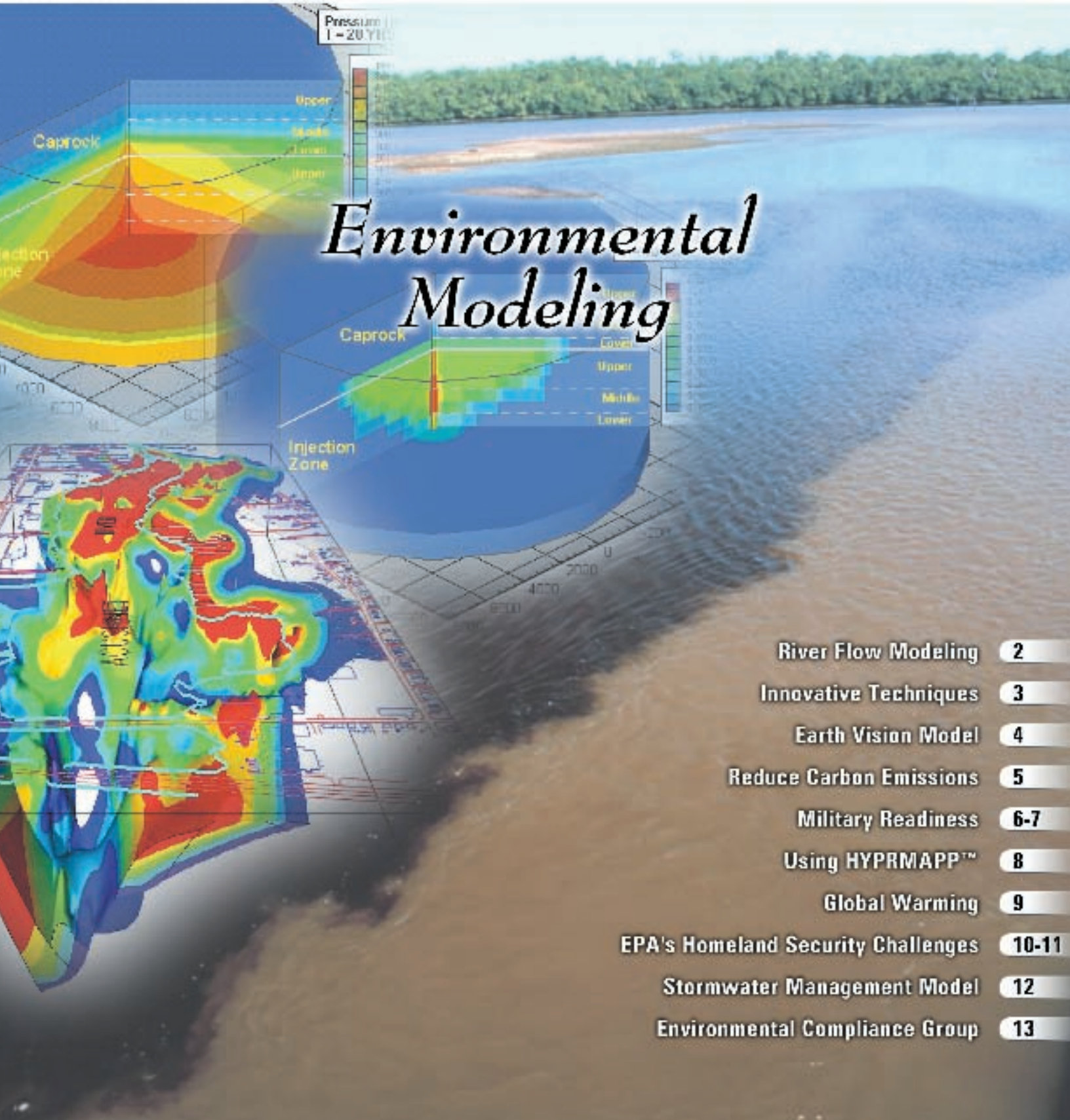
BATTELLE

Environmental Updates

Highlights of Battelle's International Environmental Leadership

Winter 2003



Environmental Modeling

BATTELLE

River Flow Modeling - *Visualizing Options*

As human activities dramatically change the world, developing tools to predict the impact of what we do before we do it will help prevent unexpected or unwanted changes to our environment, whether from building dams, disposing waste, or exploring new forms of energy. The Battelle-managed Pacific Northwest National Laboratory (PNNL) provides ways to predict these changes through its river modeling research. This form of computational fluid dynamics modeling helps decision makers understand how rivers, estuaries, and coastal environments are affected by natural and human influence.

"Our goal is to help decision makers and the public understand potential changes so they can make informed choices regarding solutions," said Marshall Richmond, who manages PNNL's river modeling research team, which focuses on two areas: water quality and fish passage. Researchers are currently studying how chemical and radionuclide contamination from waste disposal sites might affect the Columbia River. This water quality project, which is being conducted for the Department of Energy, uses computational modeling to show how contaminants can be expected to move through the water and sediments, and how contaminant concentrations will be affected by flows, tributary inputs, and reservoir operations. "We examine how the river system works today and then simulate different conditions and examine the effect that has on how contaminants move through the water," Richmond said.

In a study for the U.S. Army Corps of Engineers, PNNL researchers are exploring fish passage systems on the Columbia River. Fish migrating downstream typically swim close to the water surface, but fish that pass by the dam through the turbines have to swim deeper in the water column to reach the turbine entrances. The Corps is constructing a system at Bonneville Dam's second powerhouse to divert migrating juvenile salmon into a collector close to the water surface. Fish that pass through the collector are swept downstream of the dam, away from the turbines, through a sluiceway. PNNL's modeling of the complex three-dimensional water velocity patterns that affect the salmon as they approach the powerhouse is helping the Corps understand how the collector system will operate.

For both the water quality and fish passage models, PNNL researchers provide three-dimensional, animated presentations of the simulation data. "We have an array of tools we use to present the data in a form that bridges the worlds of fisheries, biology, civil engineering, and fluid dynamics science," Richmond said. "Tools like visualization are the best way to understand the immense amount of information gathered from a three-dimensional simulation."

For more information, contact Marshall Richmond, (509) 372-6241, marshall.richmond@pnl.gov or Joe Devary, (509) 376-8345, joe.devary@pnl.gov.

Flow lines, colored by water velocity (red for faster flow and blue for slower), depict swirling flow pattern in front of the second powerhouse at Bonneville Dam. Images such as this provide the client with a better understanding of the complex flow environments present at their hydroelectric facilities.

