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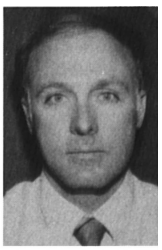
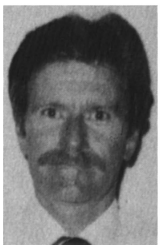
AUTHORS — DECEMBER 1989

TMI-2: DECONTAMINATION AND WASTE MANAGEMENT

QUALITY ASSURANCE IN THE REMOVAL AND TRANSPORT OF THE THREE MILE ISLAND UNIT 2 CORE

Glen R. Hayes
Joseph F. Marsden

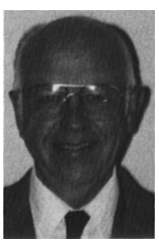




Glen R. Hayes (top) (BS, mechanical engineering, Pennsylvania State University, 1965) is a quality assurance specialist for EG&G Idaho, a U.S. Department of Energy contractor at the Idaho National Engineering Laboratory. His experience includes design, construction, operation, and in-service inspection of light water reactors. His technical interests include quality assurance, manufacturing engineering, and transportation of radioactive material. **Joseph F. Marsden** (BS, industrial engineering, Purdue University, 1972) is the quality assurance engineering manager at Three Mile Island (TMI), operated by GPU Nuclear Corporation (GPU). He has been involved in the TMI-2 cleanup with the GPU Quality Assurance Organization since 1980. He has 17 years of experience in quality assurance in the nuclear industry. His interests include procurement quality assurance and quality improvement programs.

THE EFFECTS OF HYDROGEN GENERATION ON RADIOACTIVE WASTE HANDLING TECHNOLOGY

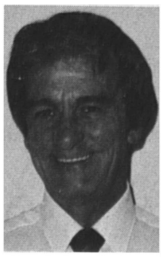
James O. Henrie



James O. Henrie (MS, engineering, Utah State University, 1951) has worked for Rockwell International and Westinghouse for 37 years. He has been the project engineer/manager for 12 nuclear research reactors and many hydrogen recombiner systems for pressurized water and boiling water reactors. His patented recombiners at Three Mile Island removed 115 kg of hydrogen from the containment building after the 1979 accident.

PROCESSING AND DISPOSAL OF RADIOACTIVE SEDIMENTS AT THREE MILE ISLAND UNIT 2

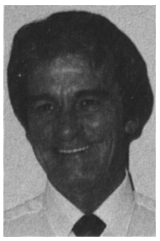
George D. Cremeans
Richard F. Mahla



George D. Cremeans (top) (BS, mechanical engineering, Clayton University, 1979) is a senior staff engineer with Bechtel National, currently assigned to the company's area office in Oak Ridge, Tennessee. During the Three Mile Island Unit 2 recovery program, he was the supervisor of systems engineering in the recovery engineering organization. He has previously worked at Morrison-Knudsen Company. His research interests are in systems engineering and practical applications of multidisciplined system designs. **Richard F. Mahla** (BS, mechanical engineering, Bucknell University, 1980) is a systems design engineer with experience in power plant start-up and operation for Bechtel Corporation. His technical interests include radwaste disposal, fluids transport, and energy engineering.

FINAL DISPOSITION OF THREE MILE ISLAND UNIT 2 ACCIDENT-GENERATED WATER

George D. Cremeans



George D. Cremeans (BS, mechanical engineering, Clayton University, 1979) is a senior staff engineer with Bechtel National, currently assigned to the company's area office in Oak Ridge, Tennessee. During the Three Mile Island Unit 2 recovery program, he was the supervisor of systems engineering in the recovery engineering organization. He has previously worked at Morrison-Knudsen Company. His research interests are in systems engineering and practical applications of multidisciplined system designs.

U.S. NUCLEAR REGULATORY COMMISSION INSPECTION OF TRANSPORTATION CASKS

Claudia M. Abbate
John W. Craig

Claudia M. Abbate (photo not available) (BS, environmental engineering, Northwestern University, 1985) is a project engineer at the U.S. Nuclear Regulatory Commission (NRC). She has performed numerous inspections at vendor facilities, was responsible for developing the inspection procedure for the fabrication of transportation casks, and was a member of the inspection teams for the fabrication of the Three Mile Island Unit 2 (TMI-2) transportation canisters and casks. She currently works in the Licensing Division at the NRC. **John W. Craig** (photo not available) (BS, nuclear engineering, University of Maryland, 1979) is a manager at the NRC. He supervised the development and implementation of the TMI-2 transportation canister and cask inspection procedure while he was the chief of the Special Project Inspection Section in the Vendor Inspection Branch. He also participated in several of the TMI-2 canister and cask inspections. He is currently the director of Project Directorate III-2 in the Licensing Division at the NRC.

PLANT EQUIPMENT MODIFICATIONS REQUIRED TO PLACE THREE MILE ISLAND UNIT 2 IN A POSTDEFUELING MONITORED STORAGE CONFIGURATION

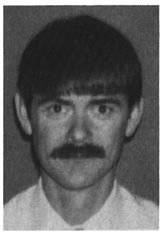
T. Chris Fonner

T. Chris Fonner (BS, nuclear engineering, University of Maryland, 1978) is a systems engineer. He was in charge of developing the postdefueling monitored storage program for system layup at Three Mile Island Unit 2. He is an ex-Navy nuclear

propulsion operator and engineering laboratory technician. His current interests include nuclear plant operations and systems engineering.

THREE MILE ISLAND UNIT 2 POSTDEFUELING REGULATORY CONSIDERATIONS

Sidney W. Smith
James J. Byrne



Sidney W. Smith (top) (BS, mechanical engineering, San Jose State University, 1968) is a consultant for S. Levy. He has been involved in licensing activities at Three Mile Island Unit 2 (TMI-2) since 1981. He was the principal author for the safety analysis report submitted in support of the facility change to postdefueling monitored storage. He has been involved in various aspects of the nuclear industry since 1968 through association with General Electric Company and S. Levy. He is interested in the nuclear licensing process and the regulatory aspects of decommissioning. **James J. Byrne** (BS, civil engineering, University of Pittsburgh, 1974) is the manager of TMI-2 licensing and has been involved in licensing the TMI-2 cleanup since 1980. His primary interests are nuclear licensing and the U.S. Nuclear Regulatory Commission regulatory process. Prior to joining GPU Nuclear Corporation, he worked as a licensing engineer for Sargent & Lundy Engineers and served in the Nuclear Navy.

