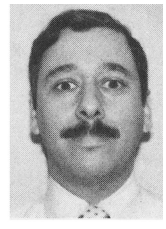
nuclear technology®

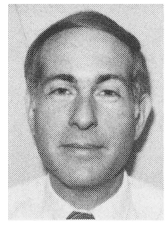
AUTHORS — JUNE 1985

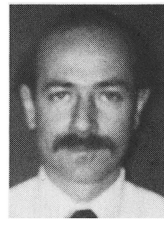
FISSION REACTORS

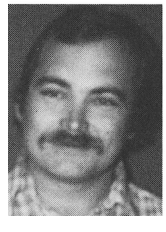
RADIATION LEVELS DURING SHUTDOWN IN BOILING WATER REACTORS

M. J. Hazzan
M. S. Stocknoff
David W. Barcomb
Timothy Irving





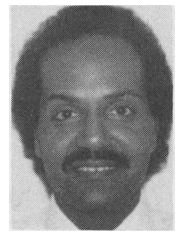




M. J. Hazzan (top right) (BS, naval architecture, United States Naval Academy, 1974) spent seven years in the nuclear navy. He has had experience in boiling water reactor plant design, probabilistic risk analysis, and severe accident source term analysis. He currently supervises the risk and source term work for Stone & Webster Engineering Corporation in Cherry Hill, New Jersey. **M. S. Stocknoff** (top left) (BS, City College of New York, 1969) attended graduate school at both the City University of New York and Rutgers University. Mr. Stocknoff has over 15 years of experience in the nuclear industry and is currently employed by Stone & Webster Engineering Corporation as lead engineer in the Nuclear Technology Division. He is responsible for radiation protection, engineered safety system and analysis, risk assessment, nuclear process engineering, radiological safety, and radiological planning for Niagara Mohawk Power Corporation's Nine Mile Point Nuclear Station-Unit 2 Project. Prior to joining Stone & Webster Engineering Corporation, he was technical supervisor of the Health Physics/Chemistry Group at the Salem Nuclear Generating Station. **David W. Barcomb** (bottom right) (AAS, mechanical technology, State University of New York at Alfred, 1973) is the unit supervisor of radiation protection at the Nine Mile Point Nuclear Station Unit 2. He has worked as a radiation protection and chemistry technician and assistant supervisor of radiation protection and chemistry for Niagara Mohawk Power Corporation since 1976. His current responsibilities at Unit 2 include facility design review, support of unit start-up, and organization of the radiation protection program. **Timothy Irving** (bottom left) (AAS, radiologic technology, State University of New York, Upstate Medical Center, 1976; BS, nuclear medicine, Rochester Institute of Technology, 1979) is currently the coordinator for ensuring that radiation exposures are as low as reasonably achievable (ALARA) for the Nine Mile Point Nuclear Stations. Since his employment with Niagara Mohawk Power Corporation in 1981, he has had responsibilities including radiation protection technician, radiation protection supervision, and corporate health physics and licensing. His present responsibilities and interest include developing and implementing the ALARA Program, Nine Mile Point Unit 2 design review, robotic applications in hazardous environments, and computer applications in ALARA engineering.

THREE-DIMENSIONAL CALCULATIONS OF FLUID-THERMAL MIXING IN A BABCOCK & WILCOX PLANT AT STAGNATED LOOP FLOW

Yassin A. Hassan

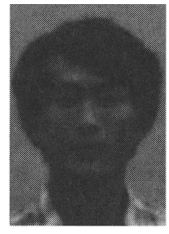


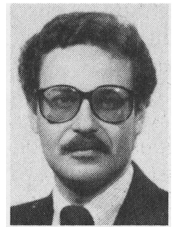
Yassin A. Hassan (BS, nuclear engineering, University of Alexandria, 1968; MS, 1975, and PhD, 1979, nuclear engineering, University of Illinois) is a principal engineer at the Nuclear Power Division, Babcock & Wilcox Company, Lynchburg, Virginia. His activities include the area of computational methods for problems in fluid flow and heat transfer. His computational work includes both finite difference and finite element techniques for various thermal-hydraulic aspects and fluid flow analysis.