BATTELLE

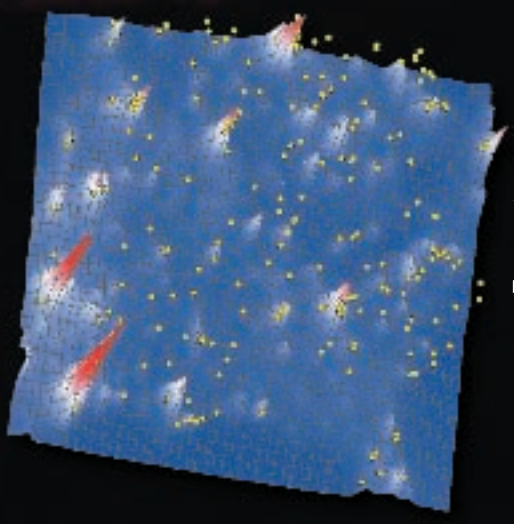
Innovative Techniques to Combine Data and Improve Environmental Modeling

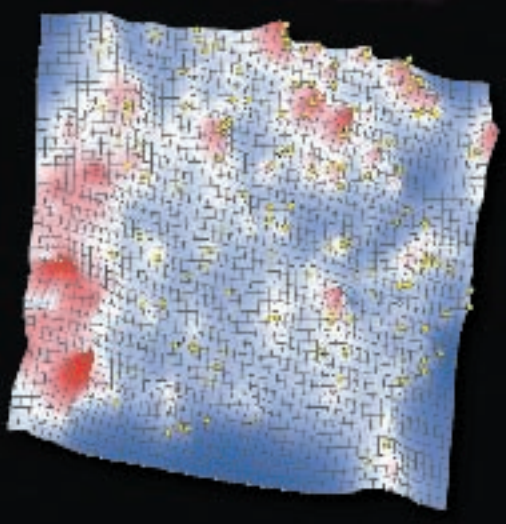
Scientific studies have shown associations between air pollutants and negative human health effects, as well as detrimental ecological impacts. However, the interplay of diverse emission sources and complex atmospheric processes makes the air pollution problem difficult to understand. Recently, Battelle developed a hierarchical Bayesian approach to statistical spatial modeling for an air quality assessment project to estimate spatial gradients, or variation, of air pollutants for the U.S. Environmental Protection Agency (EPA). (The term "hierarchical" in this context means that large numbers of variables are not modeled simultaneously, but instead dealt with in layers that build upon one another.) Such models also can define the spatial areas that episodes of unhealthy air quality will affect, or illuminate relationships between different air pollutants.

This innovative approach can be applied in most situations where two or more sources of data, which may differ in bias and precision, are collected to study one process or situation. As one example, Battelle scientists considered monitoring data and model predictions as two spatial representations of fine particulate matter. EPA's Community Multi-Scale Air Quality (CMAQ) Modeling System, which provided predictive modeling data, collected data at many locations in the study area, but its predictions were considered biased and imprecise - i.e., spatially dense but inaccurate. The monitoring data were drawn from the nation-wide Federal Reference Method (FRM) monitoring network, the 'gold standard' of air quality information as measured. Unfortunately, this network of high-quality monitoring measurements provides data from relatively few locations - i.e., spatially sparse but accurate information. By combining both sources, the hierarchical Bayesian approach takes advantage of the complementary strengths of each one.

The graphics below illustrate ambient particulate matter (PM2.5) concentration data that were collected over a large portion of the eastern United States for a two-week period in January 2000. The Bayesian surface is generally higher than the CMAQ surface, indicating that the monitoring data were used to adjust for an innate bias in the CMAQ model. Also note that the numerous local area peaks that were not necessarily accounted for, due to the relative sparseness of the monitoring data, still appear in the Bayesian surface, illustrating that the CMAQ information also has been fully incorporated.

Other applications of this modeling technique include making predictions about how air pollutants will act within defined geographic areas over a given period of time, using information from more than two inputs, and using it to make several other promising extensions. For more information, contact Dr. Steve Bortnick (614) 424-7487, bortnick@battelle.org or Dr. David Wendt (614) 424-7653, wendtd@battelle.org.





◂(a) Plot of the CMAQ model (surface) and the monitoring observations (spheres).
▸(b) Plot of the Bayesian predictions (surface) and the monitoring observations (spheres).

BATTELLE

EarthVision Model *Supports Environmental Assessment* of PCBs

Modeling demonstrates ever-increasing relevance for environmental scientists as advances in computing technologies and interdisciplinary studies help stimulate the growth of this dynamic field. Collaborative efforts between Battelle's Environmental Restoration and Coastal Resource and Environmental Management and Safety groups established a framework for strategically compiling and synthesizing large quantities of geological and chemical data to help address pressing questions faced by environmental managers. This synthesis has been essential for projects that extend over numerous years and thousands of samples.

