SECOND INTERNATIONAL SYMPOSIUM ON
UNDERGROUND INJECTION SCIENCE AND TECHNOLOGY

October 22–25, 2003 (Wednesday through Saturday)
Building 50 Auditorium
Lawrence Berkeley National Laboratory
1 Cyclotron Road, Berkeley, California 94720, USA

PRELIMINARY[*]
SYMPOSIUM AGENDA
(VERSION 031006)

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[*] Please email to cftsang@lbl.gov or jaapps@lbl.gov if there are errors, omissions or comments.

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Chin-Fu Tsang, Lawrence Berkeley National Laboratory
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Introduction

The subsurface environment is increasingly used for the injection disposal or storage of liquids, gases, and even slurries generated by industrial, oil and gas, and municipal facilities, in addition to its widespread utilization as a source of drinking water. With such exploitation, numerous technical and scientific problems arise, which are commonly addressed through research, improved technology, and analyses of case histories. In recent years, the pace of development has accelerated, and with new applications exploiting the subsurface environment, the science and technology addressing safety assessment and monitoring methods necessarily becomes more sophisticated.

The First International Symposium on deep injection disposal was held at Lawrence Berkeley National Laboratory in 1994. Key papers from that symposium were revised, reviewed, and published in *Deep Injection Disposal of Hazardous and Industrial Waste*, a book by Academic Press, which is still very much in demand. The Second International Symposium on Underground Injection Science and Technology is a timely opportunity to take stock of developments over the past nine years, assess the state of the art, and anticipate future trends. Scientific, engineering, and regulatory issues are addressed that underlie and cross-cut the domestic Class I (deep industrial/municipal and hazardous wastes), Class II (oil- and gas-related), Class III (solution mining), and Class V (other wells, generally shallow) wells. Innovative developments elsewhere in the world are also presented. The Symposium provides the opportunity for scientists, practicing engineers, and regulators from many countries to discuss important issues and exchange ideas addressing the beneficial utilization of the subsurface environment.

This symposium addresses a rich diversity of topics. For convenience, the topics are divided into six broad categories:

- History, Risk Assessment, and Regulation
- Well Testing and Hydrologic Studies
- Geochemistry
- Liquid Waste Injection
- Injection of Solids
- CO_2 Injection

Within each category, the speakers are placed in the order of their appearance. Poster presentations are grouped together on pages 8 and 9 of the Agenda and are ordered alphabetically according to the first author.

We would like to take this opportunity to acknowledge with thanks the enthusiastic support of the Symposium sponsors and co-sponsors. In particular, Bruce Kobelski and Robert Smith of the U.S. Environmental Protection Agency have provided encouragement and advice throughout the symposium organization. We are also grateful for the assistance of the Advisory Committee in suggesting symposium topics, publicizing the meeting, and reviewing symposium papers. We would like to express our

gratitude to individual staff members of Lawrence Berkeley National Laboratory who have greatly assisted us. Julie McCullough of the Technical and Electronic Information Department provided invaluable help in organizing and completing the Symposium Proceedings and book of abstracts. Her unstinting efforts and good humor throughout the process are very much appreciated. The covers of the books were designed by Maria Fink Atkinson, providing an artistic element to our efforts. To Kathleen Brower and Pat Butler, our conference coordinators, we owe our thanks for organizing the myriad behind-the scene details of the Symposium, so essential to ensuring its unqualified success. We are indebted to Marcelo Lippmann who, in coordination with Ali Khan of California DOGGR, George Robin of the U.S. Environmental Protection Agency, Region 9, Tom Box and Charlene Wardlow both of Calpine Corporation, and Bill Smith of the Northern California Power Agency, organized the field trip to The Geysers geothermal field.

