TESTING FORUM

Editorial

I was talking with Adrian Pelzner at one of our recent ASTM D-18 Committee meetings and our conversation turned to the topic of the many innovative methods and procedures used by technicians in the various laboratories. Unfortunately, these techniques are not shared with other laboratories. I asked Adrian if he would write a short dissertation summarizing some of his experiences on the subject, and he agreed. The following editorial presents his thoughts.

I heartily agree with the views in his editorial and encourage all of you who work in laboratories to share your innovative testing procedures and equipment with others in the engineering community. If you or someone in your laboratory has developed innovative procedures and equipment to increase efficiency or accuracy, please write them up and submit them to the Geotechnical Testing Journal *for consideration for publication.*

Adrian was a Senior Staff Engineer (retired) with the Strategic Highway Research Program and is a former Chairman of ASTM Committee D-18.

—Paul Knodel

Testing Laboratory Directors and Laboratory Technicians: Technology and Information Exchange

First let's define the terms I've used in the title. A *laboratory director* is in an executive position. He or she is responsible for a wide, broad array of activities in the laboratory. A partial listing of his/her duties might include the preparation of testing contract proposals, contract negotiation, overall personnel management, client contacts, productivity, corporate policy and oversight, legal testimony, profit and loss, professional improvement, education and community involvement, quality assurance, report preparation and analysis, compliance with government health and safety regulations, and implementation of new testing technology. Surely other responsibilities could be listed. Directors of noncommercial laboratories would have a somewhat different list of responsibilities if the laboratory testing was solely being performed for a single entity such as a corporation or association or if the testing was being done for the "public good" such as might be provided by federal, state, county, or municipal testing laboratories. But the message is clear, the laboratory director is in overall charge and is responsible for a wide array of diversified and often demanding functions.

The *laboratory technician* position, on the other hand, is more narrowly focused than the director's position. He or she must master many intricate details of sample logging, storage, and handling; specimen preparation and testing; and calculating and reporting test results. To accomplish these and other testing tasks safely, accurately, and efficiently requires attention to detail and often innovative techniques, equipment, and procedures. However, while the technician will rigorously adhere to and follow the designated, published, test procedure such as an ASTM standard test, the technician normally does not have the means to share his or her innovative techniques, equipment, or procedures for performing the test.

I recently retired from the Strategic Highway Research Program (SHRP). During my tenure I had the opportunity to visit commercial and noncommercial laboratories doing contract testing for SHRP. I met with laboratory directors and spent time talking with and observing the work of laboratory technicians. I was often impressed with the innovative procedures used by these technicians in handling samples and performing tests. For example, one technician had developed a jig to allow easier and more accurate critical measurements of bituminous concrete core specimens prior to running the resilient modulus test (ASTM D 4123). Another had developed a device for placing a specimen in the resilient modulus testing equipment so that the specimen could be easily, accurately, and efficiently aligned in the testing machine. Accurate alignment of the specimen is of critical importance in performing this test. A third technician had developed a procedure for rolling a bituminous core across the laboratory floor to make it far easier and more accurate in differentiating the various layers in the pavement core. Such differentiation was not nearly as visible for some cores when observed in a static position. The rolling greatly enhanced the delineation of layers for some cores. Accurate description and measurement of pavement layers is of critical importance to SHRP's pavement performance research study.

The point of this article is that many laboratory technicians have developed useful innovative devices and procedures in carrying out standard test procedures. Yet, for the most part, these very same technicians are not contributors or even readers of the *Geotechnical Testing Journal*. A knowledge resource that is both practical and innovative is essentially untapped and unshared within the laboratory testing community. The missing link here is the laboratory director. The director is more likely to be a reader and contributor to the *Journal*. For this reason there is a challenge, opportunity, and indeed responsibility, for the laboratory director to take on yet another task—that of information broker. At the risk of alienating such directors by telling them what to do, this writer encourages them to spend time with the laboratory technicians and identify useful equipment and procedures that have been developed by these technicians. Encourage the technicians to report these items to the *Journal* or to report such items for them in the *Journal*.