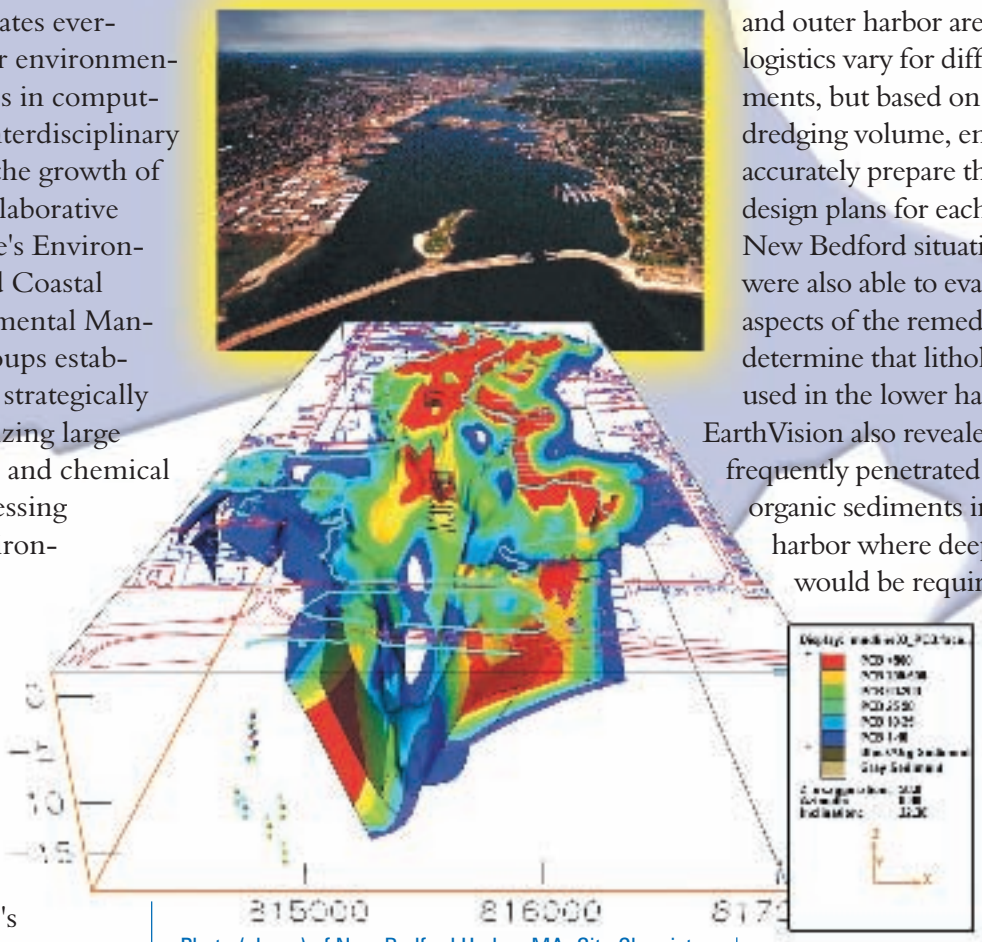


Photo (above) of New Bedford Harbor, MA. Site Chemistry Nature and Extent of PCBs.

At the New Bedford Harbor Superfund Site in Massachusetts, Battelle's EarthVision software helped describe the nature and extent of polychlorinated biphenyls (PCBs) in the harbor sediments. In one series of site rotations, this software visually and quantitatively represented more than 10 years of data and 4000 sediment samples measured for PCBs. Moreover, EarthVision can calculate the cumulative volume of material within the project boundary, based on site-specific criteria, as well as calculate volumes bounded within contaminant isoconcentration shells in three-dimensional space, thus enabling researchers to calculate contaminant mass at the site.

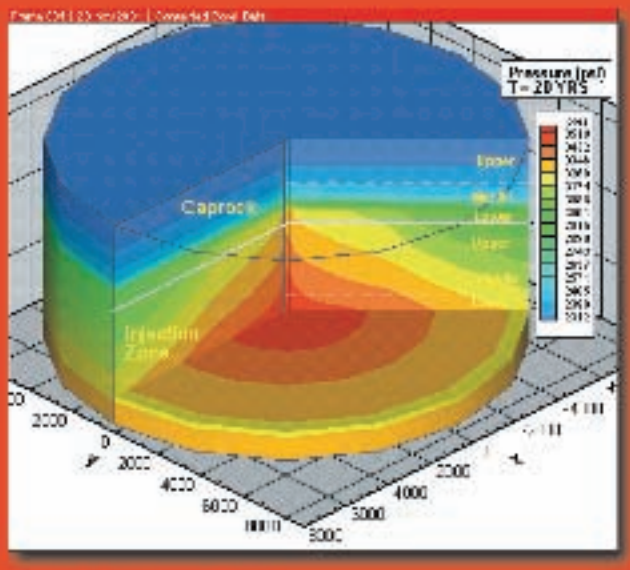
This is no small task for a remediation project that focuses on four location-specific cleanup goals: 1 ppm total PCBs for beaches adjacent to residential areas, 10 ppm for sediments inhabited by organisms that humans might eat, 25 ppm for marsh areas subject to human beach combing, and 50 ppm for less accessible salt marsh and outer harbor areas. Dredging logistics vary for different environments, but based on estimates of dredging volume, engineers can more accurately prepare their remediation design plans for each area. In the New Bedford situation, site engineers were also able to evaluate logistical aspects of the remediation and determine that lithology could be used in the lower harbor. However, EarthVision also revealed that PCBs frequently penetrated below the organic sediments in the upper harbor where deeper dredge cuts would be required.

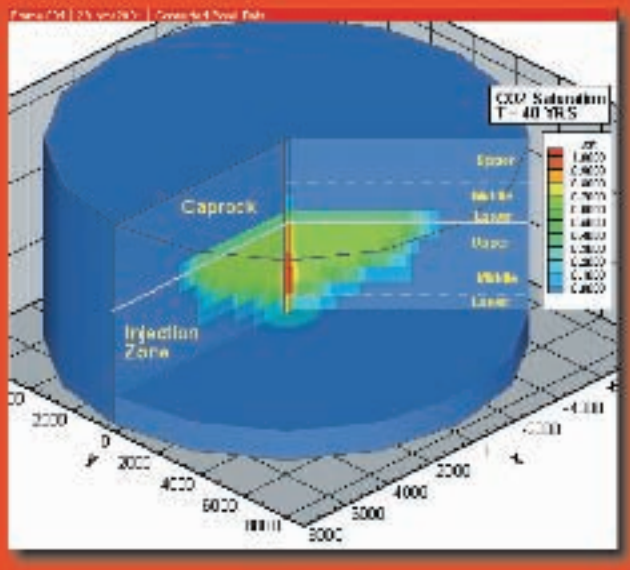
Quantitative models of environmental sites offer additional benefits to environmental forensic investigators. For example, the mass of sediments that require remediation can be further divided by PCB type or other compositional feature. The use of chemical fingerprinting extends the value of EarthVision models by enabling them to calculate the mass of sediment containing Aroclor 1254 and 1242 in New Bedford Harbor. Thereafter, remediation costs can be allocated on a mass or volume basis. In similar fashion, sources of petroleum, tar, pesticides, and other materials of environmental concern can be visualized and quantified for site-specific purposes. The Battelle toolbox, including advanced chemistry, geology, and EarthVision, provides state-of-the-art methods for visualizing and quantifying environmental data.

For additional information, contact Mr. Steven Emsbo-Mattingly at (781) 952-5246, emsbo-mattinglys@battelle.org or Mr. Jim Hicks at (614) 424-3958, hicksj@battelle.org.

BATTELLE

Evaluating Technologies Designed to *Reduce Carbon Emissions*





Power plants, refineries, and chemical operations emit large amounts of carbon dioxide into the atmosphere, which has led to efforts to control these sources of greenhouse gas emissions. Battelle scientists have recently undertaken the challenge of evaluating methods to reduce or eliminate carbon emissions, as part of ongoing projects funded by the U.S. Department of Energy (DOE) and several industrial clients. They are using sophisticated reservoir modeling techniques to simulate the injection of carbon dioxide into deep rock formations, so that they can assess the potential for geologic sequestration (removal or separation) of greenhouse gases. The process involves capture/separation of carbon dioxide from flue gases and compression into a supercritical liquid - one that has physical and chemical properties intermediate between those of liquids and gases - that may then be injected into wells drilled into deep rock formations. Petroleum reservoir models were customized to assess the storage capacity of deep rock formations.