NUCLEAR SAFETY

CONVECTIVE COOLING OF SIMULATED CORE DEBRIS BEDS

H. S. Kim
S. I. Abdel-Khalik

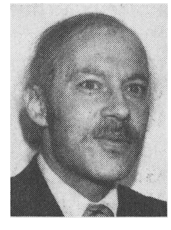




H. S. Kim (top) [PhD, nuclear engineering, University of Wisconsin-Madison (UW), 1983] is an advanced researcher at the Korean Advanced Energy Research Institute, Dae Jun, Chung Nam, Korea. Prior to his current position, he worked in the nuclear fuel services department of Commonwealth Edison Company. His research interests are in the areas of thermal hydraulics and reactor safety. **S. I. Abdel-Khalik** (PhD, mechanical engineering, UW, 1973) is a professor of nuclear engineering at UW. He joined the UW faculty in 1976 after two years of postdoctoral work in chemical engineering and one year with the nuclear industry. His current research interests are in the areas of reactor safety and fusion technology.

RADIATION TRANSPORT IN A LIQUID-METAL FAST BREEDER REACTOR DURING A LOSS OF SODIUM COOLANT REACTOR CORE DISASSEMBLY

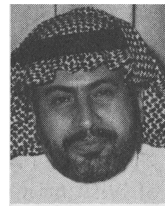
Douglas J. Rzepecki



Douglas J. Rzepecki [BSE, nuclear engineering, University of Michigan (UM), 1972; BS, physics, 1972, and MSE, nuclear engineering, 1974, UM; PhD candidate, nuclear engineering, UM, 1984] has been employed by Science Applications, Inc. (SAI) at the Sandia National Laboratories (SNL) where he works on Monte Carlo and discrete ordinates radiation transport in the Annular Core Research Reactor. Prior to joining SNL, he worked for Technadyne Engineering Consultants, developing a steam explosion data base and a hydrogen deflagration in nuclear reactor computer code (HECTR) at SNL. He has worked on consequence analyses for a probabilistic risk assessment for the Tennessee Valley Authority, did Monte Carlo time-dependent neutron and prompt and secondary gamma-ray Monte Carlo radiation transport for SAI, and did his doctoral thesis research at the Los Alamos National Laboratory.

AVAILABILITY OF THE EMERGENCY CORE COOLING SYSTEM OF A CANDU PRESSURIZED HEAVY-WATER REACTOR FOLLOWING A SMALL LOSS-OF-COOLANT ACCIDENT

Tawfik A. Al-Kusayer

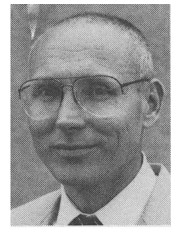


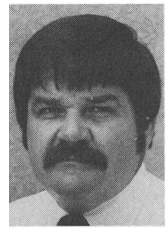
Tawfik A. Al-Kusayer (BS, electronic engineering, King Saud University; MS, nuclear engineering, Iowa State University; PhD, nuclear engineering, Iowa State University) was an assistant professor and then head of the nuclear engineering department at King Abdulaziz University in Jeddah, Saudi Arabia,

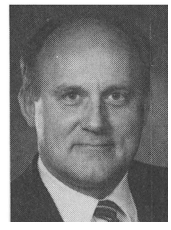
from 1982 to 1983. Since 1983 he has been an assistant professor in the electrical engineering department of King Saud University, Riyadh, Saudi Arabia, and a scientific consultant in the Nuclear Energy Division of the Saudi Arabian National Center for Science and Technology in Riyadh. His main research interests are in CANDU pressurized heavy-water reactor safety and reliability assessment and in fusion-fission (hybrid) reactors.

CIRCULATION WITHIN THE PRIMARY SYSTEM AT TMI-2 WITH LOWERED COOLANT LEVEL AND AT ATMOSPHERIC CONDITIONS

V. F. Baston
K. J. Hofstetter
A. P. Malinauskas







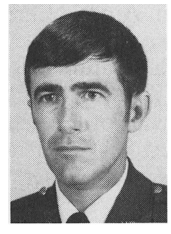
V. F. Baston (top) (BS, engineering-chemical option, 1960, and PhD, physical chemistry, 1965, University of Wyoming; postdoctoral, physical chemistry, University of Texas at Austin; registered professional engineer, Colorado and Idaho) is head and corporate officer of Physical Sciences Incorporated, an engineering consulting firm with headquarters in Sun Valley, Idaho. Consulting responsibilities include analytical model development and engineering evaluations involving process chemistry and engineering operations. Professional experience includes being an analyst for engineering test programs, a director for an analytical laboratory and pilot plant, and a part-time instructor. **K. J. Hofstetter** (center) (AB, Augustana College, 1962; PhD, nuclear chemistry, Purdue University, 1967) is the supervisor of radiochemical engineering for GPU Nuclear Corporation at Three Mile Island (TMI). It is his responsibility to direct liquid radwaste processing and radiochemical analyses for Unit-2 recovery operations. He previously worked at Allied General Nuclear Services as a radiochemistry supervisor developing nondestructive assay techniques. **A. P. Malinauskas** (bottom) (BS, chemistry, King's College, 1956; MS, physical chemistry, Boston College, 1958; PhD, physical chemistry, Massachusetts Institute of Technology, 1962) is director for U.S. Nuclear Regulatory Commission programs at Oak Ridge National Laboratory. His research interests include gas kinetic theory, separations science, and nuclear fuel and fission product chemistry. He is a member of the Technical Assistance and Advisory Group for TMI-2 recovery.

