (BMFT), August 31 and September 1, 1978, Meeting on Reactor Safety Research, Risk Analysis, Bonn, Germany.
13. Testimony by R.B. Hubbard, D.G. Bridenbaugh, and G.C. Minor before the Atomic Safety and Licensing Board, September 25, 1978 in the matter of the Black Fox Nuclear Power Station Construction Permit hearings, Tulsa, Oklahoma.
14. Testimony of R.B. Hubbard before the Atomic Safety and Licensing Board, November 17, 1978, in the matter of Diablo Canyon Nuclear Power Plant Operating License Hearings, Operating Basis Earthquake and Seismic Reanalysis of Structures, Systems, and Components, Avila Beach, California.
15. Testimony of R.B. Hubbard and D.G. Bridenbaugh before the Louisiana Public Service Commission, November 19, 1978, Nuclear Plant and Power Generation Costs, Baton Rouge, Louisiana.
16. Testimony of R.B. Hubbard before the California Legislature, Subcommittee on Energy, Los Angeles, April 12, 1979.

PUBLICATIONS AND TESTIMONY: (Contd)

17. Testimony of R.B. Hubbard and G.C. Minor before the Federal Trade Commission, on behalf of the Union of Concerned Scientists, Standards and Certification Proposed Rule 16 CFR Part 457, May 18, 1979.
18. ALO-62, Improving the Safety of LWR Power Plants, MHB Technical Associates, prepared for U.S. Department of Energy, Sandia National Laboratories, September, 1979, available from NTIS.
19. Testimony by R.B. Hubbard before the Arizona State Legislature, Special Interim House Committee on Atomic Energy, Overview of Nuclear Safety, Phoenix, AZ, September 20, 1979.
20. "The Role of the Technical Consultant," Practising Law Institute program on "Nuclear Litigation," New York City and Chicago, November, 1979. Available from PLI, New York City.
21. Uncertainty in Nuclear Risk Assessment Methodology, MHB Technical Associates, January, 1980, prepared for and available from the Swedish Nuclear Power Inspectorate, Stockholm, Sweden.
22. Italian Reactor Safety Study: Caorso Risk Assessment, MHB Technical Associates, March, 1980, prepared for and available from Friends of the Earth, Rome, Italy.
23. Development of Study Plans: Safety Assessment of Monticello and Prairie Island Nuclear Stations, MHB Technical Associates, August, 1980, prepared for and available from the Minnesota Pollution Control Agency.
24. Affidavit of Richard B. Hubbard and Gregory C. Minor before the Illinois Commerce Commission, In the Matter of an Investigation of the Plant Construction Program of the Commonwealth Edison Company, prepared for the League of Women Voters of Rockford, Illinois, November 12, 1980, ICC Case No. 78-0646.
25. Systems Interaction and Single Failure Criterion, MHB Technical Associates, January, 1981, prepared for and available from the Swedish Nuclear Power Inspectorate, Stockholm, Sweden.
26. Summary of Emergency Response Planning Criteria for Regional and Local Authorities Near Nuclear Electric Generating Stations, MHB Technical Associates, June, 1981, prepared for and available from Friends of the Earth, Rome, Italy.
27. Economic Assessment: Ownership Interest In Palo Verde Nuclear Station, September 11, 1981, prepared for and available from the City of Riverside, California.

PUBLICATIONS AND TESTIMONY: (Contd)

28. Testimony of R. B. Hubbard and G. C. Minor on behalf of Governor Edmund G. Brown Jr. before the Atomic Safety and Licensing Board, regarding Contention 1, Emergency Planning and Preparedness, January 11, 1982.

PROFESSIONAL QUALIFICATIONS OF GREGORY C. MINOR

GREGORY C. MINOR
MHB Technical Associates
1723 Hamilton Avenue
Suite K
San Jose, California 95125
(408) 266-2716

EXPERIENCE:

1976 - PRESENT

Vice-President - MHB Technical Associates, San Jose, California.
Engineering and energy consultant to state, federal, and private organizations and individuals. Major activities include studies of safety and risk involved in energy generation, providing technical consulting to legislative, regulatory, public and private groups and expert witness in behalf of state organizations and citizens' groups. Was co-editor of a critique of the Reactor Safety Study (WASH-1400) for the Union of Concerned Scientists and co-author of a risk analysis of Swedish reactors for the Swedish Energy Commission. Served on the Peer Review Group of the NRC/TMI Special Inquiry Group (Rogovin Committee). Actively involved in the Nuclear Power Plant standards Committee work for the Instrument Society of America (ISA).