The models simulated the movement of the carbon dioxide in the formations, interaction with formation fluids (brines present in the rock), and hydraulic impact of the injection system. To address the different phases of the liquid involved in the technology, the model was extensively modified in collaboration with the University of Texas at Austin. Initial calculations show that several percent of the injected carbon dioxide would dissolve into formation fluids. Because the supercritical carbon dioxide is lighter than formation brine, the remaining liquid would move upward as a separate phase until it encountered the confining layers that retain the carbon dioxide in the deep formations and prevent leakage into shallow aquifers. Over time, most of the injected fluid would gradually dissolve into the highly saline brines present in the rock formations.

The figures above show the simulated pressure and saturation of carbon dioxide around the injection well at depths of several thousand feet. Pressure increases in an inverted cone shape around the injection well. Carbon dioxide saturation distribution reflects the upward migration of the injected fluid. The modeling demonstrated the potential for geologic sequestration of greenhouse gases and has helped move the technology toward field-scale applications. Battelle is now developing and using simulation codes to design a large-scale field demonstration facility.

For more information on Battelle's carbon sequestration modeling, contact Dr. Neeraj Gupta at (614) 424-3820, gupta@battelle.org.

Battelle's *Expertise* Supports Military Readiness

As our armed forces strive to achieve higher levels of readiness during a period of potential conflict, regulators and communities near military installations are concerned about the environmental impacts of military activities. Base expansions to support additional personnel or equipment, increased training activities related to new mission objectives, and assessments of environmental impacts from existing or new weapon systems are among the issues. Traditionally, the military planning cycle did not include consideration of environmental impacts. This sometimes resulted in substantial delays, when interested parties sought information on the nature of the impacts just as a project was scheduled to begin.

Battelle has used its innovative environmental modeling techniques to evaluate several important military readiness and sustainability projects over the past several months. Considering the environmental implications of projects during their early phases can help military commands achieve adequate readiness while ensuring that environmental consequences are minimized. Recently, the U.S. Army asked Battelle to help prepare the air quality portion of the Environmental Impact Statement (EIS) for four training areas in Alaska, which encompass thousands of square kilometers of open ranges, unpaved roads, targets, and other facilities. Routine training produces air pollutant emissions in the form of fugitive particulates, vehicle exhaust, and trace elements from munitions use. Battelle scientists estimated the quantity of particulate emissions from training activities in each area and determined the impact of these emissions on surrounding air quality. They also assessed whether military activities would adversely impact nearby national parks, including Denali National Park, where Mt. McKinley is located.

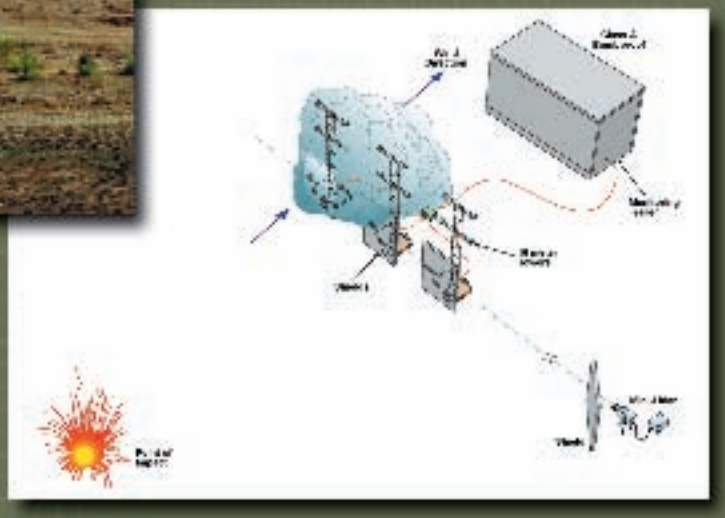
Use of a new Stryker vehicle, which is part of the Army's transformation of itself in the field, impacts ambient air quality. Personnel need extensive training to use the vehicles effectively, including mock, partial, and actual troop deployments. These maneuvers add emissions and create fugitive dust in the area. Fugitive emissions associated with travel to and from the training sites were also evaluated.

Battelle addressed the specific issues required by the EIS and used Army estimates of maneuver impact miles (MIMs) to calculate particulate emissions on unpaved roads from each class of training vehicle. These emissions were modeled as area sources, using the Industrial Source Complex Short Term model, which is the regulatory model that the U.S. Environmental Protection Agency (EPA) currently uses for a variety of air permitting applications.

The impact of emissions on visibility at national parks was also assessed.

Our scientists are also assisting several military installations during expansion projects, which now typically require an environmental modeling component to demonstrate that the projects comply with regulatory requirements. At Eareckson Air Station in the Aleutian Island chain, for example, Battelle has developed the inputs for an air quality dispersion model that simulates air pollutant releases from more than 250 different stationary sources during five different operating conditions. The large number of inputs allows complete characterization of potential air quality impacts from improvements that have been made to the Air Station over the last 20 years and from those proposed for the future. With detailed accounting of construction activity on the island, Battelle demonstrated that the operation of air pollutant sources in the past has not caused degradation of air quality on or off the island, and that proposed construction projects can also be implemented without degradation. This accounting required both detailed review of equipment changes over the years and establishment of complex models to study source-receptor relationships for critical periods of activity.

Addressing concerns about the impact of discharges from munitions is another important area in which Battelle supports military readiness. Our scientists are carrying out a multi-phase research project designed to report emissions from training ranges under EPA's Emergency Planning and Community Right-to-Know Act (EPCRA), using advanced testing and modeling techniques to understand the release and transport of toxic chemicals emitted during military testing and training activities. Both point-of-discharge and point-of-impact evaluations are being made. In addition to estimating the mechanisms and rates of toxic chemical releases from a range of munitions, Battelle is using carbon mass balance, chemical tracer, and three-dimensional photogrammetry techniques to account for plume dilution of the emissions as the emission cloud expands and moves downwind. These techniques assist in modeling transport of pollutants from both impact and firing areas. Eventually, the results of these model evaluations will be combined with chemical measurements to derive emission factors for a variety of weapons, and Battelle will apply those factors to determine emissions for a broad range of DOD training activities.



For more information, contact Joe Carvitti at (614) 424-4843, carvittij@battelle.org.

