The Interagency Steering Committee
on Multimedia Environmental Modeling

Cordially Invites you to Attend and Participate in the

International Workshop on Uncertainty, Sensitivity, and Parameter Estimation for Multimedia Environmental Modeling

To be held August 19-21, 2003
at the U.S. Nuclear Regulatory Commission Headquarters Auditorium
11545 Rockville Pike, Rockville Maryland, USA 20852
***This is an Invitation-Only Event**

International Workshop on Uncertainty, Sensitivity, and Parameter Estimation for Multimedia Environmental Modeling

On August 19-21, 2003, the **Federal Working Group on Uncertainty and Parameter Estimation** under the Federal Interagency Steering Committee on Multimedia Environmental Modeling (ISCMEM) is sponsoring an International Workshop on Uncertainty, Sensitivity, and Parameter Estimation for Multimedia Environmental Modeling. The workshop (see attached preliminary agenda) will be held at the U.S. Nuclear Regulatory Commission (NRC) Headquarters Auditorium, 11545 Rockville Pike, Rockville, Maryland, USA (see attached map and directions). The workshop objectives are to: facilitate communication among U.S. Federal Agencies' conducting research on the workshop themes; obtain up-to-date information from invited technical experts; and actively discuss opportunities and new approaches for parameter estimation, sensitivity and uncertainty analyses related to multimedia environmental modeling. Although there is no registration fee, prior registration is required by July 1, 2003. All registrants must be sponsored by one of the 8 MOU parties. Due to a limited number of registration spaces, registrants are encouraged to attend all three days of the workshop. To access thru NRC security to attend the workshop, all attendees must have photo-ID's for U.S. citizens, and passports for non-U.S. citizens.

Sponsoring Federal Agencies attending this workshop include;

Agriculture Research Service, Department of Energy, Environmental Protection Agency, Natural Resources Conservation Service, National Oceanic and Atmospheric Administration, U.S. Army Corps of Engineers, U.S. Geological Survey, and the U.S. Nuclear Regulatory Commission.

This event sponsored by the Federal Working Group on Uncertainty and Parameter Estimation under the Federal Interagency Steering Committee on Multimedia Environmental Modeling (ISCMEM)

(Please see http://www.ISCMEM.org website)

Preliminary Agenda

International Workshop on Uncertainty, Sensitivity, and Parameter Estimation for Multimedia Environmental Modeling

Dates:	August 19-21, 2003
Location:	U.S. Nuclear Regulatory Commission (NRC) Headquarters Auditorium, 11545 Rockville Pike, Rockville, Maryland, USA
Sponsorship:	The Federal Working Group on Uncertainty and Parameter Estimation[1] under the Federal Interagency Steering Committee on Multimedia Environmental Modeling (ISCMEM)
Technical Topics:	**Uncertainty Analysis**, **Sensitivity Analysis** and **Parameter Estimation** Related to **Multimedia Environmental Modeling**
Workshop Objective:	Facilitate communication among U.S. Federal Agencies' conducting research on the workshop themes, obtain up to date information from invited technical experts, and to actively discuss opportunities and new approaches for parameter estimation, sensitivity and uncertainty analyses related to multimedia environmental modeling.
Attendance:	All MOU[1] participating Federal Agencies, invited speakers and sponsored technical specialists.
Registration:	No registration fee but prior registration is required by July 1, 2003. All registrants must be sponsored by one of the 8 MOU parties. Due to a limited number of registration spaces, registrants are encouraged to attend all three days of the workshop. To access thru NRC security to

[1] Detailed information on membership, activities and technical background for the **Memorandum of Understanding** (MOU), and its Federal working groups (FWG) can be found on their public Web site: **http://ISCMEM.Org**.

attend the workshop, all attendees must have photo-ID's for U.S. citizens, and passports for non-U.S. citizens. Please e-mail address and contact information to TJN@NRC.GOV.

Documentation: Abstracts along with viewgraphs or PowerPoint presentations are requested two weeks prior to the workshop (by close of business on August 7, 2003).

Proceedings: Summary of meeting discussions and presentations, as extended abstracts with supporting technical references and Web sites, and proposal for an international conference to be held in 2004 will be posted on the MOU public Web site: http://ISCMEM.Org.