I conclude by saying that in my visits to the SHRP testing laboratories, I observed innovative procedures and devices developed by technicians. I am certain there are many, many more items for information sharing and exchange. Laboratory directors are encouraged to be information brokers and technology facilitators. The *Geotechnical Testing Journal* is an excellent forum to provide such information exchange.

—Adrian Pelzner

TESTING FORUM

Soil Expert Woodland Shockley Dies

Woodland G. "Woodie" Shockley died on Aug. 2 at the age of 77. A resident of Vicksburg, Mississippi, Shockley had been an ASTM member since 1955. He was named a Fellow of ASTM in 1979 and received the 1991 W.T. Cavanaugh Memorial Award in June of this year. Active for over 36 years on Committee D-18 on Soil and Rock, he was a steadfast contributor to the development of standards for testing soil and rock materials for engineering purposes. As recently as 1989, he had authored a new standard. Shockley held several positions on Committee D-18, including chairman (1986–1989), member of the Executive Subcommittee (1968–1978 and 1981 until his death), and Committee Historian (1978–1985). He had also served on the Editorial Board of the *Geotechnical Testing Journal* (1977–1987), and he was a member of Committee E-36 on Criteria for the Evaluation of Testing and Inspection Agencies from 1980 until his death.

Shockley also participated with distinction in the American Society of Civil Engineers (ASCE), the International Society for Soil Mechanics and Foundation Engineering, the National Society of Professional Engineers, and the National Research Council (the Highway Research Board and the Building Research Advisory Board). He was a Fellow of ASCE as well.

Born in Crisfield, Maryland, Shockley graduated with honors from Antioch College in 1936; later he pursued graduate studies in civil engineering at Massachusetts Institute of Technology (1941) and Purdue University (1948).

In 1938, Shockley began his 42-year career with the U.S. Army Corps of Engineers. First, he was employed in the Little Rock, Arkansas, District, where he worked in soils laboratory testing, soils and geologic field exploration, earth dam construction control, and design of earth embankments. In 1946, he moved to the Waterways Experiment Station in Vicksburg, Mississippi, and worked there until he retired into private consulting practice in 1980. At Vicksburg, Shockley's career progressed through various positions including chief of embankment and foundation branch, chief of mobility and environmental systems laboratory, and program manager for military engineering. On numerous occasions he was designated to represent the Corps of Engineers on interagency and international programs involving soil mechanics and foundation engineering.

Shockley was the author of over thirty papers and articles in the area of geotechnical engineering, geology, flexible pavements, and vehicle mobility. He also received several awards and citations apart from ASTM honors, including the Department of the Army Decoration for Meritorious Civilian Service (1970), and Decoration for Exceptional Civilian Service (1980); Official Commendations for Outstanding Performance, Waterways Experiment Station (1970 and each year 1972–1979); and in 1981, he was elected to the Waterways Experiment Station Gallery of Distinguished Civilan Employees.

Shockley and his wife, Hope, had been married over 52 years. He is also survived by their son, daughter, and several grandchildren.

"Woodie was a close friend to many of us on Committee D-18. He was a mentor to so many of us. His efforts and leadership abilities inspired us all. Woodie will certainly be missed by all who knew him, especially his family, peers, and friends in ASTM and ASCE."

Richard S. Ladd
Chairman, Committee D-18

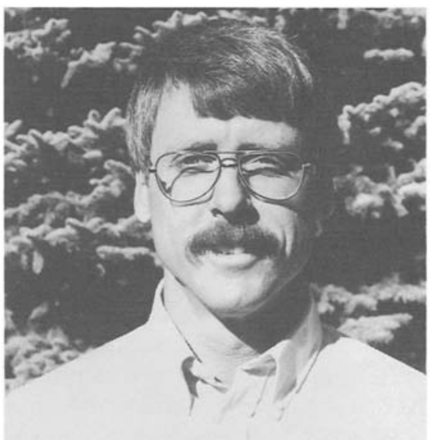
ASTM's Hogentogler Award Presented to David I. Stannard

David I. Stannard, hydrologist for the U.S. Geological Survey, Water Resources Division, in Lakewood, Colorado, is the 1991 recipient of the C. A. Hogentogler Award.