Chin-Fu Tsang
John Apps
Symposium Organizers

Agenda Outline

Wednesday, October 22, 2003	7:30 A.M. – 8.30 A.M.	Registration
	8:30 A.M. – 12:30 P.M.	Oral Session
	12:30 P.M. – 1:30 P.M.	Lunch
	1:30 P.M. – 5:30 P.M.	Oral Session
	6:00 P.M. – 8:00 P.M.	Poster Session; Reception and Barbecue Dinner[*]
Thursday, October 23, 2003	8:00 A.M. – 12:30 P.M.	Oral Session
	12:30 P.M. – 1:30 P.M.	Lunch
	1:30 P.M. – 5:30 P.M.	Oral Session
Friday, October 24, 2003	8:00 A.M. – 12:30 P.M.	Oral Session
	12:30 P.M. – 1:30 P.M.	Lunch
	1:30 P.M. – 5:30 P.M.	Oral Session
Saturday, October 25, 2003	Field Trip (Geyser Geothermal Field)	

[*] We acknowledge, with many thanks, the co-sponsorship of Bryan Cave LLP, Du Pont & Co., Inc., and Terralog Technologies USA, Inc. for this event.

WEDNESDAY, OCTOBER 22, 2003		
7:30 A.M.	Registration, Building 50 Auditorium Foyer	
Session Chair — Chin-Fu Tsang , LBNL		
Welcome and Opening Remarks		
8:30 A.M.	Pier Oddone, Deputy Director, Lawrence Berkeley National Laboratory	
	(TBD), Office of Ground Water and Drinking Water, U.S. Environmental Protection Agency, Washington, DC.	
	Mike Paque, Executive Director, Ground Water Protection Council	
History, Risk Assessment and Regulation		
9:00 A.M.	An Overview of Injection Well History in the United States	Clark, J. (E.I. du Pont de Nemours & Co., Inc.), Bonura, D.K. and Van Voorhees, R.F.
9:30 A.M.	Deep Injection Disposal of Liquid Radioactive Wastes in Russia from 1963 to 2002: Results and Consequences	Rybalchenko, A. (All-Russia Designing and Research Institute of Production Engineering (VNIPIPT), Moscow), Pimenov, M.K., Kurochkin, V.M., Kamnev, E.N., Korotkevich, V.M., Zubkov, A.A., Khafizov, R.R. and Ulushkin, A.M.
10:00 A.M.	*Mid-morning Break*	
Session Chair — Robert E. Smith, US EPA/HQ		
10:30 A.M.	Applications of Deep Well Injection of Industrial and Municipal Waste Water in Texas	Knape, B. (Texas Commission on Environmental Quality)
11:00 A.M.	An Interpretation of the Safe Drinking Water Act's "Non-Endangerment" Standard for the Underground Injection Control (UIC) Program	Kobelski, B. (U.S. Environmental Protection Agency, Washington, DC), R. E. Smith, A. L. Whitehurst
11:30 A.M.	The Appropriate Methodology for Determining the Use of a Fixed Radius Area of Review or Zone of Endangering Influence \when Conducting an Area of Review Analysis for Underground Injection Control Operations	Platt, S. (U.S. Environmental Protection Agency, Philadelphia, PA), Rectenwald, D.
12:00 noon	A Probabilistic Risk Assessment of Class I Hazardous Waste Injection Wells	Rish, W.R. (Hull and Associates, Inc.)
12:30 P.M.	*Luncheon at the LBNL Cafeteria*	