BATTELLE

Battelle Hybrid Risk-Management Methodology Using HYPRMAPP™

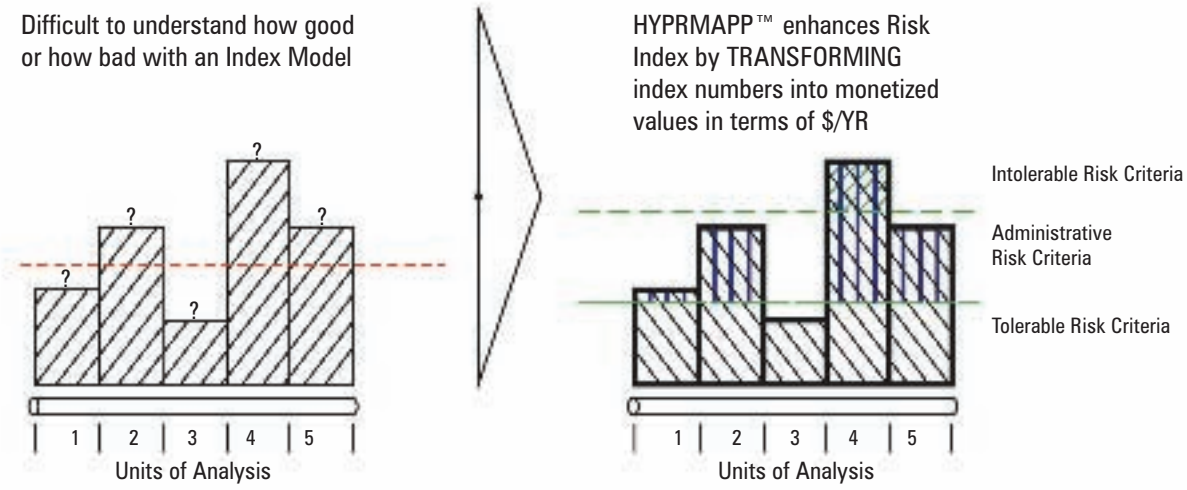
Like other important parts of the nation's industrial infrastructure, pipelines are subject to a number of risks - accidents, natural disasters, vandalism, and terrorism among them. Battelle researchers have developed a hybrid risk model, HYPRMAPP™, which bridges the gap between previous models and helps the pipeline industry manage risk more effectively than ever before. The risk index model has previously been the most popular form of risk management because of its low cost and ease of implementation. The model, which derives its results from industry-normalized accident data and limits of tolerable risk, is generalized and provides its user only a relative measure for identifying pipeline locations at greater or lower risk relative to one another. The less frequently used scenario-based model effectively identifies pipeline risks, but requires significantly more company resources and time to implement. A consultant who has expertise in facilitating scenario-based risk management techniques may be needed.

Both forms of risk management are acceptable to the U.S. Department of Transportation (DOT), Office of Pipeline Safety (OPS), but have disadvantages that Battelle's HYPRMAPP™ transcends by incorporating the advantages of each. The new methodology allows a company to make informed decisions for reducing risk that includes an understanding of the client-specific financial implications of various alternatives. This hybrid risk model provides the pipeline operator with information on the dollar costs per year if a potential risk should occur, as well as the benefit in dollars per year of reducing that risk. These results, when combined, provide a decision-making tool that helps a pipeline company weigh risk reduction alternatives that are based entirely on client-personalized business values. Using an economic benefit-to-cost basis, a company can focus its resources at those pipeline locations where risk reduction is needed most and the benefits received from risk reduction activities would be the highest.

HYPRMAPP™ 's capacity to link the relative results of a risk index model with a company's specific operating incident history and operating philosophies can transform relative risk numbers into measurable ones. The hybrid model can also be linked directly with a scenario-based risk assessment specific to a pipeline location. Or, when linked with a risk index model, it can be personalized for a company by using some of the same techniques deployed by scenario-based risk management. HYPRMAPP™ is a sophisticated new model that offers pipeline companies more effective ways of managing risk.

For additional information, please contact Tom Thomas at (614) 424-5632, thomast@battelle.org or Dr. Tom Bubenik at (614) 424-5331, bubenikt@battelle.org.

Why Hybrid Pipeline Risk Modeling & Project Prioritization HYPRMAPP™



Exploring the Implications of Global Warming

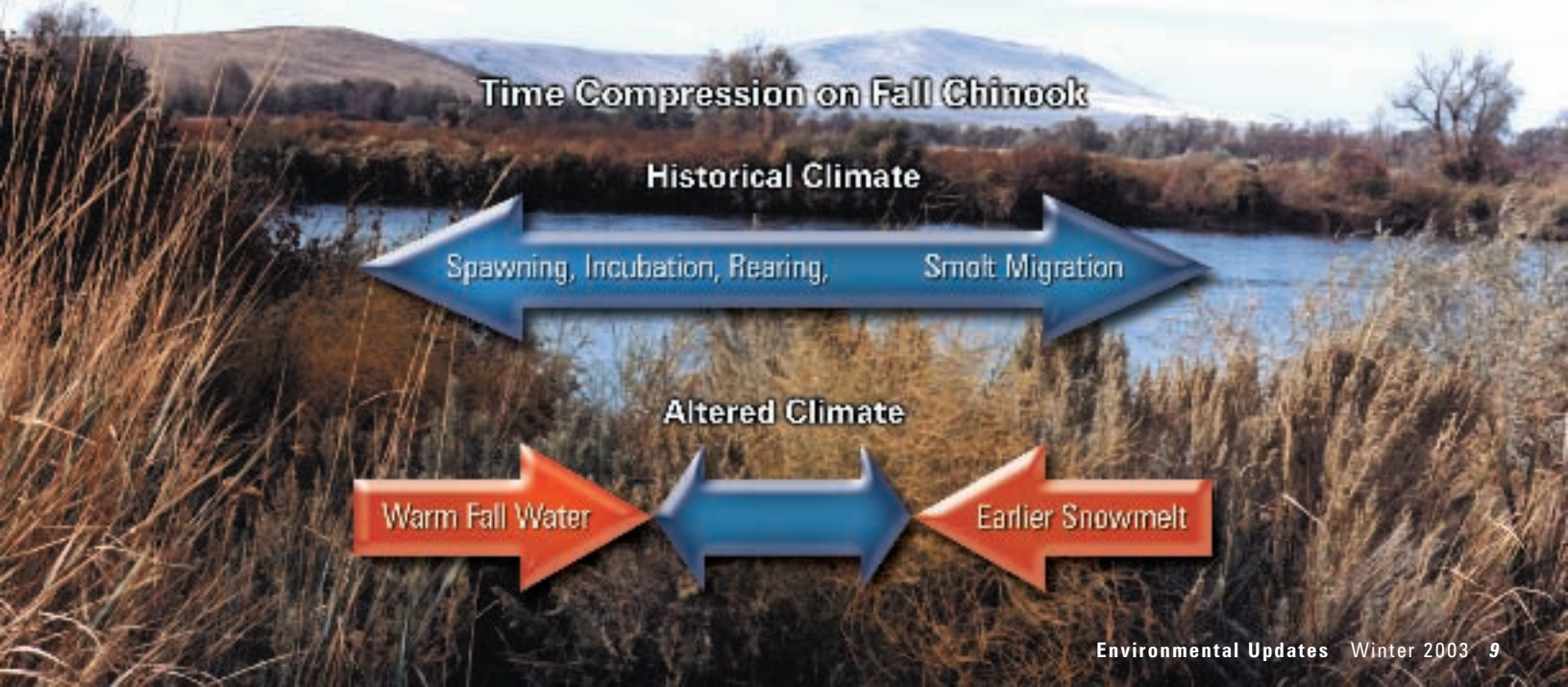
Global warming of the earth's atmosphere will significantly affect all living things that depend on water for survival - humans, plants, animals, and fish. Scientists at Battelle-managed Pacific Northwest National Laboratory (PNNL) have developed models to estimate the impact of global warming on water resources in the western United States, where managers are looking toward scientifically based solutions to address increased demands on their agencies. "Our modeling techniques can help them make better decisions by illuminating potential tradeoffs between cost and risk," said Mark Wigmosta, chief scientist with PNNL's hydrology group. These researchers have developed a modeling system that links diverse but related models. "We were one of the first to link regional climate models with distributed watershed models and are now the leader in carrying that linkage all the way through fisheries habitat," Wigmosta said.