Receiving the award at the June meeting of Committee D-18 on Soil and Rock in Atlantic City, Stannard was recognized for his paper, "Tensiometer—Theory, Construction, and Use," which was published in *Ground Water and Vadose Zone Monitoring, ASTM STP 1053*.

Established in 1953, the Hogentogler Award is given in recognition of a paper of outstanding merit on soils for engineering purposes presented before the Society. Mr. Stannard's paper will be reprinted in the March 1991 issue of *Geotechnical Testing Journal*.

A Glastonbury, Connecticut native and a resident of Kittredge Park Road in Evergreen, Colorado, Stannard earned his B.S. degree from the University of Connecticut in 1975. After graduation he obtained a position with the Water Resources Center at the University of Nebraska at Lincoln as an Engineer II. He joined the U.S. Geological Survey in 1979 with his current title. His career has concentrated in the areas of artificial recharge of ground water and evapotranspiration from wildland vegetation.



David I. Stannard

TESTING FORUM

STP 1126 to be Published from Symposium on Mapping and Geographic Information Systems

An ASTM STP, No. 1126, will be published in 1992 from the International Symposium on Mapping and Geographic Information Systems sponsored by ASTM Committee D-18 and the U.S. Geological Survey.

Maps, remote sensing imagery, and geographic information systems (GIS) have combined to become the subject of much interest as many disciplines learn each day of the usefulness of spatially distributed data. These three items have become increasingly important in providing essential data for solving problems related to ground water contamination, water resources management, construction of all types, land use, waste management, minerals exploration, transportation routing, and many others.

GIS is evolving on an exponential scale, internationally as well as in the United States, and it is almost impossible to keep up with those developments, as well as with the mapping and remote sensing developments that provide so much of the information fed into the GIS's. The proliferation of systems, hardware, software, techniques, interpretations and applications in GIS, mapping, and remote sensing has emphasized the need for development of voluntary consensus-type standard methods, practices, guides, and terminology in order to ensure uniformly high quality and interchangeable products.

To develop information needed for an accelerated standard's development effort, the American Society for Testing and Materials (ASTM) Section D18.01.03 on Remote Sensing and D18.01.05 on Mapping and GIS, which are administratively under Subcommittee D18.01 on Surface and Subsurface Characterization, along with the U.S. Geological Survey, cosponsored an International Symposium on Mapping and Geographic Information Systems in June 1990 in San Francisco. Cooperating organizations included the American Congress on Surveying and Mapping, American Society of Photogrammetry and Remote Sensing, AM/FM International, Association of American Geographers, Urban and Regional Information Systems Association, Canadian Geosciences Advisory Committee, and International Association of Hydrological Sciences. These organizations are in the process of appointing liaison members to ASTM so they can cooperate in the development of standards.

The purpose of this symposium was to bring together an interdisciplinary and international group of engineers and scientists to (1) provide a forum for many professional disciplines to exchange experiences and findings related to the needs and methods for GIS, maps, and remote sensing and the potential for, and prioritization of, standardization of some elements of each; (2) learn from both successful and unsuccessful case histories; (3) promote technology transfer between the various disciplines and countries represented; and (4) provide an educational resource for those attendees who may be considering entering for the first time into use of the three elements (GIS, maps, and remote sensing) that make up an overall land information system.

Papers were presented orally or by poster (see photos on next page) by nearly 40 international authors on each of the three main topics—mapping, remote sensing, and GIS, with emphasis on the general state-of-the-art and the development of standards. Targeted at beginners as well as advanced users, papers were delivered on the following topics:

1. *Maps*—design, techniques, new applications, and suggestions for standards for maps of all types—geologic, hydrogeologic, soils, environmental, engineering geologic, waste management, mineral, vegetation, land use, and other; uses and limitations of global positioning system instruments—were included.
2. *Remote-Sensing*—applications of all types and disciplines (esepcially related to desk-top computer applications). Some papers related remote sensing to development and interpretation of maps and interface and integration to GIS.
3. GIS—hardware and software (especially the use of desktop computer systems); interface of maps and remote sensing with GIS; new applications; success and problems; need for data standards and other standards.

