nuclear technology®

AUTHORS — AUGUST 1982

ENVIRONMENTAL TRANSPORT MECHANISMS

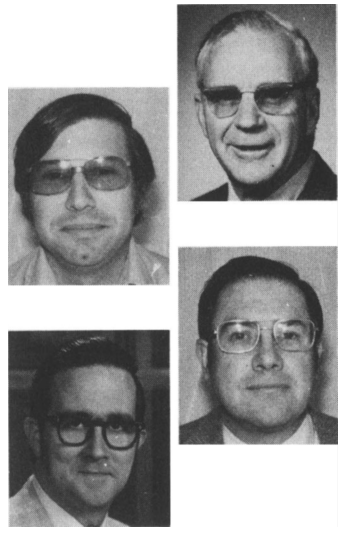
PROJECTED SUBSURFACE MIGRATION OF RADIONUCLIDES FROM BURIED IDAHO NATIONAL ENGINEERING LABORATORY TRANSURANIC WASTE

Thomas G. Humphrey
Thomas H. Smith
Matthew C. Pope

Thomas G. Humphrey (top) (BS, geology, University of Wyoming, 1956) is a geologist for the Waste Effects Branch at the Idaho National Engineering Laboratory. His professional interests include environmental geology and waste management. He has worked with both the core-drilling and subpit-sampling programs at the Radioactive Waste Management Complex. **Thomas H. Smith** (center) (PhD, mechanical engineering, University of Utah, 1968) is manager of the Waste Programs Branch at EG&G Idaho, Inc. His professional interests include transuranic waste, environmental effects analysis, and risk assessments of waste management systems. Previously at Battelle-Pacific Northwest Laboratories, he worked on heat transfer and risk analysis studies related to high-level waste. **Matthew C. Pope** (bottom) (MS, atmospheric science, Colorado State University, 1977) holds the position of scientist in the Waste Programs Division at EG&G Idaho, Inc. His professional interests include environmental assessment, solar energy research and conservation, and meteorological analysis.

BIOBARRIERS USED IN SHALLOW BURIAL GROUND STABILIZATION

John F. Cline
Dominic A. Cataldo
W. Eugene Skiens
Frederick G. Burton



John F. Cline (top right) (BS, agronomy, Colorado State University, Fort Collins, 1943) is a senior research technologist with Battelle-Pacific Northwest Laboratories (BNWL). His research interests include revegetation and stabilization of radioactive burial sites. **Dominic A. Cataldo** (top left) (PhD, plant physiology, Yale University, 1973) is a staff scientist with BNWL. His research interests include the study of pollutant absorption by plants, pollutant metabolism, and chemical fate. **W. Eugene Skiens** (bottom right) (PhD, physical chemistry, University of Washington, Seattle, 1957) is a senior research scientist at BNWL. His research interests include controlled and sustained release of chemicals and drugs from polymeric materials and physical/chemical characterization of polymers. **Frederick G. Burton** (bottom left) (PhD, biophysics, University of Rochester, 1971) is a senior research scientist at BNWL. His research interests include controlled release devices and chemical analysis of aerosols.

CAPABILITY OF FIELD INSTRUMENTATION TO MEASURE RADIONUCLIDE LIMITS

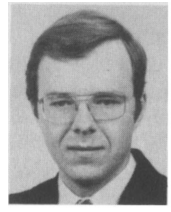
L. E. Bruns

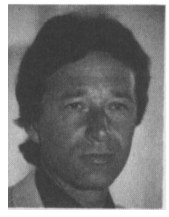
L. E. Bruns (MS, Oregon State University, 1950) has over 31 years of experience at Hanford. He has published over 120 papers on subjects ranging from Pu-U separation by a solvent extraction reflux flow sheet (his innovation) to a paper on rapid decay of concentrated radwaste by a collective accelerator. He originated the first package counter in 1957 to be used for accountability and developed the first downhole fission product-transuranic radionuclide assay system (Dev-Van-II).

