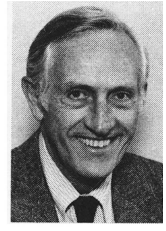
nuclear technology®

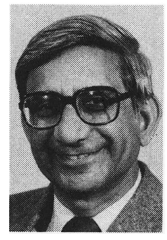
AUTHORS — NOVEMBER 1984

NUCLEAR SAFETY

VAPORIZATION OF CORE MATERIALS IN POSTULATED SEVERE LIGHT WATER REACTOR ACCIDENTS

Daniel Cubicciotti
Bal Raj Sehgal



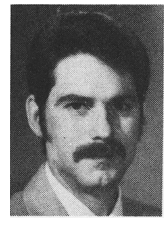


Daniel Cubicciotti (top) (PhD, chemistry, University of California, 1946) is a scientific specialist in the Materials and Corrosion Program of the Nuclear Power Division of the Electric Power Research Institute (EPRI). He has engaged in research on chemical aspects of materials behavior at high temperature since Manhattan Project days. Currently he is involved in research on the vapor transport of fission products in nuclear accidents and on effects of coolant water chemistry on boiling water reactor pipe stress corrosion cracking. **Bal Raj Sehgal** (PhD, University of California, Berkeley, 1961) is a senior scientific advisor in the Nuclear Power Division at EPRI. Before joining EPRI in 1974, he worked at Brookhaven and Argonne National Laboratories on problems in reactor physics, light water reactor analysis, fast reactor engineering, and safety. He served as visiting professor at Purdue University (1973-1974), Massachusetts Institute of Technology (1980-1981), and University of California, Berkeley (1982-1983). At EPRI he has managed programs in advanced reactors, code development and validation and is currently directing and performing research in the degraded core and source term areas.

NUCLEAR FUELS

A CRACKED-FUEL CONSTITUTIVE EQUATION

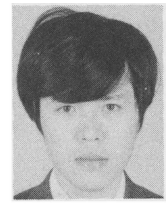
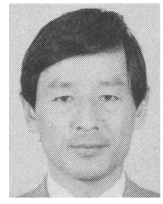
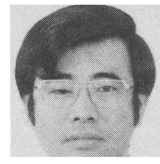
R. E. Williford



R. E. Williford (BS, mechanical engineering, and BS, mathematics, Oregon State University, 1972) has been involved with fuel rod thermal and mechanical analyses since joining Pacific Northwest Laboratory in 1975. His most recent work includes investigations into stress corrosion cracking and chemically assisted microcrack nucleation processes.

HIGH-LEVEL RADIOACTIVE WASTE GLASS SYNTHESIS AT LOW TEMPERATURES

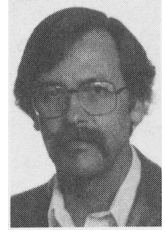
Naohito Uetake
Yoshihiro Ozawa
Makoto Kikuchi

Naohito Uetake (top) (MS, nuclear engineering, Nagoya University, Japan, 1979) is a research scientist at Energy Research Laboratory, Hitachi, Ltd. His current interests are in low- and high-level radioactive waste solidification. **Yoshihiro Ozawa** (center) (MS, nuclear engineering, 1970; PhD, nuclear engineering, Tokyo University, Japan, 1981) is a research scientist at Energy Research Laboratory, Hitachi, Ltd. His current interests are in radioactive waste management, especially radioactive iodine removal with absorbents. **Makoto Kikuchi** (bottom) (BS, chemistry, Tohoku University, 1968; PhD, chemistry, University of New York at Buffalo, 1973) is a senior engineer at Hitachi Works, Hitachi, Ltd., and is responsible for R&D of the radioactive waste system.

A SENSITIVITY STUDY OF BRINE TRANSPORT INTO A BOREHOLE CONTAINING A COMMERCIAL HIGH-LEVEL WASTE CANISTER

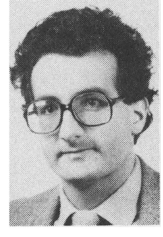
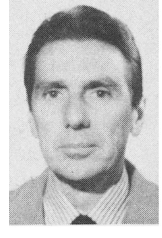
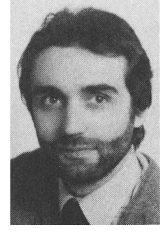
Joe L. Ratigan



Joe L. Ratigan (BS, mechanical engineering, South Dakota School of Mines and Technology, 1971; MS, mechanical engineering, University of New Mexico, 1972; PhD, civil engineering, University of California, Berkeley, 1981) is a staff scientist and manager of engineering analysis for RE/SPEC Inc. His current interests include rock mechanics aspects of radioactive waste disposal in salt, tuff, and granites, and commercial mining of evaporites.

