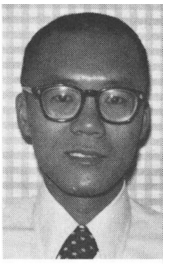
nuclear technology®

AUTHORS — JULY 1980

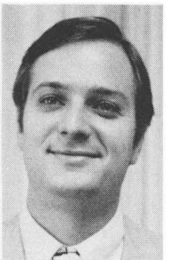
REACTORS

LIQUID-METAL FAST BREEDER REACTOR VENTED ASSEMBLY HYDRAULIC MODELING AND TESTING

James C. F. Wang
Allen E. Dubberley



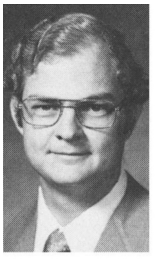
James C. F. Wang (top) (BS, mechanical engineering, National Taiwan University, 1965; MS, 1968, and ScD, 1971, aeronautics engineering, Massachusetts Institute of Technology) is a member of the technical staff at Sandia National Laboratories, Livermore, California, and is the principal investigator of the Diagnostics Assessment Program for advanced power systems. His current interests are in developing techniques to measure particle size distribution in combustion exhaust. He was a research engineer at the General Electric Company's (GE) Research & Development Center in Schenectady, New York, where he was in charge of the development of a laser velocimeter, liquid-metal fast breeder reactor (LMFBR) hydraulic modeling and testing, and other fluid-mechanical studies. **A. E. Dubberley** (BS, mechanical engineering, University of Texas at Austin, 1971; ME, mechanical engineering, Rensselaer Polytechnic Institute, 1975) is the lead engineer in the Vented Assembly Development Program at the GE Advanced Reactor Systems Department. He has worked in LMFBR, pebble-bed gas reactor, and fusion-fission hybrid component and systems analysis, and is presently the lead engineer for all GE LMFBR reference pin and assembly design procedures.

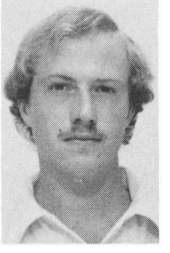


NUCLEAR FUEL CYCLES

A CONTINUOUS GLASS MELTER FOR IMMOBILIZATION OF RADIOACTIVE WASTE

C. C. Chapman
J. L. Buelt

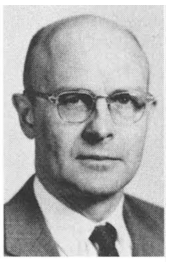


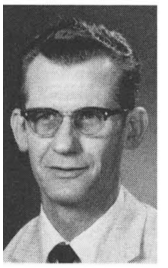


C. C. Chapman (top) (MS, mechanical engineering, Kansas State University, 1971) is a senior development engineer at Pacific Northwest Laboratory (PNL). He joined PNL in 1971 and began working in the high-level radioactive waste management field in 1973. He has led the Continuous Melter Development Program since 1973. Currently, he also coordinates research and development in support of the defense waste programs for PNL. **James L. Buelt** (BS, chemical engineering, Oregon State University) is the engineer in charge of development of the liquid-fed ceramic melter and the processes related to that piece of equipment at PNL.