Session Chairs — Robert Van Voorhees, Bryan Cave LLP, and Robyn Delehanty, EPA/HQ		
1:30 P.M.	Analysis of Injectate Location at the DuPont Beaumont Works	Mercer, J.W. (GeoTrans, Inc.), Faust, C.R., Brown, C. and Clark, J.E.
2:00 P.M.	Relative Risk Assessment of Deep Well Injection and other Management Options for Treated Wastewater in South Florida	Beard, H. (U.S. Environmental Protection Agency, Washington, DC)
2:30 P.M.	Why Current Regulations Protect Florida's Subsurface Environment	Muniz, A. (Hazen and Sawyer, P.C.), Tobon, M. and Bloetscher, F.
3:00 P.M.	UIC Class V Inventory Initiative: Using Technology to Enhance Class V Inventory and Inspection Efforts	Kelly, S. (U.S. Environmental Protection Agency, Washington, DC)
3:30 P.M.	*Mid-afternoon Break*	
4:00 P.M.	Regulatory Requirements and Practice Governing Slurry Injection of Drilling Wastes	Puder, M. (Argonne National Laboratory), Veil, J.A. and Bryson, W.
Well Testing and Hydrologic Studies		
4:30 P.M.	Replacing Annual Shut-in Well Tests by Analysis of Regular Injection Data: Field-case Feasibility Study	Silin, D. (Lawrence Berkeley National Laboratory), Tsang, C.-F. and Gerrish, H.
5:00 P.M.	Potential Corrosion and Microbiological Mechanisms and Detection Techniques in Solution Mining and Hydrocarbon Storage Wells	Davis, K. (Subsurface Technology, Inc.) and McDonald, L.
5:30 P.M.	*Adjournment*	
6:00 P.M.	***Poster Session with Reception and Barbecue Dinner**** LBNL Cafeteria Session Coordinators: Marcelo Lippmann and Dmitriy Silin, LBNL (*We acknowledge, with many thanks, the co-sponsorship of Bryan Cave LLP, Du Pont & Co., Inc. and Terralog Technologies USA, Inc. for this event.)	

Poster Session (Wednesday, October 22, 2003, 6–8 P.M.)

Predictions of Radioactive Liquid Waste Migration at the Siberian Chemical Combine Underground Injection Site Based on Mathematical Modeling	Alexandrova, L.N. (FSUGE "Hydrospetzgeologiya," Moscow, Russia), Glinsky, M.L., Danilov, V.V., Zinin, A.I., Zinina, G.A., Zubkov, A.A. and Samsonova L.M.
Hydrogeologic Studies to Assess the Feasibility of the Complex Use of the Subsurface for Native Brine Extraction and its Re-Injection after Usage at Moscow Enterprises of Power Engineering	Annenkov, A.A., (FSUGE "Hydrospetzgeologiya," Moscow, Russia) and Shipulin, Yu K.
Deep Injection of Acid Gas in Western Canada	Bachu, S. (Alberta Energy and Utilities Board, Edmonton, AB, Canada), Haug, K., Michael, K., Buschkuele, B. and Adams J.J.
Safety Assessment of Deep Liquid Organic Radioactive Waste Disposal	Balakhonov, B.G. (Siberian Chemical Combine, Russia), Zubkov, A.A. Matyukha, V.A. Noskov, M.D., Istomin, A.D., Zhiganov, A.N. and Egorov, G.F.
Modeling of Deep Well Injection of Radioactive and Non-Radioactive Wastes of Russian Nuclear Enterprises with Examples of Deep Storage Facilities of SSC RF - NIIAR (Dimitro Vgrad) and Chepets Mechanical Plant (Glazov)	Baydariko, E. (All-Russia Designing and Research Institute of Production Engineering (VNIPIPT), Moscow), Zinin, A.I., Zinina, G.A., Rybalchenko, A.I. Ulyushkin, A.M. and Zagvozkin, L.
Interpretation of Transient Permeability Tests to Analyze the Evolution of a Brine-Filled Salt Cavern	Behr, A. (University of Mining and Technology, Freiberg, Germany)
Leak-off Modeling of Fluid Injected in Gas Reservoir upon Fracture Stimulation	Behr, A. (University of Mining and Technology, Freiberg, Germany) and Mtshedlishvili, G.
Gulf Coast Borehole Closure Test Well near Orange, Texas	Clark, J.E. (E.I. du Pont de Nemours & Co., Inc.), Bonura, K., Papadeas, P.W. and McGowen, R.R.
Demonstration of Presence and Size of a CO_2-Rich Fluid Phase after HCL Injection in Carbonate Rock	Clark, J. (E.I. du Pont de Nemours & Co., Inc.), Bonura, D.K., Miller, C. and Fischer F.T.
Alaska-Sakhalinsk Symposium and UIC Oilfield Development	Cutler, T. (U.S. Environmental Protection Agency, Seattle, WA)
Maps of Site Suitability for Deep Well Injection of Industrial Waste within the Russian Federation and Contiguous States	Egorov, N.N. (FSUGE "Hydrospetzgeologiya," Moscow, Russia), Ivanova, N.F., Novoselova, V.I. and Tarasova, N.V.
Fluid Injection near the WIPP	Ghose, S. (U.S. Environmental Protection Agency, Washington, DC)
Use of Deep Geologic Horizons at Major Power Complexes in Central Russia	Gorbatenko, B.P. (Kalinin Nuclear Power Plant, Udomlia, Tverskaia Obl. Russia), Kajmin, E.P., Malinin, S.M., Pimenov, M.K., Rybalchenko, A.I., Turkovskiy, A. and Zacharova, E.V.

