Measurement & Monitoring:
17th Quarterly Literature Update

These references have been added to the literature database developed for the Measurement and Monitoring Technologies for the 21st Century (21M2) website. The searchable archive of abstracts is located at http://www.clu-in.org/programs/21m2/litsearch.cfm

Active Sampling Technique to Enhance Chemical Signature of Buried Explosives
Lovell, John S. and Patrick D. French.
Detection and Remediation Technologies for Mines and Minelike Targets IX. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5415, p 494-501, Sep 2004

Many modern landmines have a very low metal content, which severely limits the effectiveness of metal detectors. Experiments with dogs have shown that canines can smell the explosives that are known to leak from most types of landmines, which has suggested to researchers that vapor sensing is a viable approach to landmine detection. The amount of material available to passive vapor sensing systems is limited to no more than the vapor in equilibrium with the explosive related chemicals (ERCs) distributed in the surface soils over and near the landmine. For example, the low equilibrium vapor pressure of TNT in the soil/atmosphere boundary layer and the limited volume of the boundary layer air suggest that passive chemical vapor sensing systems require sensitivities in the picogram range, or lower. Many of the limitations of passive sampling methods may be overcome by the use of an active sampling method that employs a high-powered (1,200+ joules) strobe lamp to create a highly amplified plume of vapor and/or ERC-bearing fine particulates. Initial investigations have demonstrated that this approach can amplify the detectability of TNT by two or three orders of magnitude.

Airborne Detection of Urban Environmental Pollutants by FTIR System
Fang, Yonghua, Yanli Qiao, Ye Huang, and Mingpeng Shen.
Optical Technologies for Atmospheric, Ocean, and Environmental Studies. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5832, p 273-282, May 2005

The authors discuss the use of a Fourier transform infrared (FuR) spectrometer for city air pollution monitoring. Because most gaseous pollutants exhibit significant absorptivities in infrared spectral regions, an FTIR system can measure their hyperspectral absorption signatures, analyze the composition, and provide an estimate of concentration. This paper focuses on the principles of airborne pollutant detection and signal-processing techniques, such as the establishment of spectral database pro-processing and characteristic extraction identification and classification for spectral signals.

Alkaline Phosphatase Inhibition Based Electrochemical Sensors for the Detection of Pesticides
Mazzei, F., F. Botre, S. Montilla, R. Pilloton, E. Podesta, and C. Botre.
Journal of Electroanalytical Chemistry, Vol 574 No 1, p 95-100, 15 Dec 2004

A bioelectrochemical system for the determination of pesticides by enzyme inhibition data performs measurements by electrochemical monitoring of the inhibition of the catalytic activity of the enzyme alkaline phosphatase (ALP), either in the presence or in the absence of pesticides such as Malathion and 2,4-dichlorophenoxyacetic acid (2,4-D). ALP catalytic activity was determined by using two different analytical configurations: (1) an amperometric ALP-based biosensor having 3-indoxyl phosphate as the enzyme substrate, and (2) a system allowing the voltammetric determination of the electroactive products of the ALP catalyzed-reactions with two different substrates--phenyl phosphate and ascorbate-2-phosphate.

Ambient Monitoring for PCE with Automated Real-Time Gas Chromatography
Dumdei, B. (URS Corporation, Chicago, IL); G. Smith; R. O'Brien.
Proceedings of the Air and Waste Management Association's 97th Annual Conference and Exhibition--Sustainable Development: Gearing Up for the Challenge, 22-25 June 2004, Indianapolis, Indiana.

An air monitoring system was established to measure real-time impacts of perchloroethene (PCE) on the surrounding areas during a U.S. EPA removal action that involved heat-enhanced soil vapor extraction. A new development in the technology of gas chromatography sampling was used. The ambient air sampling program included a real-time automated wind direction selected sampling program combined with a newly developed concentration technology for injection into a specially designed gas chromatograph. The new technology allows ambient levels of PCE, and other air toxics, to be determined on a real-time, repetitive basis throughout the remedial activities at the site. This paper presents an introduction to the new gas chromatography methods and the results of monitoring at the site and compares the new method to other available monitoring methods.

Analysis of Hydroxylated-PCBs /Biphenyls Using Whole-Cell Sensing System
Xu, Shifen, Sapna K. Deo, and Sylvia Daunert, University of Kentucky SBRP.
Superfund Basic Research Program 2004 Annual Meeting, Seattle, WA, 3-4 November 2004, Seattle, Washington. [poster presentation]

The metabolites of polychlorinated biphenyls (PCBs), such as hydroxylated PCBs (PCB-OHs) or hydroxylated biphenyls, were identified as environmental contaminants. A research team has developed a whole-cell sensing system for the detection of PCB-OHs using the strain Pseudomonas azelaica. The bacteria Pseudomonas azelaica HBP1 can use hydroxylated biphenyls as their sole carbon and energy source. These bacteria contain the hbpCAD genes, which are responsible for the degradation of hydroxylated biphenyls. The expression of these genes is regulated by a regulatory protein encoded by the gene hbpR located upstream from the hbpCAD genes. A whole-cell sensing system was developed by fusing the gene of the reporter protein luciferase encoded by luxAB to the regulator-promoter cassette. In the presence of inducers, such as hydroxylated biphenyls or PCB-Ohs, the regulatory protein HbpR activates the transcription through the promoter resulting in the expression of the reporter gene. This expression can then be monitored by measuring bioluminescence emission after addition of a substrate for luciferase, namely, n-decanal. This whole-cell sensing system was employed in the detection of 2-hydroxybiphenyl and 2-hydroxy-3',4'-dichlorobiphenyl, achieving a detection limit of 5 x 10(-7) M. The method can potentially be employed as a rapid and sensitive way to monitor the presence of low concentrations of PCB-OHs in environmental and biological samples.

Analytical Tools for Modeling Natural Attenuation Processes at Chlorinated Solvent Contaminated Sites
Clement, T.P., K. K. Lee, and V. Srinivasan.
EWRI 2005: Impacts of Global Climate Change (Proceedings of the 2005 World Water and Environmental Resources Congress, May 15-19, 2005, Anchorage, Alaska).
ASCE Press, Reston, VA. ISBN: 0-7844-0792-4, 2005

The current version of EPA's BIOCHLOR model cannot be used to predict transport involving different retardation factors, nor can BIOCHLOR describe non-sequential biodegradation reactions. Both these limitations are associated with the assumptions involved in the multi-species analytical solution strategy employed by the BIOCHLOR model. The authors use a novel analytical solution framework to avoid these limitations and solve two example problems to illustrate the robustness of the analytical strategy for natural attenuation modeling at chlorinated solvent sites.

Anion-Exchange Chromatography of Metal Cyanide Complexes with Gradient Separation and Direct UV Detection
Karmarkar, S.V., Lachat Instruments, Milwaukee, WI.
Journal of Chromatography A, Vol 956 Nos 1-2, p 229-235, 17 May 2002

Analytical result of cyanide content can be expressed variously as free cyanide, total cyanide, weak-acid dissociable cyanide, available cyanide, and cyanide amenable to chlorination. Attention to concentration of individual metal cyanide complexes is useful in a meaningful toxicity assessment. This paper presents work to achieve separation of cyano complexes of silver, iron, gold, copper, nickel, and cobalt in two macroporous anion-exchange columns of high (QS-A1 SC) and intermediate (QS-A2 SC) hydrophobicity. On the QS-A1 SC column, the monovalent cyano complexes of silver and gold eluted last, while the multivalent (iron and copper) cyano complexes eluted early. The retention order on this column may be due to relative hydrophobicity of the metal cyanide complex and its effect on ion exchange. On the QS-A2 SC column, the separation of the cyano complexes of five other metals (excepting cyano complex with Fe) closely followed an anion-exchange mechanism. Under gradient conditions, the six metal cyanide complexes were well resolved on the QS-A2 SC column, and the method with direct UV detection at 215 nm was accurate and precise.