THE FIXATION OF RADIOIODINE WITH PORTLAND CEMENT. PART II: RADIATION STABILITY TESTS

Walter E. Clark
William B. Howerton

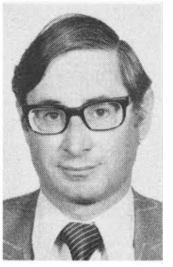


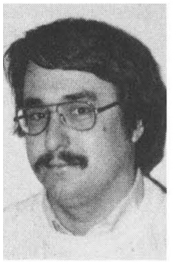


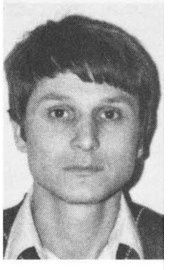
Walter E. Clark (top) (BS, chemistry, Virginia Military Institute, 1937; MA, chemistry, George Washington University, 1939; PhD, inorganic chemistry, University of Wisconsin, 1949) is a research staff member of the Chemical Technology Division at Oak Ridge National Laboratory (ORNL). His interests include the reprocessing of nuclear fuels and the separation, processing, and disposal of radioactive wastes. **William B. Howerton** is a science technologist in the Chemical Technology Division at ORNL. He has worked on a wide variety of chemical problems connected with nuclear fuel reprocessing and nuclear waste disposal. His current interests continue to be in these areas.

DYNAMIC PROCESS MODEL OF A PLUTONIUM OXALATE PRECIPITATOR

G. M. Borgonovi
J. E. Hammelman
C. L. Miller



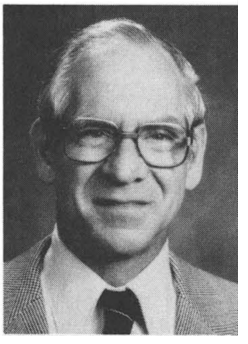




Giancarlo M. Borgonovi (top) (PhD, physics, University of Milano, Italy, 1961) was with General Atomic for 11 years, working on neutron thermalization and fuel management for high temperature gas-cooled reactors. He is presently with Science Applications, Inc. (SAI), where he is involved with nuclear safeguards and system modeling. **James E. Hammelman** (center) (BS, chemical engineering, Oregon State University, 1970; MS, chemical engineering, University of Washington, 1976) worked for Atlantic Richfield Hanford Company at the U.S. Department of Energy Hanford Reservation and currently works for SAI in McLean, Virginia. His areas of involvement include actinide and nuclear waste processing, specializing in the analysis of chemical processes. **Charles Lee Miller** (bottom) (BS, engineering, Widener College, 1968; MS, 1971, and PhD, 1974, chemical engineering, University of Maryland) is employed by SAI as a chemical process engineer specializing in nuclear fuel cycle applications. Prior to working at SAI, he was an engineer at Bechtel Power Corporation.

ALPHA WASTE PRODUCTION AND PROLIFERATION HAZARD OF DIFFERENT FUEL CYCLES

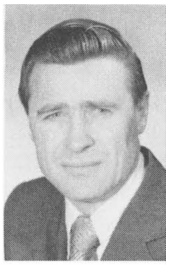
Robert P. Schuman

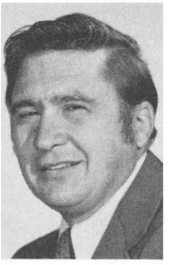


Robert P. Schuman (PhD, Ohio State University, 1946) is a senior scientist working at the Idaho National Engineering Laboratory (Allied Chemical Corp.) on the ultimate disposal of high-level defense reprocessing waste. He worked for Knolls Atomic Power Laboratory from 1947 to 1957, and at the National Reactor Testing Station from 1957 to 1969. He taught at Robert College-Boğaziçi Üniversitesi from 1969 to 1977, and made this study while he was a visiting professor at Iowa State University in 1977 and 1978. His interests include the chemical aspects of the nuclear fuel cycle, breeder reactors, actinide and fission product cross sections and decay properties, the production and burnup of nuclides in reactors, and chemical hot cell operations.

