



# 5th International Conference on Pharmaceuticals and Endocrine Disrupting Chemicals in Water

March 13–15, 2006 / Hilton Costa Mesa / Costa Mesa, California



According to the U.S. EPA, evidence suggests that environmental exposure to some anthropogenic chemicals may result in disruption of endocrine systems in human and wildlife populations. Concerns of endocrine disrupting chemicals appearing in the environment, water, soil, and food-stuffs have focused considerable national and international interest in their origin, transport, fate, and manner of detection, especially given the persistence of certain EDCs in the environment. NGWA's 5th International Conference on Pharmaceuticals and Endocrine Disrupting Chemicals in Water provides a timely and comprehensive vehicle to address this topic as science advances.

Risk management tools and the need for their further development to address pharmaceuticals and EDCs were clearly identified in the fourth conference. This fifth international conference will continue along these same avenues to provide comprehensive coverage of the latest advancements in science in this area. The conference will highlight innovative and cost-effective technologies in the equipment marketplace, as well as new regulatory approaches on human and environmental risk assessment and management in Europe and the United States. In addition to the workshops, speakers, and presentations, there will also be a field trip to the Orange County Groundwater Replenishment System where state-of-the-art treatment handles many of these compounds.

## Session Titles:

- Occurrence of pharmaceuticals and EDCs in the environment
- Human and veterinary sources of pharmaceuticals and EDCs in the environment
- Fate and transport of pharmaceuticals and EDCs in the environment
- Modeling and measurement of pharmaceuticals from hospitals, municipal and veterinary sources
- Natural attenuation of pharmaceuticals and EDCs
- Human health effects from exposure to EDCs and pharmaceuticals
- Antibiotics and drug-resistant bacteria
- Uptake of pharmaceuticals and EDCs by terrestrial and aquatic organisms
- Effects of pharmaceuticals and EDCs on wildlife
- Environmental and human risk assessment and management of pharmaceuticals and EDCs
- New regulatory approaches in the United States and Europe
- Innovative and cost-effective remediation and treatment technologies

## Co-sponsors:

U.S. EPA National Risk Management Research Laboratory  
U.S. Geological Survey Toxic Substances Hydrology Program  
German Federal Institute for Risk Assessment  
Minnesota Department of Health  
Kompetenzzentrum Wasser Berlin (Berlin Centre of Competence for Water)  
Technical University of Berlin



# Monday, March 13, 2006

8:00 a.m. - 5:00 p.m. Registration

9:00 - 9:05 a.m.

## **WELCOME**

Robert Masters, NGWA

Dana Kolpin, U.S. Geological Survey

9:05 - 9:30 a.m.

## **KEYNOTE SPEAKER**

**Diclofenac Residues as the Cause of Vulture Population Crash Across Southern Asia:  
Proof That Environmental Residues of Pharmaceuticals Can Cause Major Ecological Damage**

Lindsay Oaks, Ph.D., College of Veterinary Medicine, Washington State University

**9:30 - 11:45 a.m.**

## **PLENARY SESSION**

9:30 - 9:55 a.m.

**Long-Term Monitoring of the Loads of Pharmaceutical Residues in Municipal Surface Water in Berlin, Germany**

Thomas Heberer, Ph.D., Federal Institute for Risk Assessment; Marc Adam, Technical University of Berlin

9:55 - 10:20 a.m.

**Environmental Fate of Endocrine Disrupting Chemicals in Soil**

Guang-Guo Ying and Rai S. Kookana, Land and Water/Soil and Land Systems, CSIRO

10:20 - 10:30 a.m.

*Break*

10:30 - 10:55 a.m.

**Occurrence of Pharmaceuticals and EDCs in Dutch Drinking Water Sources**

Leo M. Puijker and Margreet N. Mons, Kiwa Water Research; Peter G.M. Stoks, Association of River Water Works

10:55 - 11:20 a.m.

**Behavior and Occurrence of Antidepressant Pharmaceuticals and Their Degradates in Municipal Waste Water**

Melissa M. Schultz, Ph.D., and Edward T. Furlong, Ph.D., National Water Quality Laboratory, U.S. Geological Survey

11:20 - 11:45 a.m.