Apparatus and Method for Chemical Agent Detection
LANL Reference No 369; DOE Reference No 100,590.
Los Alamos National Laboratory, Technology Transfer Division, 14 June 2005

Los Alamos National Laboratory has developed a method and apparatus for detecting chemical agents, comprising a mini-plasma apparatus and an elemental/ molecular emission detection means that provides some unique capabilities for chemical agent detection. A spectrometer or any mechanism that differentiates between spectral emissions can be utilized for identifying the elements and/or molecular organics present in an air sample. The invention is applicable to industrial hygiene and safety, environmental monitoring, and homeland security uses. It has the advantage of low power consumption and can be powered by dry cell batteries. The plasma discharge uses only inert gases or air, which are easy to maintain without any operational or safety concern. The low power mini-plasma formed in the inert gas/ air environment is used only to fragment and excite chemical species without destroying them; similar to flame photometry techniques. The detection means can detect both elemental and molecular (organic) information for targeted chemical agents. The device significantly reduces or completely eliminates potential false-positive responses. The device's portable size is compatible with real-time analysis. No pressurized environment is required for plasma operation; it uses a small, non-thermal microplasma source. Contact: Charles Gibson, Technology Transfer Division, 505-667-8087, gibson_charles_e@lanl.gov

Applicability of Tetrazolium Salts for the Measurement of Respiratory Activity and Viability of Groundwater Bacteria
Hatzinger, P.B., P. Palmer, R.L. Smith, C.T. Penarrieta, and T. Yoshinari.
Journal of Microbiological Methods, Vol 52, p 47-58, 2003

Aerobic respiration by indigenous bacteria in a sand and gravel aquifer was measured using tetrazolium salts and also by direct oxygen consumption using gas chromatography (GC). In groundwater and aquifer slurries, the rate of aerobic respiration calculated from the direct GC assay was more than 600 times greater than that obtained using the tetrazolium salt (INT). To explain this discrepancy, the toxicity of INT and two additional tetrazolium salts were investigated. The results of the study show that tetrazolium salt assays are likely to dramatically underestimate total electron transport system activity in groundwater, and although they may provide a reasonable overall estimate of viable cell numbers in a community of groundwater bacteria, some specific strains may be falsely considered nonviable by this assay due to poor uptake or reduction of the salts.

Application of Bio-Trap Samplers in Conjunction with Real-Time PCR (CENSUS) Analysis to Directly Assess Petroleum Hydrocarbon Degradation

Davis, G.A., D. Ogles, D. McElroy, and J. Streufert (Microbial Insights, Rockford, TN); A. Peacock (Univ. of Tennessee, Knoxville); K. Sublette (Univ. of Tulsa, Tulsa, OK).

The 11th Annual International Petroleum Environmental Conference, 11-15 October 2004, Albuquerque, NM. The Integrated Petroleum Environmental Consortium (IPEC), Univ. of Tulsa, OK.

Bio-Trap samplers are small devices that can provide an integrated picture of a microbial community over time, thus compensating for inherent variability associated with other subsurface sampling approaches. The samplers were combined with molecular-based diagnostic tools to evaluate microbial communities from three different BTEX-contaminated aquifers as a basis for developing remediation strategies. Molecular diagnostic tools based upon real-time PCR (CENSUS) were used to quantify the abundance of specific microbial functional genes associated with BTEX degradation. This combined approach led to an increased understanding of site dynamics and provided a rapid, direct method to obtain accurate information on the effectiveness of monitored natural attenuation and enhanced bioremediation strategies.

Application of H2O2 Lifetime as an Indicator of TCE Fenton-Like Oxidation in Soils

Baciocchi, R., M.R. Boni, and L. D'Aprile, Univ. di Roma, Tor Vergata, Roma, Italy.

Journal of Hazardous Materials, Vol 107 No 3, p 97-102, 19 Mar 2004

Hydrogen peroxide decomposition and trichloroethene (TCE) oxidation kinetics were studied in batch slurry experiments performed on two TCE-contaminated soils characterized by different texture and organic fraction. Experiments were also performed on sandy soil columns to more closely reproduce the typical conditions of an in situ treatment. The batch test results indicated that hydrogen peroxide lifetime was correlated to the oxidation efficiency--complete TCE oxidation was achieved only for the conditions characterized by longer hydrogen peroxide lifetime, which was obtained by addition of a stabilizer. The soil column experiments indicated that hydrogen peroxide decomposition, which was almost complete at 30 cm depth, was negligible when the stabilizer was added, and TCE oxidation was greatly improved. The authors conclude that hydrogen peroxide experiments may be useful in the first screening phase of design activity for selecting the most effective operating conditions for oxidation treatment.

Application of High-Resolution Imagery for Oil Fields Ecological Monitoring

Napryushkin, Alexandr A., Eugenia V. Vertinskaya, and Doug Gavilanes.

Remote Sensing for Environmental Monitoring, GIS Applications, and Geology IV. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5574, p 111-119, Oct 2004

The authors discuss the basic principles of the imagery interpretation approach adopted in the "LandMapper" system and describe the results of its application for Tomsk region oil fields pollution mapping using high resolution images acquired by QuickBird satellite.

Application of Ion-Sensitive Sensors in Water Quality Monitoring
Winkler, S., L. Rieger, E. Saracevic, A. Pressl, and G. Gruber, Vienna Univ. of Technology, Vienna, Austria.
Water Science & Technology, Vol 50 No 11, p 105-114, 2004

Most new sensors for water quality monitoring are compact in size and designed for in situ installation, and they use measurement principles that minimize maintenance demand. Recently, sensors based on ion-sensitive electrodes (ISEs) have been specially adapted for application in water quality monitoring. This paper describes the function principle of ISE sensors, their advantages and limitations, and the different methods for sensor calibration, drawing upon experiences with ISE sensors used in sewer networks, at different sampling points within wastewater treatment plants, and for surface water monitoring. The authors compare investment and operation costs of ISE sensors to those of other sensor types.

Arthrobacter sp. JS443-Based Whole Cell Amperometric Biosensor for p-Nitrophenol
Yu, Lei; P. Mulchandani; W. Chen; J. Wang; A. Mulchandani.
Electroanalysis, Vol 16 No 24, p 2030-2034, 2004

An amperometric microbial biosensor for highly sensitive and selective determination of p-nitrophenol (PNP) consists of PNP-degrader Arthrobacter sp. JS443 immobilized by entrapment in a Nafion polymer deposited on the top of a carbon paste electrode transducer. The biosensor is based on the measurement of the oxidation current of the intermediates 4-nitrocatechol and 1,2,4-benzenetriol formed by the highly selective oxidation of PNP by Arthrobacter sp. In tests at optimized conditions, the biosensor measured as low as 5 nM (0.7 ppb) of PNP with excellent selectivity. 3-Nitrophenol and 3-methyl-4- nitrophenol interfered, but phenolic compounds, such as 2-nitrophenol, phenol, and 3-chlorophenol, did not. The sensor was stable up to 3 days when stored in buffer at 4 degrees C.

