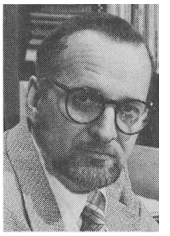
nuclear technology®

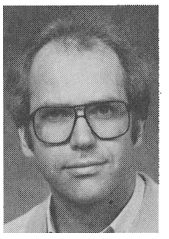
AUTHORS — JUNE 1981

NUCLEAR FUEL CYCLE EDUCATION MODULES

THEORY AND APPLICATION OF THE NUCLEAR FUEL TRAJECTORY CONCEPT

A. A. Harms
M. Heindler

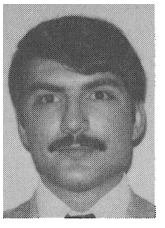


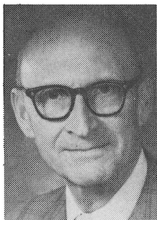


Arkadius (Archie) Harms (top) (PhD, nuclear engineering, University of Washington, 1969) is professor of physics and engineering physics at McMaster University, Hamilton, Canada. His research interests are in the areas of fission/fusion/spallation nuclear energy systems, mathematical modeling, and neutron radiography/diagnostics. **Manfred Heindler** (PhD, theoretical physics, Technical University of Graz, Austria, 1973) is a teaching-research faculty member of the Technical University of Graz. His research interests are in theoretical physics and advanced nuclear energy systems. He has previously spent study leaves in France and is a periodic visiting scientist at McMaster University, Canada.

SOLVENT EXTRACTION AND ION EXCHANGE IN THE NUCLEAR FUEL INDUSTRY

William L. MacCready
John A. Wethington, Jr.

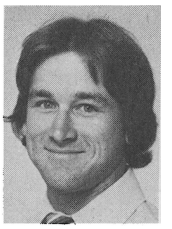


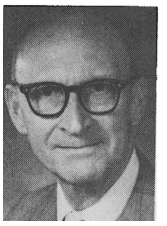


William L. MacCready (top) (BE, nuclear engineering, 1976, and MS, nuclear engineering–health physics, 1978, University of Florida) has made an extensive study of the hydrometallurgical techniques utilized in the mining and purification of uranium and in nuclear fuel reprocessing. He is currently a radiation protection engineer at Carolina Power and Light Company's H.B. Robinson Nuclear Plant. His technical interests include applied power plant health physics, reactor engineering, and most aspects of the nuclear fuel cycle. **John A. Wethington, Jr.** (AB and MA, chemistry, Emory University; PhD, physics and chemistry, Northwestern University, 1950) is professor of nuclear engineering at the University of Florida. He spent the 1979-80 academic year at the Oak Ridge National Laboratory working on problems associated with radioactive waste disposal. His research interests include technologically enhanced natural radiation and the movement of radioactive nuclides through the environment.

RADIOLOGICAL HAZARDS OF URANIUM MILL TAILINGS PILES

Glen A. Watford
John A. Wethington, Jr.

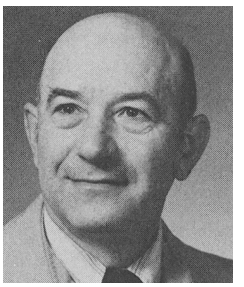




Glen A. Watford (top) (BS, nuclear engineering, University of Florida, 1979) is currently a member of the Edison Engineering Program at the General Electric Company's Nuclear Energy Business Group in San Jose, California. He has performed fuel cycle engineering analysis for product line boiling water reactors and is presently involved in nuclear analysis to support process computer modeling of the gamma-responsive TIP system. **John A. Wethington, Jr.** (AB and MA, chemistry, Emory University; PhD, physics and chemistry, Northwestern University, 1950) is professor of nuclear engineering at the University of Florida. He spent the 1979-80 academic year at the Oak Ridge National Laboratory working on problems associated with radioactive waste disposal. His research interests include technologically enhanced natural radiation and the movement of radioactive nuclides through the environment.

IN-CORE FUEL MANAGEMENT EDUCATIONAL MODULE

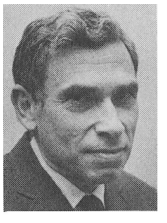
Samuel H. Levine

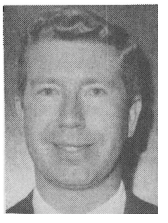


Samuel H. Levine (PhD, nuclear physics, University of Pittsburgh, 1954) is professor of nuclear engineering and director of the Breazeale Nuclear Reactor at The Pennsylvania State University. His technical interests currently are in fuel management, neutron spectrum measurements, and research with radiation sources and TRIGA reactors.