1972 - 1976

Manager, Advanced Control and Instrumentation Engineering,
General Electric Company, Nuclear Energy Division, San Jose,
California.

Managed a design and development group of thirty-four engineers and support personnel designing systems for use in the measurement, control and operation of nuclear reactors. Involved coordination with other reactor design organizations, the Nuclear Regulatory Commission, and customers, both overseas and domestic. Responsibilities included coordinating and managing the design and development of control systems, safety systems, and new control concepts for use on the next generation of reactors. The position included responsibility for standards applicable to control and instrumentation, as well as the design of short-term solutions to field problems. The disciplines involved included electrical and mechanical engineering, seismic design and process computer control/programming.

1970 - 1972

Manager, Reactor Control Systems Design, General Electric Company,
Nuclear Energy Division, San Jose, California.

Managed a group of seven engineers and two support personnel in the design and preparation of the detailed system drawings and control documents relating to safety and emergency systems for nuclear reactors. Responsibility required coordination with other design organizations and interaction with the customer's engineering personnel, as well as regulatory personnel.

1963 - 1970

Design Engineer, General Electric Company, Nuclear Energy Division,
San Jose, California.

Responsible for the design of specific control and instrumentation systems for nuclear reactors. Lead design responsibility for various subsystems of instrumentation used to measure neutron flux in the reactor during startup and intermediate power operation. Performed lead system design function in the design of a major system for measuring the power generated in nuclear reactors. Other responsibilities included on-site checkout and testing of a complete reactor control system at an experimental reactor in the Southwest. Received patent for Nuclear Power Monitoring System.

1960 - 1963

Advanced Engineering Program, General Electric Company; Assignments
in Washington, California, and Arizona.

Rotating assignments in a variety of disciplines:

- Engineer, reactor maintenance and instrument design, KE and D reactors, Hanford, Washington, circuit design and equipment maintenance coordination.
- Design engineer, Microwave Department, Palo Alto, California. Worked on design of cavity couplers for TWT's.
- Design engineer, Computer Department, Phoenix, Arizona. Design of core driving circuitry.
- Design engineer, Atomic Power Equipment Department, San Jose, California. Circuit design and analysis.
- Design engineer, Space Systems Department, Santa Barbara, California. Prepared control portion of satellite proposal.

- Technical Staff - Technical Military Planning Operation. (TEMPO), Santa Barbara, California. Prepare analysis of missile exchanges.

- During this period, completed three-year General Electric program of extensive education in advanced engineering principles of higher mathematics, probability and analysis. Also completed courses in Kepner-Tregoe, Effective Presentation, Management Training Program, and various technical seminars.

EDUCATION

University of California at Berkeley, BSEE, 1960.

Advanced Course in Engineering - three-year curriculum, General Electric Company, 1963.

Stanford University, MSEE, 1966.

HONORS AND ASSOCIATIONS

- Tau Beta Pi Engineering Honorary Society.
- Co-holder of U.S. Patent No. 3,565-760, "Nuclear Reactor Power Monitoring System," February, 1971.
- Member: American Association for Advance of Science.
- Member: Nuclear Power Plant Standards Committee, Instrument Society of America.

