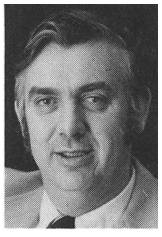
nuclear technology®

AUTHORS — DECEMBER 1988

FIFTH INTERNATIONAL RETRAN MEETING

OVERVIEW OF 1986-1987 RETRAN ACTIVITY

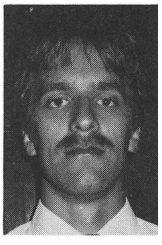
Lance J. Agee

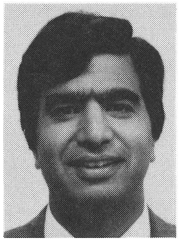


Lance J. Agee (BS, engineering science, 1965; MS, nuclear engineering, 1966, University of Nevada, Reno) has been the manager of the System Safety and Licensing Analysis Subprogram in the Nuclear Reload Management Program, Nuclear Safety Technical Department at the Electric Power Research Institute (EPRI) since 1980. Agee joined EPRI in 1975 as a project engineer in the Nuclear Safety and Analysis Department, moving to project manager of the Thermohydraulic Analysis Program in 1978. His primary interests are in numerics and thermohydraulics. Two of his better known accomplishments are the RETRAN computer code and the reactor analysis support packages (RASP).

RETRAN APPLICATION FOR ISSUE RESOLUTION

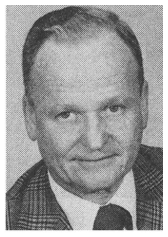
Peter J. Jensen
V. K. (Bindi) Chexal
Jason Chao
William H. Layman





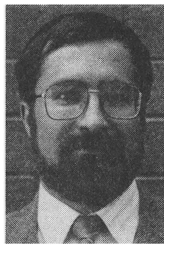
Peter J. Jensen (top) (BS, 1982, and MS, 1984, nuclear engineering, Oregon State University) has participated in the development of RETRAN and has performed a variety of thermal-hydraulic analyses using RETRAN. He is currently a program manager of RETRAN development applications at Energy Incorporated. **V. K. (Bindi) Chexal** (center) (BS, mechanical engineering, Thapar Institute of Technology, India, 1970; MS, mechanical engineering, Georgia Institute of Technology, 1972) is a subprogram manager in the Nuclear Safety Analysis Center, Nuclear Power Division of the Electric Power Research Institute (EPRI). His assignments at EPRI have included matrix management of several issues—pressurized thermal shock, emergency core cooling methodology, piping integrity, and flow-assisted corrosion. From 1975 to 1977, he worked for Atomic Energy of Canada, Ltd., and before joining EPRI, he spent 5 years with Quadrex Corporation. **Jason Chao** (bottom) [MA, physics, University of Texas at Austin, 1974; PhD, nuclear engineering, Massachusetts Institute of Technology (MIT), 1979] is presently a project manager at EPRI. He has participated in plant analyses related to pressurized thermal shock, steam generator tube rupture, anticipated transient without scram, and scram reduction issues at EPRI. His past experience includes design studies of reduced enrichment fuel for research reactors at Science Applications, Inc., for

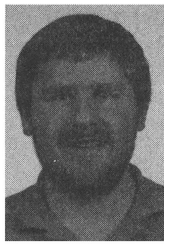
Argonne National Laboratory, a design study of tokamak fusion reactor blanket at MIT, and experimental investigations on nuclear structure of krypton isotopes with a Van de Graaff Accelerator at the University of Texas at Austin. **William H. Layman** (right) is currently manager of generic safety analysis at EPRI and has been involved in nuclear power since 1952. He was formerly assistant director of the Atomic Energy Commission's Division of Reactor Safety Research, and before that he was chief of the Water Reactors Branch of the Division of Reactor Development and Technology. His work in the nuclear field began with 9 years of service in the U.S. Navy's nuclear submarine program.