The symposium papers will be used as a basis for developing mapping, remote sensing, and GIS standards by Sections D18.01.03 on Remote Sensing and D18.01.05 on Mapping and GIS.

Persons desiring additional technical information on the activities related to mapping, GIS, and remote sensing standards should contact Ivan Johnson, Chairman, ASTM Subcommittee D18.01, 7474 Upham Court, Arvada, Colorado 80003 USA (Phone: 303/425-5610). Persons desiring a copy of the STP on Mapping and GIS should contact the Marketing and Sales Office, ASTM, 1916 Race Street, Philadelphia, Pennsylvania 19103 USA (Phone: 215/299-5536).

Donald C. Knodel Receives ASTM's Award of Merit at Philadelphia Presentation

Donald C. Knodel, senior research engineer at E. I. du Pont de Nemours & Company, in Wilmington, Delaware was named a Fellow of ASTM on October 22. The Award of Merit and the accompanying honorary title of Fellow of the Society were established in 1949 by the ASTM Board of Directors to recognize distinguished service by individual members.

Committee D-13 on Textiles commended Knodel for outstanding leadership in the committee and for exceptional contributions to the development of textile flammability standards.

A Charleston, West Virginia native and a resident of Crestfield Road in Wilmington, Knodel earned his B.A. in physics from Muhlenberg College in 1957. After graduation, Knodel joined the staff at Du Pont as a high-speed photography research engineer. He functioned in various positions over the years with the main thrust of his career focusing on fabric and garment flammability research.

FIG. 1—*A final panel session had panel members and audience exchanging questions and opinions regarding mapping, remote sensing, and GIS standards. Shown left to right are Ivan Johnson, Symposium Chairman, Arvada, Colorado; James Fulton, U.S. Geological Survey, Reston, Virginia; Vernon Singhroy, Canada Center for Remote Sensing, Ottawa, Ontario; Manfred Ehlers, National Center for Geographic Information and Anaysis, Orono, Maine; Mason Hewett, III, EPA, Las Vegas, Nevada; and George Ulrich, U.S. Geological Survey, Reston, Virginia.*

FIG. 2—*Live demonstration of GIS at a desk-top computer work station during one of the poster sessions.*

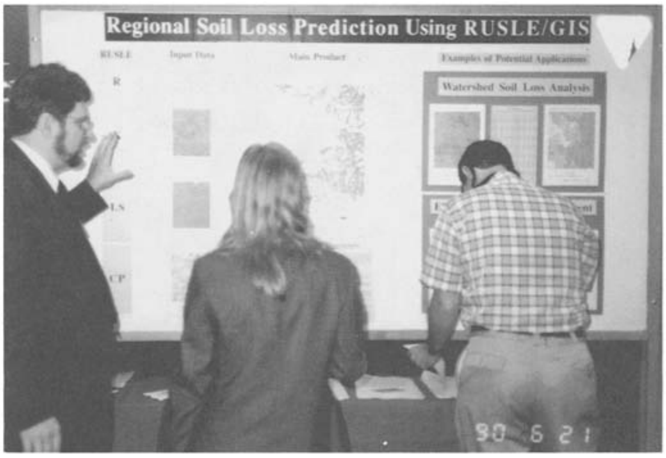


FIG. 3—*One of the many poster papers showing GIS applications.*

Knodel has been a member of the Society since 1975, making contributions as subcommittee chairman, second vice chairman, processing awards, and special assignments. He has participated in several task groups and is the primary author or promotor of numerous standards.

Knodel is also a member of the National Fire Protection Association and the International Organization for Standardization.

Call for Papers

Symposium on Hydraulic Conductivity and Waste Contaminant Transport

Papers are invited for a Symposium on Hydraulic Conductivity and Waste Contaminant Transport sponsored by ATSM Committee D-18 on Soil and Rock and its Subcommittee D18.04 on Hydrologic Properties of Soil and Rock. The symposium will be held 21–22 Jan. 1993 in San Antonio, Texas in conjunction with the 17–22 Jan 1993 standards development meetings of Committee D-18.

