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T R A N S F E R

Great Plains/Rocky Mountain Hazardous Substance Research Center

Plans forming for Kansas City conference

Plans and details continue to be formulated for the Great Plains/Rocky Mountain Hazardous Substance Research Center's 12th annual Conference on Hazardous Waste Research to be held in Kansas City, Mo., May 20-22, 1997, at the Kansas City Airport Hilton.

Conducted under the theme, "Building Partnerships for Innovative Technologies," the conference will focus on the various aspects of research, education, and technology transfer and training in the Great Plains and Rocky Mountains.

Preceding the two and one-half day event on Monday, May 19, will be the 8-hour HAZWOPER Training Course and a short course on acid mine drainage. Two workshop topics set for Thursday afternoon, May 22, after the close of the conference, will be Designer Chelators and Prepared Bed Land Treatment.

As a part of the regular format of the conference, Blase Leven, national coordinator for the R2D2 (Research and Re-education for Department of Defense) Program, and Larry Erickson, director of the GP/RM HSRC, are developing two sessions focused on creating partnerships to address environmental challenges shared by federal, state, and private organizations—Partnerships and Technology Innovation and Commercialization of Innovative Technologies. Each forum will feature success stories and discuss specific opportunities for future partnerships.

Leven is also planning a student technical session/seminar in conjunction with the conference involving research and professional development topics for R2D2 students.

Co-sponsors of the conference are U.S. EPA Region VII, the Waste-management Education and Research Consortium (WERC), the National Institute of Environmental Health Sciences (NIEHS), and the National Mine Land Reclamation Center (NMLRC). Cooperating sponsors include AlliedSignal-DOE, Midwest Research Institute, Kansas Petroleum Council, Kansas Independent Oil and Gas Association, Terracon, and Black and Veatch.

Proposals ranked for funding consideration

The HSRC Science and Training/Technology Transfer Advisory Committees met in Denver, Colo., Nov. 19-21 and recommended a total of 17 proposals for possible funding. The consideration process included a general discussion of each proposal, followed by a ranking session.

The Science Advisory Committee ranked 10 proposals as follows:

- **96-15** — Development of a Novel Fixed Bed Catalytic Reactor System for the Destruction of Contaminants in Waste Water and Remediation of Contaminated Aquifer Systems, R.L. Valentine, University of Iowa.
- **96-4** — An interdisciplinary Approach to Manipulation of Contaminant Transport Using Biofilm Barriers in Soils, D.A. Buttry, L.A. Bul-

continued on page 3

Deadline for abstracts for Hazardous Waste Research Conference:

February 1, 1997

Submit to:
Conference on Hazardous Waste Research
HSRC
Kansas State University
101 Ward Hall
Manhattan, KS 66502-2502
Contact: Carla Wolfe, 913-532-7464

For more details, check our WWW site:
http://www.engg.ksu.edu/HSRC/Conferences.html

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Let's take advantage of natural processes

Trichloroethylene (TCE) is a very common ground water contaminant. It is not readily biodegraded in soil, but it degrades quickly in the atmosphere. It is a volatile compound. Researchers in Nebraska have demonstrated that if they irrigate with TCE-contaminated water, the TCE vaporizes and is degraded in the atmosphere, and the irrigation water accomplishes its purpose free of TCE.

Vegetation can be used to bring TCE-contaminated ground water to the unsaturated zone where it may be transformed, or it may diffuse to the atmosphere through the soil or within the vegetation. Center research has shown that TCE concentrations in the gas phase near the soil surface are below detectable levels, even though TCE ground water concentrations are above 200 mg/liter.

This is because the gas phase diffusion is very rapid compared to the rate of migration of TCE to the unsaturated zone with the water brought up by the vegetation. This solar-driven pump and treat system is inexpensive and takes advantage of the rapid degradation of TCE in the atmosphere.

A mathematical model has been developed to describe the fate of the TCE in the subsurface. This technology is ready for field testing.

Larry Erickson
Center Director

HSRC *Update* on center activities .....