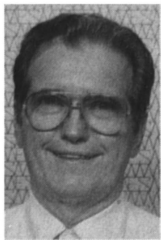
THE EVALUATION OF RADIONUCLIDE PENETRATION OF STRUCTURAL CONCRETE SURFACES IN THE THREE MILE ISLAND UNIT 2 REACTOR BUILDING

Clay M. Davis

Clay M. Davis (MS, biology, Tennessee Technological University, 1981) is a senior engineer with the Labor Relations, Safety and Health Organization of Bechtel Construction Company. He is currently assigned to the Oak Ridge National Laboratory's Remedial Investigation/Feasibility Study Project as the project's lead health physicist. He has 8 years of experience in specialized investigations associated with nuclear recovery and remediation projects. His current professional endeavors include assessment of special hazards associated with remedial investigation at research facilities.

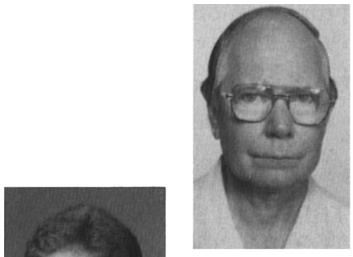
ANALYSIS OF DATA FROM LEACHING CONCRETE SAMPLES TAKEN FROM THE THREE MILE ISLAND UNIT 2 REACTOR BUILDING BASEMENT

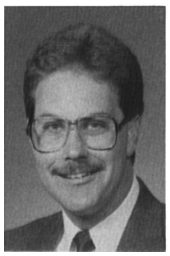
Emory D. Collins
W. Donald Box
Herschel W. Godbee
Timothy C. Scott



Emory D. Collins (top) (BS, chemical engineering, Auburn University, 1958) is head of the Process Development Section, Chemical Technology Division, at Oak Ridge National Laboratory (ORNL), operated by Martin Marietta Energy Systems, Inc. He has also been manager of Three Mile Island technical support at ORNL since 1983 and was a co-developer of the process used to decontaminate the high-activity-level water at Three Mile Island Unit 2. His primary technical interests are in radiochemical engineering development. **W. Donald Box** (bottom) (BS, chemistry, University of Louisville, 1952) is an engineer in the Engineering Coordination and Analysis Section, Chemical Technology Division, at ORNL. His primary research interests are drop testing of shipping containers, hot cell decontamination by

electropolishing, and low-level liquid waste transfer. **Herschel W. Godbee** (top) (BS and PhD, chemical engineering, Georgia Institute of Technology) has been associated with the Chemical Technology Division of ORNL since 1958. He is currently involved in research and development studies in the fields of mass transfer and the management of radioactive, hazardous, and mixed wastes. **Timothy C. Scott** (bottom) (PhD, chemical engineering, University of Wisconsin-Madison, 1985) is a group leader in the Energy Research Programs, Chemical Technology Division, at ORNL. His primary research interests involve the study of transport and chemical reaction phenomena as they relate to multiphase separation systems. His current emphasis is on the use of external electromagnetic fields to enhance multiphase separation systems. He is also an adjunct associate professor of chemical engineering at the University of Tennessee.





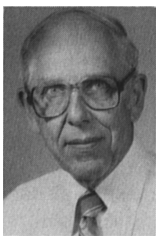
DESIGN OF A FILTER AID AND COAGULANT ADDITION SYSTEM AT THREE MILE ISLAND UNIT 2

Pieter R. van Stolk
Mark D. Smith

Pieter R. van Stolk (photo not available) (BSNE, Georgia Institute of Technology) has been a mechanical engineer at Bechtel Power Corporation for the last 11 years. He specializes in hydraulic and heat transfer systems. He currently works at the Three Mile Island Unit 2 (TMI-2) cleanup project. **Mark D. Smith** (photo not available) (BS, nuclear engineering, Iowa State University; MEng, engineering science, Pennsylvania State University) was a member of the water clarity task group during the efforts to solve the TMI-2 reactor vessel water clarity problems. He assisted with deep-bed filter testing as well as coagulant and bodyfeed activities.

CHARACTERIZATION STUDIES OF SOLIDS FROM REACTOR COOLANT SYSTEM WATER AND TEST FILTER MEDIA FROM THREE MILE ISLAND UNIT 2

David O. Campbell



David O. Campbell (PhD, physical chemistry, Illinois Institute of Technology, 1953) has been engaged in chemical research at the Oak Ridge National Laboratory since 1953. His major interests include chemical separations, nuclear fuel reprocessing, actinide chemistry, and nuclear reactor chemistry. He has served on several assistance, advisory, and review groups concerned with the Three Mile Island Unit 2 recovery program since 1979.

UTILIZATION OF THREE MILE ISLAND UNIT 2 RESEARCH AND DEVELOPMENT INFORMATION IN JAPAN

Nobuyuki Tabata
Fujio Masuda

Nobuyuki Tabata (top) (BS, nuclear engineering, University of Tokyo, Japan, 1970) is currently a deputy manager of the advanced power reactor engineering department at the Nuclear Power Research and Development Center of Tokyo Electric Power Company. He has participated in the research and development of the fast breeder reactor demonstration plant in Japan. His past experience includes participation in the Three Mile Island Unit 2 (TMI-2) research project in Japan, light water reactor fuel and core management, and start-up tests of boiling water reactor (BWR) plants. **Fujio Masuda** (BS, nuclear engineering, University of Tokyo, Japan, 1968) is engineering manager of the Safety Engineering Section for BWRs at Toshiba Corporation.