The two-day symposium will focus on determination of hydrologic properties of soil and rock. Particular emphasis will be given to laboratory and field measurements of hydraulic conductivity of soil and rock and the determination of parameters relevant to waste contaminant transport, including sorption/desorption characteristics and hydraulic conductance parameters. Methods of measurement relevant to fluid flow in porous media, including characterization of pore-size distribution and secondary porosity, are also within the scope of the conference. Papers on determination of parameters related to transport of nonaqueous phase liquids through soil and rock are welcomed. Case histories comparing laboratory and in situ measurements are especially encouraged. The hydraulic conductivity of, and waste transport through, aquifers, aquitards, compacted soil liners, vertical cut-off walls, drainage networks, and the vadose zone are included in the scope of the symposium. Fluid flow through geosynthetics and modeling of flow through porous media (except for modelling to simulate measurement of hydraulic conductivity and waste contaminant transport parameters) are beyond the scope of the symposium.

Prospective authors are requested to submit a title, a 300–500 world abstract, and the ASTM Paper Submittal Form by **January 10, 1992** to Dorothy Savini, Symposia Operations, ASTM, 1916 Race Street, Philadelphia, PA 19103-1187, Telephone: 215/299-5413. Paper Submittal Forms are available from Ms. Savini or from Symposium Chairman Professor David E. Daniels.

Authors will be notified of their acceptance for presentation by March 10, 1992 by the symposium chairman. ASTM may print and distribute abstracts with the approval of the symposium chairman.

A Special Technical Publication (STP) based on the symposium proceedings is anticipated by ASTM. Papers presented at the symposium will be included in the STP if they are approved through the ASTM peer review process. Main authors will receive a complimentary copy of the volume(s) containing their papers. The main author is the author corresponding with the ASTM publications staff. All published authors may purchase reprints of the papers at cost.

Final manuscripts for the STP based on this symposium are due by **September 10, 1992**. This deadline will be rigidly enforced. All papers received after this deadline may be forwarded to the appropriate ASTM journal to be considered for publication.

More information is available from Symposium Chairman Professor David E. Daniels, University of Texas-Austin, Civil Engineering Dept., Austin, TX 78712-1076, Tel: 512/471-4730.

Symposium on Superfund Risk Assessment in Soil Contamination Studies

The Symposium on Superfund Risk Assessment, co-sponsored by ASTM Committee D-18 on Soil and Rock and its subcommittees D18.06 on Physico-Chemical Properties of Soil and D18.14 on Geotechics of Waste Management in cooperation with U.S. Army Environmental Hygiene Agency, will be held January 30–31, 1992.

Thursday, January 30, 1992

8:00 a.m.
Opening Remarks—To Be Announced

SESSION I: SITE CHARACTERIZATION

8:40 a.m.
A Guide for Site and Soil Description for Hazardous Waste Site Characterization—R. Cameron, Lockheed Engineering and Sciences Company, Las Vegas, Nevada

9:00 a.m.
Development of a Comprehensive Testing Protocol to Assess the Health Hazard of an Uncontrolled Hazardous Waste Site—C. S. Anderson, K. C. Donnelly and K. W. Brown, Texas A&M University, College Station

9:20 a.m.
Logging and Interpreting Geologic Data: An Innovative Approach—C. Moran, C. Kufs, and D. Messinger, Roy Weston, Inc., West Chester, Pennsylvania

9:40 a.m.
Evaluation of a Rapid Headspace Analysis Method for Analysis of Volatile constituents in Soils and Sediments—W. R. Sims, B. B. Looney, and C. A. Eddy, Westinghouse Savannah River Company, Aiken, South Carolina

10:00 a.m. BREAK

10:20 a.m.
Field Screening Procedures Applied to Soils and the Use of this Data in Risk Assessments—J. R. Clarkson, E. Peuler, James Montgomery Consulting Engineers, Metairie, Los Angeles, California, USA; C. Menzie, D. Crotwell, T. Bordenave, M. Metcalf, and D. Pahl, Menzie-Cura Associates, Chelmsford, Massachusetts