Applying the models to the Yakima River Basin in Washington State, scientists created a historic climate simulation based on observed carbon dioxide emissions from fossil fuel combustion, and compared the results with three future climate simulations based on likely increases in global population, economic growth, and energy production. All three simulations indicated that there would be more rain than snow in fall and winter, causing increased winter runoff and decreased winter snowpack. "We'll see a major shift in timing of runoff due primarily to an increase in air temperature," Wigmosta said. More precipitation as rain in fall and winter would mean a decrease of natural water storage in the snowpack, and less winter snowpack would lead to an earlier runoff, with water levels peaking as early as March, rather than May as in past years.

This change may significantly impact fish populations in the Yakima River. For example, adult fall Chinook begin their upstream migration in the autumn. The resulting salmon smolt migrate downstream the following spring, but under future climate scenarios, stream temperature remains high later in the fall, which may delay upstream migration of adult salmon. In addition, if spring snowmelt occurs more than a month earlier than in the past, time available for spawning, incubation, and rearing of smolt before they migrate downstream is further compressed. Other fish species, even other Chinook salmon runs, will be impacted differently.

Storing increased runoff in the fall and winter and releasing it during the time of the historical spring snowmelt may be one approach to solving this problem. However, as water resource managers consider changes in operating procedures, they must also consider other, often conflicting, water uses such as irrigation. "We believe the research we're doing will help water resource managers make increasingly difficult decisions about how to use water resources in the future," Wigmosta said.

For additional information, please contact Mark Wigmosta, (509) 372-6238, mark.wigmosta@pnl.gov or Joe Devary, (509) 376-8345, joe.devary@pnl.gov.



FIRST TEST UNDER WAY

Battelle Responds to EPA's *Homeland Security Challenges*

Battelle is stepping up to a new and important environmental challenge-helping the U.S. EPA respond to Homeland Security needs. EPA is expanding the scope of its Environmental Technology Verification (ETV) program to address Homeland Security needs. The ETV Advanced Monitoring Systems (AMS) Center, which Battelle has managed in partnership with EPA since 1997, will continue to verify the performance of monitoring technologies for natural species and pollutants in air, water, and soil, while taking on an expanded role in Homeland Security.

Confirming Battelle's expanded support are Teresa Harten (center), EPA's ETV Program Director; Robert Fuerst, Project Officer for the AMS Center in EPA's National Exposure Research Laboratory; and Karen Riggs, Battelle's program manager for the AMS Center.

The AMS Center has begun verifying monitoring technologies that can help protect the nation's drinking water supply. Beginning in January, the AMS Center will conduct the first ETV verification test for Homeland Security by evaluating portable analyzers that can detect cyanide in drinking water. Five vendors have submitted six test kits and sensors for this test (see box).

Battelle also will help EPA protect the public in workplaces and other buildings that may be subject to chemical or biological attack. This responsibility includes detecting chemicals and biological contaminants in indoor environments and identifying methods and equipment for decontaminating buildings and indoor surfaces. Battelle will:

- Manage the ETV Building Decontamination Center, which will verify the performance of decontamination technologies for indoor surfaces contaminated with chemical and biological agents under a new $5M task order contract with EPA.
- Verify the performance of detection and monitoring technologies that measure contamination from chemical/biological agents in indoor environments under a new $4M task order contract with EPA.

The new ETV programs are being directed by the EPA Office of Research and Development's new National Homeland Security Research Center (NHSRC), based in Cincinnati. The NHSRC manages, coordinates, and supports a wide variety of homeland security research and technical assistance efforts.

Research at the NHSRC will focus on developing methods to clean up contaminated buildings (the Safe Buildings Program), protecting the nation's water supply (the Water Security Program), and improving risk assess-ment techniques (the Rapid Risk Assessment Program).

Three stakeholder committees are being organized by Battelle to support the new verification initiatives: a Water Security Stakeholder Committee, Building Detection and Monitoring Stakeholder Committee, and Building Decontamination Stakeholder Committee. The stakeholder committees will provide advice and guidance in selecting and prioritizing technologies to be tested; assist in identifying vendors; provide perspectives of regulators, technology users, and investors; and review verification test plans and reports.

The new programs are being conducted by Battelle staff in Columbus, Cincinnati, and Seattle and managed by Karen Riggs, program manager for the AMS Center. "We are very pleased to be awarded this additional work, which allows us to help EPA address homeland security needs and to continue verifying technologies that will address these needs," Riggs said.

Other Battelle staff involved in the new programs include Tom Kelly, Amy Dindal, Kent Hofacre, Dan Janke, Gretchen Hund, Todd Peterson, and Helen Latham.

For more information on the ETV program, contact Karen Riggs at (614) 424-7379, riggsk@battelle.org.