**Distribution and Fate of Estrogenic Hormones and Alkylphenols in Representative French Municipal Waste Water Treatments Plants**

Luis Castillo, Dept. of Wastewater Treatment; Alain Huyard, Suez Environnement; Gaëlle Herry, Veolia Environnement; Jacqueline Pasanau, Dept. of Wastewater Treatment; Caroline Raulet and Patricia Mivelaz, Veolia Environnement; Mar Esperanza, Cyrille Gogot, Auguste Bruchet, and Marie-Laure Janex-Habibi, Suez Environnement; Jens Meinhold, Dept. of Wastewater Treatment

11:45 - 1:00 p.m.

*Lunch (on your own)*

**1:00 - 2:20 p.m.**

## **EFFECTS AND RESISTANCE (concurrent session)**

1:00 - 1:20 p.m.

**Using Fish as Indicators for Quantifying Endocrine Disruption in Effluent-Dominated and Effluent-Dependent Streams**

Nick Paretti, B.S., University of Arizona, and U.S. Geological Survey; David Walker, Ph.D., University of Arizona; Gail E. Cordy, M.S., U.S. Geological Survey

1:20 - 1:40 p.m.

**A Novel Method for the Rapid Assessment of Bacterial Resistance in the Australian Aquatic Environment**

Andrew J. Watkinson, University of Queensland; Gino Micalizzi, Queensland Health Scientific Services; Simon D. Costanzo, Ph.D., University of Queensland

1:40 - 2:00 p.m.

**Antibiotic Resistance of Public Health Concern in Bacteria Isolated from Environmental Samples**

Lisa R. Fogarty and Joseph Duris, U.S. Geological Survey

2:00 - 2:20 p.m.

**Characterization of Triclosan-Degrading Cultures and Consortium**

Fuman Zhao, Chang-Ping Yu, Ph.D., and Kung-Hui (Bella) Chu, Ph.D., P.E., Texas A&M University

2:20 - 2:40 p.m.

*Break*

**1:00 - 2:20 p.m.**

## **PART ONE: FATE IN SOIL (concurrent session)**

1:00 - 1:20 p.m.

**Environmental Fate of Endocrine Disrupting Chemicals in Soil**

Guang-Guo Ying and Rai S. Kookana, University of Adelaide

1:20 - 1:40 p.m.

**Fate of Selected Endocrine Disrupting Chemicals In Recycled Water Through A Hawaii Soil**

Sanjay K. Mohanty and Chittaranjan Ray, University of Hawaii at Mano

1:40 - 2:00 p.m.

**Natural Attenuation of Organochlorine Pesticides in Sediments from Long Island Sound**

Youxian Wu, Ph.D., Lijia Yang, Pengfei Zhang, Ph.D., Urs Jans, Ph.D., City College of New York, CUNY; Michael Melcer, Ph.D., U.S. Merchant Marine Academy

2:00 - 2:20 p.m.

**Estimating Sorption of Human Pharmaceuticals to Sediment Based on Pharmacological Data**

Mike Williams and Rai Kookana, Ph.D., University of Adelaide; Desmond B. Williams, Ph.D., University of South Australia

2:20 - 3:00 p.m.

*Break*

- 2:40 – 4:00 p.m. BANK FILTRATION SESSION**  
 2:40 – 3:00 p.m. **Natural Attenuation of Pharmaceutical Residues During Bank Filtration**  
 Thomas Heberer, Ph.D., Federal Institute for Risk Assessment; Britta Fanck and Andy Mechlinski, Technical University of Berlin
- 3:20 – 3:40 p.m. **A Final Report on Pharmaceuticals and Endocrine Disrupting Compounds in a Riverbank Filtration System, Platte River, Nebraska**  
 Jason R. Vogel, Ph.D., Michael T. Meyer, and Edward T. Furlong, Ph.D., U.S. Geological Survey
- 3:40 – 4:00 p.m. **Fate of Chlorinated Flame Retardants in the Environment and Water Treatment**  
 Jorg Drewes, Ph.D., Christiane Hoppe, Christopher Bellona, and Gary Wang, Colorado School of Mines
- 4:00 – 5:00 p.m. *Break*  
 5:00 – 7:00 p.m. Ice-Breaker Reception