Environmental analysis training

The first training project funded by the Native American and Other Minority Institutions (NAOMI) program was held at Sinte Gleska University (SGU), Rosebud, S.D., Nov. 20-22, 1996. The training, sponsored by SGU and the University of Nebraska-Lincoln, was targeted at tribal environmental professionals and environmental monitoring teachers, and students from tribal colleges and secondary schools. The training was conducted by staff from SGU's environmental science and conservation and Lakota studies department faculty, the University of Nebraska Water Center staff, and water resource personnel from the Rosebud Lakota Tribe.

For more detailed information on this training, please refer to the article on page three of the enclosed *Earth Medicine* newsletter.

Pesticide technology curriculum for Native Americans

A pesticide technology curriculum for Native Americans is being developed by Haskell Indian Nations University and Kansas State University. The curriculum will center on a series of interactive, video-taped and textual materials that are compatible with Native American value systems, to provide tribal nations and communities with a basis for understanding the principles of integrated pest management. The curriculum will also provide this audience with a means of reducing the impact of pests that affect human health and agricultural production on tribal lands, a means of protecting environmental and human health, and an opportunity to incorporate Native American knowledge into pest management practices.

The curriculum is being designed for use by member institutions of the American Indian Higher Education Consortium in their training of second year students and for entry-level personnel in tribal environmental offices.

Hot Links

Web sites focus on phytoremediation

This month's Hot Links highlights the growing number of sites focusing on phytoremediation technology.

http://www.engg.ksu.edu/HSRC/phytorem.html

The HSRC's own phytoremediation Web page currently includes a summary paper on this new technology, information on joining the phytoremediation e-mail discussion list, and links to other phytoremediation sites. The site is still under construction, so if you have important links on the subject, please forward them to hsrc@engg.ksu.edu.

http://www.usu.edu/~cpl/phytorem.html

Information on phytoremediation research at Utah State University.

http://www.cache.net/~pkinetic/phyto.htm

The home page of PHYTOkinetics Inc., a technology startup company offering phytoremediation services. The site includes a brief description of ongoing field projects.

http://scaffold.walcoff.com/estcp2/projects/cleanup/remed/rem_p1.html

Describes a DOD project to remediate explosives wastes using constructed wetlands.

http://es.inel.gov/ncerqa/grants/94eng/eng08.html

A Rutgers reseach project studying the use of phytoremediation at metals-contaminated sites.

HSRC ranks proposals

continued from page 1

la, J.P. Turner, and Q.D. Skinner, University of Wyoming.

96-3 — Performance of Prototype Biofilm Barriers, J.P. Turner and Q.D. Skinner, University of Wyoming.

96-18 — Adsorption/Desorption and Diffusion of Hazardous Organic Substances and Water in Contaminated Soil: Molecular Simulation and Experiment, S. Jiang, Kansas State University.

96-6 — Improved Phytoremediation of Ammunition Wastes through the Characterization of Nitroreductase Enzymes from Plants, J.L. Schnoor and C.L. Just, University of Iowa.

96-5 — Thermal and Photo-Assisted Methods for the Catalytic Destruction of Chlorinated Hydrocarbons on Metal Oxide and Oxide-Supported Metal Catalysts, V.H. Grassian, University of Iowa.

96-20 — Oxidative Pretreatment of Heavy Metal Wastes: Development of Ozone and Hydroxyl Radical Rate Constants for EDTA-Metal Chelates, C.D. Adams, University of Missouri-Rolla.

96-17 — The Effect of Higher Plants on Bioremediation of Aged Petroleum Contaminated Soil, M.K. Banks and A.P. Schwab, Kansas State University.

96-1 — Application of PGNAA Remote Sensing Methods to Real-Time, Non-Intrusive Determination of Contaminant Profiles in Soils, R.E. Faw and K.J. Shultis, Kansas State University.

96-12 — Remediation of Chlorinated VOCs: Performance Models and Economic Analysis, B.I. Dvorak, University of Nebraska-Lincoln; and R.L.Segar, University of Missouri-Columbia.

The Training and Technology Transfer Advisory Committee recommended funding of the following proposals:

Tr96-01 — Understanding Behavior of Nonaqueous Phase Organic Waste Chemicals in Aquifers and Problem Solution - T.H. Illangasekare, Colorado State University.