A PRODUCTION FACILITY FOR THE SOLIDIFICATION OF HIGH-LEVEL RADIOACTIVE WASTES

G. E. Bingham
B. R. Wheeler

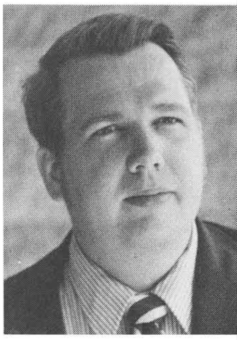




G. E. Bingham (top) (BS, chemical engineering, Oregon State University, 1956; MBA, University of Idaho, 1973) is presently Allied Chemical Corporation's project manager for the $81 million New Waste Calcining Facility that is being constructed at the Idaho Chemical Processing Plant (ICPP). Bingham entered the nuclear field at the Idaho National Engineering Laboratory in 1958 as a reactor engineer and since has served in several positions of increasing responsibility in reactor operations, reactor transient and destructive testing, reactor containment and safety tests, ICPP technical support, and project management. **Bert R. Wheeler** (BS, civil engineering, Utah State University, 1952; MS, chemical engineering, Purdue University) is presently the assistant general manager for all production-related activities as well as for the project management activities at ICPP. Wheeler joined ICPP in 1955 as a research engineer and over the years assumed various positions in technical, project-related, and production programs at ICPP. He has made significant contributions and guided programs in the radioactive waste management and fuel reprocessing fields of endeavor at ICPP.

SEPARATION OF AMERICIUM, CURIUM, AND TRIVALENT LANTHANIDES FROM HIGH-LEVEL WASTES BY OXALATE PRECIPITATION: EXPERIMENTS WITH SYNTHETIC WASTE SOLUTIONS

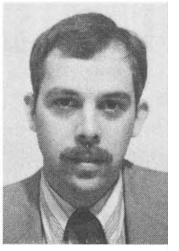
Charles W. Forsberg

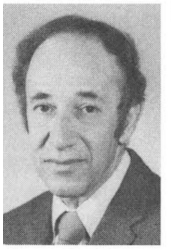


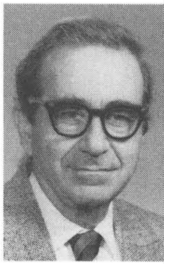
Charles Forsberg (BS, chemical engineering, University of Minnesota, 1969; MS, 1971, and ScD, 1973, nuclear engineering, Massachusetts Institute of Technology) is currently involved in waste management studies at Oak Ridge National Laboratory. He has done experimental research on various techniques to remove americium and curium from high-level wastes and is currently involved in estimations of waste volume generation by various parts of the nuclear fuel cycle.

THE SORPTION OF TECHNETIUM AND IODINE RADIOISOTOPES BY VARIOUS MINERALS

R. Strickert
A. M. Friedman
S. Fried



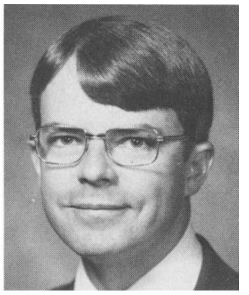




Richard Strickert (top) (PhD, chemistry, Washington University, 1976) is presently a research scientist at Battelle-Pacific Northwest Laboratories. At the time this work was performed, he was a post-doctoral research associate at Argonne National Laboratory (ANL). His work has been in the area of hot-atom and radiochemistry. His current interests include nuclear waste and geologic media interactions involving multivalent species. **A. M. Friedman** (center) (PhD, nuclear chemistry, Washington University, 1953) is a senior chemist at ANL, where he has worked since 1953. His interests are in nuclear structure, application of nuclear techniques to medicine, and radioactive waste disposal. He is currently a visiting professor at the University of Chicago. **Sherman Fried** (bottom) (PhD, University of Chicago) worked at Northwestern University from 1942 to 1943 before coming to the Metallurgical Laboratory (now ANL). He worked at the Radiation Laboratory, University of California, from 1960 to 1966. His field of research has continued to be the chemistry of the actinide elements with interest in basic research as well as with applications to special problems. A senior scientist, he is involved in studies of migration of actinides from radionuclide repositories into the environment.