BASIC ELEMENTS OF LIGHT WATER REACTOR FUEL ROD DESIGN

Joel Weisman
Roy Eckart

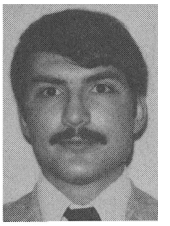


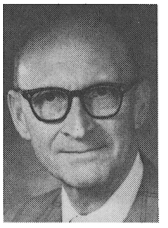


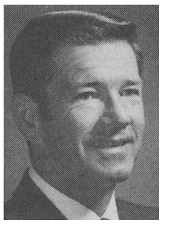
Joel Weisman (top) (PhD, University of Pittsburgh) is professor of nuclear engineering at the University of Cincinnati (UC). Prior to his university affiliation, he spent 18 years in industry, where his last position was that of manager of thermal and hydraulic analysis for the Westinghouse Electric Corporation Pressurized Water Reactor Division. He is coauthor of the American Nuclear Society monograph *Thermal Analysis of Pressurized Water Reactors* (2nd ed., 1979) and editor of *Elements of Nuclear Reactor Design* published by Elsevier-North Holland. **Roy Eckart** (PhD, UC) is associate professor of nuclear engineering at the UC. He has been with UC for 14 years, where he teaches and conducts research activities in the nuclear fuel cycle. Before coming to UC, Eckart had ten years of industrial experience, primarily with the General Electric Company (GE) and the National Aeronautics and Space Administration. At GE, he participated in the design of nuclear fuel for the Aircraft Nuclear Propulsion Project, nuclear rocket program, and the Boiling Water Reactor Maritime Nuclear Steam Propulsion Project (630A program).

URANIUM EXTRACTION FROM FLORIDA PHOSPHATES

William L. MacCready
John A. Wethington, Jr.
Fred J. Hurst





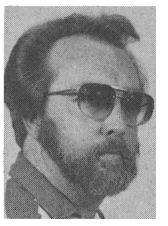


William L. MacCready (top) (BE, nuclear engineering, 1976, and MS, nuclear engineering–health physics, 1978, University of Florida) has made an extensive study of the hydrometallurgical techniques utilized in the mining and purification of uranium and in nuclear fuel reprocessing. He is currently a radiation protection engineer at Carolina Power and Light Company's H.B. Robinson Nuclear Plant. His technical interests include applied power plant health physics, reactor engineering, and most aspects of the nuclear fuel cycle. **John A. Wethington, Jr.** (center) (AB and MA, chemistry, Emory University; PhD, physics and chemistry, Northwestern University, 1950) is professor of nuclear engineering at the University of Florida. He spent the 1979-80 academic year at the Oak Ridge National Laboratory (ORNL) working on problems associated with radioactive waste disposal. His research interests include technologically enhanced natural radiation and the movement of radioactive nuclides through the environment. **Fred J. Hurst** (bottom) (BS, chemistry, Mississippi College, 1942) is a research chemist in the Chemistry Division at ORNL. His work has involved conception and development of recovery processes for uranium, thorium, vanadium, and other metals from their ores. The development work has included such unit operations as roasting, leaching, solvent extraction, ion exchange, and high-pressure liquid chromatography. At present, he is engaged in commercializing processes for recovery of uranium from wet-process phosphoric acid. For this development, ORNL recently was the recipient of the Kirkpatrick Award.

NUCLEAR SAFETY

TRANSIENT DEBRIS FREEZING AND POTENTIAL WALL MELTING DURING A SEVERE REACTIVITY INITIATED ACCIDENT EXPERIMENT

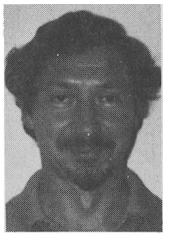
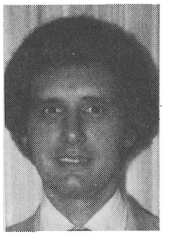
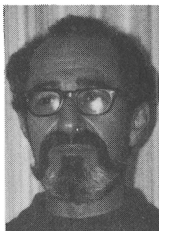
Mohamed S. El-Genk
Richard L. Moore



Mohamed S. El-Genk (top) (BS, nuclear engineering, University of Alexandria, Egypt, 1968; MS, 1975, and PhD, 1978, nuclear engineering, University of New Mexico) is currently an engineering specialist in the light water reactor (LWR) Fuel Behavior Research Division at EG&G Idaho, Inc. His research has been in areas of heat transfer with change-of-phase and vapor explosion, with application to both liquid-metal fast breeder reactor and LWR safety analysis. His current interest is in the hydrodynamics and heat transfer of fluidized beds with application to LWR safety. **Richard L. Moore** (MS, civil engineering, Colorado State University, 1973) has been involved in analyzing fluid flow and heat transfer problems associated with nuclear safety since 1974. He is presently a supervisor in the Thermal Analysis Branch at the Idaho National Engineering Laboratory. His current interests are in the areas of numerical and analytical modeling of core meltdown phenomena as well as single and multiphase transport phenomena.