PERSONAL DATA

Born: June 7, 1937
 Married, three children
 Residence: San Jose, California

PUBLICATIONS AND TESTIMONY

1. G.C. Minor, S.E. Moore, "Control Rod Signal Multiplexing," IEEE Transactions on Nuclear Science, Vol. NS-19, February, 1972.
2. G.C. Minor, W.G. Milam, "An Integrated Control Room System for a Nuclear Power Plant," NEDO-10658, presented at International Nuclear Industries Fair and Technical Meetings, October, 1972, Basle, Switzerland.
3. The above article was also published in the German Technical Magazine, NT, March, 1973.
4. Testimony of G.C. Minor, D.G. Bridenbaugh, and R.B. Hubbard before the Joint Committee on Atomic Energy, Hearings held February 18, 1976, and published by the Union of Concerned Scientists, Cambridge, Massachusetts.
5. Testimony of G.C. Minor, D.G. Bridenbaugh, and R.B. Hubbard before the California State Assembly Committee on Resources, Land Use, and Energy, March 8, 1976.
6. Testimony of G.C. Minor and R.B. Hubbard before the California State Senate Committee on Public Utilities, Transit, and Energy, March 23, 1976.
7. Testimony of G.C. Minor regarding the Grafenrheinfeld Nuclear Plant, March 16-17, 1977, Wurzberg, Germany.
8. Testimony of G.C. Minor before the Cluff Lake Board of Inquiry, Regina, Saskatchewan, Canada, September 21, 1977.
9. The Risks of Nuclear Power Reactors: A Review of the NRC Reactor Safety Study WASH-1400 (NUREG-75/0140), H. Kendall, et al, edited by G.C. Minor and R.B. Hubbard for the Union of Concerned Scientists, August, 1977.
10. Swedish Reactor Safety Study: Barsebäck Risk Assessment, MHB Technical Associates, January, 1978. (Published by Swedish Department of Industry as Document SdI 1978:1)
11. Testimony by G.C. Minor before the Wisconsin Public Service Commission, February 13, 1978, Loss of Coolant Accidents: Their Probability and Consequence.
12. Testimony by G.C. Minor before the California Legislature Assembly Committee on Resources, Land Use, and Energy, AB 3108, April 26, 1978, Sacramento, California.

PUBLICATIONS AND TESTIMONY

13. Presentation by G.C. Minor before the Federal Ministry for Research and Technology (BMFT), Meeting on Reactor Safety Research, Man/Machine Interface in Nuclear Reactors, August 21, and September 1, 1978, Bonn, Germany.
14. Testimony by G.C. Minor, D.G. Bridenbaugh, and R.B. Hubbard, before the Atomic Safety and Licensing Board, September 25, 1978, in the matter of the Black Fox Nuclear Power Station Construction Permit Hearings, Tulsa, Oklahoma.
15. Testimony of G.C. Minor, ASLB Hearings Related to TMI-2 Accident, Rancho Seco Power Plant, on behalf of Friends of the Earth, September 13, 1979.
16. Testimony of G.C. Minor before the Michigan State Legislature, Special Joint Committee on Nuclear Energy, Implications of Three Mile Island Accident for Nuclear Power Plants in Michigan, 10/15/79.
17. A Critical View of Reactor Safety, by G.C. Minor, paper presented to the American Association for the Advancement of Science, Symposium on Nuclear Reactor Safety, January 7, 1980, San Francisco, California.
18. The Effects of Aging on Safety of Nuclear Power Plants, paper presented at Forum on Swedish Nuclear Referendum, Stockholm, Sweden, March 1, 1980.
19. Minnesota Nuclear Plants Gaseous Emissions Study, MHB Technical Associates, September, 1980, prepared for the Minnesota Pollution Control Agency, Roseville, MN.
20. Testimony of G.C. Minor and D.G. Bridenbaugh before the New York State Public Service Commission, Shoreham Nuclear Plant Construction Schedule, in the matter of Long Island Lighting Company Temporary Rate Case, September 22, 1980.
21. Testimony of G.C. Minor and D.G. Bridenbaugh before the New Jersey Board of Public Utilities, Oyster Creek 1980 Refueling Outage Investigation, in the matter of Jersey Central Power and Light Rate Case, February 19, 1981.
22. Testimony of R. B. Hubbard and G. C. Minor on behalf of Governor Edmund G. Brown Jr. before the Atomic Safety and Licensing Board, regarding Contention 1, Emergency Planning and Preparedness, January 11, 1982.
23. Testimony of D. G. Bridenbaugh and G. C. Minor on behalf of Governor Edmund G. Brown Jr., before the Atomic Safety and Licensing Board, regarding Contention 10, Pressurizer Heaters, January 11, 1982.

PUBLICATIONS AND TESTIMONY

24. Testimony of D. G. Bridenbaugh and G. C. Minor on behalf of Governor Edmund G. Brown, Jr. before the Atomic Safety and Licensing Board, regarding Contention 12, Block and Pilot Operated Relief Valves, January 11, 1982.