His past experience includes loss-of-coolant accident analysis, probabilistic risk assessment of BWRs, and participation in the TMI-2 research project in Japan. His current interests include comprehensive evaluation of severe accident and human factors.

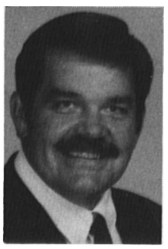
USE OF DEEP-BED FILTRATION TECHNOLOGY IN THE CLEANUP OF THREE MILE ISLAND UNIT 2

Mark Douglas Smith

Mark Douglas Smith (photo not available) (BS, nuclear engineering, Iowa State University; MEng, engineering science, The Pennsylvania State University) was a member of the water clarity task group assisting with the deep-bed filter testing and coagulant and bodyfeed activities during the efforts to solve the Three Mile Island Unit 2 vessel water clarity problems. He assisted with deep-bed filter testing as well as coagulant and bodyfeed activities.

THE IDENTIFICATION AND CONTROL OF MICROORGANISMS AT THREE MILE ISLAND UNIT 2

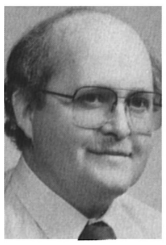
Kenneth J. Hofstetter
Beverly S. Ausmus

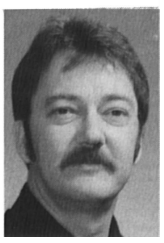


Kenneth J. Hofstetter (top) (AB, Augustana College, 1962; PhD, Purdue University, 1967) is a research staff scientist in the Environmental Technology Section at Savannah River Laboratory. He directed liquid radioactive waste processing and radiochemical analyses at Three Mile Island Unit 2 (TMI-2). His research specialties include the development of nondestructive assay techniques, real-time monitoring for radioactive materials, decontamination, and radiochemical analyses. **Beverly S. Ausmus** (BS, Carson-Newman College; MS and PhD, ecosystems analysis, University of Tennessee) is vice president of environmental waste management for Gibbs & Hill. She was project manager for the biological decontamination of TMI-2. Her experience includes environmental waste management, site characterization, microbial detection, corrosion prevention, biomediation, and biological decontamination technologies.

SAMPLING AND EXAMINATION METHODS USED FOR THREE MILE ISLAND UNIT 2

Alan W. Marley
Douglas W. Akers
Charles V. McIsaac

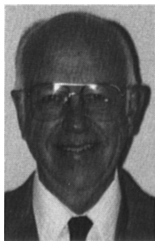




Alan W. Marley (top) (AA, nuclear technology, Eastern Idaho Technical College, 1975) is a scientist in the nuclear science unit of EG&G Idaho (EG&G), Idaho National Engineering Laboratory (INEL). He is currently completing a BS degree in computer science at the University of Idaho. He was involved in radiation measurements during the initial cleanup activities at Three Mile Island Unit 2 (TMI-2) and has been responsible for analysis, data reduction, and sample tracking of various TMI-2 samples. His current interests include advanced computer-controlled data acquisition systems. **Douglas W. Akers** (center) (BA, chemistry, Idaho State University) is currently the technical leader of the Radiological Physics Section at EG&G. He has been involved in the examination and analysis of results from TMI-2 since shortly after the accident. He is currently involved in examinations of the lower head of the TMI-2 reactor vessel and in the development of nuclear materials measurement methods. **Charles V. McIsaac** (bottom) (BS, earth and planetary sciences, Massachusetts Institute of Technology, 1971) is a research staff member of the physics and mathematics group at INEL. His current research interest is in the area of low-level radioactive waste.

TIMING OF THE THREE MILE ISLAND UNIT 2 CORE DEGRADATION AS DETERMINED BY FORENSIC ENGINEERING

James O. Henrie



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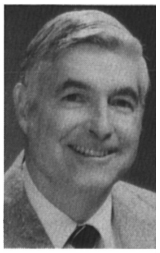
THREE MILE ISLAND UNIT 2 CORE GEOMETRY

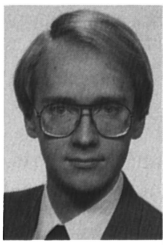
Malcolm L. Russell
Richard K. McCardell

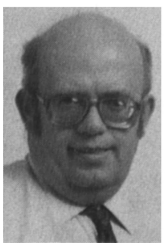


Malcolm L. Russell (top) (BS, mechanical engineering, University of Vermont, 1958) provided technical and administrative support for various Three Mile Island Unit 2 (TMI-2) sample acquisition and examination projects. He is currently involved in the planning of a modular high-temperature gas-cooled reactor (MHTGR) for production of nuclear materials and power at the Idaho National Engineering Laboratory (INEL). **Richard K. McCardell** (BS, 1969, and MS, 1962, physics, Idaho State University) was responsible for the sample acquisition and examination program for the TMI-2 Accident Evaluation Program. He is currently working on safety model and code development for the MHTGR at INEL.

SCANNING ELECTRON MICROANALYSIS TECHNIQUES FOR THREE MILE ISLAND UNIT 2 CORE SAMPLES

Bruce A. Pregger
Charles S. Olsen

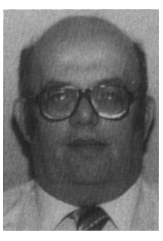




Bruce A. Pregger (top) (PhD, materials science, University of Delaware, 1986) is a senior scientist with EG&G Idaho (EG&G) at the Idaho National Engineering Laboratory (INEL), where he has been involved in developing a scanning electron microscope laboratory dedicated to the remote examination of radioactive material. His current research interest is in severe fuel damage experiment core material interactions. **Charles S. Olsen** (PhD, metallurgy, University of Utah, 1967; MBA, Idaho State University, 1984) is a principal program specialist with the Multimegawatt Project Integration Office at INEL operated by EG&G. He worked at INEL for 21 years in developing and implementing nuclear reactor materials testing programs and evaluating materials performance and characterizing materials properties for nuclear safety research. His current research interests are in developing materials and fuels for advanced nuclear space power systems.