Preliminary Agenda -
International Workshop on Uncertainty, Sensitivity and Parameter Estimation

August 19

9:00 a.m. Welcome and Opening Remarks..... Ashok Thadani, Director, Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission (NRC)

9:15 Introduction of the Workshop Objectives, Technical Themes, and Goals ..... George Leavesley, U.S. Geological Survey (USGS) and *Co-Chair, Federal Working Group on Uncertainty & Parameter Estimation (FWG)*

9:30 Federal Agency Overviews of Parameter Estimation, Sensitivity and Uncertainty Approaches [focus on agency's motivation, activities, capabilities and research related to the workshop themes (15 minutes each)]

U.S. Nuclear Regulatory Commission..... Tom Nicholson, NRC/RES
U.S. Environmental Protection Agency..... Justin Babendreier, EPA
U.S. Geological Survey..... George Leavesley, USGS

10:15 BREAK

10:35 Federal Agency Overviews (continue)

National Oceanic & Atmospheric Administration ..... Bruce Hicks, NOAA
U.S. Department of Energy ..... Beth Moore, DOE
USDA/Agricultural Research Service ..... Mark Weltz, ARS
U.S. Army Corps of Engineers ..... Earl Edris, USACOE

11:35 LUNCH

Session Theme: Parameter Estimation Approaches, Applications, and Lessons Learned — Identification of Research Needs

Session Facilitator: Earl Edris, USACOE Session Rapporteur: Phil Meyer, PNNL

12:40 p.m. Unsaturated Zone Parameter Estimation Using HYDRUS and Rosetta Codes .... Rien van Genuchten and Jirka Simunek, ARS

1:05 Parameter Estimation and Predictive Uncertainty Analysis for Ground and Surface Water Models using PEST . . . .John Doherty, Watermark Numerical Computing, Inc., Australia

1:35 A Priori Parameter Estimation: Issues and Uncertainties .... George Leavesley, USGS

2:00 Multi-objective Approaches for Parameter Estimation and Uncertainty .... Luis Bastidas, Utah State University

2:30 BREAK

2:50 Using Sensitivity Analysis in Model Calibration Efforts ..... Claire R. Tiedeman

and Mary C. Hill, USGS

3:15 Jupiter Project - Merging Inverse Problem Formulation Technologies ....Mary Hill, Eileen Poeter*, Colorado School of Mines, J. Doherty and Ned Banta

3:40 Reactive Transport Parameter Estimation . . . .Jim Davis, USGS

4:05 Impact of Sensitive Parameter Uncertainties on Dose Impact Analysis for Decommissioning Sites ..... Boby Abu-Eid and Mark Thaggard, NRC

4:25 Discussion of Parameter Estimation Approaches and Applications (Rapporteur & Facilitator)

5:30 ADJOURN

August 20

8:30 a.m. Review Agenda and Announcements .. T Nicholson, USNRC and *FWG Co-Chair*

Session Theme: Sensitivity Analysis Approaches, Applications and Lessons Learned — Identification of Research Needs

Session Facilitator: Tom Nicholson, NRC Session Rapporteur: Sitakanta Mohanty, CNWRA

8:45 Global Sensitivity Analysis: Novel Settings and Methods ....Andrea Saltelli, European Commission Joint Research Center, Italy

9:25 Sampling-Based Approaches to Uncertainty and Sensitivity Analysis ....Jon Helton, Arizona State University

9:55 Uncertainty and Sensitivity Analysis for Environmental and Risk Assessment Models ..... Christopher Frey, North Carolina State University

10:25 BREAK

10:45 Practical Strategies for Sensitivity Analysis Given Models with Large Parameter Sets . . . . . .Terry Andres, University of Manitoba, Canada

11:15 An Integrated Regional Sensitivity Analysis & Tree-Structured Density Estimation Methodology . . . . . Femi Osidele & Bruce Beck, University of Georgia

11:45 Uncertainty and Sensitivity Analyses in the Context of Determining Risk Significance . . . . . Sitakanta Mohanty, CNWRA

12:10 p.m. Discussion of Sensitivity Approaches and Applications with emphasis on relationship to Parameter Estimation and Uncertainty (Rapporteur & Facilitator)

12:30 LUNCH

1:20 Discussion of Sensitivity Approaches and Applications with emphasis on relationship to Parameter Estimation and Uncertainty (Continued)

Session Theme: Uncertainty Analysis Approaches, Applications and Lessons Learned — Identification of Research Needs

Session Facilitator: Rien van Genuchten, ARS Session Rapporteur: Sitakanta Mohanty, CNWRA

1:40 Uncertainty, Identifiability, and Predictability: Past, Present, and Future ....Bruce Beck, University of Georgia

2:10 Uncertainty in Catchment Modeling: A Manifesto for Equifinality .... Keith Beven, University of Lancaster, United Kingdom

2:40 Model Abstraction Techniques Related to Parameter Estimation and Uncertainty ..... Yakov Pachepsky, ARS

3:05 BREAK

3:25 Towards a Synthesis of Qualitative and Quantitative Uncertainty Assessment: Applications of the Numeral, Unit, Spread, Assessment, Pedigree (NUSAP) System...Jeroen van der Sluijs, Copernicus Institute for Sustainable Development and Innovation, Utrecht University, The Netherlands