Prediction of Industrial Waste and Ground Water Migration during Underground Injection of Industrial Waste	Grabovnicov, V.A. (FSUGE "Hydrospetzgeologiya," Moscow, Russia)
The Assessment of Receiving Strata Isolation in Studying the Feasibility of Underground Injection of Industrial Waste: The Principal Tasks and their Solution	Grabovnicov, V.A. (FSUGE "Hydrospetzgeologiya," Moscow, Russia), Egorov, N.N. and Efimova, I.V.
Results of Long-Term Deep Liquid Radioactive Waste Injection Site Operation at the Siberian Chemical Combine	Korotkevich, V.M. (MinAtom RF), V. M. Kondakov, A. A. Zubkov, A.S. Ryabov,.A. Sukhorukov and V.V. Danilov
Liquid Radioactive Wastes Disposal into Deep Geologic Formation at the Research Institute of Atomic Reactors (Russia)	Mironov, V.V. (Institute of Nuclear Reactors (Dmitrovgrad, Ulianovskaia Obl., Russia), Ulyshkin, A.M., Ladzin, A.S. and Kuprienko, V.I.
Regulatory and Technical Impacts of South Florida's Regional ASR Program	Muniz, A. (Hazen and Sawyer, P.C.), Tobon, M. and Bloetscher, F.
Information Technology Tools Available for Underground Injection Control	Paque, M. (Ground Water Protection Council), Belieu, S. and Jehn, P.
Investigation of Chemical Interactions Between Waste, Native Fluid, and Host Rock during Deep Well Injection	Spycher, N. (Lawrence Berkeley National Laboratory) and Larkin, R.
Physico-chemical Aspects of Injection of Non-conventional Fluids and their Implications on Field Testing and Monitoring	Tsang, Chin-Fu (Lawrence Berkeley National Laboratory), John A. Apps and Jonny Rutqvist
Hydrodynamic Investigation for Toxic Waste Injection in Volzski Organic Synthesis Plant, Volgograd Oblast, Russia	Veretennikov, J.N. (State Scientific Center NIOPIC, Moscow, Russia)
Calculation of Solution Mining in Horizontal and Vertical Caverns	Webb, S. W. (Sandia National Laboratory)
Non-Darcy Flow Behavior near High-Flux Injection Wells in Porous and Fractured Formations	Wu, Y-S. (Lawrence Berkeley National Laboratory)
Effect of Man-Caused Transformations of Deep Liquid Radioactive Waste Repository-Containing Rocks on Radionuclide Migration	Zakharova, E.V. (IPC RAS, Russia), Kaimin, E.P., Zubkov, A.A., Makarova, O.V. and Danilov, V.V.
Formation of Mobile Long-Lived Radionuclide Species and their Part in Migration Processes (The Results of Monitoring and Studies at the Deep LRW Injection Site of SCC)	Zakharova, E.V. (IPC RAS, Russia), Kaimin, E.P., Ermolaev, V.M. and Zubkov, A.A.
Grouting with Mineral Forming Solutions — A New Technique for Sealing of Porous and Fractured Rock by Directed Crystallization Processes	Ziegenbalg, G. (Freiberg University of Mining and Technology, Freiberg, Germany)
Radionuclide Distribution in the Sand Collector Layer of the Deep Repository in the Course of Acidic Liquid Radioactive Waste Disposal	Zubkov, A.A. (Siberian Chemical Complex, Seversk, Russia), Balakhonov, B.G., Sukhorukov, V.A., Noskov, M.D., Istomin, A. D., Kessler, A.G., Zhiganov, A.N., Zakharova, E.V., Darskaya, E.N. and Egorov, G.F.