APPLICATION OF SEVERE FUEL DAMAGE EXPERIMENTS TO EVALUATING THREE MILE ISLAND UNIT 2 CORE MATERIALS BEHAVIOR

Charles S. Olsen
Richard R. Hobbins
Beverly A. Cook

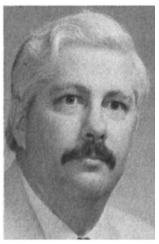


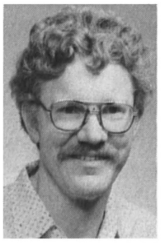
Charles S. Olsen (right) (PhD, metallurgy, University of Utah, 1967; MBA, Idaho State University, 1984) is a principal program specialist with the Multimegawatt Project Integration Office at the Idaho National Engineering Laboratory (INEL), operated by EG&G Idaho (EG&G). He worked at INEL for 21 years in developing and implementing nuclear reactor materials testing programs, evaluating materials performance, and characterizing materials properties for nuclear safety research. His current research interests are in developing materials and fuels for

advanced nuclear space power systems. **Richard R. Hobbins** (right) (AB, physical chemistry, Princeton University, 1960; PhD, physical metallurgy, University of Delaware, 1969) is a principal scientist in the Fuels and Materials Unit of EG&G at INEL. He has been at the INEL for 20 years, working in the areas of fuel behavior and reactor safety, especially under severe accident conditions. **Beverly A. Cook** (left) (BS, metallurgical engineering, University of Washington, 1975) is manager of the materials technology group of the science and technology department at INEL. Her previous work involved failure analysis of nuclear materials tested under design-basis and severe accident conditions. Her present work includes managing an organization performing research in materials, materials processing, and materials characterization for both nuclear and nonnuclear applications.

THREE MILE ISLAND UNIT 2 DATA QUALIFICATION AND DATA BASES

Daniel W. Golden
Ronne W. Brower
James L. Anderson
Larry J. Fackrell
Robert D. McCormick





Daniel W. Golden (top right) [BS, engineering, California State University; SM (NA and ME) and ocean engineering, Massachusetts Institute of Technology, 1975] is a senior engineering specialist in the energy and systems technology group (ESTG) of EG&G Idaho (EG&G) at the Idaho National Engineering Laboratory (INEL). His current interests are the analysis of plant transients, accident management strategies, and the application of data bases to engineering problem resolution. **Ronne W. Brower** (top left) (BS, physics, Idaho State University, 1959) works in a measurements system engineering unit for EG&G at INEL. His primary area of experience has been in experimental systems design and the analysis of transient measurements in large single-event experiments. His current interests include the development of on-line computer techniques to validate measurement results under transient test conditions. **James L. Anderson** (center right) (MS, mechanical engineering, Oregon State University, 1974) is a senior engineering specialist in the ESTG at INEL. His research interests include multiphase thermal hydraulics, scaled experimental systems analysis, and measurement systems development. **Larry J. Fackrell** (bottom left) (BS, mathematics, Brigham Young University, 1974) is a computer programmer for EG&G at INEL. His primary experience has been in the development of data bases and data base software for both mainframe and personal-computer environments. He developed the software for the Three Mile Island Unit 2 data bases. His current interests are data base and data base software development. **Robert D. McCormick** (bottom right) (MS, electrical engineering, University of Idaho, 1961) has had experience in instrumentation, test engineering, measurements, and test data analysis in both nuclear and nonnuclear applications. Currently he is an engineering specialist with the U.S. Nuclear Regulatory Commission's Regulatory and Technical Assistance Unit at INEL.

ANALYSIS OF HYDROGEN BURN IN THE THREE MILE ISLAND UNIT 2 ACCIDENT WITH THE CONTAIN1.1 COMPUTER CODE

Ken Muramatsu
Kunihisa Soda

Ken Muramatsu (top) (BS, nuclear engineering, Tokyo University, Japan, 1975) has been involved in the development and application of computer codes for thermal-hydraulic analysis of reactor accidents since 1975 at the Japan Atomic Energy Research Institute (JAERI). His current interest is in severe accident analysis for probabilistic safety analysis of light water reactors (LWRs). **Kunihisa Soda** (PhD, energy engineering, Uni-

versity of Illinois, Chicago, 1971) joined JAERI in 1972 and has worked on various projects on LWR safety analysis and experiments. He is head of the Severe Accident Research Laboratory at JAERI.

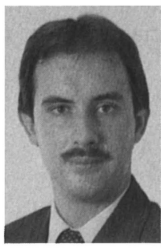
ANALYSIS OF THE REFILL PHENOMENA DURING THE THREE MILE ISLAND UNIT 2 ACCIDENT

Yasushi Nomura
James L. Anderson

Yasushi Nomura (top) (BS, 1967, and Dr. Eng., 1984, nuclear engineering, Tokyo University, Japan) is a senior researcher in the Japan Atomic Energy Research Institute. His current interests are criticality accident assessment and probabilistic safety analyses. **James L. Anderson** (MS, mechanical engineering, Oregon State University, 1974) is a senior engineering specialist in the Energy and Systems Technology Division at the Idaho National Engineering Laboratory. His research interests include multiphase thermal hydraulics, scaled experimental systems analysis, and measurement systems development.

POTENTIAL FOR RECRITICALITY OF THE RELOCATED CORE

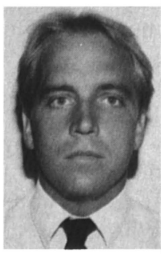
Bernard R. Bandini
Anthony J. Baratta



Bernard R. Bandini (right) [MS, Pennsylvania State University (PSU)] is a PhD candidate and graduate assistant in nuclear engineering at PSU. His interests are in fission reactor shielding and core analysis. **Anthony J. Baratta** (left) (PhD, physics, Brown University, 1979) is an associate professor of nuclear engineering at PSU. His research interests include light water reactor transient analysis and neutron transport.