First Test of Homeland Security Technologies Is Under Way

On January 13, the AMS Center began conducting the first ETV verification test of technologies with Homeland Security applications. This test will evaluate the performance of portable analyzers that can detect cyanide in water. Five vendors have submitted six technologies. Two types of technologies that can detect the presence of free cyanide in water will be tested.

- Colorimeters test kits include reagents that, when added to a water sample, react with the available cyanide ion to form a colored solution. A vial containing this solution is inserted into the hand-held colorimeter that measures the intensity of the sample's color and reports the cyanide concentration.

- Ion selective electrodes function as a sensor that, when inserted into a water sample, a data readout device reports the concentration of free cyanide.

The EPA has set 0.2 milligrams per liter as the maximum amount of cyanide that can be present in drinking water because of the toxicity of free cyanide to humans. The purpose of the tests of the analyzers and test kits is to determine the performance precision, accuracy, detection limits, and other performance characteristics of the technologies.

Chemetrics' VVR Photometer

LaMotte's Smart 2

Orbeco-Hellige's Analyst 975MP

Thermo-Orion's AQUAfast IV Colorimeter

Battelle's ETC2 Facilitates Modernization of EPA's Storm Water Management Model

In 1971, the U.S. Environmental Protection Agency (EPA), which had recently been established by the Nixon administration, introduced the Storm Water Management Model (SWMM, pronounced "swim") computer software. After 30 years of dramatic changes in the computer and software industry, SWMM remains the industry standard for storm water modeling and has thousands of users.

SWMM is used to model the movement of precipitation through four "layers": atmosphere, land area, groundwater, and transport. The modeling process begins with the atmosphere from which precipitation falls onto the land. The land area module receives rainfall data and models the flow into groundwater, transport and storage, and outflow. The model provides information that managers need to address important environmental issues, including stormwater runoff, combined sewer overflow, and other drainage systems flow issues. Although the original SWMM model has been improved substantially over the years as a result of partnerships between EPA and the private sector, EPA recently decided to collaborate with industry to modernize the model by rewriting the 50,000 lines of patchwork FORTRAN code into C++, using an object-oriented programming approach. New features, including an interface to run under Windows® and industry standard formats to allow interface with geographical information systems and computer-aided design software will be added.

Battelle's Environmental Technology Commercialization Center (ETC^2) has facilitated two Cooperative Research and Development Agreements (CRADAs) between EPA and Camp, Dresser and McKee (CDM) to improve the model and software. CDM, a global consulting, engineering, construction, and operations firm, was part of the development team that helped create SWMM three decades ago. The cooperative work includes development of a reliable C++ coded version of the SWMM computational engine that can be run alone or as a dynamic link library of functions, and a GUI (graphical user interface) shell to allow it to run under Windows. A user's manual will also be developed.

Under the second CRADA, CDM and EPA are developing a generalized tool for computing inflow hydrographs at a sewer junction; writing code to link inflow hydrographs to the EXTRAN model; developing a Windows-based control system; and preparing a technical guide. A panel of technical experts will ensure that the tools developed have national application and documentation that is technically sound and clear. When the revision is completed in about two years, the improved SWMM software will benefit stormwater modelers nationwide.

For more information, contact Harry Stone at (513) 362-2602, stoneh@battelle.org.

New Staff Strengthen Existing Environmental Compliance Group

New staff members bring added depth to Battelle's consulting expertise in the area of environmental compliance activities at industrial and government facilities. Now assembled as part of a group devoted to understanding the regulatory and industrial arena, these staff members deal with the multitude of compliance issues associated with routine industrial process operations, expansions, and high-level compliance planning that is critical to continued operations in today's regulatory environment.

Joseph Carvitti

Mr. Carvitti has 25 years of consulting experience in environmental issues relating to air quality, RCRA, NPDES, and TSCA. Mr. Carvitti has a bachelor's degree in civil engineering and a master's degree in environmental engineering from the University of Cincinnati. Mr. Carvitti can be reached at (614) 424-4843, carvittij@battelle.org.

Jeffery Ferg

Mr. Ferg has more than 12 years of professional environmental experience. He has extensive air quality project management experience in regulatory compliance. Mr. Ferg has a geologic engineering degree from Purdue University and a master's degree in environmental engineering from the University of Cincinnati. Mr. Ferg can be reached at (614) 424-5970, fergj@battelle.org.

Anthony Wisbith

Mr. Wisbith has more than 30 years of experience in environmental engineering. He has been responsible for directing ambient air, indoor air, fugitive emissions, and continuous source monitoring activities. Mr. Wisbith has a bachelor's degree in environmental engineering from Pennsylvania State University. Mr. Wisbith can be reached at (614) 424-3124, wisbitha@battelle.org.

Darrell Joseph

Mr. Joseph has more than 30 years of experience in air quality and meteorological monitoring, project management, and air emissions inventories. Mr. Joseph received a bachelor's degree in physics and mathematics from Mount Union College, Ohio. Mr. Joseph can be reached at (614) 424-3645, josephd@battelle.org.

Kelley Hand

Ms. Hand's expertise consists of air permitting, EPCRA reporting, and multi-media environmental compliance review. Ms. Hand, a registered professional engineer (P.E.), received a bachelor's degree in chemical engineering from The Ohio State University. Ms. Hand can be reached at (614) 424-7551, handk@battelle.org.

Michael Rectanus

Mr. Rectanus's experience includes permit application development, pollution prevention and emergency response planning, site/construction management, and activities related to cessation of industrial operations. Mr. Rectanus received his bachelor's degree in chemical engineering from Ohio University. Mr. Rectanus can be reached at (614) 424-7552, rectanusm@battelle.org.

Richard Kussman

Mr. Kussman joined Battelle after retiring as a Colonel of the U.S. Army's Medical Service Corps. He has more than 27 years of diverse environmental experience, including projects involving solid waste, hazardous waste, and explosive and munitions waste. Mr. Kussman has bachelor's and master's degrees in civil engineering from Kansas State University. Mr. Kussman can be reached at (410) 306-8560, kussmanr@battelle.org.

Gary E. Baker

Mr. Baker has more than 23 years' environmental engineering experience. He has managed and conducted well over 600 technical projects ranging from air pollution control cost estimating to Air Force Installation Restoration Program cleanup. Mr. Baker holds a bachelor's degree in science comprehensive, and two master's degrees, one in environmental science and the other in civil and environmental engineering. Mr. Baker can be reached at (937) 258-6762, bakerg@battelle.org.