Assessing Denitrification in Groundwater Using Natural Gradient Tracer Tests with 15N: In Situ Measurement of a Sequential Multistep Reaction
Smith, R.L., J.K. Bohlke, S.P. Garabedian, K.M. Revesz, and T. Yoshinari.
Water Resources Research, Vol 40, p 1-17, 2004

Denitrification was measured within a nitrate-contaminated aquifer using natural gradient tracer tests with 15N nitrate. The aquifer contained zones of relatively high concentrations of nitrite (up to 77 uM) and nitrous oxide (up to 143 uM). Previous studies at the site used the acetylene block technique to examine groundwater denitrification. Small-scale tracer tests were conducted by injecting 15N nitrate and bromide as tracers into a depth interval that contained nitrate, nitrite, nitrous oxide, and excess nitrogen gas. The tests showed that the rate of nitrate removal by denitrification was much slower than the rate of transport indicated by a 1-D transport model, which suggests that nitrate would migrate several kilometers downgradient before being completely consumed.

Assessment of Remote Sensing Capability By Ground Spectrometry Data in View of Monitoring of Oil-Contamination Areas and Man-Caused Waste Storage Places
Polyakov, A.I. (Ministry of Education & Science, Almaty, Kazakhstan); B.V. Geldyev; N.P. Ogar; M.I. Bitenbaev.
Geo-Imagery Bridging Continents: 20th ISPRS Congress, 12-23 July 2004, Istanbul, Turkey. International Society for Photogrammetry & Remote Sensing and Spatial Information Sciences, p 740-742, 2004

The authors present optical-spectrometric data on optical reflectance spectra taken from spills of oil and pure mazut (heavy fuel oil) in soils. The data prove that even insignificant mazut contamination

in soils leads to noticeable changes in characteristics of optical reflectance spectra that are quite detectable by remote sensing techniques. Reliable area monitoring for oil contamination can be carried out by remote sensing techniques in combination with field spectrometry.
http://www.cartesia.org/geodoc/isprs2004/comm7/papers/145.pdf

ATR-FTIR Spectroscopic Analysis of Metal-Complexed EDTA and EDDS

Pidsosny, Katie L. and Katherine C. Lanigan, Univ. of Detroit Mercy, Detroit, MI.
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. CHED 136.

Analysis by ATR-FTIR (Attenuated Total Reflectance-Fourier Transform Infrared) spectroscopy affords greater spectroscopic resolution to aqueous solutions by minimization of the absorption of infrared radiation by water. The authors discuss examinations of EDTA (ethylenediaminetetraacetic acid) and EDDS (ethylenediamine-N, N'-disuccinic acid) in the aqueous phase in which pH was varied while the infrared spectra of these compounds in the presence of metal ions were recorded using a flow-through cell for in situ analysis. Metal-ligand complexation was detected by monitoring vibrational band frequencies.

Attachment of an Electron-Withdrawing Fluorophore to a Cryptand for Modulation of Fluorescence Signaling

Bag, B. and P.K. Bharadwaj, Indian Inst. of Technology, Kanpur, India.
Inorganic Chemistry, Vol 43 No 15, p 4626-30, 26 July 2004

When the fluorophore 7-nitrobenz-2-oxa-1,3-diazole is attached to a secondary amine, it provides an integrated fluorophore-receptor configuration. When a metal ion enters the cavity, the photoinduced intramolecular electron transfer (PET) is blocked, causing recovery of fluorescence, with Cd(II) giving the highest quantum yield. With perchlorate or tetrafluoroborate salts of Cd(II), the metal ion enters the cavity, causing recovery of fluorescence; however, in the presence of coordinating ions, such as Cl-, NO3-, and SCN-, the metal ion comes out of the cavity, causing PET to take place once again, and the fluorescence is lost. Hence, translocation of Cd(II) between the inside and outside of the cryptand cavity can lead to reversible on/off fluorescence.

Automated Water Analyser Computer Supported System (AWACSS) Part II: Intelligent, Remote-Controlled, Cost-Effective, On-Line, Water-Monitoring Measurement System

Tschmelak, J., et al, Eberhard-Karls-Univ. of Tuebingen, Tuebingen, Germany.
Biosensors and Bioelectronics, Vol 20 No 8, p 1509-1519, 15 Feb 2005

This paper presents a novel analytical system, the Automated Water Analyser Computer Supported System (AWACSS), which is based on immunochemical technology. The system can measure several organic pollutants at low nanogram per liter level in a single quick (minutes) analysis without any prior sample pre-concentration or pre-treatment steps. Drinking, ground, surface, and waste water systems were used for the evaluation of system performance in analyzing a wide range of organic pollutants, such as modern pesticides, endocrine-disrupting compounds and pharmaceuticals. This paper reports on the system performance, first real sample measurements, and an international collaborative trial (inter-laboratory tests) to compare the biosensor with conventional analytical methods. Additionally, it describes a protocol that was developed and applied for analysis of river sediments and food samples. More information about the AWACSS is available on line.
http://www.ei.sk/resource/WP5%20Newsletter%20AWACSS%20FINAL.pdf

Augmenting Groundwater Monitoring Networks near Landfills with Slurry Cutoff Walls
Hudak, P.F., Univ. of North Texas, Denton.
Environmental Monitoring & Assessment, Vol 90 No 1-3, p 113-120, Jan 2004

A test of slurry cutoff walls used in conjunction with monitoring wells to detect contaminant releases from a solid waste landfill took place in a small landfill oriented oblique to regional groundwater flow in a shallow sand aquifer. A 5-well network with no cutoff wall detected 81% of contaminant plumes originating within the landfill's footprint, whereas detection efficiencies of networks augmented with cutoff walls ranged from 81 to 100%. The most efficient network--four wells and a centrally located, downgradient cutoff wall--detected 100% of contaminant releases. The method in this case was not cost-effective, as increases in detection efficiency were too small to offset construction costs for cutoff walls. An 8-well network with no cutoff wall also attained a 100% detection efficiency at about one-third the cost of the most efficient wall-augmented network.

Autonomous Monitoring of Fluid Movement Using 3-D Electrical Resistivity Tomography
LaBrecque, D.J. (Multi-Phase Technologies, LLC, Sparks, NV); G. Heath (INEEL); R. Sharpe (Multi-Phase Technologies, LLC, Sparks, NV); and R. Versteeg (INEEL).
Journal of Environmental and Engineering Geophysics, Vol 9 No 3, p 167-176, Sep 2004

Potential applications of the electrical resistivity tomography (ERT) method include monitoring of advanced remediation methods, vadose zone fluid-flow, and the ground beneath the tanks at the Hanford reservation. For the method to be cost effective, future systems will need to be highly automated. The authors compare different strategies for collecting 3-D data sets and provide an example of a successful autonomous acquisition system that was used to monitor a field experiment at the Idaho National Engineering and Environmental Laboratory (INEEL). The system collected data used to monitor infiltration of water into interbedded sediment and basalt layers.
http://www.mpt3d.com/AutonomousMonitoringUsingERT.pdf

Autonomous Water Monitoring Sensor
LANL Reference No 596; DOE Reference No 104,850.
Los Alamos National Laboratory, Technology Transfer Division, 9 June 2005

The invention is a material that can be coated onto the surface of a sensor transducer that will permit the autonomous, near real-time detection of pathogens in various water supply or storage systems. The material is a thin film consisting of a self-assembled monolayer (SAM) of molecules that minimize non-specific absorption of organisms and proteins, and a low concentration of a multidentate ligand that is covalently attached to the SAM surface through a variable length linker. Transduction of the molecular recognition event can be achieved by several approaches currently being developed, including a shear-horizontal surface acoustic wave device, the Hartman interferometer, and various optical detection sensors, such as surface plasmon resonance. The sensor is reagentless, can be self-cleaned, and can operate in the field with minimal attendance. The sensor can be applied to water quality monitoring, process water monitoring, and assessment of biofouling. Contact: Allen Morris, LANL Technology Transfer Division, 505-665-9597, tamorris@lanl.gov

Avoidance Tests with Collembola and Earthworms as Early Screening Tools for Site-Specific Assessment of Polluted Soils

da Luz, T.N., R. Ribeiro, and J.P. Sousa, Univ. de Coimbra, Largo Marques de Pombal, Coimbra, Portugal.