DRILLING OPERATIONS TO REMOVE THE LOWER CORE SUPPORT ASSEMBLY AT THREE MILE ISLAND UNIT 2

Herbert W. Kirkland
Marc A. Nemser
William M. Laney



Herbert W. Kirkland (top) (BS, mechanical engineering, Virginia Polytechnic Institute and State University, 1984) is an engineer at Bechtel Power Corporation (BPC) and is responsible for the analysis and design of mechanical systems associated with various projects. His interests include systems engineering and project management. **Marc A. Nemser** (center) (Assoc. Deg., mechanical engineering technology, Pennsylvania State University, 1978) is an engineer with BPC in the defueling engineering group at Three Mile Island Unit 2. His primary interests include nuclear plant system engineering and design. **William M. Laney** (bottom) (BA, physics, Texas Christian University, 1967) is an engineer in the mechanical engineering group at the Idaho National Engineering Laboratory, operated by EG&G Idaho. He has extensive experience in the development of specialized equipment for use in nuclear reactor safety research and development. He is currently engaged in the development of an environmentally safe depleted uranium test facility for the U.S. Army.

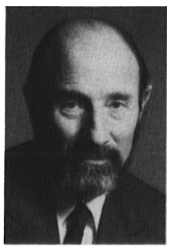
THREE MILE ISLAND UNIT 2 ANALYSIS EXERCISE: CATHARE COMPUTATIONS OF PHASES 1 AND 2 OF THE ACCIDENT

Patrick Dumaz

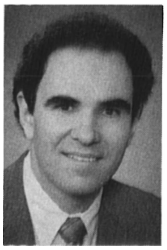
Patrick Dumaz (Eng. ENSAM, mechanical engineering, 1983; Dr. Engineer, solid mechanics, Université de Grenoble, France, 1985) is a research engineer at the Nuclear Safety Institute of the Commissariat à l'Energie Atomique. He is currently interested in thermal-hydraulic calculations with the CATHARE code and the interpretation of aerosol experiments.

CLOSING PLENARY—ENHANCED REACTOR SAFETY: LESSONS LEARNED FROM THREE MILE ISLAND UNIT 2

Sid Langer
Dennis Owen



Sid Langer (top) (PhD, physical chemistry, Illinois Institute of Technology) worked on the Three Mile Island Unit 2 (TMI-2) Accident Evaluation Program at EG&G Idaho (EG&G), Idaho National Engineering Laboratory (INEL). He was previously employed at General Atomics, working on the high-temperature gas-cooled reactor, the gas-cooled fast breeder reactor, and a number of other programs. **Dennis Owen** (BS, chemistry, California State University, 1969) is president of ENCORE Technical Resources, an engineering consulting and technical communications firm. He has been a consultant to the nuclear power industry since 1984. Previously, he worked for EG&G at INEL and for the General Electric Company at the Vallecitos Nuclear Center. Most of his career has been spent working on light water reactor fuels and materials and has included the TMI-2 core examination, severe accident reactor experiments, postirradiation examination of experimental fuel assemblies, and design modifications to commercial fuel to improve performance. His current interests include nuclear industry technology transfer and innovations in engineering communications.



MATERIALS BEHAVIOR

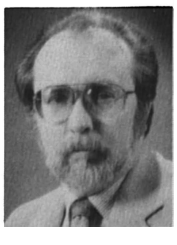
THERMAL INTERACTIONS DURING THE THREE MILE ISLAND UNIT 2 2-B COOLANT PUMP TRANSIENT

Pui Kuan
James L. Anderson
E. L. Tolman

Pui Kuan (top) (BS, astronomy, California Institute of Technology; MA, 1972, and PhD, 1973, astronomy, University of California–Berkeley) is a senior engineering specialist at the Idaho National Engineering Laboratory (INEL). He has been involved in the planning and analysis of experiments performed at the Loss-of-Fluid Test (LOFT) Facility and the Power Burst Facility (PBF). He has also contributed to the development of the Three Mile Island Unit 2 (TMI-2) accident scenario. **James L. Anderson** (center) (MS, mechanical engineering, Oregon State University, 1974) is a senior engineering specialist in the Energy and Systems Technology Division at the INEL. His research interests include multiphase thermal hydraulics, scaled experimental systems analysis, and measurement systems development. **E. L. Tolman** (bottom) (BS, physics, and MS, nuclear engineering) has been involved in light water reactor research at the INEL. He most recently managed the technical analysis conducted for the U.S. Department of Energy TMI-2 Accident Evaluation Program. Prior to his work on TMI-2, he was responsible for design and analysis of severe accident and large-break loss-of-coolant accident experiments in the LOFT Facility, and separate-effects fuel damage experiments in the PBF. He is currently employed by Advanced Nuclear Fuels.

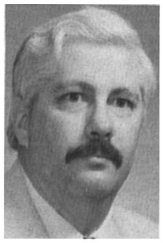
THREE MILE ISLAND UNIT 2 DEGRADED CORE HEATUP AND COOLDOWN ANALYSIS

Richard L. Moore
Daniel W. Golden
E. L. Tolman



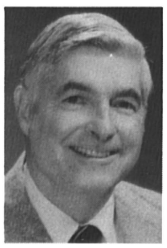
Richard L. Moore (right) (MS, civil engineering, Colorado State University, 1973) is currently a senior engineering specialist in the nuclear engineering and reactor design group at EG&G Idaho. He has over 20 years of experience in thermal-hydraulic modeling. His current interest is in modeling core meltdown phenomena

associated with light water reactors. **Daniel W. Golden** (top) [BS, engineering, California State University; SM (NA and ME) and ocean engineering, Massachusetts Institute of Technology, 1975] is a research engineer with INEL. For the past 9 years, his work has been related to reactor thermal hydraulics and fuel behavior during severe accident conditions. His current interests are accident management issues and their resolution. **E. L. Tolman** (bottom) (BS, physics, and MS, nuclear engineering) has been associated with light water reactor research conducted at the Idaho National Engineering Laboratory (INEL). He most recently managed the technical analysis conducted for the U.S. Department of Energy TMI-2 Accident Evaluation Program, an industrywide program to establish a more complete understanding of the TMI-2 accident. Prior to his work on TMI-2, he was responsible for the design and analysis of both severe accident and large-break loss-of-coolant accident experiments conducted in the Loss-of-Fluid Test (LOFT) Facility, and separate effects fuels damage experiments conducted in the Power Burst Facility. He is currently employed by Advanced Nuclear Fuels.