FULL-SCALE IN-CAN MELTING FOR VITRIFICATION OF NUCLEAR WASTES

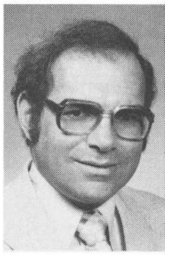
H. Thomas Blair

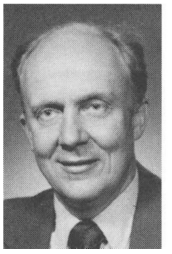


H. Thomas Blair (BS, ceramic engineering, University of Utah, 1968) is a development engineer at Pacific Northwest Laboratory, operated for the U.S. Department of Energy. He is currently involved in the development and demonstration of high-level nuclear waste solidification processes and equipment, with special concentration on vitrification. He has also done development work in mixed-oxide fuel fabrication processes.

SPENT FUEL HEATUP FOLLOWING LOSS OF WATER DURING STORAGE

Allen S. Benjamin
David J. McCloskey



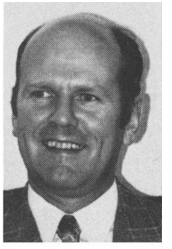


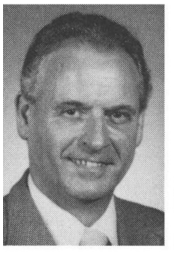
Allen S. Benjamin (top) (BS, aeronautical engineering, 1964, and MS, mechanical engineering, 1966, Brown University; PhD, heat and mass transfer, University of California, Los Angeles, 1976) is a technical staff member in the Nuclear Facility Analysis Division at Sandia National Laboratories (SNL), Albuquerque, New Mexico. He is currently the principal investigator for the development and analysis of core melt accident mitigation systems involving containment venting. **David J. McCloskey** (BS, chemical engineering, 1958, and MS, mechanical engineering, 1959, Stanford University; PhD, engineering science and applied mathematics, California Institute of Technology) is manager of the Nuclear Fuel Cycle Safety Research Department at SNL, where programs are being carried out for the U.S. Nuclear Regulatory Commission in improved light water reactor safety, probabilistic risk assessment, and safeguards.

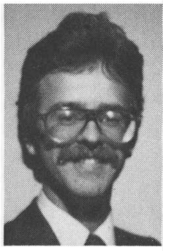
REACTORS

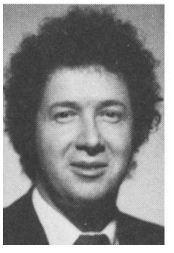
PROTECTION OF NUCLEAR POWER PLANTS AGAINST SEISM

C. Plichon
R. Gueraud
M. H. Richli
J. F. Casagrande







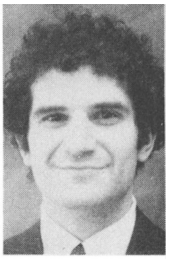


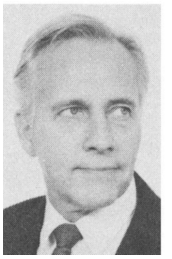
Claude Edouard Plichon (top right) (Grenoble Polytechnical Institute, 1959) has worked with Electricité de France (EdF) since 1962, and has introduced and developed within the Project Department the notion of earthquake engineering. In particular, he developed vibration codes for the turbo-generator plinths and has introduced the principle of decoupling of soil vibrations for French pressurized water reactor buildings. He is responsible for seismic analysis, in particular on overseas projects. **Roger Gueraud** (top left) (University of Paris, 1949) is presently chief engineer of the Civil Engineering Department of the Services Etudes et Projets Thermiques et Nucléaires (a division of EdF). He is responsible for the analysis and design of structures subjected to dynamic loadings, such as vibrations on structures in nuclear power plants due to equipment, earthquake, and missile impact. **Marc Richli** (bottom right) (Ecole Polytechnique, 1970; Ecole Nationale des Ponts et Chaussees, 1973) is a Spie-Batignolles engineer currently involved in seismic analysis and soil structure interaction. He has been in charge of the mathematical aspects of the aseismic bearing development since 1975. **Jean François Casagrande** (bottom left) (mechanical engineering and development, National Institute of Applied Sciences, 1971) has been dealing with the aseismic bearing system for Spie-Batignolles since 1976, especially in the technology and tribology aspects.