Environmental Toxicology & Chemistry, Vol 23 No 9, p 2188-93, Sep 2004

Avoidance tests with earthworms and collembolans were conducted to demonstrate their feasibility as early screening tools for assessing the toxic potential of metal-polluted soils. Four different soils were obtained from an abandoned mining area, and all possible paired combinations were assessed for an avoidance response by the organisms. Both species were able to avoid the most contaminated soils, though the earthworms and springtails differed in sensitivity to metals, especially when testing the two most polluted soils, which had different contamination profiles. Earthworms exhibited a more consistent, less variable response than springtails. Overall, the organisms showed the potential to be used as screening tools in contaminated land.

Bioavailable Ferric Iron (BAFeIII) Assay, ESTCP Project Number CU-0009: Cost and Performance Report

Lebron, C. (NFESC); P. Evans, M. Trute, R. Olsen, and R. Chappell (CDM); J. Wilson and C. Adair (EPA/Ada); E. Weber, J. Kenneke, and B.T. Thomas (EPA/Athens); T. DiChristina (GIT); J. Drexler (UC).

Environmental Security Technology Certification Program (ESTCP), CR-05-005-ENV, 41 pp, 2005

A bioavailable ferric iron (BAFeIII) assay was invented and developed by CDM with funding from the U.S. Air Force. This report describes the demonstration and validation of this novel analytical technology at four DoD installations. The assay is a standardized bioassay that directly measures the concentration of BAFeIII in soil or sediment. A BAFeIII test kit based on the assay is manufactured by New Horizons Diagnostics Corporation (NHD) of Columbia, MD. BAFeIII is an important terminal electron acceptor with significant assimilative capacity in many natural environments. Dissolved ferrous iron (Fe II) in groundwater is typically measured to assess Fe III reduction and calculate assimilative capacity, but this measurement underestimates this terminal electron accepting process because most Fe II remains bound to the soil. Dissolved Fe II also gives no indication of the amount of Fe III present in aquifer soil that is bioavailable. BAFeIII in the soil must be measured to quantify the true assimilative capacity of an aquifer. Iron-reducing bacteria (FeRB) use and are dependent on BAFeIII. FeRB are known to oxidize or mineralize various organic compounds, such as benzene, toluene, vinyl chloride (VC), and methyl tertiary butyl ether (MTBE). Continued activity over a period of years is dependent on the presence of sufficient BAFeIII. BAFeIII can also affect reductive dechlorination in MNA and EAB applications. BAFeIII can result in TCE being reductively dechlorinated to cDCE only, and further reductive dechlorination can be inhibited. Thus, knowledge of the BAFeIII concentration can indicate the potential for incomplete reductive dechlorination of TCE. It can also be used for planning EAB remedies. If the BAFeIII concentration is sufficient to inhibit cDCE reductive dechlorination, reductive dechlorination of TCE to cDCE and VC followed by oxidative biodegradation of VC and possibly cDCE under iron-reducing conditions may be a better approach. The overall objective of this project was to demonstrate and validate the performance of the BAFeIII assay as an analytical technology for use in supporting bioremediation.

http://stinet.dtic.mil/cgi-bin/fulcrum_main.pl?database=ft_u2&keyfieldvalue=ADA435716&filename=%2Ffulcrum%2Fdata%2FTR_fulltext%2Fdoc%2FADA435716.pdf

Biodegradation of Monoethanolamine in Soil Monitored by Electrical Conductivity Measurement: an Observational Approach
Wong, R.C.K. (Univ. of Calgary, Calgary, AB, Canada); L.R. Bentley; A.W. Ndegwa; A. Chu; M. Gharibi; S.R.D. Lunn.
Canadian Geotechnical Journal, Vol 41 No 6, p 1026-1037, 2004

Monoethanolamine (MEA) is commonly used by the natural gas industry to remove acid gases from the natural gas stream. Tests conducted to examine the biodegradability of MEA in soil indicate that MEA is successfully biodegraded or transformed into simple compounds under aerobic and anaerobic conditions. During degradation of MEA, five ranges of electrical conductivity (EC) were noted and correlated with five geochemical zones or ranges consisting of various concentrations of MEA and its byproducts. By identifying these in situ EC ranges, an electrical resistivity tomography image can allow a geochemical interpretation of the subsurface that can provide useful information for detailed site assessment and remediation design.

Bioluminescent Bioreporter Integrated Circuit Detection Methods
Simpson, Michael L., Michael J. Paulus, Gary S. Sayler, Bruce M. Applegate, Steven A. Ripp.
Assignee: UT-Battelle, LLC, Oak Ridge, TN.
U.S. Patent and Trademark Office, Washington, DC. U.S. Patent 6,905,834, 14 June 2005

This patent discloses monolithic bioelectronic devices comprising a bioreporter and an OASIC. These bioluminescent bioreporter integrated circuits are useful in detecting substances such as pollutants, explosives, and heavy metals residing in areas such as groundwater, industrial process vessels, and battlefields. Also disclosed are methods and apparatus for detection of particular analytes, including ammonia and estrogen compounds.

A Biomarker Model of Sublethal Genotoxicity (DNA Single-Strand Breaks and Adducts) Using the Sentinel Organism Aporrectodea longa in Spiked Soil
Martin, F.L. (Lancaster Univ., Lancaster, UK); T.G. Piearce; A. Hewer; D.H. Phillips; K.T. Semple.
Environmental Pollution, Vol 138 No 2, p 307-315, Nov 2005

Earthworms (Aporrectodea longa) are being tested for potential use as risk biomarkers during the remediation of contaminated land. To determine whether genotoxicity measures could be applied to this organism's intestinal tissues, earthworms were added for 24 h (or 7 days) to soil samples spiked with benzo[a]pyrene (B[a]P) and/or lindane. The preliminary results suggest that earthworm tissues may be incorporated into genotoxicity assays to facilitate hazard identification within terrestrial ecosystems.