- 3:00 – 4:00 p.m. PART TWO: FATE IN SOIL (concurrent session)**  
 3:00 – 3:20 p.m. **Nonylphenol and Polybrominated Diphenylethers Ground Water Effects from Land-Applied Biosolids**  
 Jason Engstrom, David M. Quanrud, Ph.D., and R.G. Arnold, University of Arizona
- 3:20 – 3:40 p.m. **Preliminary Assessment of Biocide Inputs to U.S. Water Resources and Soils**  
 Jochen Heidler, M.S., and Rolf U. Halden, Ph.D., P.E., Johns Hopkins Bloomberg School of Public Health
- 3:40 – 4:00 p.m. **Sorption and Degradation of Selected EDCs Under Aerobic and Anaerobic Conditions**  
 Guang-Guo Ying, Land and Water, CSIRO; Rai S. Kookana, University of Adelaide
- 4:00 – 5:00 p.m. *Break*  
 5:00 – 7:00 p.m. Ice-Breaker Reception

## Tuesday, March 14, 2006

- 8:00 a.m. – 4:00 p.m. Registration
- 8:30 – 11:45 a.m. PLENARY SESSION**  
 8:30 – 8:55 a.m. **The Effectiveness of Riverbank Filtration to Remove Endocrine Disrupting Chemicals**  
 Carsten K. Schmidt, Ph.D., and Heinz-Jürgen Brauch, DVGW-Water Technology Center
- 8:55 – 9:20 a.m. **QSPR Modeling of Ozone and Chlorine Reactions with EDCs and Pharmaceuticals**  
 Dawn Lei, Ph.D., Shane A. Snyder, Rebecca A. Trenholm, and Brett J. Vanderford, Southern Nevada Water Authority, River Mountains Water Treatment Facility
- 9:20 – 9:45 a.m. **Pharmaceuticals in the Environment: An Australian Perspective**  
 Simon D. Costanzo, Ph.D., EnTox, University of Queensland
- 9:45 – 10:10 a.m. **Bioaccumulation of Organic Waste Water Contaminants in Earthworms: Sentinel Indicators of Terrestrial Waste Water Contamination**  
 Chad A. Kinney, Ph.D., Eastern Washington University; Edward T. Furlong, Ph.D., National Water Quality Laboratory, U.S. Geological Survey; Dana W. Kolpin, Ph.D., U.S. Geological Survey; Mark R. Burkhardt, Ph.D., Steven D. Zaugg, Ph.D., and Stephen L. Werner, B.S., National Water Quality Laboratory, U.S. Geological Survey
- 10:10 – 10:30 a.m. *Break*  
 10:30 – 10:55 a.m. **Concentrations and Removal of Pharmaceutical Compounds at Three Waste Water Plants in New York State, 2003–2004**  
 Patrick J. Phillips, U.S. Geological Survey; Edward T. Furlong, Ph.D., National Water Quality Laboratory, U.S. Geological Survey; Beverley Stinson, Ph.D., Metcalf and Eddy; Steven D. Zaugg, Ph.D., Steven G. Smith, National Water Quality Laboratory, U.S. Geological Survey; Kathleen Esposito, Metcalf and Eddy; Dana W. Kolpin, Ph.D., U.S. Geological Survey; Melissa M. Schultz, Ph.D., National Water Quality Laboratory, U.S. Geological Survey
- 10:55 – 11:20 a.m. **Detection of Environmental Estrogens and Concurrent Observation of Feminization of Fathead Minnows in Waste Water Effluent**  
 James Gray, Ph.D., National Water Quality Laboratory, U.S. Geological Survey; Alan Vajda and David Norris, University of Colorado; Larry Barber, National Research Program, U.S. Geological Survey
- 11:20 – 11:45 a.m. **Attenuation of Waste Water-Derived Contaminants in an Effluent-Dominated River**  
 Lorien Fono, M.S., and David L. Sedlak, Ph.D., University of California; Bryan Brooks, Ph.D., Kevin Chambliss, Ph.D., Mohammed Mottaleb, and Alejandro Ramirez, Baylor University; Betty Jordan, P.E., Alan Plummer Associates
- 11:45 – 1:00 p.m. *Lunch (provided)*