THURSDAY, OCTOBER 23, 2003		
Session Chairs — Noel Scrivner, Du Pont Engineering Technology, and Karsten Pruess, Lawrence Berkeley National Laboratory		
8:00 A.M.	Characterization of Subsurface Heterogeneity: Integration of Soft and Hard Information using a Multi-dimensional Coupled Markov Chain Approach	Park, E. (Delft University of Technology, The Netherlands), Elfeki, A. and Dekking, M.
8:30 A.M.	Large Scale 3-D Modeling of Injected Waste Transport in a Sandy-Clay Formation	Pozdniakov, S.P. (Moscow State University, Russia), Bakshevskay, V.A., Zubkov, A.A., Danilov, V.V., Rybalchenko, A.I. and Tsang, C.-F.
9:00 A.M.	Modeling Density Changes in Hazardous Disposal Well Plumes	Larkin, R. (R. G. Larkin Consulting) and Clark, J.
9:30 A.M.	Experimental Study of Injection Interval Hydraulic Isolation from the Overlying Formation at the Disposal Site of the Siberian Chemical Complex using High-accuracy Hydraulic Heads Measurements	Zubkov, A.A. (Siberian Chemical Complex, Seversk, Russia), Sukhorukov, V.A., Zykov, A.I., Redkin, E.A., Pozdniakov, S.P., Shestakov, V.M., Bakshevskay, V.A. and Kurochkin, V.M.
10:00 A.M.	*Mid-morning Break*	
Geochemistry		
10:30 A.M.	Water-Rock Geochemical Considerations for Aquifer Storage and Recovery: Florida Case Studies	Arthur, J. (Florida Geological Survey), Dubous, A. and Cowart J.
11:00 A.M.	Short- and Long-Term Fate of Trace Metal Contaminants in Anoxic Aqueous Environments as a Function of Background Electrolyte and Temperature	Trivedi, P. (University of Delaware), Sparks, D., Dyer, J.A., Scrivner, N.C. and Pandya, K.
11:30 A.M.	Predicting Trace-Metal Fate in Aqueous Systems using a Coupled Equilibrium-Surface-Complexation, Dynamic-Simulation Model	Dyer, J. (Du Pont Engineering Technology), Scrivner, N., Fritzler, B., Trivedi, P., Sparks, D.L. and Sanders S.
12:00 A.M.	A Study of Radionuclide Adsorption/Desorption with Application to Radioactive Waste Disposal Sites	Rumynin, V.G. (Institute of Environmental Geology, RAS, and St.-Petersburg State University, Russia)
12:30 P.M.	*Luncheon at the LBNL Cafeteria*	