10:40 a.m.
Impact of the Distribution of the Soil Contamination Data Set on the Human Health Risk Assessment—S. J. Laszewski and S. G. Lehrke, Foth and Dyke, Green Bay, Wisconsin

11:00 a.m.
Identification and Evaluation of Chemicals of Concern in a Baseline Risk Assessment—R. A. Streeter, B. Molholt, and C. Jampo, ERM, Inc., Exton, Pennsylvania

11:20 a.m.
Preliminary Assessment of Soil and Groundwater Contamination Using a User-Friendly, Contamination Transport Software Package—D. Corwin, B. L. Waggoner, and J. D. Rhoades, U.S. Department of Agriculture, Riverside, California

11:40 a.m.
Selection of Indicator Chemicals at Hazardous Waste Sites—P. S. Houctter, Oak Ridge National Laboratory, Oak Ridge, Tennessee

12:00 noon LUNCH (ON YOUR OWN)

SESSION II: FATE AND TRANSPORT

1:20 p.m.
The Use of Environmental Endpoints and Test Methods for Evaluating Soil Conditions at Superfund Sites—C. Menzie, D. Burmaster, D. Morgan, D. Unites, and S. Zemba, Menzie-Cura Associates, Inc., Chelmsford, Massachusetts

1:40 p.m.
Fate and Transport of Hazardous Waste Constituents and As-

sessment of Environmental Risk from Hydrocarbon Contaminated Soils—R. Sober, RFS Consulting, Inc., Tulsa, Oklahoma

2:00 p.m.
Optimized Characterization Methods and Treatability Assessment for Heavy Metal Contamination in Soils and Industrial Residue—W. Baum and T. Weyand, Pittsburgh Mineral and Environmental Technology, Inc., New Brighton, Pennsylvania

SESSION III: TOXICITY, EXPOSURES AND RECEPTORS

2:20 p.m.
Contribution of Childhood Ingestion of Contaminated Soil to Lifetime Carcinogenic Risk: Guidance for Inclusion in Risk Assessment—J. Hixson, R. Jennings, and S. Smith, Radian Corp., Austin, Texas

2:40 p.m.
Inhalation of Volatile Chemicals from Residental Use of Contaminated Water—S. Smith, J. R. Beck, and R. Joseph, Radian Corp., Austin, Texas

3:00 p.m. BREAK

3:20 p.m.
A Comparison of the Integrated Uptake Biokenetic Model to Traditional Exposure Assessment Approaches—P. Chrastowski, Clement International Corp., Fairfax, Virginia

3:40 p.m.
Thermodynamic Model for Estimating Inhalation Exposure to VOC's during Showering Activities—S. Bhattacharjee and S. Ardalan, Hardin Lawson Associates, Novato, California

4:00 p.m.
Toxicity Assessment of Hazardous Waste Sites at a Federal Facility—R. H. Ross and P.-Y. Lu, Oak Ridge National Laboratory, Oak Ridge, Tennessee

4:20 p.m.
The Effect of "Hot Spots" on Exposure Concentrations in Soils—S. Zemba and M. Pilkington, Cambridge Environmental, Inc., Cambridge, Massachusetts

Friday, January 31, 1992

8:25 a.m.
Introductory Remarks—K. Hoddinott, Symposium Chairman

SESSION IV: RISK CHARACTERIZATION/
CASE STUDIES

8:30 a.m.
Utilization of Uptake Biokenetics (UBK) Lead Model to Assess Risk in Contaminated Sites—H. Choudhury, W. B. Peirano, C. DeRosa, R. Elias and J. Cohen, U.S. Environmental Protection Agency, Cincinnati, Ohio

8:50 a.m.
A PC-Executable Program for Risk Characterization Evaluations of Environmental Pollutants—M. Small, U.S. Army Biomedical Research and Development Laboratory, Frederick, Maryland