Tr96-02 — Field Testing the Biodegradation of TNT, HMX and RDX by White Rot Fungus (F600) Using Spent Pulper Waste as Inoculum - J. Bumpus, University of Northern Iowa and C. Johnston, Mycotech Corporation.

Tr96-03 — In-Situ Vibrorecovery of LNAPL Contaminants - A Technology Transfer Project (previously TR95-5) - L.N. Reddi, Kansas State University.

Tr96-04 — Bioremediation Training and Technology Transfer: A Workshop for Developing Risk-Based, Decision-Making Strategies - A.B. Cunningham, Montana State University.

Tr96-05 — Collaborative Environmental Seminar Series - G.L. Godfrey and W.L. Griswold, Haskell Indian Nations University, and S.C. Grant and B.A. Leven, Kansas State University.

Tr96-06 — Pesticide Training Program for Farm Families and Urban Homeowner Families, B.C. Kross, University of Iowa.

Tr96-09 — Environmental Data Technology Transfer Project, L.N. Reddi and S.C. Grant, Kansas State University.

Consortium Directory

Our World Wide Web address is:
http://www.engg.ksu.edu/HSRC/home.html

Key personnel at each university are:

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KSU team works with industrial partners

By J. Patrick McDonald

Phytoremediation is an exciting area of hazardous waste remediation research. The use of vegetation to reduce levels of toxic compounds in soil and ground water can provide another tool in the site remediation arsenal.

Three KSU researchers are working toward this goal with a field demonstration project. Kathy Banks, Paul Schwab, and Rao Govindaraju have teamed up with two industrial partners to evaluate the use of this promising technology at sites contaminated with petroleum hydrocarbons.

The goal of the project is to demonstrate vegetation-enhanced biodegradation of petroleum contamination in soil in a field setting. In addition to the science aspects of the project, the researchers hope that a successful field demonstration will aid the adoption of this technology; thus the project has a significant technology transfer aspect.

Three petroleum contaminated sites were selected in cooperation with industrial partners. The three sites, one in the Northeast, one on the Gulf Coast, and the last on the West Coast, were identified, sampled for petroleum hydrocarbons, further characterized with geostatistical analysis, and divided into plots for application of various vegetation.

At the Northeast site, contamination consists of 1-, 2-, 3-, and 4+ ring aromatic polar compounds. Three 33' × 20' plots were prepared. Two of these plots were planted with sorghum and perennial warm season grass, and the third was left bare.

At the Gulf Coast site, four 30' × 60' plots were prepared in August 1994 and vegetated with cowpeas (legumes), Pensacola Bahia (grass), and sorghum, in addition to the unvegetated control.

At the West Coast site, four plots were prepared with tall fescue, native California perennial grasses, and a mixture of cool season grasses and legumes recommended for erosion control, along with the bare control plot.

Reasearch findings

At the Gulf Coast site, the legume plot was reseeded with sweet clover and the grass plot was overseeded with a cool season annual grass (rye). The sorghum and rye grew well; however, the sweet clover did not and that plot was again reseeded with St. Augustine grass in April 1995. All vegetated plots had statistically significant higher TPH degradation than the unvegetated plot. The vegetated plots also showed significant increases in microbial and fungal activity. Based on results of the study, the industrial partner seeded the entire area with cool season annual rye in May 1996. Final results of the 21-month sampling period are shown in Table 1.

For the West Coast site, preliminary (three months) observations are available. While it is impossible to establish trends from a single observation, this data in conjunction with the findings from the Gulf Coast site are promising. Both the tall fescue plot and the erosion control mixture of legumes and cool season grasses showed significant reduction in TPH. Preliminary results are shown in Table 2. The native California mixture provided only fair growth, while the tall fescue had excellent vegetative cover. Researchers are awaiting analysis of additional samples taken in April and July of 1996.

No results are yet available for the Northeast site.

Potential development

Phytoremediation has significant applications for the remediation of hazardous waste sites. This field demonstration will provide the petroleum industry, individual landowners, and regulatory agencies field evidence of successful application of the technology.