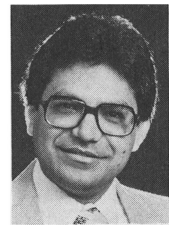
GRAVITATIONAL COLLISION EFFICIENCY OF NONSPHERICAL AEROSOLS I: DEFINITIONS OF SHAPE FACTORS

GRAVITATIONAL COLLISION EFFICIENCY OF NONSPHERICAL AEROSOLS II: MOTION OF AN OBLATE SPHEROID IN A VISCOUS FLUID

GRAVITATIONAL COLLISION EFFICIENCY OF NONSPHERICAL AEROSOLS III: COMPUTER PROGRAM NGCEFF AND CALCULATION OF SHAPE FACTORS

Ronald F. Tuttle
Sudarshan K. Loyalka





Ronald F. Tuttle (top) (BS, chemical engineering, 1968; MS, nuclear engineering, 1970; and PhD, nuclear engineering, 1980, University of Missouri-Columbia) is an officer at the Air Force Technical Applications Center, Nuclear Division, Patrick Air Force Base, Florida. His current interests include transport mechanisms for radionuclides in the environment and modeling source terms for the release of radionuclides from nuclear facilities. **Sudarshan K. Loyalka** (BE Mech. Hons., University of Rajasthan, India, 1964; MS, 1965, and PhD, 1967, nuclear engineering, Stanford University) is a professor of nuclear engineering and Huber O. Croft Professor of Engineering at the University of Missouri-Columbia. His research interests are in the areas of

kinetic theory of gases, neutron transport, aerosol mechanics, and nuclear reactor physics and safety. He was a visiting scientist at Max-Planck Institut für Strömungsforschung, Gottingen, Federal Republic of Germany from 1969 to 1971.

FUEL CYCLES

FUEL MANAGEMENT AND CORE DESIGN CODE SYSTEMS FOR PRESSURIZED WATER REACTOR NEUTRONIC CALCULATIONS

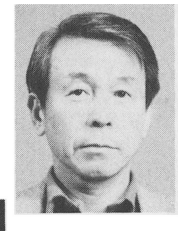
Carol Ahnert
José M. Aragonés

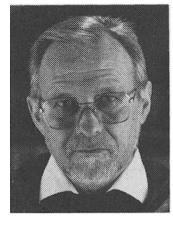
Carol Ahnert (top) (Lic, physics, Complutensis University of Madrid, 1969) is the main investigator in reactor physics of the Division of Reactors of the Junta de Energía Nuclear (National Nuclear Research Center of Spain). She is working on development and validation of reactor physics methods and codes for fuel management and core design of power and experimental reactors. **José M. Aragonés** (BS and MS, industrial engineering, 1969, and PhD, nuclear engineering, 1977, Polytechnical University of Madrid) is a full professor in the nuclear engineering department of the Polytechnical University of Madrid. He is working in the development of methods and codes for light water reactor fuel management and core design and for physics of inertial confinement fusion. His interests are in nuclear physics, reactor physics, particle transport, and reactor design of fission and fusion nuclear reactors.