MATERIALS PERFORMANCE IN NUCLEAR STEAM GENERATORS

IN-SERVICE MONITORING AND SERVICING AFTER LEAK DETECTION FOR THE LIQUID-METAL FAST BREEDER REACTOR STEAM GENERATORS OF PHÉNIX AND SUPER PHÉNIX

L. Castelnau
T. Desmas
A. M. Lapicoré
P. Mainy

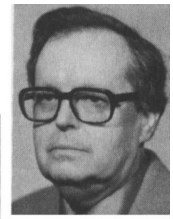


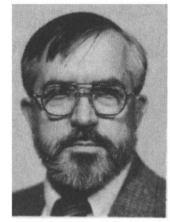


L. Castelnau (top) (ingineer, Ecole Nationale des Techniques Avancées and Institut National des Sciences et Techniques Nucléaires, 1976) is a senior engineer with NOVATOME, where he is in charge of all the work performed on the liquid-metal fast breeder reactor (LMFBR) steam generators, in relation with Electricité de France (EDF), the manufactor, and the licensing authorities. **T. Desmas** (center) (engineer, Ecole Nationale Supérieure d'Electrotechnique et de Génie Physique, 1976) has worked since 1978 at the Direction des Etudes et Recherches of EDF, where he develops the leak detection systems for LMFBR steam generators, principally the acoustic systems. **A. M. Lapicoré** (bottom) (MS, physics, 1969, and DEA, thermodynamics, 1970, University of Provence) is a senior engineer with the French Commissariat à l'Energie Atomique. He is involved in the licensing of the Super Phénix reactor plant. At the time this work was performed, he was in charge of the nondestructive examination of the SPX1 steam generators. He is presently in charge of the coordination of the French Water Sodium Reaction Program being carried out at Cadarache. Photo and biography of **P. Mainy** were not available at publication time.

MAGNETITE DISSOLUTION AND CREVICE STUDIES WITH CHELANT SOLUTIONS

R. G. Charles
James G. Cleary
M. J. Wootten



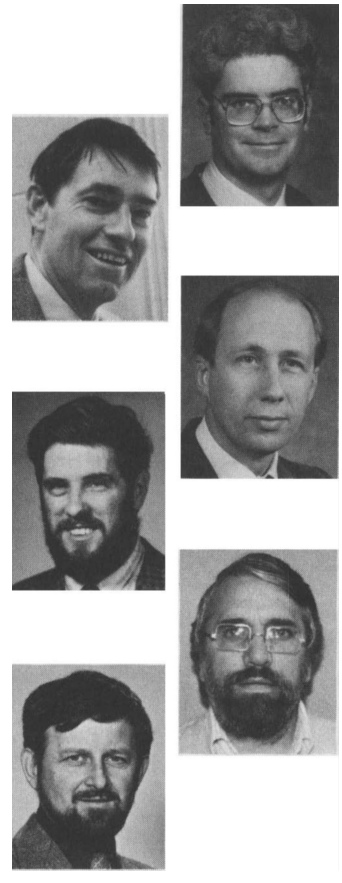


R. G. Charles (top) (PhD, chemistry, University of Pittsburgh, 1952) has been with the Westinghouse Research and Development (R&D) Center since 1952, and is currently an advisory scientist in the Physical and Inorganic Chemistry Department. He has specialized in the general areas of metal chelate and organometallic chemistry and has also published widely in the fields of thermodynamics, corrosion, solution chemistry (aqueous and liquid alkali metal), and thermal analytical methods. **James G. Cleary** (center) (BS, psychology and metallurgical engineering, University of Pittsburgh, 1965) is a senior engineer with the Westinghouse R&D Center where he has worked in the fields of process development and material corrosion. **M. J. Wootten** (bottom) (BSc, 1966, and PhD, 1969, chemistry,

University of Leicester, England) is currently manager of chemistry field development and applications in the Westinghouse Nuclear Technology Division. He has extensive experience in the area of high-temperature aqueous corrosion of nuclear power plant materials and part of his prior work experience included responsibility for the Westinghouse R&D Laboratory effort on steam generator chemistry programs.