Bruker Daltonics Inc. Raid-M Ion Mobility Spectrometer: Environmental Technology Verification Report
Hofacre, K., T. Derringer, D. Folsom, P. Larkowski, T. Kelly, L. Sinnott, C. Hamilton, and Z. Willenberg, Battelle, Columbus, OH.
Environmental Technology Verification (ETV) Program, 55 pp, Apr 2004

The RAID-M is a chemical detector that uses the principle of IMS to detect, classify, quantify, and continuously monitor concentrations of chemical warfare (CW) agents and toxic industrial chemicals. The identity of substances detected is displayed both by class and by specific agent, simulant, or toxic chemical. All classes can be displayed independently. Relative concentrations are indicated by a bar display with eight increments. In addition to use in the field, the RAID-M is designed to be capable of operating within collective protection facilities. The RAID-M can be operated while

being held in one hand. It has no protruding parts and weighs less than 2.80 kilograms (6.4 pounds), excluding battery. The RAID-M contains a small radioactive sealed source that is completely housed and is such that RAID-M can be stored in bulk. The RAID-M is 400 millimeters (mm) (15.7 inches) long, 115 mm (4.5 inches) wide, and 165 mm (6.5 inches) high. The RAID-M is of a one-tube design, with automatic polarity switching (i.e., both positive and negative ions are automatically monitored, in alternate intervals of 2 to 3 seconds), and is fully microprocessor-controlled. It has a remote display and control option. The display shows agent identity and a relative indication of hazard level. The RAID-M incorporates a built-in audible alarm to indicate agent detection, and visual alarms to warn of a low battery and other faults. The RAID-M is powered by an integral, primary battery and can accept power input from a variety of sources including vehicles (12- to 24-volt direct current nominal) or from a 240-volt, 50-Hertz, alternating current power supply. This report details an evaluation of the instrument for response time, recovery time, accuracy, repeatability, response threshold, temperature and humidity effects, interference effects, cold-/hot-start behavior, battery life, and operational characteristics.
http://www.epa.gov/etv/verifications/vcenter12-1.html

Calibration and Deployment of Custom-Designed Bioreporters for Protecting Biological Remediation Consortia from Toxic Shock
Wiles, Siouxsie and Andrew K. Lilley (CEH Oxford, Oxford, UK); Jim C. Philp (Napier Univ., Edinburgh, Scotland); Mark J. Bailey and Andrew S. Whiteley (CEH Oxford, Oxford, UK).
Environmental Microbiology, Vol 7 No 2, p 260-269, Feb 2005

Site-specific lux-based bioreporters have been developed from an industrial wastewater treatment system addressing coking effluents. The authors describe biosensor deployment to provide a strategic sensing network for protecting bacterial communities involved in the biological breakdown of coking effluents. This evaluation demonstrated the utility of strategic placement of reporters around heavy industry treatment systems and the reliability of the reporter strains under normal operational conditions.

Case Study of the Triad Approach: Expedited Characterization of Petroleum Constituents and PCBs Using Test Kits and a Mobile Chromatography Laboratory at the Former Cos Cob Power Plant Site
U.S. EPA, Office of Superfund Remediation and Technology Innovation, Brownfields Technology Support Center, Washington, DC.
EPA 542-R-04-008, 116 pp, June 2004

This case study was prepared by the Brownfields Technology Support Center as part of EPA's ongoing initiative to promote the use of an integrated Triad approach to limit decision uncertainty at hazardous waste sites through the use of sound science. The Triad approach, which consists of systematic planning, dynamic work strategies, and real-time measurement technologies that include field-based analyses is a viable method for streamlining site investigations.
http://www.clu-in.org/download/char/coscob-casestudy_final.pdf

Characterization and Availability of Cyanide in Solid Mine Tailings from Gold Extraction Plants
Zagury, G.J., K. Oudjehani, and L. Deschenes, Ecole Polytechnique de Montreal, Montreal, QC.
Science of the Total Environment, Vol 320 Nos 2-3, p 211-224, 29 Mar 2004

Solid mill tailings aged 6 to 9 years and recently discharged tailings from two gold mining sites were sampled at various depths. An assessment of the soluble cyanide fraction showed the total cyanide concentration (CNT) in fresh tailings was higher and the pH more alkaline compared to the aged ones. In aged tailings, the enumeration of total heterotrophic and cyanide-resistant bacteria showed significant indigenous microflora, but no growth on agar plates was detected in fresh tailings, suggesting an evolution and a gradual acclimatization of bacterial populations with weathering. The fresh tailings contained elevated concentrations of CNT, weak acid dissociable cyanide (CNWAD), cyanate (CNO-), and thiocyanate (SCN-) in the supernatant solution collected in situ, whereas these species were not detectable in aged tailings. In fresh tailings, approximately 50% of the cyanides were quantifiable with the standard acid reflux/distillation method, whereas only 15 to 33% of the actual total cyanide content was measured by the standard method in aged tailings. These results underline the necessity of performing a preliminary alkaline extraction prior to total cyanide determination.

Characterization of Microbial Communities in MTBE and TBA Contaminated Aquifers Utilizing Bio-Sep Bio-Traps

Sublette, K.L. and M. Boone (Univ. of Tulsa, Tulsa, OK); D. White, A. Peacock, and A. Biernacki (Univ. of Tennessee, Knoxville); G. Davis (Microbial Insights, Inc., Rockford, TN); R. Kolhatkar (Atlantic Richfield, La Palma, CA).

Albuquerque, NM. The Integrated Petroleum Environmental Consortium (IPEC), Univ. of Tulsa, OK. 2004

Subsurface biofilm sampling by conventional means requires coring of aquifer sediments and extraction of viable microorganisms or biomarkers (lipids, DNA); however, the efficiency of these extractions varies with the geochemistry of the sediments. Biofilms characteristic of aquifer conditions can be rapidly and efficiently collected using a biofilm sampling system or "bio-trap" based on Bio-Sep technology. Bio-Sep consists of spherical beads 3 to 4 mm in diameter engineered from a composite of 25% aramid polymer (Nomex) and 75% powdered activated carbon (PAC) with a porosity of 75%. The median pore diameter is 1.9 microns, but large macropores (> 20 microns) also exist inside the beads. Beads are surrounded by an ultrafiltration-like membrane with pores of 1 to 10 microns; the internal surface area is greater than 600 square m/g. These sampling systems were used to investigate the microbiology of three aquifers containing MTBE, TBA, and BTEX. Bio-traps were incubated in each aquifer for 30 and 60 days and analyzed by phospholipids fatty acid (PLFA) analysis and PCR amplification of 16S rDNA, followed by DGGE and sequencing of major bands.

Chemical and Biological Sensors: Defining Suitability for Sensor Networks

Wilson, Denise, Univ. of Washington, Seattle.

The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. ANYL 33.

This paper addresses sensor network issues of signal stability and extraction in terms of (a) identifying the most likely technologies matched to sensor networks, (b) outlining key characteristics of these sensors, and (c) presenting strategies for overcoming issues with fouling, drift, noise, calibration, and other sensor instabilities at the signal-processing level. Examples are provided of surface plasmon resonance for environmental monitoring, miniaturized fluorescence analysis systems for biological monitoring, and sensors containing chemiresistors for monitoring toxic vapors.