MOLTEN MATERIAL BEHAVIOR IN THE THREE MILE ISLAND UNIT 2 ACCIDENT

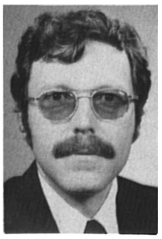
Richard R. Hobbins
Malcolm L. Russell
Charles S. Olsen
Richard K. McCardell

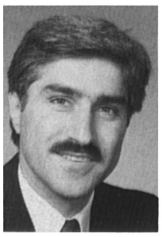


Richard R. Hobbins (top right) (AB, physical chemistry, Princeton University, 1960; PhD, physical metallurgy, University of Delaware, 1969) is a principal scientist in the Fuels and Materials Unit of EG&G Idaho (EG&G) at the Idaho National Engineering Laboratory (INEL). He has been at the INEL for 20 years, working in the areas of fuel behavior and reactor safety, especially under severe accident conditions. **Malcolm L. Russell** (top left) (BS, mechanical engineering, University of Vermont, 1958) provided technical and administrative support for various Three Mile Island Island Unit 2 (TMI-2) sample acquisition and examination projects. He previously was manager for the loss-of-fluid test (LOFT) instrumented-fuel design, fabrication, and examination program. Prior to the TMI-2 and LOFT work, he provided technical support to plant operations at the S1C (prototype submarine power plant in Windsor, Connecticut) and SL-1 (prototype portable boiling water reactor at the INEL) projects. He currently provides technical and administrative support to the planning of a modular high-temperature gas-cooled reactor (MHTGR) for production of nuclear materials and power at the INEL. **Charles S. Olsen** (bottom right) (PhD, metallurgy, University of Utah, 1967; MBA, Idaho State University, 1984) is a principal program specialist with the Multimegawatt Project Integration Office at the INEL, operated by EG&G. He worked at the INEL for 21 years in developing and implementing nuclear reactor materials testing programs, evaluating materials performance, and characterizing materials properties for nuclear safety research. His current research interests are in developing materials and fuels for advanced nuclear space power systems. **Richard K. McCardell** (bottom left) [BS, physics, Idaho State University (ISU), 1960; MS, physics, ISU, 1962] was responsible for sample acquisition and examination for the TMI-2 Accident Evaluation Program. He previously was responsible for experiment specification and analysis for almost all of the experiments that were performed in the Power Burst Facility. He began his career as a member of the experimental group responsible for the Spert 1 destructive test program and is currently responsible for safety model and code development for the MHTGR version of the New Production Reactor.

THE OVERALL SOURCE RANGE MONITOR RESPONSE DURING THE THREE MILE ISLAND UNIT 2 ACCIDENT

Anthony J. Baratta
Alireza Haghighat
Bernard R. Bandini





Anthony J. Baratta (top) (PhD, physics, Brown University, 1979) is an associate professor of nuclear engineering at The Pennsylvania State University (PSU). His research interests include light water reactor transient analysis and neutron transport. **Alireza Haghighat** (center) (PhD, nuclear engineering, University of Washington, 1986) is an assistant professor of nuclear engineering at PSU. His current interests are in computational methods in reactor physics, neutronics and thermal-hydraulic modeling, and development and implementation of new transport theory algorithms for vector/parallel processors. **Bernard R. Bandini** (bottom) (MS, PSU) is a PhD candidate and graduate assistant in nuclear engineering at PSU. His interests are in fission reactor shielding and core analysis.

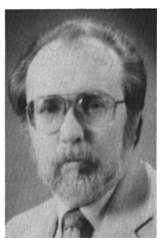
THE THREE MILE ISLAND UNIT 2 CORE RELOCATION—HEAT TRANSFER AND MECHANISM

Michael Epstein
Hans K. Fauske

Michael Epstein (top) (PhD, mechanical engineering, Polytechnic Institute of Brooklyn, 1970) is a vice president of consulting services at Fauske & Associates, Inc. (FAI). He had a 9-yr association with the Argonne National Laboratory (ANL), where he was manager of the Post-Accident Heat Removal Section in the Reactor Analysis and Safety Division. He served as a consultant to various industries and on several government committees and review panels. His research centers on thermal-hydraulic and transport phenomena in turbulent and multiphase systems, with particular emphasis on nuclear and chemical reactor safety applications. **Hans K. Fauske** (DSc, Norwegian Institute of Technology, 1963) is the president of FAI. In 1975 he became the first recipient in the field of reactor technology to receive the University of Chicago Medal for Distinguished Performance at ANL, and in 1982 he became the third recipient of the "Tommy" Thompson Award, the highest honor the American Nuclear Society gives in the field of reactor safety.

COMPARISON OF THERMAL AND MECHANICAL RESPONSES OF THE THREE MILE ISLAND UNIT 2 REACTOR VESSEL

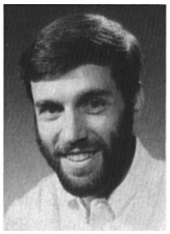
Gary L. Thinnes
Richard L. Moore



Gary L. Thinnes (top) (MS, civil engineering, University of Nebraska, 1974) is an engineering specialist in the applied mechanics group at EG&G Idaho (EG&G) and has 15 years of experience in the structural analysis of nuclear reactor systems and components. He is currently involved with structural analysis of fuel and reactor components under severe accident conditions. **Richard L. Moore** (MS, civil engineering, Colorado State University, 1973) is currently a senior engineering specialist in the nuclear engineering and reactor design group at EG&G. He has over 20 years of experience in thermal-hydraulic modeling. His current interest is in modeling core meltdown phenomena associated with light water reactors.