In addition to presentations and publications, a summary report will be circulated throughout the petroleum industry upon successful completion of

Table 1. Percent reduction in TPH over time in Gulf Coast field study

Plant species	6 months	14 months	21 months
Sorghum	17 %	15%	35%
Legume/Grass*	3%	27%	46%
Grass	36%	45%	50%
Unplanted	14%	10%	21%

*St. Augustine grass was planted at eight months into the study.

Table 2. Percent reduction in TPH over time in West Coast field study

Plant species	3 months
Native California mixture	7%
Tall fescue	34%
Erosion control mixture	29%
Unplanted	3%

the project. Acceptance of the technology for petroleum remediation may lead to further development of phytoremediation for other types of organic contaminants.

Pictured here is the plot at the Gulf Coast work site.

Principal investigators

M.K. Banks, associate professor of civil engineering, Kansas State University, Manhattan, KS 66506.

A.P. Schwab, professor of agronomy, Kansas State University, Manhattan, KS 66506

R. S. Govindaraju, associate professor of civil engineering, Kansas State University, Manhattan, KS 66506.

Publications

Reilley, K., M.K. Banks, and A.P. Schwab,, "Dissipation of Polynuclear Aromatic Hydrocarbons in the Rhizosphere," *Journal of Environmental Quality*, 25:212-219, 1996.

Wetzel, S., M.K. Banks, and A.P. Schwab, "Rhizosphere Effects on the Degradation of Pyrene and Anthracene in Soil," in press, American Chemical Society Symposium Series, 1996.

Schwab, A.P., M.K. Banks, and M. Arunachalam, "Influence of the Rhizosphere on Biodegradation of Phenanthrene and Pyrene," in *Bioremediation: Bioremediation of Recalcitrant Organics*, Hinchee, R.E., D.B. Anderson, and R.E. Hoeppel, Eds. Battelle Memorial Institute, pp. 23-30, 1995.

Schwab, A.P. and M.K. Banks, "Phytoremediation of Petroleum-Contaminated Soils," in *Bioremediaton of Contaminated Soils*, American Society of Agronomy Monograph, in press, 1996.

Lee, E. and M.K. Banks, "Bioremediation of Petroleum-Contaminated Soil Using Vegetation: A Microbial Study," in *Journal of Environmental Science and Technology*, A28(10):2187-2198, 1993.

Lee, Euisang, "The Fate of Polycyclic Aromatic Hydrocarbons in the Rhizosphere of Festuca arundinacea," Ph.D. dissertation, May 1996.

Wetzel, S., "Biodegradation and Analysis of Pyrene in Rhizosphere Soils," M.S. thesis, May, 1995.

Arunachalam, M., "Microbial Degradation of Polycyclic Aromatic Hydrocarbons in Rhizosphere Soil," M.S. thesis, May, 1995.

This view shows the area of work at the West Coast field site.

Plant study focus of Davis' research

By Mary Rankin

Larry Davis, professor of biochemistry at Kansas State University since 1975, has long had an interest in environmental problems. Growing up in the mining and steel mill area of western Pennsylvania, he saw strip mines every day on his way to school and lived within two miles of a sintering plant that he said, "spewed forth hundreds of tons of red dust."

Although he obtained his Ph.D. at the Albert Einstein medical school, he has been involved with plant study for over 30 years, beginning with his dissertation work on spinach enzymes. One focus of his research since 1970 has been biological nitrogen fixation in all its aspects from molecular biology to field and breeding applications.