3:55 Hydrogeologic Conceptual Model and Parameter Uncertainty.....Shlomo Neuman, University of Arizona

4:25 Development of a Unified Uncertainty Methodology ..... Phil Meyer, Pacific Northwest National Laboratory

4:50 Discussion of Uncertainty Approaches and Applications (Rapporteur & Facilitator)

5:30 ADJOURN

August 21

8:15 a.m. Review Agenda and Announcements .. G. Leavesley, USGS and *FWG Co-Chair*

Session Theme: Parameter Estimation, Sensitivity and Uncertainty Approaches — Applications and Lessons Learned

Session Facilitator: George Leavesley, USGS Session Rapporteur: Bruce Hicks, NOAA

8:30 Probabilistic Risk Assessment for Total Maximum Daily Surface-Water Loads .....Ken Reckhow, Duke University

Preliminary Agenda -
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9:00 A Stochastic Risk Model for the Hanford Nuclear Site .....
..... Paul W. Eslinger, Pacific Northwest National Laboratory

9:25 National-Scale Multimedia Risk Assessment for Hazardous Waste Disposal
..... Justin Babendreier, EPA

9:50 BREAK

10:10 Ground-Water Parameter Estimation and Uncertainty Applications .....
..... Earl Edris, USACOE

10:35 Parameter Estimation by Combining Flow and Geophysical Models .....
..... G. Michael Shook, Idaho National Engineering and Environmental Laboratory

11:00 Use of Fractional Factorial Design for Sensitivity Studies .....Richard Codell, NRC

11:20 Roundtable Discussion by Session Facilitator and Rapporteurs Focusing on List of Salient Points Identified during the Workshop and Suggestions on Future Directions for Parameter Estimation, Sensitivity and Uncertainty Research

12:10 LUNCH

Session Theme: Towards Development of a Common Software Application Programming Interface (API) for Uncertainty, Sensitivity, and Parameter Estimation Methods & Tools

Afternoon Working Session (All Workshop Participants Are Encouraged to Attend):

Session Facilitator: George Leavesley, USGS Session Rapporteur: Justin Babendreier, EPA

1:00 p.m. The Related Role of Environmental Modeling Frameworks..... Gerry Laniak, EPA and *Co-Chair, Federal Working Group on Frameworks and Technology*

1:25 Example conceptual structure for a common UA/SA/PE API .... MOU Participants Panel: Steve Fine; EPA; Karl Castleton, PNNL; and Rob Wallace, USACOE

1:50 Open Discussion: Introductions, Session Objectives & Technical Goal
.....George Leavesley, USGS and FWG Co-Chair

Panel and Audience Discussion - Building Consensus on API Structure
(Technologist to Scientist Discussions)

2:40 - 3:00 BREAK

3:00 Panel Discussion (continued) ..... Facilitator: George Leavesley, USGS and Rapporteur: Justin Babendreier, EPA

Preliminary Agenda -
International Workshop on Uncertainty, Sensitivity and Parameter Estimation

3: 50 Closing Remarks ..... Mark Dortch, USACOE and *Chair, Federal Interagency Steering Committee*

4:00 ADJOURN

Program Format:

- Each presenter is encouraged to provide an extended abstracts (200 words minimum up to 6 pages maximum) along with a list of keywords, Web site links and references for distribution prior to the workshop;
- Program is organized into 4 thematic sessions on parameter estimation, sensitivity, uncertainty, and applications; each session highlights invited talks (30 minutes) by selected experts and contributed papers (25-20 minutes) on applications which focus on the technical theme;
- Extended discussion periods at the end of each thematic session;
- Session rapporteurs will list methods, approaches and applications identified, with emphasis on practical strategies for each theme;
- Attendees will be provided an opportunity to provide written questions and suggestions to the session rapporteurs during breaks prior to the discussion periods;
- A roundtable discussion by the session rapporteurs and facilitators will summarize the workshop's overall technical ideas and themes for consideration in proposing a international conference;
- Final working session for "Technologist to Scientist" discussions will focus on development of a common software Application Programming Interface (API) for uncertainty analysis, sensitivity analysis, and parameter estimation methods and tools.

Web site Links:

MOU Public Web site: http://ISCMEM.Org

PNNL Web site for Uncertainty Research http://nrc-hydro-uncert.pnl.gov/

Andrea Saltelli, Applied Statistics Web site:http://www.jrc.cec.eu.int/uasa and forum for sensitivity analysis: http://sensitivity-analysis.jrc.cec.eu.int/

Jeroen van der Sluijs, Universiteit Utrecht Web site: http://www.chem.uu.nl/nws/www/nws.php3?pp=sluijs_a
NUSAP (Numeral, Unit, Spread, Assessment, Pedigree) - The Management of Uncertainty and Quality in Quantitative, Information Web site: http://www.nusap.net

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