9:10 a.m.
Assessment of Health Risk from Waste in Three Surface Impoundments—R. Moore, EcoTek, Erwin, Tennessee

9:30 a.m.
Estimating Risk at Superfund Sites Contaminated with Radiological and Chemical Wastes—A. Temeshy, L. M. Sims, and J. M. Liedle, Bechtel National, Inc., Oak Ridge, Tennessee

9:50 a.m. BREAK

10:10 a.m.
Risk Evaluation of Lead in Soil and Ground Water at the H. Brown Superfund Site in Walker, MI—S. Turnblom and S. Meadows, PRC Environmental Management, Inc., Seattle, Washington

10:30 a.m.
Business Approach to Risk Assessment at Hazardous Waste Sites—G. M. Elliott and K. Lee, Golder Associates, Inc., Atlanta, Georgia

10:50 a.m.
Baseline Risk Assessment for the California Gulch Superfund Site—G. L. Almquist, M. E. Witt, and R. T. Sprague, Roy F. Weston, Inc., Lakewood, Colorado; and Keneth W. Wangerud, U.S. Environmental Protection Agency, Denver, Colorado

11:10 a.m.
Design of a Site Investigation for an Underwater White Phosphorus Munitions Burial Site—J. Wrobel, U.S. Army, Aberdeen Proving Grounds, Maryland

11:30 a.m.
Reducing the Number of Chemicals of Potential Concern: Four Case Studies—L. Tesch and D. Huff, B&V Waste Science and Technology Corp., Chicago, Illinois

11:50 a.m. LUNCH (ON YOUR OWN)

SESSION V: ECOLOGICAL ASSESSMENT

1:20 p.m.
Soil Contamination Evaluations: Biological Assessment of Metal Effects using Field and Laboratory Methods—G. Linder, Environmental Toxicology Services, Corvallis, Oregon, USA; B. Pastorak, PTI Environmental Services, Bellevue, Washington, USA; and W. Williams, EPT Business Enterprise Center, Corvallis, Oregon

1:40 p.m.
Assessing Risk to Non-Human Receptors from Exposure to PAH Contaminated Sediments in Marine Aquatic Environments—

J. Cura and C. Menzie, Menzie-Cura Associates, Inc., Chelmsford, Massachusetts

2:00 p.m.
Estimation of Bioconcentration of Polynuclear Aromatic Hydrocarbons (PAHs) in Sea Lamprey (Petromyzon Marinus) and Fish Tissue at a Hazardous Waste Site: Implications for Soil/Sediment Remediation and Ambient Water Quality Standard Setting—B. Stephanatos, D. F. Knorr, M. A. Hewitt, Environmental Resources Management, Inc., Exton, Pennsylvania

SESSION VI: ESTABLISHING CLEANUP LEVELS

2:20 p.m.
Methodology to Establish Action Levels for Petroleum Hydrocarbons in Soil Based on Model Leaching Potential to Ground Water—L. T. Srinivasan and J. P. Krueger, Remcor, Inc., Pittsburgh, Pennsylvania

2:40 p.m.
Probabilistic Techniques for Backcalculating Soil Cleanup Targets—D. Burmaster, Aleceon Corp, Cambridge, Massachusetts, USA; E. Crouch, Cambridge Environmental, Inc., Cambridge, Massachusetts; and C. Menzie, Menzie-Cura Associates, Inc., Chelmsford, Massachusetts

3:00 p.m. BREAK

3:20 p.m.
Risk Assessment of Sites Contaminated with Chloronated Solvents—A. Huggins, Environmental Resources Limited, London, UK

3:40 p.m.
Risk Assessment Methods for Establishing Clean Closure Levels—J. D. Riggenbach, R. A. Streeter, and S. C. Hess, ERM-South, Inc., Tampa, Florida

4:00 p.m.
Assessing the Pros and Cons of the EPA Approach of Risk Assessment in the United Kingdom—P. Pritchard, Barnus Limited, Leatherhead, Surrey, UK

4:20 p.m.
Closing Remarks—K. Hoddinott, Symposium Chairman

4:30 p.m. SYMPOSIUM ADJOURNS

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