THE ORIGIN AND CONSEQUENCES OF RADIAL HELIUM PROFILES IN FAST REACTOR CLADDING

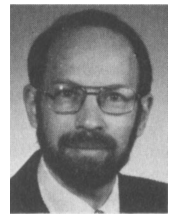
F. A. Garner
C. W. Hunter
G. D. Johnson
E. P. Lippincott
J. O. Schiffgens
Harry Farrar IV



F. A. Garner (top right) (PhD, nuclear engineering, University of Virginia, 1969) is a fellow scientist in the Radiation Effects, Materials Technology Group at Hanford Engineering Development Laboratory (HEDL). His research focuses on the areas of alloy development and response of engineering materials to irradiation in thermal, fast, and fusion reactors. **C. W. Hunter** (top left) (PhD, metallurgy and materials science, Lehigh University, 1968) is currently manager of the Transient Performance and Properties Group at HEDL. His research interests are in the area of evaluation of reactor environment on fuel and structural material performance. **G. D. Johnson** (center right) (MS, materials science, Washington State University, 1973) is currently manager of the Mechanical Properties Group at HEDL. His research and management activities have centered on the development of materials for nuclear systems. **E. P. Lippincott** (center left) (PhD, nuclear physics, Massachusetts Institute of Technology, 1966) is a senior scientist in the Irradiation Environment Group at HEDL. His activities focus on reactor physics and neutron dosimetry for a wide variety of materials and nuclear systems. **J. O. Schiffgens** (bottom right) (PhD, solid state science, Pennsylvania State University, 1968) participated in this research effort while at HEDL and is currently employed by the Nuclear Regulatory Commission, Materials Engineering Branch. His activities at HEDL were in the area of analysis of radiation damage processes in engineering materials. **Harry Farrar IV** (bottom left) (PhD, nuclear physics, McMaster University, Canada, 1962) is currently manager of materials and nuclear technology at Rockwell International Corporation Energy Systems Group. His research interests center on the development of mass spectrometer systems for accurate measurement of minute amounts of helium, and the application of these measurements to a wide variety of nuclear and geophysical questions.

PRACTICALITY OF AND BENEFITS FROM THE APPLICATIONS OF OPTIMAL CONTROL TO PRESSURIZED WATER REACTOR MANEUVERS

David D. Ebert



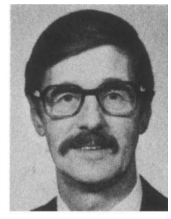
David D. Ebert (BS, applied mathematics and engineering physics, University of Wisconsin, 1963; MS, 1965, and PhD, 1972, nuclear engineering, Georgia Institute of Technology) is an associate professor of mechanical engineering at The Catholic University of America. He has worked in the areas of

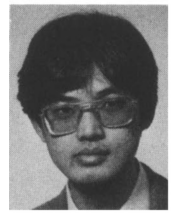
neutron noise analysis and reactor dynamics and control, and is presently involved in applying optimal control techniques to nuclear plant safety and control.

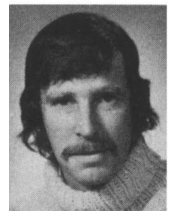
NUCLEAR FUELS

THE THERMAL STABILITY OF Al-USiAl DISPERSION FUELS AND Al-U ALLOYS

Melville A. Feraday
Moon T. Foo
Ross D. Davidson
John E. Winegar





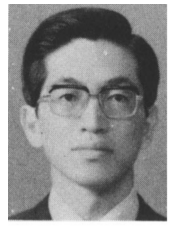


Melville A. Feraday (top right) (BSc, mechanical engineering, Queens University, Kingston, 1954; MSc, material science, University of Waterloo, 1970) was head of the Advanced Fuel Development Section, Fuel Materials Branch at the Chalk River Nuclear Laboratories (CRNL), Chalk River, Ontario, Canada. His experience includes fabrication of oxide and metal fuels along with the application of robotic technology to the recycle fuel industry. **Moon T. Foo** (top left) (BSc, metallurgical engineering, University of Toronto, 1980) is in the Advanced Fuel Development Section, Fuel Materials Branch at CRNL. Since 1980 he has been involved in the development of low-enrichment uranium fuel for research reactors. His present interest is the development of Al-USiAl dispersion fuels for the two research reactors at CRNL. **Ross D. Davidson** (bottom right) (technologist, metallurgical technology, Mohawk College, Hamilton, 1971) is a member of the System Materials Branch at CRNL. His experience includes ten years of electron microscopy of materials used in the nuclear industry. He is now also actively engaged in scanning auger microprobe analysis. **John E. Winegar** (bottom left) joined the Metallurgical Engineering Branch of CRNL in 1966 and has worked in the field of x-ray diffraction since 1974. His current interests in this field involve the measurement of crystallographic texture, dislocation density, and residual stress in metals.