WASH-1400: QUANTIFYING THE UNCERTAINTIES

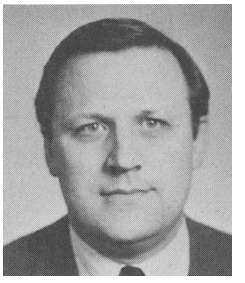
R. C. Erdmann
F. L. Leverenz, Jr.
G. S. Lellouche

Robert C. Erdmann (top) (PhD, applied mechanics and physics, California Institute of Technology, 1965) is a senior vice-president and is manager of the Engineering and Physics Group of Science Applications, Inc. (SAI). He was a participant in the *Reactor Safety Study* and has led or participated in risk analyses in many aspects of nuclear energy as well as in commercial product safety. Prior to joining SAI in 1973, he was on the staff at the University of California at Los Angeles. **Fred L. Leverenz, Jr.** (center) (MSE, University of Santa Clara, 1978) is manager of the Probabilistic and Statistical Systems Division at SAI. His experience includes involvement in several probabilistic risk assessments (PRA), including the *Reactor Safety Study*, and in PRA methods development for the Electric Power Research Institute (EPRI). **Gerald S. Lellouche** (bottom) (PhD, North Carolina State University, 1960) is responsible for research in the areas of statistics and consequence analysis for EPRI. Prior to joining EPRI, he worked for Brookhaven National Laboratory in the areas of reactor kinetics, reactor design, and thermal hydraulics.

ANALYSIS OF PRESSURIZED WATER REACTOR PRIMARY CIRCUIT PROCESSES AND FUEL ROD HEATUP IN THE CASE OF SEPARATED COOLANT

S. Benedek

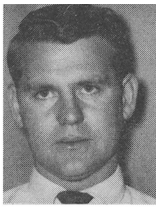


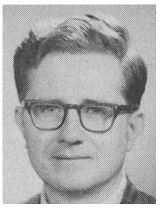
S. Benedek (Dr., mechanical engineering, TU Budapest, Hungary, 1972) is research engineer at Electrical Power Research Institute, Budapest. His present interests are in the areas of fluid mechanics, heat transfer, reactor analysis, and safety.

MATERIALS

EXPERIMENTAL MODELING OF HYDROGEN EVOLUTION RATES FROM SURFACES WITH EXPOSED ZINC METAL OR ZINC PRIMER COATING IN CONTACT WITH CONTAINMENT SPRAYS IN PWR NUCLEAR POWER PLANTS

L. E. S. Smith
R. O. Lane
W. Alexander Van Hook

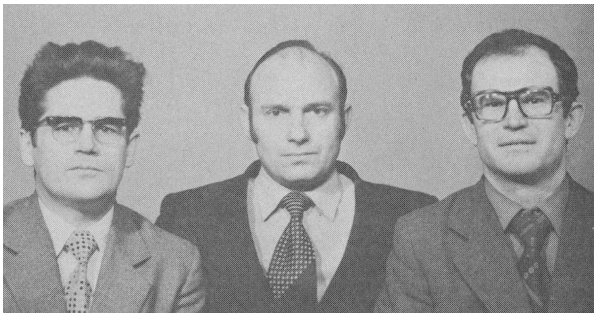




L. E. S. Smith (top) is a research chemist at the Tennessee Valley Authority (TVA) Singleton Materials Engineering Laboratory. **R. O. Lane** (center) is the director of Singleton Laboratory. **W. Alexander Van Hook** (bottom), professor of chemistry at the University of Tennessee in Knoxville, is a consultant to TVA.

STRENGTHENING AND VOID FORMATION IN THE Mo-Zr-B ALLOY UNDER NEUTRON IRRADIATION

V. A. Kazakov
A. S. Pokrovsky
A. V. Smirnov

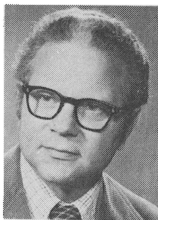


V. A. Kazakov (left) (Dr., technical sciences, Moscow Physical Engineers' Institute, 1974), **A. S. Pokrovsky** (center) (Dr., physical and mathematical sciences, Central Scientific Research Institute of Ferrous Metals, 1979), and **A. V. Smirnov** (right) (junior research worker, Moscow Physical Engineers' Institute, 1973) are all members of the Radiation Effects and Promising Materials Group of the Materials Division at the Scientific Research Institute of Atomic Reactors, which was named after V. I. Lenin. The authors have a combined total of more than 30 years of experience in the structural materials radiation metallurgical science of fission reactors and in the evaluation of radiation effects in metals, primarily in the refractory metals and alloys. They are currently focusing this experience on the evaluation of radiation effects to be anticipated in future fusion reactors.

NUCLEAR FUELS

CORRELATION OF FAILURE TIMES FOR IODINE STRESS CORROSION CRACKING OF ZIRCALOY

S. Shann
D. R. Olander



Shih Shann (top) (BS, nuclear engineering, National Tsin-Hua University, Taiwan, 1972) is a graduate student in the Nuclear Engineering Department of the University of California, Berkeley (UCB). **D. R. Olander** (ScD, chemical engineering, Massachusetts Institute of Technology, 1958) is a professor of nuclear engineering at the UCB, and principal investigator in the Materials and Molecular Research Division of the Lawrence Berkeley Laboratory. His research and professional interests are in the fields of reactor fuel element materials and chemistry, chemical kinetics of gas-solid reactions, and uranium enrichment by the gas centrifuge.