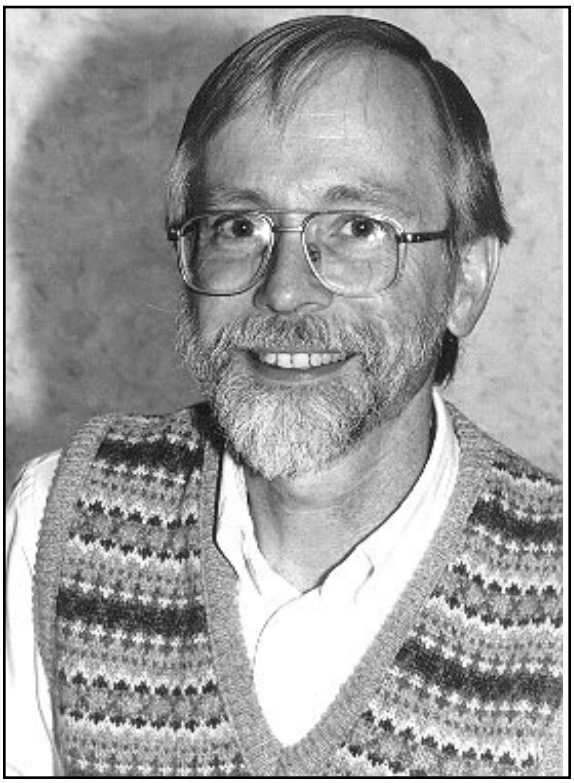
Both diffusion and mass transport are important problems in understanding nitrogen fixation, and Davis said his work in that role led naturally to examining the role of plants in transfer of volatile organic contaminants from the vadose zone and ground water via plants. Nitogenase is assayed by study of volatile compounds — acetylene and ethylene — so Davis said he was prepared to handle the contaminants of interest.

Along the way in his career, Davis ended up developing a number of chemical analytical techniques and has taught a course in plant biochemistry for nearly 20 years. He is also heavily involved with high school teacher enhancement programs sponsored by NSF and Howard Hughes Medical Institute.

Davis has been involved with the Hazardous Substance Research Center at K-State almost since its inception, but has had support for research only since 1990 when John Tracy of South Dakota State University submitted a proposal to model the benefits of plants in bioremediation. "I have provided the experimental side of that operation," Davis explained, "developing a mesocosm method for monitoring the interaction of plants and contaminants."

When the NAOMI project began, Davis made an effort to reach out to other institutions to provide summer opportunities for research. In the summer of 1995, Dr. Y. Sohni of Alabama A & M worked with Davis in trying to isolate toluene and TCE-degrading microorganisms from rhizosphere soil. Since that time, a graduate student in his laboratory has carried on the work. During the summer of 1996, Jamison Bear of Haskell spent some time working with Davis. His interest is in strategies for remediation on Native American lands.

A local Manhattan, Kan., high school student, Nancy Chou, began work with Davis in the summer of 1995 also, concentrating on the potential of land plants in TNT degradation. She continued her work through the academic year and a final report of it appeared in the 1996 HSRC *Proceedings of the Annual Meeting*. Chou was selected at a regional science fair to attend the International Science and Engineering Fair in Phoenix, Ariz., for work based on this same project.



Larry Davis

Last year, Davis said, two other local high school students worked with him developing science fair projects, one on use of plants to decrease nitrate pollution, the other to examine the heavy metal tolerance of plants.

Davis is presently involved in a local landfill test case to see whether leaching can be controlled through the use of trees and alfalfa. This effort has ties with several private firms and government agencies that are attempting to implement similar efforts. He credits two workshops on the role and use of plants in bioremediation, provided by HSRC, with being most helpful in getting this effort going. "Technology transfer efforts such as this have been as much a learning as teaching experience for me," Davis said, adding that stressing the importance to universities of "building effective interfaces between

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research and applications" is one of his goals.

"Telling others what to do is nowhere near as interesting as doing it yourself ," Davis said in response to questions about his teaching and research activities. "I certainly cannot agree with scientists, mostly biomedical," he added, "who feel that you're a failure if you work in the lab after age 35." Although he has advanced through the ranks at KSU and taken on more administrative duties, "hands-on research" is still his favorite activity.

He feels his most successful aspects of teaching are those that involve one-to-one interaction, showing how science is done. Davis has worked on teacher enhancement projects over the years and written papers for teachers to help them carry out research in the classroom with minimal capital investment. He has also been involved in translating highly technical research findings into terms that can be understood by average people. In this effort, he has been a technical consultant to citizen groups dealing with problems of heavy metal contamination in the tri-state mining area.

In speaking of those in his field whose work he admires, Davis singled out the Wisconsin School of E.B. Fred, P.W. Wilson, and R.H. Burris, in the area of nitrogen fixation. This group laid the groundwork and did pioneering studies far ahead of their colleagues and competitors with severely limited funding. All three stayed active in science as long as their health permitted, not for financial gain, but because they enjoyed it. E.B. Fred was going well past 90 and R.H. Burris is still active after 80.