RADIOACTIVE WASTE MANAGEMENT

USING COPPER HEXACYANOFERRATE (II) IMPREGNATED ZEOLITE FOR CESIUM REMOVAL FROM RADIOACTIVE LIQUID WASTE

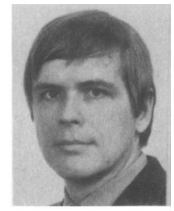
Fumio Kawamura
Kenji Motojima

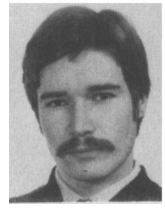


Fumio Kawamura (top) (BS, chemical engineering, Gunma University, 1970; MS, 1972, and Dr. Eng., 1976, Tohoku University) has been a research scientist at the Energy Research Laboratory, Hitachi Ltd. since 1976, specializing in transport phenomena. He is currently working in the field of radioactive waste management and reactor water chemistry. **Kenji Motojima** (MS, chemistry, Kyoto Imperial University, 1944; Dr. Sci., 1957) is chief engineer of Energy Research Laboratory, Hitachi Ltd. From 1957 to 1979, he belonged to the Japan Atomic Research Institute. He has been director of Takasaki Research Institute, Isotope Center and Oarai Research Institute, and a scientific counselor. His main research has been in the development of photometric determination methods of microamounts of many metals using oxine and use of these methods for the analyses of nuclear materials. The alkali titrimetry of free acid and uranium, which he developed, has been widely used in reprocessing process of nuclear fuel.

INCINERATION OF ION-EXCHANGE RESINS IN A FLUIDIZED BED

Matti Valkiainen
Mikko Nykyri





Matti Valkiainen (top) (MSc, physics, University of Helsinki, 1972) has worked as a research officer at the Reactor Laboratory of the Technical Research Centre of Finland since 1972. He has worked in the area of radiation effects in insulators and is currently engaged in low- and medium-level waste volume reduction and solidification. **Mikko Nykyri** (MSc, mechanical engineering, Helsinki University of Technology, 1978) has worked at the Reactor Laboratory of the Technical Research Centre of Finland since 1978. His work has been in nuclear waste management and heat transfer studies.

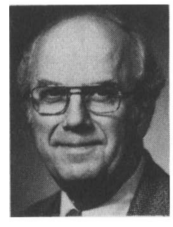
A MODEL OF BRINE MIGRATION AND WATER TRANSPORT IN ROCK SALT SUPPORTING A TEMPERATURE GRADIENT

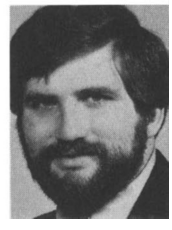
D. R. Olander

D. R. Olander (ScD, chemical engineering, Massachusetts Institute of Technology, 1958) is a professor of nuclear engineering at the University of California-Berkeley, and principal investigator at the Materials and Molecular Research Division of the Lawrence Berkley Laboratory. His research and professional interests are in the fields of reactor fuel element materials and chemistry and the chemical kinetics of gas-solid reactions.