NUCLEAR FUELS

MIGRATION BEHAVIOR OF FISSION PRODUCTS IN AND FROM SPHERICAL HIGH-TEMPERATURE REACTOR FUEL ELEMENTS

Kousaku Fukuda
Ekkehard Groos
John Rau



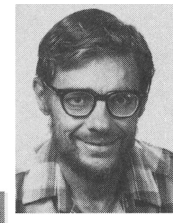


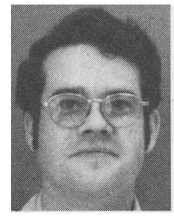
Kousaku Fukuda (top) (PhD, metallurgist, Kyushu University, 1968) has worked in the Department of Nuclear Fuels and Materials of the Japan Atomic Energy Research Institute since 1968. He has been engaged in the development of coated particle fuels for the high-temperature gas-cooled reactor (HTGR) and is interested in the diffusion of fission products in HTGR fuels and irradiation behavior of the fuels. **Ekkehard Groos** (center) (Dr. phil. nat., chemistry, University of Frankfurt, 1961) has been at the Institute of Reactor Materials of the Nuclear Research Center (KFA), Jülich, since 1965. He works on irradiation experiments and postirradiation examination, leading a group of scientists and engineers in the hot cell laboratories. **John Rau** (bottom) (Dipl.-Phys., physics, University of Hamburg, 1952) has been employed at KFA, Jülich, since 1962. He is involved in the postirradiation examination of nuclear fuels in the Hot Cell Section of the Institute for Reactor Materials. His main field of work is in the behavior of fission products in high-temperature reactor fuel elements.

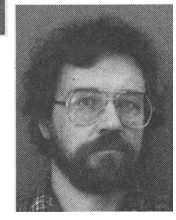
RADIOACTIVE WASTE MANAGEMENT

PLUTONIUM, AMERICIUM, AND NEPTUNIUM SPECIATION IN SELECTED GROUNDWATERS

Jess M. Cleveland
Terry F. Rees
Kenneth L. Nash





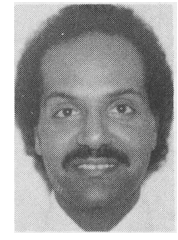


Jess M. Cleveland (top) (BS, chemistry, Georgia Institute of Technology, 1951; MS, chemistry, 1955, and PhD, inorganic chemistry, 1959, University of Colorado) is chief of the Transuranium Research Project (TRP) of the U.S. Geological Survey. His current interests include actinide element coordination chemistry and the groundwater chemistry of the transuranium elements. **Terry F. Rees** (center) (BS, chemistry, Metropolitan State College, 1974; MS, chemistry, 1981, and PhD, applied chemistry, 1982, Colorado School of Mines) is a research chemist in the TRP of the U.S. Geological Survey. His current research interest is in the geochemical behavior of the transuranium elements under conditions expected in and near possible nuclear waste repositories. **Kenneth L. Nash** (bottom) (BA, chemistry, Lewis University, 1972; MS, chemistry, 1975, and PhD, inorganic chemistry, 1978, Florida State University) is a research chemist in the TRP of the U.S. Geological Survey. His primary research interest is in the solution chemistry of the actinide elements and its application to nuclear waste disposal.

FISSION REACTORS

TRANSIENT TWO-PHASE BLOWDOWN PREDICTIONS OF AN INITIALLY STAGNANT SATURATED LIQUID STEAM IN A VESSEL USING TRAC-PF1

Yassin A. Hassan

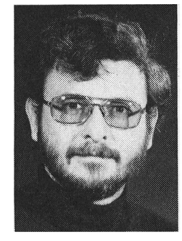


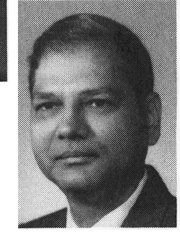
Yassin A. Hassan (BS, nuclear engineering, University of Alexandria, 1968; MS, 1975, and PhD, 1979, nuclear engineering, University of Illinois) is a principal engineer at the Nuclear Power Division, Babcock & Wilcox Company, Lynchburg, Virginia. His activities include the area of computational methods for problems in fluid flow and heat transfer. His computational work includes both finite difference and finite element techniques for various thermal-hydraulic aspects and fluid flow analysis.

TECHNIQUES

PROTON DOSIMETER DESIGN FOR DISTRIBUTED BODY ORGANS

John W. Wilson
Govind S. Khandelwal





John W. Wilson (top) (BS, Kansas State University, 1962; MS, 1969, and PhD, 1975, College of William and Mary) is a research scientist at the U.S. National Aeronautics and Space Administration, Langley Research Center, and an adjunct assistant professor at Old Dominion University. His research interests include nuclear reaction and transport theory and nuclear-induced plasma and laser kinetics. **Govind S. Khandelwal** (PhD, physics, University of North Carolina, 1966) is a professor of physics at Old Dominion University, Norfolk, Virginia. His fields of interest are theoretical atomic, nuclear, and radiation physics.