ENROLLMENT & REGISTRATION

The fee for the short course is $200. Payment is expected at the time of registration unless other arrangement is made. Fee covers instruction, course notes, textbook, refreshments, and certificate of participation. Lodging and meals are not covered. Payment in full must be received prior to the beginning of the course. The registration fee may be paid by check, VISA, MasterCard, American Express, purchase order, or by a request to invoice employer. Government employees may forward purchase orders before completion of the course. Enrollment is limited. In case of cancellation, tuition is refunded minus $50 fee, and the right to course materials is forfeited. Substitutions are permitted at any time.

COURSE CREDIT

Upon request, the Colorado School of Mines will award 2 Continuing Education Units (CEU) for completion of the course.

COURSE LOCATION

The course will be held in the Green Center, Rm. 257 at the Colorado School of Mines in Golden, Colorado. A city and campus map will be sent to you upon course enrollment.

TRANSPORTATION AND LODGING

The Colorado School of Mines is located in Golden, which is 20 minutes west of Denver, 1 hour west of the Denver International Airport and can be reached by taxi, airport shuttle or rental car. Lodging is available in Golden, within walking distance of the campus. Information regarding transportation, parking, and lodging will be sent upon registration.

This course is sponsored by Environmental Security Technology Certification Program (ESTCP)
http://www.estcp.org/

INFORMATION

International Ground Water Modeling Center
Colorado School of Mines
Golden, Colorado 80401-1887
Phone: (303) 273-3103
Fax: (303) 384-2037
e-mail: igwmc@mines.edu

REGISTRATION

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Golden, Colorado 80401-1887
Phone: (303) 273-3103
Fax: (303) 384-2037
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REGISTRATION FORM:

Transport Optimization Short Course

Date: _____
Name: _____
Affiliation: _____
Address: _____
_____
_____
Phone: _____
Fax: _____
Email: _____

_____ **$ (US) Enclosed**

___VISA ___ MC ___ AMEX
card# _____
exp.date _____
Make check payable to: IGWMC
Mail to registration address above
Office use only: Ck# _____ **$** _____
Voucher # _____ **Date** _____
Confirmation _____

INTERNATIONAL GROUND WATER MODELING CENTER

Transport Optimization Short Course

INSTRUCTORS:

B. Minsker (University of Illinois)
C. Zheng (University of Alabama)
R. Peralta (Utah State University)
R. Greenwald (GeoTrans, Inc.)

Golden, Colorado
March 17-19, 2004

http://www.mines.edu/igwmc/

The IGWMC of the Colorado School of Mines is a center for information, education, and research in ground-water modeling and advancing the appropriate use of quality-assured models in ground-water resources protection and management.

OVERVIEW

This course is intended to increase awareness of environmental project managers and the groundwater modeling community regarding the use of "transport optimization" tools to optimize pumping strategies for real-world plume remediation problems. Transport optimization links mathematical optimization techniques with simulations of groundwater flow and contaminant transport (such as with MODFLOW and MT3DMS) to determine the best combination of well locations and pumping rates for a P&T system.

The course will provide fundamental concepts regarding the transport optimization approach, including a discussion of how to formulate real-world problems in terms of an objective function (to be minimized and maximized) and a series of constraints that must be satisfied. The course will then provide instruction on the use of two transport optimization codes:

- *Modular Groundwater Optimizer (MGO)*, developed by the University of Alabama
- *Simulation/Optimization Modeling System (SOMOS)*, developed by Utah State University

These codes were both applied to three real-world sites in a recently completed demonstration project for the Department of Defense, and each code is available for free download. The developers of these codes (Dr. Chunmiao Zheng and Dr. Richard Peralta) are instructors for this course.

COURSE DESCRIPTION

This course includes three sessions over a 2.5 day period (ending at lunchtime on Friday, March 19):

Session 1 (Background):

> This will include an introduction to transport optimization concepts, formulating problems, global search optimization techniques (such as genetic algorithms and simulated annealing), and a discussion of a recently completed transport optimization demonstration project sponsored by ESTCP and USEPA (with leveraged funds from USACE). This session will be led by Barbara Minsker and Rob Greenwald.

Session 2 (MGO Code):

> This will include an introduction to the MGO code, including a discussion of program structure, input requirements, and limitations. Sample applications will be discussed, and one or more example problems will be solved in hands-on computer exercises. This session will be led by Chunmiao Zheng.

Session 3 (SOMOS Code):

> This will include an introduction to the SOMOS code, including a discussion of program structure, input requirements, and limitations. Sample applications will be discussed, and one or more example problems will be solved in hands-on computer exercises. This session will be led by Richard Peralta.

COURSE AUDIENCE

This course is intended for groundwater modelers, and/or site managers who make decisions regarding long-term pumping strategies associated with pump-and-treat systems. No groundwater modeling experience is required to attend this course.

INSTRUCTORS

The instructors for this course are experts on coupling simulation models with optimization techniques.

Barbara Minsker, Ph.D., is an Associate Professor in the Department of Civil and Environmental Engineering and the National Center for Supercomputing Applications at the University of Illinois Urbana-Champaign. Dr. Minsker is an expert in environmental systems analysis, including optimization of long-term groundwater monitoring and remediation designs. She was recently awarded the American Society of Civil Engineers Walter L. Huber Civil Engineering Research Prize "for optimization of ground water remediation and monitoring design and effective and efficient use of genetic algorithms." Dr. Minsker holds a B.S. in operations research and a Ph.D. in Environmental Systems Engineering from Cornell University.

Chunmiao Zheng, Ph.D., is a professor of hydrogeology in the Department of Geological Sciences at the University of Alabama. He was a senior hydrogelogist and director of software development at S.S. Papadopulos & Associates, Inc. from 1988 to 1993. Dr. Zheng is developer of MT3D/MT3DMS, a widely used contaminant fate and transport simulation model. He has published over 50 papers and book chapters on both applied and theoretical aspect of hydrogeology, contaminant transport, and optimal groundwater management. Dr. Zheng holds a Ph.D. in hydrogeology from the University of Wisconsin-Madison.

Richard Peralta, Ph.D., PE, directs the Water Dynamics Lab of the Utah State University Research Foundation and is a professor in the USU Department of Biological and Irrigation Engineering. Dr. Peralta has over 20 years of experience building optimization models for optimizing groundwater, conjunctive water, and contamination management. He has used those models to in developing optimal pump and treat strategies for over ten sites, saving clients millions of dollars. He has served on environmental program technical review teams and negotiated with regulators at real-world sites to achieve optimal solutions. Dr. Peralta has co-authored over 45 peer-reviewed journal articles and almost 200 other reports and publications.

Robert M. Greenwald is a Principal Hydrogeologist at GeoTrans, Inc., in charge of the Freehold, New Jersey office. He has coded, tested, and documented an optimization module for MODFLOW (MODMAN) for ground-water management applications and has developed interface software for models based on commercial GIS and CAD software. He has applied ground-water models at numerous RCRA and CERCLA sites. Mr. Greenwald has an M.S. degree in Applied Hydrogeology from Stanford University.