Session Chairs — George Robin, EPA/Region9, and Tom Box, Calpine Corp.		
1:30 P.M.	Bacterial Diversity in Water at the Deep-well Monitoring Site Tomsk-7	Nedelkova, M. (Institute of Radiochemistry, Forschungszentrum Rossendorf, Germany), Radeva, G. and Selenska-Pobell, S.
Liquid Waste Injection		
2:00 P.M.	Update — World's Deepest Class V Disposal Well in its 17th Year	Bundy, J. (Subsurface Technology, Inc.)
2:30 P.M.	Injecting Brine and Inducing Seismicity at the World's Deepest Injection Well, Paradox Valley, Southwest Colorado, USA	Bundy, J. (Subsurface Technology, Inc.), Mahrer, K. Ake, J., Block, L. and O'Connell D.
3:00 P.M.	Review of Injection Reservoir Information in Relation to Earthquakes in Ashtabula, Ohio	Gerrish, H. (U.S. Environmental Protection Agency/Region 5) and Nieto, A.
3:30 P.M.	*Mid-afternoon Break*	
4:00 P.M.	Geodetic Monitoring at the Mirovo Salt Deposit, Bulgaria	Raynov, G. (Geoprecise Engineering Ltd., Sofia Bulgaria), Kotzev, V. and Blagoev, D.
4:30 P.M.	Stability Analysis of a Solution Cavity Resulting from Underground Injection	Nopper Jr., R. (E. I. du Pont de Nemours & Co., Wilmington, DE), Miller, C. and Clark Jr., J.E.
5:00 P.M.	Injection of Brine from Cavern Leaching into Deep Saline Aquifers – Long Term Experiences in Modeling and Reservoir Survey	Zemke, J. (Untergrundspeicher- und Geotechnologie-Systeme GmbH, Germany), Stoewer, M. and Borgmeier, M.
5:30 P.M.	*Adjournment*	

FRIDAY, OCTOBER 24, 2003		
Session Chairs — Jim Mercer, GeoTrans, Inc. an Slava Rumynin, Russian Academy of Sciences		
8:00 A.M.	Case Study: Evaluation of Oilfield and Water Well Disposal Well Designs for Oil Sands Facility in Northern Alberta, Canada	Champollion, Y. (Golder Associates Ltd.), Gleixner, M.R., Wozniewicz, J., MacFarlane, W. and Skulski L.
8:30 A.M.	Injection of Organic Liquid Waste in a Basaltic Confined Coastal Aquifer, Reunion Island	Martial, J.S. (Université de La Réunion, Réunion) Join, J.L. and Coudray, J.
Injection of Solids		
9:00 A.M.	International Database on Slurry Injection of Drilling Wastes	Veil, J.A. (Argonne National Laboratory, Washington, DC) and Dusseault, M.B.
9:30 A.M.	Alaskan UIC Solid Waste Disposal	Cutler, T. (U.S. Environmental Protection Agency, Seattle, WA)
10:00 A.M.	*Mid-morning Break*	
10:30 A.M.	Design and Operational History of a Non-Hazardous Oil and Gas Waste Disposal Cavern on the Texas Gulf Coast	Brassow, C.L. (Coastal Caverns, Inc., Houston, Texas)
11:00 A.M.	Disposal of Meat and Bone Meal and Residual Ash by Injection into Deep Geological Formations	Brkic, V. (INA Oil Industry Plc. Zagreb, Croatia), Gotovac, H. and Omrcen, B.
11:30 A.M.	Thermal treatment, Carbon Sequestration, and Methane Generation through Deep Well Injection of Biosolids	Bruno, M.S. (Terralog Technologies USA, Inc.), Young, J.T., Moghaddam, O., Wong, H. and Alatriste F.
CO_2 Injection		
12:00 noon	The Potential for CO_2 Sequestration in Large Aquifer Structures in North-Eastern Germany	Stöwer M. (Untergrundspeicher- und Geotechnologie-Systeme GmbH, Germany), Gilch, W. and Zemke J.
12:30 P.M.	*Luncheon at the LBNL Cafeteria*	