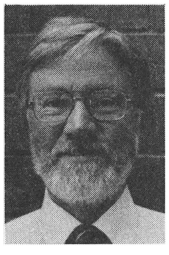


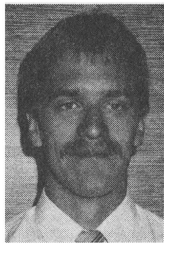
FEATURES OF THE RETRAN-03 COMPUTER CODE

M. P. Paulsen
B. E. Griebenow
L. R. Feinauer
J. H. McFadden
Peter J. Jensen





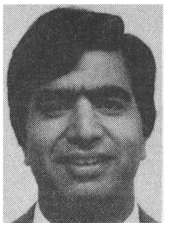




M. P. Paulsen (top right) (MS, nuclear science and engineering, Idaho State University, 1974) is manager of Engineering Software at EI International, Inc. (EI). He has held lead positions in the development of nonequilibrium two-phase flow models and numerical solution methods for the RETRAN computer code. His primary interests include two-phase flow and numerical simulation of engineering problems. **B. E. Griebenow** (top left) (BS, mechanical engineering, University of Idaho, 1984) is a senior engineer at EG&G Idaho, Inc., the U.S. Department of Energy prime contractor at the Idaho National Engineering Laboratory (INEL). He is currently working with prototypical mechanical designs in support of various projects at the INEL. **L. R. Feinauer** (center right) (BS, physics, Brigham Young University, 1977; ME, mechanical engineering, University of Idaho, 1982; PhD course work completed, working on dissertation, University of Idaho) is currently a senior specialist at Power Computing Company in Dallas, Texas. His interests include computational fluid dynamics and heat transfer. **J. H. McFadden** (bottom left) (PhD, nuclear engineering, Iowa State University, 1968) is a technical director with EI. From 1968 to 1975, he was involved in modeling two-phase flow and the development of two-fluid computer codes. Since joining EI in 1975, he has continued to work in the area of two-phase flow and system modeling for the RETRAN computer code. **Peter J. Jensen** (bottom right) (BS, 1982, and MS, 1984, nuclear engineering, Oregon State University) has participated in the development of RETRAN and has performed a variety of thermal-hydraulic analyses using RETRAN. He is currently program manager of RETRAN development applications at EI.

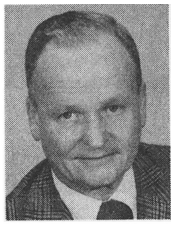
AN ANALYSIS OF THE CHERNOBYL ACCIDENT USING RETRAN-02/MOD3

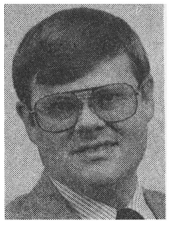
Jason Chao
V. K. (Bindi) Chexal
William H. Layman
Gary Vine
Peter J. Jensen
Adi R. Dastur

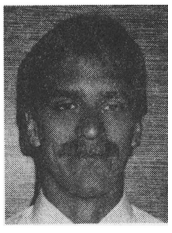


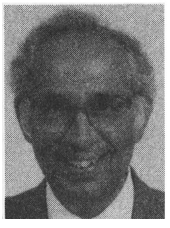
Jason Chao (top) [MA, physics, University of Texas at Austin, 1974; PhD, nuclear engineering, Massachusetts Institute of Technology (MIT), 1979] is presently a project manager at the Electric Power Research Institute (EPRI). He has participated in plant analyses related to pressurized thermal shock, steam generator tube rupture, anticipated transient without scram, scram reduction, and reactivity transients in light of the Chernobyl accident. His past experience includes design studies of reduced enrichment fuel for research reactors at Science Applications, Inc., for Argonne National Laboratory, and a design study of tokamak fusion reactor blanket at MIT. He is a registered professional engineer in mechanical engineering in the state of California. **V. K. (Bindi) Chexal** (bottom) (BS, mechanical engineering, Thapar Institute

of Technology, India, 1970; MS, mechanical engineering, Georgia Institute of Technology, 1972) is a subprogram manager in the Nuclear Safety Analysis Center, Nuclear Power Division of EPRI. His assignments at EPRI have included matrix management of several issues—pressurized thermal shock, emergency core cooling methodology, piping integrity, and flow-assisted corrosion. From 1975 to 1977, he worked for Atomic Energy of Canada, Ltd. (AECL), and before joining EPRI, he spent 5 years with Quadrex Corporation. **William H. Layman** (top right), is currently director of EPRI's Nuclear Safety Analysis Center and has been involved in nuclear power since 1952. He was formerly assistant director of the U.S. Atomic Energy Commission Division of Reactor Safety Research, and before that he was chief of the Water Reactors Branch of the Division of Reactor Development and Technology. His work in the nuclear field began with 9 years of service in the U.S. Navy's nuclear submarine program. **Gary Vine** (top left) (BS, physics and applied mathematics, U.S. Naval Academy; MS, physics, U.S. Naval Postgraduate School) is a project manager at EPRI. He conducts safety analyses of commercial nuclear power plants with emphasis on operating experience and generic safety issues. He joined the institute in 1981. Before joining EPRI, he spent 11 years with the U.S. Navy in the nuclear submarine program. **Peter J. Jensen** (bottom right) (BS, 1982, and MS, 1984, nuclear engineering, Oregon State University) has participated in the development of RETRAN at EI International, Inc., where he is currently program manager of RETRAN development applications. **Adi R. Dastur** (bottom left) (University of Bombay, India and University of Toronto, Canada) heads the Reactor Physics Section at AECL, CANDU Operations.