- 1:00 – 2:20 p.m. PART ONE: TREATMENT (concurrent session)**
- 1:00 – 1:20 p.m. **Investigations of Occurrence and Elimination of Hazardous Compounds in Waste Water Treatment Plants**  
Sebastian Zuehlke, Ph.D., A. Ligon, M. Spittler, and H. Fahlenkamp, Institute of Environmental Research, University of Dortmund
- 1:20 – 1:40 p.m. **Fate of Chlorinated Flame Retardants in the Environment and Water Treatment**  
Jorg Drewes, Ph.D., Christiane Hoppe, Christopher Bellona, and Gary Wang, Environmental Science and Engineering, Colorado School of Mines
- 1:40 – 2:00 p.m. **A Novel Approach for Monitoring Waste Water–Derived Chemical Contaminants in Indirect Potable Reuse**  
Eric Dickenson, Ph.D., and Jorg Drewes, Colorado School of Mines; David L. Sedlak, Ph.D., University of California; Shane A. Snyder, Southern Nevada Water Authority, River Mountains Water Treatment Facility
- 2:00 – 2:20 p.m. **Removal of EDCs During Subsurface Wetland Treatment**  
Brianna L. Dorie, Peter Littlehat, David Quanrud, Ph.D., and Robert G. Arnold, University of Arizona
- 2:20 – 2:40 p.m. *Break*
- 1:00 – 2:20 p.m. FATE SESSION**
- 1:00 – 1:20 p.m. **The Fate of Selected Veterinary Antibiotics in Two Missouri Anaerobic Swine Lagoons**  
Keith A. Loftin, Ph.D., U.S. Geological Survey; Craig D. Adams, Ph.D., University of Missouri-Rolla; Cynthia Henny, Ph.D., Indonesia Institute of Sciences; Melanie R. Mormile, Ph.D., University of Missouri-Rolla; Michael T. Meyer, Ph.D., U.S. Geological Survey; Rao Surampalli, Region 7, U.S. EPA
- 1:20 – 1:40 p.m. **Estrogenic, Androgenic, and Antagonistic Activity in Poned Waste Water Effluent**  
Otakuye Conroy, David M. Quanrud, Ph.D., Wendell P. Ela, and Robert G. Arnold, University of Arizona
- 1:40 – 2:00 p.m. **Bacterial Metabolism of Selected PPCPs**  
Anthony G. Hay, Ph.D, Robert W. Murdoch, B.S., Abigail E. Wise, B.S., and Giomar Rivera-Cancel, B.S., Cornell University
- 2:00 – 2:20 p.m. **Robabilistic Modeling and Meta–Analysis for the Fate and Transport of USGS's 30 Emerging Contaminants**  
Hoa T. Trinh, Christian M. Lastoskie, and Peter Adriaens, University of Michigan
- 2:20 – 3:00 p.m. *Break*
- 3:00 – 5:00 p.m. PART TWO: TREATMENT (concurrent session)**
- 3:00 – 3:20 p.m. **Fate of Nonylphenol and PBDEs During Waste Water Treatment: Seasonal Effects**  
Sondra S. Teske, Ph.D., Jianmin Zhang, D.M. Quanrud, Ph.D., R.G. Arnold, and W.P. Ela, University of Arizona
- 3:20 – 3:40 p.m. **Reduction of Estrogenic Activity During Advanced Waste Water Treatment: Application of the U.S. EPA–Developed Luciferase Reporter Gene Assay**  
Patricia A. Orosz-Coghlan, M.S., and David M. Quanrud, Ph.D., University of Arizona; Beverley Stinson, Ph.D., Metcalf and Eddy; Robert G. Arnold, Ph.D., University of Arizona
- 3:40 – 4:00 p.m. **Treatment of Hospital Waste Water and Urine with Zero Valent Iron to Minimize the Environmental Contamination with Iodinated X–Ray Contrast Media**  
Anke Putschew, Agueda Solis Tellez, Ulf Miehe, and Martin Jekel, Water Quality Control
- 4:00 – 4:20 p.m. **Removal of Selected Pharmaceuticals and Endocrine Disrupting Substances Using Granular Activated Carbon: Isotherm and Kinetic Studies**  
Zirui Yu, Sigrid Peldszus, Peter M. Huck, and William B. Anderson, University of Waterloo
- 4:20 – 4:40 p.m. **Toxicological Relevance of Pharmaceuticals and Endocrine Disrupting Chemicals in Water**  
Gretchen M. Bruce, B.S., and Richard C. Pleus, Intertox Inc.; Shane A. Snyder, Southern Nevada Water Authority; Erin M. Snyder, Intertox Inc.
- 4:40 – 5:00 p.m. **Development of a Bioassay to Measure Thyroid Hormone Activity in Environmental Samples**  
Peter Littlehat Jr, M.S., Cynthia Adamson, Ph.D., David Quanrud, Ph.D., Robert G. Arnold, Ph.D., Joseph J. Bahl, Ph.D., and Eugene Morkin, M.D., University of Arizona
- 3:00 – 5:00 p.m. OCCURRENCE SESSION (concurrent session)**
- 3:00 – 3:20 p.m. **Analysis and Occurrence of EDCs and Pharmaceuticals in Reuse, Surface, and Drinking Waters**  
Brett J. Vanderford, Rebecca A. Trenholm, and Shane A. Snyder, Southern Nevada Water Authority
- 3:20 – 3:40 p.m. **Pharmaceuticals and Personal Care Products in the Waters of Michigan**  
Lisa Anderson and Alan E. Kehew, Ph.D., Western Michigan University; Sheridan Kidd Haack, Ph.D., U.S. Geological Survey