GENERATION AND VITRIFICATION OF HIGH-LEVEL LIGHT WATER REACTOR LIQUID WASTE

Earl J. Wheelwright
William J. Bjorklund
Larry M. Browne
Garry H. Bryan
Langdon K. Holton
Everett R. Irish
Dan H. Siemens





Earl J. Wheelwright (group photo, standing right) (PhD, physical chemistry, Iowa State University, 1955) was leader of the Waste Preparation Task of the Nuclear Waste Vitrification Project (NWVP). He is a senior staff scientist at Pacific Northwest Laboratory (PNL) with interests in fuel reprocessing and the recovery and utilization of byproducts from nuclear waste. **William J. Bjorklund** (group photo, standing center) (BS, chemical engineering, University of Washington, 1969) was lead process engineer for the Waste Vitrification Task. He currently manages the Defense Waste Vitrification Program at PNL. **Larry M. Browne** (single photo, bottom) (BS, chemical engineering, Montana State University, 1975; MBA, University of Washington, 1979) was process engineer–solvent extraction and plutonium calcination. He is currently a construction superintendent for J. A. Jones Construction Services Company, Richland, Washington. **Garry H. Bryan** (group photo, seated right) (MS, chemistry, Colorado School of Mines, 1976) was senior operations engineer for the Waste Preparations Task of NWVP. He is now working in the chemistry of the actinides, fission products, and nuclear waste. **Langdon K. Holton** (group photo, seated left) (MS, chemical engineering, University of Washington, 1981) was process engineer–fuel dissolution and waste solidification for the NWVP. He is now working on development of nuclear and hazardous waste immobilization processes. **Everett R. Irish** (single photo, top) (MS, chemical engineering, University of Colorado, 1947) was manager of technical integration for NWVP. He is currently senior officer, Waste Management Section, Division of Nuclear Safety and Environmental Protection of the International Atomic Energy Agency, Vienna. **Dan H. Siemens** (group photo, standing left)

was leader of the Waste Vitrification Task. He is currently manager of the Zeolite Vitrification Demonstration Program at PNL.

MATERIALS

RESPONSE OF LOFT SELF-POWERED NEUTRON DETECTORS TO REACTOR COOLANT DENSITY VARIATIONS DURING LOCA SIMULATIONS

James P. Adams
Victor T. Berta

James P. Adams (top) (BS, physics, Brigham Young University, 1968; PhD, nuclear physics, Iowa State University, 1972) has been at the Idaho National Engineering Laboratory (INEL) (EG&G Idaho, Inc., prime contractor) since 1979, working in reactor safety research. His current interests include integral reactor thermal and hydraulic analysis as well as application of in-core nuclear instrumentation to thermal and hydraulic measurements. He is currently a senior scientist in the loss-of-fluid test (LOFT) research group. **Victor T. Berta** (BS, physics, 1962, and MS, nuclear physics, 1963, University of Wyoming) has been at INEL (currently with EG&G Idaho, Inc.) since 1963 in reactor safety research. Specific areas of research relative to this paper have been in process and experimental nuclear instrument design and analysis of nuclear data associated with the SNAPTRAN and LOFT research programs. He is currently supervisor of the Experiment Analysis and the Experiment Physics and Applications Sections in the LOFT program.