Session Chair — John A. Apps, LBNL and John Veil, Argonne National Laboratory		
1:30 P.M.	CO_2 Sequestration in Bedded Sandstone-shale Sequences	Xu, T. (Lawrence Berkeley National Laboratory), Apps, J.A. and Pruess, K.
2:00 P.M.	Underground Injection of Carbon Dioxide in Salt Beds	Bachu, S. (Alberta Energy and Utilities Board, Edmonton, AB, Canada) and Dusseault, M.B.
2:30 P.M.	Imaging of CO_2 Injection during an Enhanced-Oil-Recovery Experiment	Gritto, R. (Lawrence Berkeley National Laboratory), Daley, T.M. and Myer, L.R.
3:00 P.M.	Pore-space Ownership: Who Controls the Rights to Store CO_2?	Wilson, Elizabeth J. (U.S. Environmental Protection Agency, RTP, NC)
3:30 P.M.	*Mid-afternoon Break*	
4:00 P.M.	West Coast Regional Carbon Sequestration Partnership	Larry Myer (University of California Office of the President and Lawrence Berkeley National Laboratory)
Conclusions		
4:30 P.M.	Summary, Perspective and Comments	Don L. Warner, University of Missouri, La Rolla.
5:00 P.M.	Concluding Remarks	Chin-Fu Tsang, Lawrence Berkeley National Laboratory
5:15 P.M.	Concluding Remarks	Bruce Kobelski, U.S. Environmental Protection Agency, Washington, D.C.
5:30 P.M.	*Adjournment*	

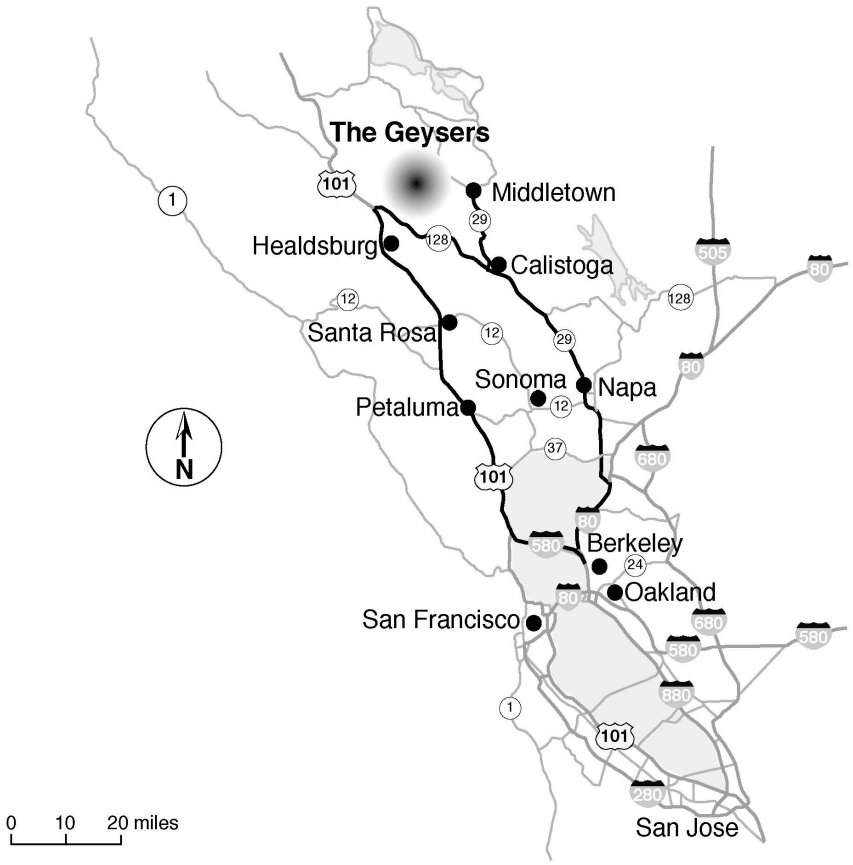
Saturday, October 25, 2003

Field Trip to The Geysers Geothermal Field

Coordinators:
Ali Khan (California DOGGR), George Robin (EPA-IX), & Marcelo Lippmann (LBNL)
with invaluable support from Calpine Corp. and Northern California Power Agency