MELCOR ANALYSIS OF THE THREE MILE ISLAND UNIT 2 ACCIDENT

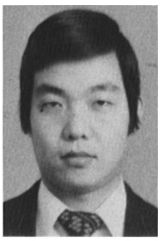
Edward A. Boucheron
John E. Kelly

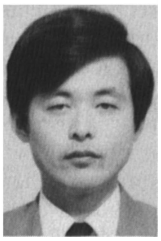


Edward A. Boucheron (top) (PhD, mechanical engineering, Rensselaer Polytechnic Institute, 1986) is a member of the technical staff in the Thermal-Hydraulics Analysis Division (THAD) at Sandia National Laboratories (SNL). He is involved in modeling, assessment, and code development for application in severe accident risk studies. His research interests include modeling of phase change heat transfer. **John E. Kelly** (PhD, nuclear engineering, Massachusetts Institute of Technology, 1980) is supervisor of the THAD at SNL. His current research is directed toward developing severe accident simulation models and computer codes and applying these to risk assessment studies.

THERMAL-HYDRAULIC ANALYSIS OF THE INITIAL PHASE OF THE THREE MILE ISLAND UNIT 2 ACCIDENT

Kazuichiro Hashimoto
Kunihisa Soda
Hideo Sekiya





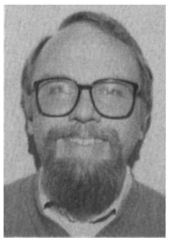
Kazuichiro Hashimoto (top) (BS, electrical engineering, Keio University, Japan, 1976) is a research engineer at Japan Atomic Energy Research Institute (JAERI). He is engaged in severe accident research for light water reactors (LWRs). His current interest is in the pool scrubbing effect of aerosols under severe accident conditions in LWRs. **Kunihisa Soda** (center) (PhD, energy engineering, University of Illinois, Chicago, 1971) joined JAERI in 1972 and has worked on various projects on LWR safety analysis and experiments. He is head of the Severe Accident Research Laboratory at JAERI. **Hideo Sekiya** (bottom) (BS, agrobiology, The University of Tokyo, Japan, 1982) is a research engineer at CSK Corporation. He is engaged in severe fuel damage research for LWRs from the viewpoint of probabilistic safety analysis and artificial intelligence. He has worked at JAERI where he performed reliability testing of pressure boundary components.

SIMULATION OF THE FIRST 174 MINUTES OF THE THREE MILE ISLAND UNIT 2 ACCIDENT USING MAAP 3.0B

Ariel Sharon
Laurence J. Godin
Francisco J. de Mora
Robert E. Henry
Garry R. Thomas

Ariel Sharon (top) (BS, 1970, and MS, 1976, chemical engineering, Technion, Israel; PhD, chemical engineering, Northwestern University, 1979) joined the faculty of nuclear engineering in Ben Gurion University, Israel, in 1980 where he conducted research on various light water reactor (LWR) thermal-hydraulic topics, including simulation of various steam generator transients. In 1982 he joined Fauske & Associates, Inc. (FAI) where he serves as a project manager on a large variety of simulation projects and benchmarking including the Three Mile Island Unit 2 (TMI-2) and the Chernobyl accidents as well as many experimental programs. He has also conducted numerous safety analyses of nuclear power plants in the United States and abroad. Currently, he is working on introducing severe accident phenomena to full-scope simulators, for the purpose of operator training and accident management evaluations. **Laurence J. Godin** (bottom) (Eng. Deg., Ecole Polytechnique Feminine Paris, France, 1985; MS, nuclear engineering, Institut National des Sciences et Techniques Nucléaires–Genie Atomique Paris, France, 1986) joined Argonne National Laboratory in 1986 where she worked on analysis for replacement of high-enrichment fuel with low-enrichment fuel for research and test reactors. Since 1987, she has been a nuclear engineer at FAI. She conducted plant response analysis to severe

accidents as part of a probabilistic risk assessment program and participated in the TMI-2 Standard Problem study. She is currently involved in the development of a severe accident analysis program for CANDU-type reactors. **Francisco J. de Mora** (top) (BS and MS, mechanical engineering, Marquette University, 1987) is an engineer in the Nuclear Division of FAI. He is involved in safety evaluation of pressurized water reactors. A photograph and a biography for **Robert E. Henry** were not available at publication time. **Garry R. Thomas** (bottom) (BS, mechanical/nuclear engineering, California State University at San Jose, 1964; graduate work, nuclear engineering, University of California, Berkeley, 1964–66) is a research engineer at Lawrence Livermore National Laboratory involved in thermal analysis experiments involving laser-induced isotopic separation of uranium. He has 22 years of analytical and experimental experience in evaluating nuclear fuel rod and core behavior during conditions ranging from off-normal operations to extremely severe accident situations in both liquid-metal fast breeder reactors and LWRs. From March 1979 until 1988 he focused on the TMI-2 accident and its consequences, particularly the development of models for correctly representing the behavior of severely degraded LWR cores.



ATHLET ANALYSIS OF THE THREE MILE ISLAND UNIT 2 ACCIDENT

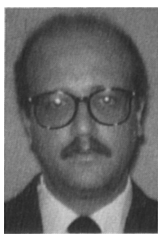
Adly B. Wahba
Fritz Steinhoff

Adly B. Wahba (top) [BSc, physics, Ein Schams University, Cairo, Egypt, 1955; Dr. Ing., mechanical engineering, Technische Hochschule München, Federal Republic of Germany (FRG), 1964] has been a research engineer at the Gesellschaft für Reaktorsicherheit (GRS) since 1971. Twice he was on assignment as the German representative to the loss-of-fluid test project in Idaho. His technical interests and research for 18 years have been in the area of reactor safety for both light water and fast breeder reactors. **Fritz Steinhoff** (Dipl. Ing., chemical engineering, Technical University of Munich, FRG, 1970) works at the Laboratorium für Reaktorregelung und Anlagensicherung of the Technical University in Munich and at the GRS in Cologne. His main interests lie in the field of reactor safety analysis, especially in the development and application of thermal-hydraulic codes for light water reactors.