ANALYSES

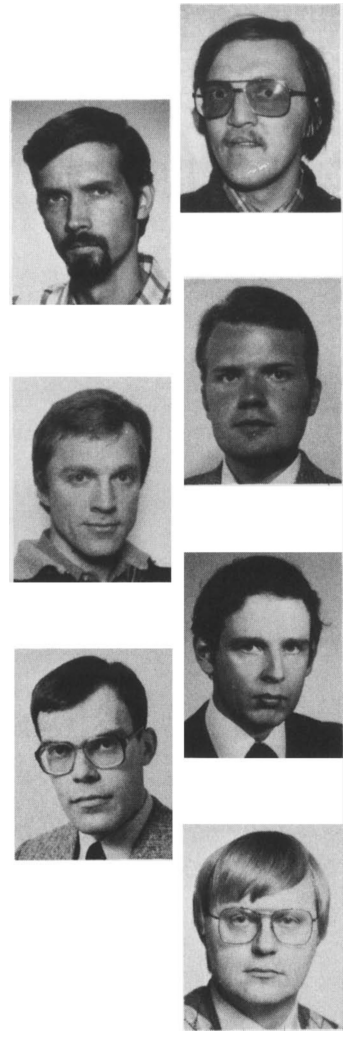
REEVALUATION OF SPATIAL WEIGHTING FACTORS FOR EX-CORE NEUTRON DETECTORS

Hiroshi Tochihara
Eiji Ochiai
Tadashi Hasegawa

Hiroshi Tochihara (center) (BS, 1966, and MS, 1968, nuclear engineering, Tokyo University) is a nuclear engineer at Mitsubishi Atomic Power Industries engaged in nuclear design of commercial pressurized water reactors (PWRs) and reload core design. His recent interest is in advanced PWR technology. **Eiji Ochiai** (right) (BS, physics, Kyoto University, 1972) is a nuclear engineer at Mitsubishi Atomic Power Industries engaged in radiation analysis of commercial PWRs. His current interests are in gamma-ray heating, skyshine problems, and steam generator tube rupture analysis. **Tadashi Hasegawa** (left) (BS, 1977, and MS, 1979, nuclear engineering, Kyoto University) is a nuclear engineer at Mitsubishi Atomic Power Industries engaged in radiation analysis of commercial PWRs. His current interests are in neutron skyshine and streaming problems.

MULTICOMPONENT ACTIVATION DETECTORS FOR REACTOR NEUTRON SPECTROSCOPY

P. A. Aarnio
M. J. Koskelo
P. D. Lund
V. K. Maunula
J. T. Routti
J. V. Sandberg
H. J. Takala

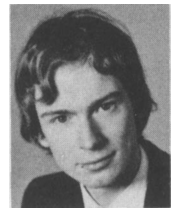


P. A. Aarnio (top right) (MS, technical physics, Helsinki University of Technology, 1978) has been working on gamma spectrum analysis, activation detectors, and hadron cascade simulations. He is currently working at the European Organization for Nuclear Research (CERN), Geneva. **M. J. Koskelo** (top left) (MS, technical physics, 1976, and Dr. Techn., nuclear engineering, 1981, Helsinki University of Technology) has been working on gamma spectrum analysis programs and activation detectors. He is currently working for Canberra Industries, Inc., Connecticut. **P. D. Lund** (second from top right) (MS, 1980, and Lic. Techn., 1981, technical physics, Helsinki University of Technology) is working in the Helsinki University of Technology. His current interests are new energy systems and energy storage. **V. K. Maunula** (center left) (MS, technical physics, Helsinki University of Technology, 1978) is working as an inspector in the Finnish Institute of Radiation Protection. His current interest is safety aspects of light water reactor (LWR) fuel technology. **J. T. Routti** (second from bottom right) (MS, technical physics, Helsinki University of Technology, 1964; MS, 1966, and PhD, 1969, nuclear engineering, University of California at Berkeley) has been working on gamma spectrum analysis, activation detectors, hadron cascade simulations, and radiation safety at Lawrence Berkeley Laboratory and at CERN. He has been professor of nuclear engineering in the Helsinki University of Technology since 1975. His current interests also include studies of energy policies, nuclear energy, and new energy systems. **J. V. Sandberg** (bottom left) (MS, technical physics, 1977, and Lic. Techn., nuclear engineering, 1981, Helsinki University of Technology) has been working on spectrum unfolding, activation detectors, and hadron cascade simulations, previously at CERN and currently at the Helsinki University of Technology. **H. J. Takala** (bottom right) (MS, technical physics, Helsinki University of Technology, 1979) has been working in the Helsinki University of Technology and in the Finnish Institute of Radiation Protection. His current interest is safety aspects of LWR fuel technology.

RADIOISOTOPES AND ISOTOPES

THE PRACTICAL AND PHYSICAL ASPECT OF URANIUM ISOTOPE SEPARATION WITH LASERS

F. S. Becker
K. L. Kompa



F. S. Becker (Diplom, physics, University of Karlsruhe, 1977; PhD, physics, University of Munich, 1981) worked from 1977 to 1981 for the Max-Planck-Institut für Quantenoptik, Garching, Federal Republic of Germany, on the development of a 16-μm laser and problems related to laser isotope separation. He is now working for Siemens Semiconductor Research Laboratories. His interests are solid state physics and laser isotope separation. Photo and biography of **K. L. Kompa** were not available at publication time.