Environics USA Inc. M90-D1-C Chemical Warfare Agent Detector: Environmental Technology Verification Report
Hofacre, K., T. Derringer, D. Folsom, T. Kelly, L. Sinnott, & Z. Willenberg, Battelle, Columbus, OH.
U.S. EPA, Environmental Technology Verification (ETV) Program, 47 pp, Dec 2004

The M90-D1-C CW agent detector is designed to detect and identify nerve, blister, blood, and choking agents using Environics' patented open-loop ion mobility spectrometry (IMS) technology to provide continuous, real-time operation without the need for expendable desiccant cartridges or membranes. The M90-D1-C is fully automatic and provides the operator with audible and visible alarms upon detecting CW agents. The M90-D1-C display identifies the agent class (nerve, blister, blood), indicates the relative agent concentration (low/medium/high), and indicates whether the concentration is increasing or decreasing. This alarm information can be provided to a remote computer/control station through the data connector on the M90-D1-C. The M90-D1-C can be upgraded to detect new agents by changing data libraries. The M90-D1-C is a multi-application instrument, capable of operating as a point detector to provide an early warning of approaching toxic chemical gas or as a chemical agent monitor to identify and monitor personnel, vehicles, and equipment for contamination. The rugged instrument is generally carried by people, but it can be installed on vehicles. It also can be used as a fixed detector, operating without constant supervision. Both local and distant alarms are provided, and the M90-D1-C can be used to automatically trigger closing down ventilation systems to secure buildings and positions from further agent contamination. This report details an evaluation of the instrument for response time, recovery time, accuracy, repeatability, response threshold, temperature and humidity effects, interference effects, cold-/hot-start behavior, battery life, and operational characteristics.
http://www.epa.gov/etv/verifications/vcenter12-1.html

Chitosan-Clay Nanocomposites: Application as Electrochemical Sensors
Darder, M., M. Colilla, and E. Ruiz-Hitzky, Inst. de Ciencia de Materiales de Madrid, CSIC, Cantoblanco, Madrid, Spain.
Applied Clay Science, Vol 28 Nos 1-4, p 199-208, Jan 2005

Biopolymer/clay nanocomposites are being developed into electrochemical sensors for the potentiometric determination of anionic species. The high affinity between chitosan, a cationic natural polymer, and the montmorillonite clay substrate is the basis of the high stability of the intercalated biopolymer against desorption or degradation, as well as the attendant long-term stability of the developed sensors. The film-forming tendency of chitosan is reduced due to its interaction with the montmorillonite, leading to robust 3-D nanocomposites that exhibit both structural and functional properties. Combined with graphite particles, these materials are employed simultaneously as the active phase and the electronic collector of the developed electrochemical sensors. The resulting sensors show a higher selectivity towards monovalent rather than di- or trivalent anions and the best potentiometric response towards nitrate ions.

A Comparison of Classical and Molecular Methods for Counting Soil Bacteria at the Site of an Old Crude Oil Spill
Key, Kate (Rhodes College, Memphis, TN); Kathleen Duncan (Univ. of Oklahoma, Norman); Kerry L. Sublette (Univ. of Tulsa, Tulsa, OK).
The 11th Annual International Petroleum Environmental Conference, 11-15 October 2004, Albuquerque, NM. The Integrated Petroleum Environmental Consortium (IPEC), Univ. of Tulsa, OK.

Extraction of soil bacteria with a buffer followed by dilution and plating on a selective agar medium is a classical method of counting soil bacteria. Because research has shown that less than 10% of all soil bacteria are actually culturable, this method may provide an incomplete picture of the soil microbe community, though it is useful in providing temporal or spatial trends in specific nutritional groups. All soil microbes posses a cytoplasmic membrane composed of a bilayer of phospholipids and proteins. These phospholipids are readily extracted from soil, and quantitated by GC/MS. Upon cell death, phospholipids are rapidly broken down; hence, phospholipid concentrations (pmol/g soil) reflect live culturable and non-culturable biomass. Further characterization of the fatty acid components of these phospholipids yields valuable information about community structure, metabolic status, and adaptation to environmental stress. In this presentation, phospholipid fatty acid (PLFA) analysis has been compared to viable plate counts (PCA and hydrocarbons) in an investigation of an old crude oil spill. PLFA analysis provided much more information about soil microbial communities and their activity than the classical viable plate counts, though the hydrocarbon-amended plates did provide information on the spatial distribution of hydrocarbon degraders not ascertained by PLFA analysis.

Comparison of Diffusion- and Pumped-Sampling Methods to Monitor Volatile Organic Compounds in Massachusetts, July 1999-December 2002
Archfield, S.A., and D.R. LeBlanc.
U.S. Geological Survey Scientific Investigations Report 2005-5010, 53 pp, 2005

To evaluate diffusion sampling as an alternative method to monitor volatile organic compound (VOC) concentrations in groundwater, concentrations in samples collected by traditional pumped sampling methods were compared to concentrations in samples collected by diffusion sampling for 89 monitoring wells at or near the Massachusetts Military Reservation, Cape Cod. Samples were analyzed for 36 VOCs. There was no substantial difference between the ability of diffusion and pumped samples to detect the presence or absence of a VOC. In wells where VOCs were detected, diffusion-sample concentrations of tetrachloroethene (PCE) and trichloroethene (TCE) were significantly lower than pumped-sample concentrations. Because PCE and TCE concentrations detected in the wells dominated the calculation of many of the total VOC concentrations, when VOC concentrations were summed and compared by sampling method, visual inspection also showed a downward concentration bias in the diffusion-sample concentration. The degree to which pumped- and diffusion-sample concentrations agreed was not a result of variability inherent within the sampling methods or the diffusion process itself. A comparison of the degree of agreement in the results from the two methods to 13 quantifiable characteristics external to the sampling methods offered only well-screen length as being related to the degree of agreement between the methods; however, there is also evidence to indicate that the flushing rate of water through the well screen affected the agreement between the sampling methods. Despite poor agreement between the concentrations obtained by the two methods at some wells, the degree to which the concentrations agree at a given well is repeatable. A one-time, well-by-well comparison between diffusion- and pumped-sampling methods could determine which wells are good candidates for the use of diffusion samplers. For wells with good method agreement, the diffusion-sampling method is a time-saving and cost-effective alternative to pumped-sampling methods in a long-term monitoring program.
http://water.usgs.gov/pubs/sir/2005/5010/

Comparison of Radiometric and Chemometric Sensitivities for Heterodyne and Direct Detection DIAL
Senft, Daniel C.; D.F. Pierrottet; J.A. Dowling; B.T. Kelly; A.P. Peredo.
Report No: AFRL-DE-PS-TR-2004-1094, DTIC: ADA429186, 126 pp, July 2004

The heterodyne / direct detection DIAL comparison (HD/DD DC) experiment series was conducted at Kirtland AFB, NM, to simultaneously characterize and compare the radiometric and chemical detection sensitivities of heterodyne and direct detection DIAL systems. The system

developed by the Air Force Research Laboratory Directed Energy Directorate demonstrated the first known programmable and shot-to-shot wavelength-agile heterodyne DIAL measurements. The experiments studied radiometric issues, speckle mitigation through spread spectrum (modelocked) operation, and chemical detection sensitivities. The measurements were performed over horizontal paths at standoff ranges from 4 to 15 km, using both natural and man-made targets. Heterodyne and direct detection radiometric and chemometric results are presented and contrasted, and are compared with predictions from simulations and models.
http://handle.dtic.mil/100.2/ADA429186

Comparison of SPME Headspace Analysis to US EPA Method 5030/8260B for MTBE Monitoring
Stringfellow, W.T. and K.-C. Oh.
Ground Water Monitoring & Remediation, Vol 25 No 2, p 52-58, 2005

This paper presents a simple, automated solid-phase microextraction (SPME) method for the analysis of MTBE and TBA in water. The headspace (HS) of a water sample is extracted with a carboxen/polydimethylsiloxane SPME fiber, and the MTBE and TBA are desorbed into a gas chromatograph (GC) and detected using a mass spectrometer (MS). The method is optimized for the routine analysis of MTBE and TBA, with a level of quantitation of 0.3 and 4 ug/L, respectively, in water. When this simple, inexpensive, accurate, and sensitive method was compared with the certified U.S. EPA Method 5030/8260B (purge and trap/GC/MS) using split samples, it showed directly comparable results.