HEALTH PHYSICS AND ENVIRONMENTAL RELEASES

WORKER EXPOSURES DURING THE THREE MILE ISLAND UNIT 2 RECOVERY

Dale J. Merchant



Dale J. Merchant has been assigned to the radiological engineering department at Three Mile Island Unit 2 since 1983. His responsibilities have included decontamination and robotic activities, and he has served as as-low-as-reasonbly-achievable coordinator for the radiological controls department. He has 15 years of experience in the nuclear industry, primarily in health physics.

REMOTE TECHNOLOGY AND ENGINEERING

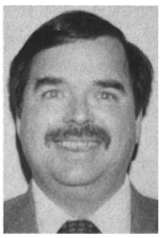
THREE MILE ISLAND UNIT 2 REACTOR VESSEL HEAD AND PLENUM REMOVAL

C. W. (Swede) Hultman
Richard W. Jackson

C. W. (Swede) Hultman (top) (BS, mechanical engineering, Michigan Technological University) is a product line manager, providing service to utilities on nuclear plant equipment maintenance, repair, and replacement at Bechtel/KWU Alliance. He worked at Bettis Atomic Power Laboratory on various assignments in reactor engineering and was manager of the steam generator activity for the Naval Nuclear Program until 1977. He worked for Nuclear Projects on the Standardized Nuclear Unit Power Plant System until 1981 when he joined Bechtel to assist in the recovery of the damaged Three Mile Island Unit 2 (TMI-2) reactor. There he worked as a task leader with technical responsibility for reactor disassembly and preparation for defueling. He was deputy project manager and deputy manager of defueling for Bechtel National at TMI until 1987 when he joined the Bechtel/KWU Alliance. **Richard W. Jackson** (mechanical engineering, University of Maryland) currently serves as project engineering manager for Bechtel Power Corporation's operating plant services group and is responsible for engineering services for nuclear and fossil plants. In an earlier assignment, he was responsible for facility and system modifications for the decontamination and defueling of TMI-2. In this capacity, he coordinated engineering activities for removal of the reactor vessel head.

THREE MILE ISLAND UNIT 2 CORE REGION DEFUELING

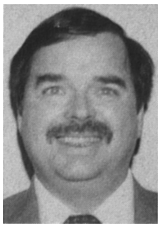
Jon M. Rodabaugh
David K. Cowser



Jon M. Rodabaugh (top) (MS, mechanical engineering, Union College, 1975) was the task manager for defueling both the core region and the upper core support assembly at Three Mile Island Unit 2 (TMI-2). He is currently a project engineering manager in design engineering at the Savannah River site. His interests include radioactive material handling, radwaste management, and systems engineering. **David K. Cowser** (BS, mechanical engineering, University of Tennessee, 1982) is project engineer for the recovery of the damaged TMI-2 reactor. He has had extensive experience in the use of remote technologies to install, maintain, and decommission equipment and facilities used in fuel processing, isotope production, and reactor defueling. His interests include systems engineering, value engineering, and productivity improvement.

DISASSEMBLY AND DEFUELING OF THE THREE MILE ISLAND UNIT 2 UPPER CORE SUPPORT ASSEMBLY

Jon M. Rodabaugh



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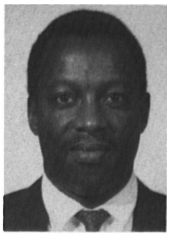
OPERATIONS AND ACHIEVEMENTS OF REMOTE EQUIPMENT AT THREE MILE ISLAND UNIT 2

Michael D. Pavelek II
Wayne Underhill
F. Lee Bozorgi
Joseph F. Boudreaux

Michael D. Pavelek II (right) (BS, sociology, University of Pittsburgh) was manager of decontamination at Three Mile Island Unit 2 (TMI-2) through April 1988. His responsibilities included the initial accident radiological response team, engineering of initial environmental characterizations within the sealed TMI-2 reactor building, preparation of the decontamination plan, and management of decontamination engineering and operations. His current technical interest is radioactive and hazardous site remediation. Photographs and biographies for **Wayne Underhill**, **F. Lee Bozorgi**, and **Joseph F. Boudreaux** were not available at publication time.

AN OVERVIEW OF NUCLEAR CRITICALITY SAFETY ANALYSES PERFORMED TO SUPPORT THREE MILE ISLAND UNIT 2 DEFUELING

Daniel S. Williams
John C. Rommel
Raymond L. Murray



Daniel S. Williams (top) [BS, physics, Millersville State College, 1975; MS, nuclear engineering, Pennsylvania State University (PSU), 1988] has worked in the nuclear industry for 12 years, including 6 years with the Three Mile Island Unit 2 (TMI-2) Recovery Project. During that time, he was responsible for radiation analysis performed to support defueling systems design for TMI-2. Currently, he is a project engineer for Bechtel Power Corporation, responsible for home office support to the TMI-2 defueling program. **John C. Rommel** (bottom) (BS, 1980, and MS, 1981, nuclear engineering, PSU) has worked in the nuclear industry for 8 years and has been associated with the TMI-2 Recovery Project for over 6 years. During this time, his responsibilities included criticality safety and licensing support for the TMI-2 defueling. Currently, he is deputy supervisor of the nuclear systems and analysis group for Bechtel Power Corporation, where he is responsible for analytical support in the areas of thermal hydraulics and radiation protection for nuclear power plants. **Raymond L. Murray** (photo not available) is professor emeritus of the Department of Nuclear Engineering at North Carolina State University (NCSU). He participated in the Manhattan Project in World War II in uranium isotope separation research and production, and later in nuclear criticality safety. He helped develop the first university program in nuclear engineering and the first university reactor at NCSU. He serves as consultant to Bechtel on TMI-2 recovery and to Los Alamos National Laboratory on new production reactor safety.