Battelle Welcomes Jill Engel-Cox

After seven years with Battelle, Ms. Jill Engel-Cox joins Measurement and Data Analysis Sciences in the Environmental Sector as a Principal Research Scientist. Located in the Battelle Arlington (Virginia) office, she leads and participates in international and domestic projects in the fields of environmental monitoring and assessment, air quality policy, and pollution prevention, with a focus on the clear and useful communication of environmental data to policymakers, stakeholders, and the public.

Ms. Engel-Cox spent three years as the Pollution Prevention program manager at Pacific Northwest National Laboratory and co-authored *Pollution Prevention Opportunity Assessments for Research & Development Laboratories* (Battelle Press). She moved to Washington, D.C., to take a Science and Engineering Policy Fellowship from the American Association for the Advancement of Science, where she worked at the U.S. EPA's Office of International Activities and Office of Research and Development.

She has conducted projects with several Battelle-managed laboratories, private industry, and other government agencies such as NASA and U.S. AID. Before she joined Battelle, she worked for Westinghouse Hanford in Richland, Washington, and for the South Coast Air Quality Management District in Los Angeles, California.

Ms. Engel-Cox holds an M.S. in mechanical/environmental engineering from Colorado State University, and a B.S. in mechanical engineering and a B.A. in honors liberal arts from University of Texas in Austin. She is in the process of obtaining her Ph.D. in environmental science from the University of Maryland, Baltimore County. She can be reached at (703) 875-2144, engelcoxj@battelle.org.

Battelle Welcomes Leslie Lundgren

Battelle is pleased to announce the addition of Leslie Lundgren, Project/Program Manager, to its Coastal Resource and Environmental Management and Safety (CREMS) group. Ms. Lundgren is a Civil Engineer with over 22 years experience in engineering, biological and physical science fields. She specializes in the management, marketing, and technical aspects of environmental engineering projects. As Project/Program Manager, Ms. Lundgren will manage coastal resource projects based out of the San Francisco office.

During her career, Ms. Lundgren has worked in a vast range of engineering, planning, regulatory, and project management positions. Additionally, she has overseen projects with numerous regulatory compliance issues under federal, state, and local environmental agencies. Ms. Lundgren received her bachelor of science degree in civil engineering from San Francisco State University.

For additional information, please contact Ms. Lundgren at (415) 273-7159, lundgrenl@battelle.org.

Hitt Institute Offers PIM Workshop for Pipeline Professionals

The Hitt Institute of Technology Training is offering a workshop for pipeline professionals beginning May 5th through 9th , 2003. The workshop, entitled "Implementing an Integrity Management Program under the Recent/Proposed OPS Rules," will be held at Battelle in Columbus, Ohio and at Battelle's Pipeline Technology Training Center in nearby West Jefferson, Ohio. The workshop has been specifically designed to provide information needed to begin planning an effective Pipeline Integrity Management program. The fee for attending this course is $2500 ($2300 for registrations received before April 15, 2003). For details and registration information visit www.battelle.org/conferences/hitt/integrity.

Battelle *Participates* in Conferences

Beautiful Vancouver, British Columbia, Canada is the host city for the 2003 International Oil Spill Conference (IOSC) scheduled for April 6-10, 2003. IOSC 2003 is regarded as the world's premier oil spill prevention, response, and science conference. Battelle's Coastal Resource and Environmental Management and Safety (CREMS) group is hosting a booth at the conference. Please come visit us at booth # 622. For additional information, contact Paul Boehm at (781) 895-4862, boehmp@battelle.org.

CREMS is also participating as a sponsor of Restore America's Estuaries Inaugural National Conference on Coastal and Estuarine Habitat Restoration. The conference will be held April 13-16, 2003 in Baltimore, Maryland.

The purpose of the conference is to mobilize the coastal and estuarine habitat restoration community - including participants from the government, corporate, non-profit and education sectors - to advance our knowledge, practice, pace and success in habitat restoration.

For additional information, contact Karen Foster at (781) 952-5370, foster@battelle.org, or Sally Yozell at (781) 952-5331, yozells@battelle.org.

Battelle *Co-sponsors EPA Pollutants Conference*

The 26th Annual Conference on Analysis of Pollutants in the Environment is jointly sponsored by Battelle and the U.S. Environmental Protection Agency (EPA). The conference will be held from April 29-30, at the Holiday Inn Chicago Mart Plaza Hotel, Chicago, Illinois. This conference continues to be recognized as the leading forum for discussion of technical issues related to environmental water regulations and compliance monitoring. Representatives from EPA's Office of Water will present the most recent developments in technology for use in the laboratory. Presenters also include state and independent laboratory experts, federal and state regulatory personnel, and consultants in the environmental measurements field. For additional information, please contact Bob Beimer at (781) 952-5332, beimerr@battelle.org.

Battelle Environmental Updates
Winter 2002 Information

- ⬭ Please add my name to your mailing list
- ⬭ Please note my change of address
- ⬭ No, I no longer wish to receive a FREE copy of Battelle Environmental Updates
- ⬭ I am interested in hearing more about what Battelle can do in the following areas.

- ☐ Human Exposure & Risk Assessment
- ☐ Ecological Risk Assessment
- ☐ Natural Resource Management
- ☐ Chemical Analysis
- ☐ Fate, Transport & Effects of Contaminants
- ☐ Environmental Forensics Investigations
- ☐ Pipeline Technology Center
- ☐ Statistical Design
- ☐ Atmospheric Science & Applied Technology
- ☐ Environmental Remediation
- ☐ Oil & Gas Industry Consulting
- ☐ Environmental Management Information Systems
- ☐ Environmental Safety & Health Systems
- ☐ Source Emissions Characterization & Monitoring
- ☐ Environmental Systems & Decision Analysis
- ☐ Life Cycle Assessment & Management
- ☐ Environmental Policy and Program Development

Name: _____ **Title:** _____

Company: _____

Address: _____

City: _____ **State:** _____ **Zip:** _____ **Country:** _____

Telephone: _____ **Fax:** _____

E-mail: _____

Please fax this form to (781) 934-2124 or mail it to the following address:

Joan Sundstrom
Battelle
397 Washington Street
Duxbury, MA 02332

Battelle Environmental Updates is the official newsletter of the international environmental practice of Battelle Memorial Institute, a 8,900-employee, international research organization headquartered in Columbus, Ohio. We welcome your comments and suggestions. **If you would like additional information about any of the articles, our services, or the authors, please contact Joan Sundstrom at (888)-290-0571 or via e-mail at sundstrj@battelle.org.**

Battelle

397 Washington Street
Duxbury, Massachusetts 02332-0601

Address Service Requested

Non-Profit
U.S. Postage
PAID
Columbus, OH
Permit No. 909