Comparative Study of Four Sequential Extraction Methods for Mercury Speciation in Contaminated Soils
Gavilan, I.G. and E.S. Santos (UNAM, Ciudad Universitaria, Coyoacan, Mexico); M. Yarto (Inst. Nacional de Ecologia, Insurgentes Cuicuilo, Mexico); J. Castro-Díaz and A. Gavilan-Garcia (Inst. Nacional de Ecologia, Delegacion Coyoacan, Mexico); R. Rosiles (UNAM, Ciudad Universitaria, Mexico); S.T. Suarez; J. Esquivel.
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. ENVR 160.

The speciation of mercury is a critical determinant of its mobility, reactivity, and potential bioavailability in mining regions. Activities developed in this project include (1) a review of the four sequential extraction methods as reported in scientific literature by Biester, DiGiulio, Lacerda, and Bloom and (2) application of the selective extraction methodologies for mercury speciation in blank soils with a known concentration of different mercury species. After selective extraction, quantification of mercury was developed at each stage by cold vapor atomic absorption spectrometry. Overlapping of the different species was evaluated to identify deviations to the methodology related to the soil properties.

Concrete Slab and Bio-Shield Sampling, Characterization, and Analysis Using the Trupro(R) Advanced Sampling and Analysis System at Omega West Reactor Los Alamos National Laboratory
Aggarwal, S., G. Charters, and D. Thacker, New Millennium Nuclear Technologies, Lakewood, CO.
Proceedings of Waste Management 2004, 29 February - 4 March, Univ. of Arizona, Tucson. Paper WM-4067, 8 pp, 2004

Radioisotopes can penetrate porous concrete and contaminate the concrete well below the easily measured surface. In conjunction with portable radiometric instrumentation, TRUPRO(R), a concrete profiling technology, produces a profile of radiological or chemical contamination through the material being studied. TRUPRO(R) has four major components: a drill with a specialized cutting and sampling

head, drill bits, a sample collection unit, and a vacuum pump. The drill head is used under hammer action to penetrate hard surfaces, which causes the bulk material to be pulverized as the drill travels through the radioactive media efficiently transmitting to the sampling unit a representative sample of powdered bulk material. The profiling equipment is designed to sequentially collect all material from the hole. The bulk material samples are continuously retrieved by use of a specially designed vacuumed sample retrieval unit that prevents cross contamination of the clean retrieved samples. No circulation medium is required with this profiling process; therefore, the only byproduct from drilling is the sample. The data quality, quantity, and representativeness can be used to produce an activity profile from the hot spot surface into the material being sampled. The performance of a volumetric concrete or metal characterization safely and quickly (without lab intervention) is the objective of this characterization technology. This presentation discusses the deployment of a TRUPRO(R) concrete sampling and profiling tool to the Omega West Reactor located at Technical Area 2 in Los Alamos Canyon. The slabs and subsurface structures were to be sampled and characterized in support of cost-effective, safe, and waste-minimized removal of the slabs and bioshield foundation footers for DOE's Cerro Grande Rehabilitation Project.
http://www.wmsym.org/abstracts/2004/pdfs/4067.pdf

Continuous Microwave-Assisted Extraction Coupled with Derivatization and Fluorimetric Monitoring for the Determination of Fluoroquinolone Antibacterial Agents from Soil Samples
Morales-Munoz, S., J.L. Luque-Garcia, and L. de Castro, Univ. of Cordoba, Cordoba, Spain.
Journal of Chromatography A, Vol 1059 No 1-2, p 25-31, 3 Dec 2004

An automated screening approach for fluoroquinolone (FQ) antibiotics (norfloxacin and ciprofloxacin) in soil samples consists of dynamic microwave-assisted extraction and subsequent real-time, on-line monitoring of the extracted analytes. The extraction stops when complete leaching of the analytes has been reached (independently of the sample matrix), avoiding excess extraction times. The target analytes are fluorometrically monitored after derivatization with a terbium /tri-n-octylphosphine oxide/cetylpyridinium chloride/acetate buffer solution. The approach allows monitoring only of the overall content of the species that yield fluorescent complexes with the derivatizing reagent, so the use of chromatography is required for individual separation/quantification of the target compounds.

Cooper Environmental Services XCEM Multi-Metals Continuous Emission Monitor: Environmental Technology Verification Report
Myers, J., T. Kelly, C. Lawrie, and K. Riggs, Battelle, Columbus, OH.
U.S. EPA, Environmental Technology Verification (ETV) Program, 56 pp, May 2002

The XCEM extracts a sample of stack gas and concentrates the metals of interest on a chemically treated filter tape. Following collection, the filter tape advances, moving the sample spot to an analysis area where a laboratory-grade X-ray fluorescence (XRF) instrument is used to determine metal mass. The system is automated for extraction, sampling and analysis, and control, and produces concentration data every 10 to 20 minutes for 19 elements of interest. In comparisons with results from EPA Method 29 (M29), the XCEM relative accuracy for Cd, Cr, and Ni was less than 26%. The remaining metals (As, Ba, Hg, Pb, Sb, and Zn) had RA values between 37 and 67%. The reported XCEM concentrations were uniformly high for As. The XCEM was consistently low for Zn, Ba, and Sb. XCEM Hg readings were very low at the start of each test day, rising gradually until they stabilized. This behavior is possibly a result of equilibration of the XCEM inlet line with vapor-phase mercury. The best agreement of XCEM and M29 Hg results (within about 20%) was found with M29 runs

conducted late in the test day, when XCEM readings had stabilized. When calculated using nine runs, the RA for Cd, Cr, and Ni was between 11 and 20% and the remaining metals had an RA between 36% (Pb) and 82% (Hg). Correlation of XCEM and M29 results was calculated for five elements that varied enough during the test to justify this comparison. For Ni, Pb, Sb, and Zn, r2 values exceeding 0.95 were found, though the r2 value for Pb decreased to 0.75 when the high Pb levels in Runs 1 and 2 were excluded. For Hg, an r2 value of 0.39 was found, due, in part, to the equilibration issue noted above. The XCEM's precision, as RSD of successive readings with stable metal concentrations, ranged from 6 to 21% over the nine target metals. This precision includes variability in the metals injection and the test facility, as well as in the XCEM itself. XCEM span and zero drift were assessed over the four test days. Daily span readings of Cd, Cr, Hg, and Pb exhibited percent RSD values of 0.47 to 2.33 and no significant trends over time. Zero readings for all four elements were near or below the respective detection limits on all test days. The RSD of the XCEM's Pd internal standard was approximately 2.5%, with no significant trend over time. The XCEM results showed statistically significant positive and negative bias relative to M29 results for all the target metals, based on M301 procedures. The XCEM functioned in an automated manner and automatically recorded concentrations, temperatures, flow rates, and QA data. It exhibited no mechanical problems, had an effective uptime of 100%, and a response time of 20 minutes.
http://www.epa.gov/etv/verifications/vcenter1-20.html

Coordination Chemistry of N-Aminopropyl Pendant Arm Derivatives of Mixed N/S-, and N/S/O-Donor Macrocycles, and Construction of Selective Fluorimetric Chemosensors for Heavy Metal Ions
Aragoni, M.C., et al, Univ. degli Studi di Cagliari, Univ. di Monserrato, Monserrato, CA, Italy.
Dalton Transactions, No 18, p 2994-3004, 21 Sep 2005

This paper details an investigation of the coordination chemistry of the N-aminopropyl pendant arm derivatives (L(1c-4c)) of mixed donor macrocyclic ligands toward various heavy metals in aqueous solution. The protonation and stability constants with the metal ions were determined potentiometrically and compared, where possible, with those of the unfunctionalized macrocycles. The measured values show that Hg(II) and Cu(II) in water have the highest affinity for all ligands considered, with the N-aminopropyl pendant arm weakly coordinating the metal centers.