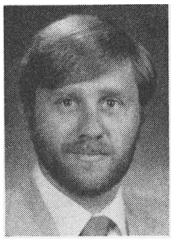


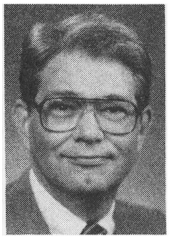


RESULTS OF CAROLINA POWER AND LIGHT COMPANY'S ANALYSIS OF BRUNSWICK UNIT 1 START-UP TESTS USING RETRAN

Steven J. Ganthner
A. Frank Wenger

Steven J. Ganthner (top) (BA, physics, Rice University, 1977; MS, mechanical engineering, University of Texas at Austin, 1980) is a senior engineer with Carolina Power and Light (CP&L) Company. Previous assignments have included in-core fuel management and reload design analysis. For the last 2 years, he has been involved in the generation of neutronics data for the RETRAN model development effort and reload licensing transient analysis. **A. Frank Wenger** (MS, nuclear engineering, North Carolina State University, 1976) has worked at CP&L since 1981. His work activities include the development and qualification of RETRAN models and methods used for nuclear power plant transient system and hot bundle analysis. Additional work includes the development of computer codes used to evaluate critical heat flux and model uncertainties as well as codes to provide a RETRAN interface with fuel pin mechanical and core hydraulic codes. He participated in the development and qualification of the one-dimensional neutronics methodology.

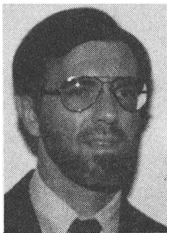




QUALIFICATION OF RETRAN FOR SIMULATOR APPLICATIONS

James F. Harrison

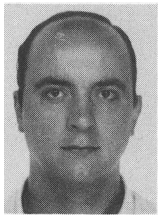
James F. Harrison (BS, mechanical engineering, Wichita State University, 1969) has worked at Babcock & Wilcox and Energy Inc., and presently serves as the technical director for WOTEC, Inc. He has experience in a wide variety of system dynamic modeling and analysis areas. He was the program manager for RETRAN-01 and served as chair of the design review board for

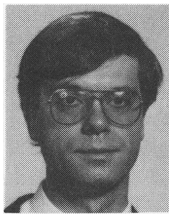


RETRAN-02. He has been involved in the development and modification of numerous RETRAN models for both pressurized water reactor and boiling water reactor plants. He has also developed models for full-scope training simulators and provided independent evaluations of simulator capability.

QUALIFICATION OF A RETRAN-02 MODEL FOR COFRENTES

J. J. Martínez Caballero
Pablo García Sedano

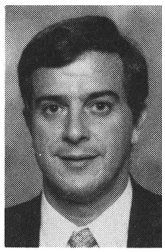


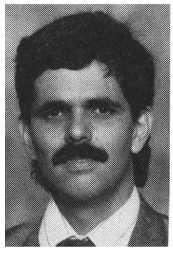


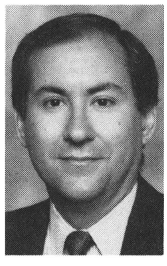
J. J. Martínez Caballero (top) (industrial engineering, Polytechnical University of Madrid, Spain, 1983) has worked in the areas of neutron damage, tritium generation, and energy deposition in cavity designs for inertial confinement fusion reactors. Since 1985, he has been involved with RETRAN model development and transient analysis in the nuclear department at Unión Iberoamericana de Tecnología Eléctrica, S.A. (UITESA). His current interests include accident analysis and transient evaluation support. **Pablo García Sedano** (industrial engineering, University of Bilbao, Spain, 1979) is presently nuclear department manager at UITESA. Since 1980, he has worked at several Spanish companies in the areas of nuclear safety, fuel management, and reactor thermohydraulics. His areas of interest are core neutronics, thermohydraulics phenomena, and calculational methods.