In his spare time Davis enjoys gardening and woodworking and said they basically give him the same enjoyment as hands-on research. In the gardening area, he has done "a fair amount of rose breeding," having propagated several different species. He is currently helping his wife Linda in her quest for seeds of the species of the Great Plains for a book she is developing. They have three children, two sons and a daughter.

In woodworking, he likes to construct larger and smaller pieces of furniture, both for artistic and practical purposes. He also takes on woodworking projects at his church, where he sings in the choir, and volunteers his efforts for landscaping and flower arranging. Davis has also participated in community choral groups when "their schedule and [his] are in sync."

Repository documents available through HSRC

As part of a continuing series on the holdings of the Hazardous Substance Research Center repository, following is a partial list of holdings available for checkout or interlibrary loan from Farrell Library at Kansas State University (KSU). This list is of some of the most recent acquisitions.

Floppy disk copies of the entire list of holdings are also available. To request a disk copy of the list, write to Repository List, HSRC, Kansas State University, 101 Ward Hall, Manhattan, KS 66506-2502, 913-532-6519, FAX 913-532-5985.

Rec# 1147. Visual Reclamation. Whitefish, MT: Mine Design, Operations & Closure Conference, 1995. VHS Tape.

Rec# 1148. Application of the UMTRCA Uranium Tailings Reclamation Decision Process & Experience to Hard Rock Mining. Whitefish, MT: Mine Design, Operations & Closure Conference, 1995. VHS Tape.

Rec# 1149. Phytoremediation of Lead-Contaminated Soils & Sludges. Manhattan, KS: 1996. VHS Tape.

Rec# 1150. High Elevation Ecosystem Restoration. Whitefish, MT: Mine Design, Operations & Closure Conference, 1995. VHS Tape.

Rec# 1151. Ground Movement at Golden Sunlight Mine in Jefferson County, Montana. Whitefish, MT: Mine Design, Operations & Closure Conference, 1995. VHS Tape.

Rec# 1153. Practical Applications of Sulfate-Reducing Bacteria to Control Acid Mine Drainage at the Lilly/Orphan Boy Mine. Whitefish, MT: Mine Design, Operations & Closure Conference, 1995. VHS Tape.

Rec# 1154. Basin Creek Mine Closure Reclamation Techniques. Whitefish, MT: Mine Design, Operations & Closure Conference, 1995. VHS Tape.

Rec# 1155. Update on Mike Horse Mine: Grouting & ARD Control Research Project. Whitefish, MT: Mine Design, Operations & Closure Conference, 1995. VHS Tape.

Rec# 1156. Mineralogical Considerations in Acid Rock Drainage Prediction and Control. Whitefish, MT: Mine Design, Operations & Closure Conference, 1995. VHS Tape.

Rec# 1157. Feasibility of Biological Destruction of Cyanide to Aid Closure of Cyanide Leach Operation. Whitefish, MT: Mine Design, Operations & Closure Conference, 1995. VHS Tape.

Rec# 1158. Use of Kinetic Test Data to Develop Site Specific Criteria for Acid Generation & Potential. Whitefish, MT: Mine Design, Operations & Closure Conference, 1995. VHS Tape.

Rec# 1159. Ongoing Research of Biological Removal of Nitrates from Mine Waters, TVX Mineral Hill Mine. Whitefish, MT: Mine Design, Operations & Closure Conference, 1995. VHS Tape.

Rec# 1160. Sweetgrass Hills Steep Slope Reclamation. Whitefish, MT: Mine Design, Operations & Closure Conference, 1995. VHS Tape.

Rec# 1161. Overview of Acid Rock Drainage Potential in Western Australia. Whitefish, MT: Mine Design, Operations & Closure Conference, 1995. VHS Tape.

Rec# 1162. Permanent Visual Restoration of Mining Scars Using Permeon Simulated Desert Varnish. Whitefish, MT: Mine Design, Operations & Closure Conference, 1995. VHS Tape.

Rec# 1163. Subaqueous Deposition of Tailings: Summary of Canadian Research and Applications. Whitefish, MT: Mine Design, Operations & Closure Conference, 1995. VHS Tape.