CHEMICAL PROCESSING

THE USE OF YTTRIUM FOR THE RECOVERY OF TRITIUM FROM LITHIUM AT LOW CONCENTRATIONS

Robert E. Buxbaum
Ernest F. Johnson



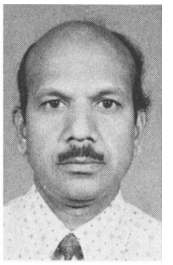


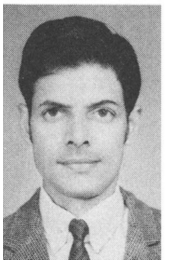
Robert E. Buxbaum (top) (BE, chemical engineering, The Cooper Union for the Advancement of Science and Art, New York, 1976; MA, chemical engineering, Princeton University, 1977) is a doctoral candidate in the Department of Chemical Engineering of Princeton University conducting research on the equilibrium and transport properties of the system lithium-tritium-yttrium at temperatures only slightly above the melting point of lithium. **Ernest F. Johnson** (PhD, chemical engineering, University of Pennsylvania, 1949) is professor and past chairman of the Department of Chemical Engineering at Princeton University. He has been associated since 1955 with the Princeton Plasma Physics Laboratory, working primarily on fuel handling problems for nuclear fusion power reactors and on the conceptual designs of such machines and their hybrids with fission reactors.

REACTORS

BeH_2 AS A MODERATOR IN MINIMUM CRITICAL MASS SYSTEMS

K. Subba Rao
M. Srinivasan



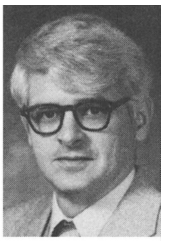


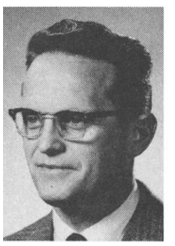
Kodati Subba Rao (top) (MSc, physics, Benaras Hindu University, 1956; MS, electrical engineering, University of Rochester, 1960; MS, nuclear engineering, University of Illinois, 1962) has been actively engaged in experimental and computational reactor physics at the Bhabha Atomic Research Centre (BARC), Trombay, India, since 1963. He worked earlier on pulsed neutron experiments. He is currently associated with the Critical Experiments Program at BARC. **Mahadeva Srinivasan** (BSc, physics, University of Madras, 1955; Graduate, BARC Training School, 1958; MSc, physics, University of Bombay, 1966) has been in charge of the Critical Experiments Group at BARC since 1964. In 1968 and 1969, he was on loan to the Chalk River Nuclear Laboratories in Canada. His current interests include nuclear criticality physics, research reactor safety, and noise analysis of nuclear systems.

RADIOACTIVE WASTE

APPLICATION OF SOL-GEL TECHNOLOGY TO FIXATION OF NUCLEAR REACTOR WASTE

W. J. Lackey
R. E. Blanco
A. L. Lotts





W. J. Lackey (top) (BS, ceramic engineering and metallurgical engineering, 1961, and MS, 1961, and PhD, 1969, ceramic engineering, North Carolina State University) is group leader of the Fuel Cycle Technology Group in the Metals and Ceramics Division at Oak Ridge National Laboratory (ORNL). Lackey is involved in process and equipment development and characterization for nuclear fuels and waste. **Raymond E. Blanco** (center) (BS, chemical technology, North Dakota State University) is program manager for waste processing development at ORNL and has been associated with U.S. atomic energy programs since 1944. Blanco is a specialist in radioactive waste treatment and disposal, nuclear fuel processing, and other nuclear fuel cycle technologies. **A. L. "Pete" Lotts** (bottom) (BS, 1955, and MS, 1957, metallurgical engineering, Virginia Polytechnic Institute and State University) is program director of the nuclear fuel and waste program at ORNL.