***Note**: Except for pickup time, all times are approximate. They will depend largely on road and weather conditions.*

07:45 A.M.	Pickup at Durant Hotel
07:55 A.M.	Pickup at Shattuck Hotel
10:00 A.M.	Arrival at Calpine's Geysers Visitor Center in Middletown. Coffee and refreshments will be served. Field trip participants will have time to look at displays and listen to a short presentation on The Geysers geothermal steam field.
11:00 A.M.	Bus leaves the Visitor Center
11:00 A.M.–1:30 P.M.	Tour of the steam field. Stops (or drive-by) at Middletown treatment plant, field overlook, power plants, well sites, a pumping station, and areas with geothermal manifestations.
1:30 P.M.	Arrival at the West Field Office. Lunch (sandwiches and salads, etc.) will be served. Short presentation on The Geysers injection operations will be given.
2:30 P.M.	Bus leaves for Healdsburg.
3:30–4:30 P.M.	Free time at Healdsburg. Several wine tasting rooms as well as shops and cafes can be found around the city's plaza.
4:30 P.M.	Bus leaves for Petaluma
5:30–7:00 P.M.	Dinner, Table Service at Graziano's restaurant in Petaluma. A technical talk will be presented during dessert.
8:00 P.M.	Arrival at Berkeley hotels



Route of the October 25, 2003 field trip to The Geysers

Starting in Berkeley, the bus will go north on Interstate 80. Then, it will drive on California Highway 29 going up the Napa Valley. At Calistoga, it will leave the valley, cross the hills and reach Middletown. There, the tour will stop at Calpine's Geysers Visitor Center. Then, the bus will follow HW 175 for a short distance, before turning west on Socrates Mine Rd to reach The Geysers steam field at approximate 3000 ft elevation. After visiting and stopping at points of interest, and having lunch, the group will continue traveling west, going down the Geysers Road and HW 128 until reaching HW 101 and the town of Healdsburg. After a stop, the bus will continue traveling south to the town of Petaluma. Following dinner, the tour will go back on HW101 South. Finally, it will cross the San Rafael-Richmond Bridge, and return to Berkeley after traveling short distances on HW 580 East and Interstate 80 South.

GENERAL INFORMATION

SHUTTLE SERVICE
Complimentary shuttle service is available to meeting participants from Doubletree, Durant and Shattuck Hotels. The bus-es will leave from the front of the hotel each morning.

- Depart from Shattuck Hotel at 7:15 am
- Depart from Durant Hotel at 7:30 am
- Depart from Doubletree Hotel at 7:30 am

The buses will return to the hotels at the close of each day's program.

REGULAR BERKELEY LAB SHUTTLE SERVICE
There is a regular "Berkeley Lab" shuttle providing service to downtown Berkeley approximately every 10 minutes from 6:20 to 5:40 P.M., and every 20 minutes from 5:50 to 6:50 P.M. The downtown stop is located on Center Street near the corner of Shattuck and Center, next to the Wells Fargo Bank. It is one block from the Shattuck Hotel. The downhill shuttle boards at the main pick-up stop by Building 65.

MESSAGES
The phone number for the symposium registration desk is 510-486-6281.
There will be a message board in the auditorium lobby near the coffee break area.

TELEPHONES AND INTERNET ACCESS
Public telephones are located on the fourth floor of Build-ing 50. As you exit the auditorium, turn left down the stairs and proceed straight down the hallway to the end and the last exit to your right. There is also a public phone located in the foyer of the cafeteria. Short complimentary phone calls within the US can be made at the Registration Desk. Limited internet access is available on the computers in the Library on the fourth floor of Building 50. As you exit the auditorium, turn left, walk down the stairs and proceed straight down the hallway. The Library is on your left.

RESTROOMS (TOILETS)
As you exit the auditorium, turn left and either walk down the stairs to the fourth floor or up the next set of stairs to the fifth floor of Building 50B. The women's room is in the hallway straight ahead on the right-hand side. The men's room is in the hallway on the right on the left-hand side.

POSTER SESSION
The poster session will be held Monday, October 22 from 6 pm to 8 pm, in the Cafeteria, Building 54. Posters can be set up beginning at 4:30 P.M. The session is held concurrently with Symposium Reception and Buffet Dinner. A special shuttle service to the Berkeley hotels will leave at 8 p.m. from the Cafeteria parking lot.