Rec# 1164. Kendall Mine Closure & Reclamation. Whitefish, MT: Mine Design, Operations & Closure Conference, 1995. VHS Tape.

Rec# 1165. CFC's and the Ozone Layer -- Disrupting a Delicate Balance. Washington, DC: American Chemical Society, 1996.

Calendar

Jan. 28-29 — Risk-Based Corrective Action (ASTM Standards), Kansas City, MO; Univ. of Mo.-Columbia, Virginia Nettleton, 573-882-2087.

Jan. 29 — Project Designer Refresher, Kansas City, KS; National Asbestos Training Center, Barbara Miles, 913-897-8528.

Jan. 30 — Contractor/Supervisor Refresher, Kansas City, KS; National Asbestos Training Center, Barbara Miles, 913-897-8528.

Jan. 31 — Inspector/Management Planner Refresher, Kansas City, KS; National Asbestos Training Center, Barbara Miles, 913-897-8528.

Feb. 10-12 — Lead Inspector Training, Kansas City, KS; Mid-States Rocky Mountain Regional Lead Training Center, Barbara Miles, 913-897-8528.

Feb. 13-14 — Lead-Based Paint Risk Assessment, Kansas City, KS; Mid-States Rocky Mountain Regional Lead Training Center, Barbara Miles, 913-897-8528.

Feb. 13 — Air Quality Management Update, St. Louis, MO; Univ,. of Mo.-Columbia, John Atkinson, 573-882-8880.

Feb. 21 — HAZWOPER Refresher, Kansas City, KS; University of Kansas Center for Environmental Education and Training, Shirley Welhoelter, 913-897-8527.

Feb. 25-26 — Real Estate Phase I Assessment (ASTM Standards), Memphis, TN; Univ. of Mo.-Columbia, Virginia Nettleton, 573-882-2087.

Feb. 28 — Inspector/Management Planner Refresher, Kansas City, KS; National Asbestos Training Center, Barbara Miles, 913-897-8528.

March 4 — HAZWOPER Refresher, Columbia, MO; Univ. of Mo.-Columbia, Virginia Nettleton, 573-882-2087.

March 5 — Advanced Hazardous Waste Management, Columbia, MO; Univ. of Mo.-Columbia, Virginia Nettleton, 573-882-2087.

March 6 — Air Quality Management Update, Kansas City, MO; Univ. of Mo.-Columbia, John Atkinson, 573-882-8880.

March 6-7 — Department of Transportation Requirements for Hazardous Materials Handling, Columbia, MO; Univ. of Mo.-Columbia, Virginia Nettleton, 573-882-2087.

March 20 — Advanced Water Treatment, Columbia, MO; Univ. of Mo.-Columbia, Virginia Nettleton, 573-882-2087.

March 25 — Contractor/Supervisor Refresher, Kansas City, KS; National Asbestos Training Center, Barbara Miles, 913-897-8528.

March 26 — Inspector/Management Planner Refresher, Kansas City, KS; National Asbestos Training Center, Barbara Miles, 913-897-8528.

March 27 — Project Designer Refresher, Kansas City, KS; National Asbestos Training Center, Barbara Miles, 913-897-8528.

April 7-11 — Hazardous Waste Site Operations (40 hour), Kansas City, KS; University of Kansas Center for Environmental Education and Training, Shirley Welhoelter, 913-897-8527.

April 8-9 — ISO 14000 Auditing for Managers, Kansas City, MO; Univ. of Mo.-Columbia, Virginia Nettleton, 573-882-2087.

April 14-16 — Hazardous Materials Emergency Response (24 hour), Kansas City, KS; University of Kansas Center for Environmental Education and Training, Shirley Welhoelter, 913-897-8527.

April 23-25 — Certified Hazardous Materials Manager Review, Columbia, MO; Univ. of Mo.-Columbia, John Atkinson, 573-882-8880.

April 25 — HAZWOPER Refresher, Kansas City, KS; University of Kansas Center for Environmental Education and Training, Shirley Welhoelter, 913-897-8527.

April 26 — Certified Hazardous Materials Manager Examination, Columbia, MO; Univ. of Mo.-Columbia, John Atkinson, 573-882-8880.

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T R A N S F E R

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