RETRAN APPLICATIONS AT FLORIDA POWER & LIGHT TO SUPPORT OPERATIONS AND TRAINING

Jorge Arpa
Jose Ramos
Juan R. Villar



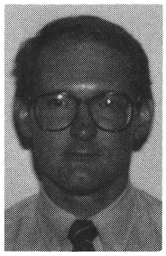




Jorge Arpa (top) (BS, mechanical engineering, University of Barcelona, Spain, 1970; DEA, 3^{e} Cycle, nuclear physics, University of Paris, 1972; MS, nuclear engineering, Purdue University, 1976) is a senior nuclear engineer in the Thermal Hydraulics and Safety Section of Nuclear Fuels at Florida Power & Light Company (FPL). He joined FPL in 1984 after 7 years with Energy Incorporated, where he was involved in probability risk analysis, code development and applications, and training. His current interests include transient simulation, severe accident issues, and licensing. **Jose Ramos** (center) (BS, 1977, and ME, 1986, nuclear engineering, University of Florida) is an engineer in the Thermal Hydraulics and Safety Analysis Section of Nuclear Fuels at FPL. He joined FPL in 1982 after 3 years in the Thermal-Hydraulics Section at Babcock & Wilcox's Nuclear Power Generation Division. His current interests include core thermal hydraulics, control systems modeling, and space applications of nuclear-powered reactors. **Juan R. Villar** (bottom) (BEE, 1970, and MS, 1975, electrical engineering, Georgia Institute of Technology) is a section supervisor in the Instrumentation and Control/Electrical Section of Power Resources Services at FPL. He joined FPL in 1981 after 4 years teaching at Florida International University. His interests include power system dynamic simulations associated with reliability and security, and planning of regional and bulk transmission systems.

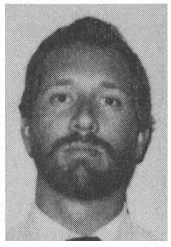
QUALIFICATION OF THE OCONEE RETRAN MODEL BY COMPARISON WITH PLANT TRANSIENT DATA

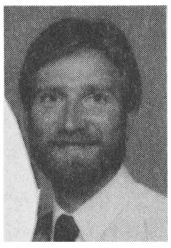
Steven P. Nesbit
Richard J. Gerling
Gregg B. Swindlehurst



Steven P. Nesbit (right) (BS, 1980, and ME, 1982, nuclear engineering, University of Virginia) has worked in the Safety Analysis Group for the Duke Power Company in Charlotte, North Carolina, since 1982. He has performed extensive RETRAN analyses of the Oconee plant. Current interests include applying RETRAN, RELAP5, and other codes to in-house reload

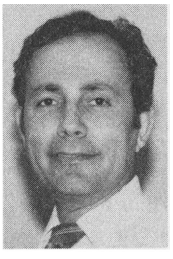
analysis and safety analysis for the Oconee, McGuire, and Catawba plants. **Richard J. Gerling** (top) (BS, mechanical engineering, Michigan State University, 1981) has performed RETRAN analyses on the Palisades plant for Consumers Power Company and on the Oconee plant for the Duke Power Company. He is currently working in the area of general safety analysis applications for Consumers Power. **Gregg B. Swindlehurst** (bottom) (BSE, nuclear engineering, University of Michigan, 1977) currently supervises the Safety Analysis Group at Duke Power Company, where he has been involved in safety analysis support of the seven Duke nuclear units for 11 years. Current interests include control room simulator validation and broadening the utility scope of safety analysis responsibilities.



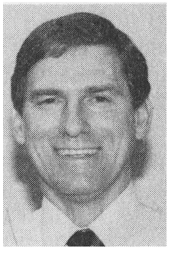


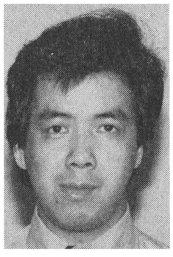
OYSTER CREEK RETRAN LICENSING MODEL DEVELOPMENT

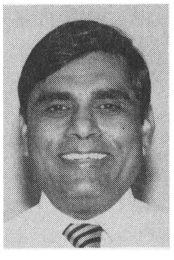
Mansur A. Alammar
Ronald V. Furia
Jimmy H. Chin
Chandrakant B. Mehta