- 3:40 - 4:00 p.m. **Detection of Residual Pharmaceuticals in Alberta Surface Waters**  
David A. Humphries, Environmental Monitoring, Alberta Research Council
- 4:00 - 4:20 p.m. **Pharmaceuticals, Endocrine Disrupting Compounds, and Microbial Indicators of Fecal Contamination in Ground Water in the Helena Valley, Montana**  
Kathleen J. Miller, CGWP, Montana Bureau of Mines and Geology
- 4:20 - 4:40 p.m. **Occurrence of a Selected Suite of Emerging Contaminants in the Ohio River Basin**  
Christopher C. Barry, Marshall University
- 4:40 - 5:00 p.m. **Selecting PPCP Sampling Scenarios and Key Compounds for Analysis**  
Peter P. Zawadzka Jr., Woodard & Curran

## Wednesday, March 15, 2006

- 8:00 - 10:00 a.m. Registration
- 8:30 - 11:45 a.m. PLENARY SESSION**
- 8:30 - 8:55 a.m. **Antibiotics in Sewage, Recycled Water, and the Aquatic Environment: An Australian Perspective**  
Andrew J. Watkinson and Simon D. Costanzo, Ph.D., University of Queensland; Edwin J. Murby, National Measurement Institute
- 8:55 - 9:20 a.m. **Fate of Endocrine Disruptors, Antibiotics, and Pharmaceuticals During Municipal Waste Water Treatment: The Role of Biosolids**  
Craig L. Just, Ph.D., and Brett Woods, Civil and Environmental Engineering; John Vargo and Michael D. Wichman, University of Iowa Hygienic Laboratory; Gene F. Parkin, Civil and Environmental Engineering
- 9:20 - 9:45 a.m. **Fate of Organic Waste Water Contaminants in Onsite Waste Water Treatment Systems**  
Kathleen E. DeJong, and Robert L. Siegrist, Colorado School of Mines; Larry B. Barber U.S. Geological Survey
- 9:45 - 10:10 a.m. **Attenuation of Organic Micropollutants During Riverbank Filtration: Results from Field Studies and Laboratory Experiments**  
Christiane Hoppe, Terry Jennings, and Jorg Drewes, Ph.D., Colorado School of Mines
- 10:10 - 10:30 a.m. *Break*
- 10:30 - 10:55 a.m. **Measurement of Total Estrogenic Activity in Biosolids and Soils: Challenges and Implications**  
Jianmin Zhang, Otakuye Conroy, David M. Quanrud, Ph.D., Robert G. Arnold, Ph.D., and Wendell P. Ela, University of Arizona
- 10:55 - 11:20 a.m. **EDCs in Sammamish River Valley Surface Water, Ground Water, and Storm Water, King County, Washington**  
Richard A. Jack, M.S., Deb Lester, Eric Ferguson, Fran Sweeney, Dana Walker, Diane McElhany, and Jim Buckley, Dept. of Natural Resources, King County, Washington
- 11:20 - 11:45 a.m. **Fate and Transport of Pharmaceutical Compounds in Septic System Plumes**  
Cherilyn Carrara, University of Waterloo; Carol Ptacek, Ph.D., Environment Canada NWRI; William D. Robertson, Ph.D., and David W. Blowes, Ph.D., University of Waterloo; Edward Sverko, B.S., Environment Canada NWRI
- 11:45 - 11:55 a.m. Thanks and Wrap-Up
- End of Conference**