AMERICIUM FILTRATION IN GLAUCONITIC SAND COLUMNS

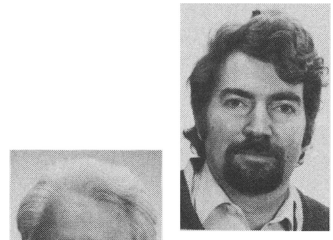
A. Saltelli
A. Avogadro
G. Bidoglio

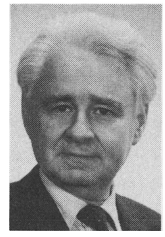




A. Saltelli (top) (PhD, inorganic chemistry, Rome University, Italy, 1976) was involved between 1975 and 1981 in chemical kinetics and liquid-metal technology. He also worked on fast reactor materials at Argonne National Laboratory in 1981. He is currently at the Joint Research Centre of the Commission of the European Communities at Ispra, Italy, working on risk assessment studies and model development for radionuclide transport in multicomponent systems. **A. Avogadro** (center) (PhD, chemistry, University of Turin, Italy, 1955) is head of the Nuclear Fuel Cycle Sector at the Ispra Establishment. He has been engaged in research on fuel cycle chemistry and related safety aspects since 1960. His current interests include assessment and experimental activities connected with nuclear waste disposal in continental and marine environments. **G. Bidoglio** (bottom) (PhD, physical chemistry, University of Milan, Italy, 1980) is working in the field of nuclear waste management at the Joint Research Centre, conducting research on the impact of radionuclides on the environment. His research interests deal with release and transport of actinides through geological media, chemical species determination, and environmental chemistry of actinides.

RADIOACTIVE WASTE REPOSITORIES IN HARD ROCK AQUIFERS—HYDRODYNAMIC ASPECTS

Roger Thunvik
Carol Braester

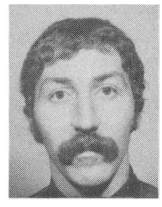


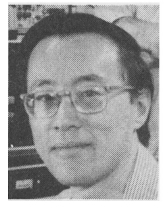


Roger Thunvik (top) (MSc, engineering science, 1968, and PhD, 1978, Royal Institute of Technology) is a researcher at Royal Institute of Technology, Stockholm. His current interests are concerned with flow through fractured rocks and numerical modeling. **Carol Braester** (BS, engineering science, 1956; MSc, 1966, and PhD, 1970, reservoir engineering) is a professor in reservoir engineering, currently spending his sabbatical year at Royal Institute of Technology in Stockholm and is on leave from Technion—Israel Institute of Technology. His current interests are in numerical simulation of flow problems related to radioactive waste repositories.

POTENTIAL EFFECTS OF GAMMA IRRADIATION ON THE CHEMISTRY AND ALKALINITY OF BRINE IN HIGH-LEVEL NUCLEAR WASTE REPOSITORIES IN ROCK SALT

S. V. Panno
P. Soo



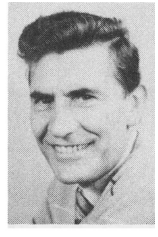


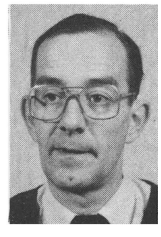
S. V. Panno (top) (MS, economic geology, Southern Illinois University at Carbondale, 1978) is a senior geochemist with Roy F. Weston Consultants. His work is concerned with the U.S. Department of Energy effort on the Nuclear Waste Terminal Storage Program. Prior to joining Weston, he was involved in research on low-temperature ore deposits, radiation effects on natural materials, and high-level waste management. **P. Soo** (BS, physical metallurgy, 1963; PhD, physical metallurgy, 1966, University of Liverpool) is an associate head of the Nuclear Waste Management Division at Brookhaven National Laboratory where he is involved in assessing high-level waste package performance.

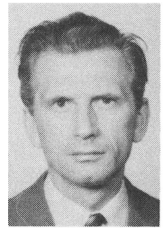
MATERIALS

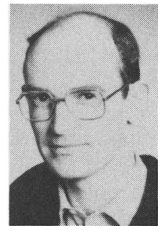
INTERCOMPARISON OF PREDICTED DISPLACEMENT RATES BASED ON NEUTRON SPECTRUM ADJUSTMENTS (REAL-80 EXERCISE)

Willem L. Zijp
Éva M. Zsolnay
Henk J. Nolthenius
Egon J. Szondi
Gerardus C. H. M. Verhaag