Mansur A. Alammar (top right) (PhD, nuclear engineering, Iowa State University, 1981) is a senior engineer at GPU Nuclear Corporation (GPUN). For the last 6 years, he has been involved with boiling water reactor (BWR) safety analysis and reload applications using RETRAN/RELAP5 computer codes. **Ronald V. Furia** (top left) (BS, physics, Manhattan College, 1970; MS, nuclear engineering, Pennsylvania State University, 1975) has worked for GPUN since 1975. He has supervised the GPUN reload methods development for the Oyster Creek Nuclear Generating Station and is currently the manager of Oyster Creek fuel projects. During his career, he has worked in the areas of fuel management, reactor physics, core thermal hydraulics, and reactor operations support. **Jimmy H. Chin** (bottom right) (BS, physics, MS, nuclear engineering, Polytechnic Institute of Brooklyn) has worked in the area of computer modeling in the nuclear field. He has worked in the loss-of-fluid test program with EG&G Idaho, Inc. in the thermal analysis department at the Idaho Nuclear Engineering Laboratory from 1980 to 1983. He is presently working with GPUN in the Oyster Creek fuel projects group performing analysis in support of the reload efforts and plant operations. **Chandrakant B. Mehta** (bottom left) (MS, physics, Gujarat University, India; MS, nuclear engineering, Polytechnic Institute of New York, 1981) has been working as a member of the nuclear analysis and fuels group at GPUN since 1981. He has done fuel cycles benchmark for both pressurized water reactor (Three Mile Island) and BWR (Oyster Creek). He has also done extensive analysis in reload methods development for the Oyster Creek (BWR) plant.

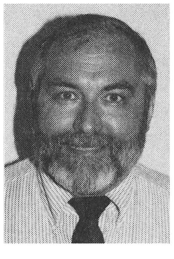


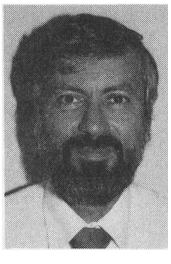




RETRAN MODELING OF THE PRESSURIZED WATER REACTOR CONTROL ROD EJECTION TRANSIENT

Joseph O. Erb
James G. Miller



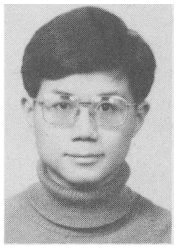


Joseph O. Erb (top) (ME AD, engineering administration, George Washington University, 1981) is a senior staff engineer in the nuclear analysis and fuel department of Virginia Electric and Power Company (VEPCo). He worked at Energy Inc. and Babcock & Wilcox before joining VEPCo. He has worked in the areas of reactor thermal hydraulics and modeling of reactor transient analyses. His present activities include loss-of-coolant accident modeling and the development and use of reactor coolant system transient analysis models. **James G. Miller** (MS, nuclear engineering, Pennsylvania State University, 1975) is a senior staff engineer in the nuclear analysis and fuel department of VEPCo. Since joining VEPCo in 1975, he has worked in the areas of

reactor physics modeling, reload core design, reactor transient analysis, and fuel performance evaluation. His present interests are in the development of fuel rod design and transient analysis models.

BOILING WATER REACTOR CORE STABILITY ANALYSIS WITH RETRAN

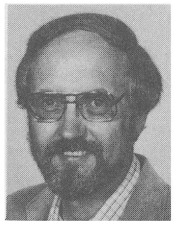
Shie-Jeng Peng



Shie-Jeng Peng (BS and MS, nuclear engineering, National Tsing-Hua University, Taiwan, 1975; PhD, nuclear engineering and science, Rensselaer Polytechnic Institute, 1984) is an associate nuclear engineer at Middle South Utility System Services, Inc. His job responsibilities include performing transient analyses persuant to the operation of a boiling water reactor. His interests include safety analysis, thermal hydraulics, and nuclear engineering.

BOILING WATER REACTOR STABILITY ANALYSIS WITH RETRAN

John Sorensen



John Sorensen (MSME, University of California, 1968) has worked in the nuclear industry for over 24 years. His work has been primarily in the areas of transient thermal hydraulics and heat transfer. While at General Electric Company, he developed several computer codes for the analysis of loss-of-coolant accidents in boiling water reactors (BWRs). He is currently an engineering consultant at S. Levy, Inc. where his activities are focused in the areas of BWR thermal-hydraulic transient analysis.