Willem L. Zijp (top right) (physics degree, experimental physics with mathematics and radiochemistry, Free University Amsterdam, The Netherlands, 1956) has been employed since 1957 at the Netherlands Energy Research Foundation (ECN), in Petten. He leads the Radiation Metrology and Applied Systems Analysis (RMASA) group. His interests include gamma-ray and neutron spectrometry, statistical treatment of observational data, and safeguarding of nuclear materials. **Éva M. Zsolnay** (top left) (MS, physics) is an associate professor at the training nuclear reactor at Budapest Technical University. Her main interests include reactor physics, neutron spectrometry, and reactor dosimetry. **Henk J. Nolthenius** (center right) (Netherlands professional engineer, 1972) has been employed at ECN since 1960 in the RMASA group. **Egon J. Szondi** (bottom left) (MS, mechanical engineering, 1964; MS, nuclear engineering, 1970; and Dr. Eng., nuclear engineering, 1972, Budapest Technical University) is a research engineer at the training nuclear reactor at the Budapest Technical University. His work covers development of computer codes and application of computers to the different nuclear engineering tasks, primarily in the field of reactor dosimetry. **Gerardus C. H. M. Verhaag** (bottom right) (Eng. applied physics, College of Advanced Technology, Eindhoven, 1979) has been employed at ECN in the RMASA group since 1980.

HEAT TRANSFER AND FLUID FLOW

APPLICATION OF THE LIMIT CODE TO THE ANALYSIS OF CONTAINMENT HYDROGEN TRANSPORT

Vincent P. Manno
Michael W. Golay

Vincent P. Manno (top) [BS, nuclear engineering science, Columbia University, 1976; MS, 1979, and ScD, 1983, nuclear engineering, Massachusetts Institute of Technology (MIT)] was a postdoctoral associate in the Department of Nuclear Engineering at MIT when this paper was written and is currently an assistant professor of mechanical engineering at Tufts University. He was previously employed as a nuclear safety engineer at a major utility. His areas of technical interest are thermal hydraulics, computational methods, and engineering analysis of power plant design. **Michael W. Golay** (BE, mechanical engineering, University of Florida, 1964; PhD, nuclear engineering, Cornell University, 1969) is an associate professor of nuclear engineering at MIT. His technical interests center on the application of engineering principles to the solution of environmental and safety problems of electric power production.

NUCLEAR FUELS

FUEL FOAMING AND COLLAPSE DURING LIGHT WATER REACTOR CORE MELTDOWN ACCIDENTS

August W. Cronenberg
Douglas W. Croucher
Philip E. MacDonald

August W. Cronenberg (center) (PhD, engineering science, Northwestern University, 1971) is presently an independent consultant working on various aspects of reactor safety and fuel behavior. He worked at Argonne National Laboratory from 1971 to 1974, was professor of chemical and nuclear engineering at the University of New Mexico from 1974 to 1977, and a senior scientist at EG&G Idaho from 1977 to 1979. His main interests are in the areas of thermal and material science, and reactor safety. **Douglas W. Croucher** (left) (PhD, nuclear engineering, University of New Mexico, 1975) is a manager at EG&G Idaho responsible for experiment specification and analysis for the OECD-LOFT project. His research interests include fission product and aerosol release and transport, transient fuel rod behavior, and light water reactor (LWR) safety. **Philip E. MacDonald** (right) (BS, science engineering, University of Michigan, 1966) is a manager of EG&G Idaho's systems analysis division, responsible for LWR safety code development work. His current interests include analysis of fuel behavior during normal and accident conditions, LWR safety research, and code development.

ANALYSES

URANIUM-235 MEASUREMENT IN WASTE MATERIAL BY RESONANCE NEUTRON RADIOGRAPHY

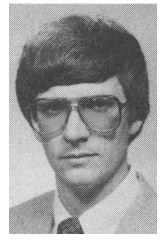
Roald A. Schrack

Roald A. Schrack (BA, 1949, and MS, 1950, University of California, Los Angeles; PhD, University of Maryland, 1961) has been a physicist at the National Bureau of Standards (NBS) for the past 35 years. He has carried out research in particle

physics, mainly on the interactions of neutral mesons and neutrons, using the accelerators and reactor at NBS. For the past several years, much of his work has been related to nondestructive analysis and examination applications of neutron measurement techniques.

NUMERICAL SIMULATION OF PHOTON RESPONSE IN PORTAL MONITORS

Randall R. Nason



Randall R. Nason (BS, 1977, and MS, 1979, nuclear engineering, Kansas State University) is a member of the technical staff at Sandia National Laboratories, Albuquerque, New Mexico. He has worked in the area of nuclear safeguards for the past five years performing neutron and gamma-ray transport calculations in support of projects related to the design of domestic and international safeguards systems. His current research interests lie in the area of reactor vulnerability analysis using fault trees.