Cost Analysis of ELISA, Solid-Phase Extraction, and Solid-Phase Microextraction for the Monitoring of Pesticides in Water
Dalvie, M.A., E. Sinanovic, L. London, E. Cairncross, A. Solomon, and H. Adam, Univ. of Cape Town, Cape Town, South Africa.
Environmental Research, Vol 98 No 1, p 143-50, May 2005

A cost analysis of three analytical methods--enzyme-linked immunosorbent assays (ELISA), solid-phase microextraction (SPME), and traditional solid-phase extraction methods (SPE)--was based on a hypothetical sampling scenario encompassing a grape farming rural region, weekly grab samples collected from eight sites, transport of samples via courier, and endosulfan and chlorpyrifos analysis conducted by a local higher educational institution laboratory. SPME had the lowest cost per sample (US $37), followed by SPE (US $48.50) and ELISA (US $60). Recurrent costs formed the bulk of the costs of all three methods (91 to 97%). The cost of supplies was particularly high for ELISA (US $34 per sample). Other laboratories in South Africa quote a substantially higher charge per sample for all three methods than the example's estimates. The sensitive, reliable, quick, and less costly SPME method is recommended for the long-term monitoring of pesticide pollution.

Cost and Performance Report for LNAPL Characterization and Remediation: Partition Interwell Tracer Testing (PITT) and Rapid Optical Screening Tool (ROST) Characterization and Evaluation of the Feasibility of Surfactant Enhanced Aquifer Remediation (SEAR) at the Chevron Cincinnati Facility, Hooven, OH
U.S. EPA, Office of Superfund Remediation and Technology Innovation, Washington, DC.
EPA 542-R-05-017, 42 pp, Feb 2005

This case study summarizes the application of innovative technologies used in the site characterization and feasibility studies and a technology evaluation of surfactant enhanced aquifer remediation (SEAR) conducted for LNAPL at the Chevron Cincinnati Facility in Hooven, OH. It summarizes the evaluation of the use of SEAR as a potential innovative and aggressive technology to treat LNAPL at this site.
http://www.epa.gov/tio/download/rtdf/napl/cpchevron.pdf

Cost-Effective Investigation of Contaminated Land: Application of the Innovative OCLI Method to Organic Contamination
Taylor, P.D. and M.H. Ramsey, Univ. of Sussex, Brighton, UK.
Land Contamination and Reclamation, No 13 No 1, p 11-21, 2005

Every measurement taken to assess contaminant concentration contains uncertainty due to the errors that are always present within implementation of sampling and chemical analysis techniques. This uncertainty may lead to costly misclassification errors, such as unnecessary remediation and delays. To reduce the uncertainty, an innovative statistical method, the optimized contaminated land investigation (OCLI) method, has been applied to measurements of soil samples taken during the recent investigation of a commercial site. The uncertainty generated by the measurement strategy was estimated using the simple and inexpensive balanced design protocol and ranged from 40 to 79% for the different contaminants considered (at 95% confidence). The authors have taken the measurements (and attendant site-specific costs) of the organic contaminant indenol(123cd)pyrene to demonstrate the usefulness of the OCLI method. OCLI calculations showed that the measurements were not fit for purpose in this instance and estimated the loss of around Pound Sterling 1,600 per sampling location, whereas the calculated optimal level of uncertainty value for this contaminant is around Pound Sterling 300 per location. The OCLI method also provides valuable information on the potential measurement strategy. For example, because the uncertainty from the field sampling was much larger than that of the chemical analysis, the optimal uncertainty (and hence lowest expectation of loss value) is predicted to be achieved by taking a threefold sample composite. More information about the OCLI method is available on line at http://www.sussex.ac.uk/cer/1-2-2-10-4.html

Construction of a Sensor for the Determination of Cyanide in Industrial Effluents: a Method Based on Quartz Crystal Microbalance
Mirmohseni, A. and A. Alipour, Univ. of Tabriz, Tabriz, Iran
Sensors and Actuators B: Chemical, Vol 84 Nos 2-3 , 15 May 2002, P 245-251

In developing a quartz crystal microbalance (QCM) system for the detection of cyanide in industrial effluents, a thin layer of nickel is coated on the quartz electrodes. Nickel reacts with cyanide ions in the presence of oxygen after soaking in cyanide solution, causing a decrease in electrode mass, which is responsible for a frequency shift that is linearly related to the concentration of cyanide ions in solution. The method can measure cyanide ions in the range of 0 to 10 ppm. No major interference was found to affect performance, and the sensor obtained a lower limit of detection of 0.28 ppm. Comparative tests revealed no significant difference between the ASTM method and the proposed QCM techniques.

CORONA Project Update
The UofA Geotechnical Centre 2004 Report. Univ. of Alberta Geotechnical Centre, p 11, Dec 2004

The Consortium for Research on Natural Attenuation (CORONA) program has recently focused on analytical data used to support interpretation of natural attenuation. A variety of groundwater sampling systems have been compared for assessment of spatial, temporal, and methodological differences, e.g., discrete-interval air-lift systems, small-diameter direct-push systems, multilevel systems, diffusion samplers, and the industry standard bailer and Waterra samplers. Depth-specific sampling identified notable variations over short intervals. The main influence noted is that longer screened wells (3 m) tend to increase the estimated thickness of contamination, but do not notably underestimate the plume concentration levels. These samples therefore appear to identify 'average' conditions to a reasonable degree.

Cost and Performance Report of Dissolved Hydrogen Analyzer
Lebron, C.A. and B. Sugiyama (NFESC); P.J. Evans, M. Trute, R.J. Olsen, and J. Eisenbeis (CDM, Bellevue, WA); F. Chapelle (USGS).
Report Number: NFESC-CR-05-001-ENV, DTIC: ADA430661, 33 pp, Dec 2004

Monitored natural attenuation (MNA) is a cost-effective remediation approach that is applicable to many sites and has been embraced by the DoD. MNA can be implemented at petroleum hydrocarbon, chlorinated hydrocarbon, and metal-contaminated sites as an alternative to groundwater pump and treat methods. Determination of MNA's technical applicability for a given site is based on sampling and analysis, data evaluation and modeling, and long-term monitoring. Parameters that are evaluated include concentrations of contaminants, electron acceptors, and electron donors. These concentrations in combination with hydrogeologic, soil, and microbial characteristics are used to assess the fate and transport of contaminants and the potential for natural attenuation. This report describes the demonstration of a novel analytical technology: a dissolved hydrogen (DH) analyzer. The report describes demonstration of the DH analyzer at three DoD sites, as well as supplemental development of the DH analyzer.
http://handle.dtic.mil/100.2/ADA430661

Coupling Intelligent Algorithms with Common Parameter On-Line Monitoring as a Surveillance Tool for Drinking Water Security: Recognizing and Identifying Distribution System Incursions
Kroll, D. and K. King, Hach Homeland Security Technologies, Loveland, CO.
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. ANYL 37.

This presentation describes a system designed to address the problem of drinking water distribution system monitoring. The developed system employs an array of common analytical instrumentation coupled with advanced interpretive algorithms to provide detection and identification response networks that are capable of enhancing system security. The system is shown to be a practical measure to help detect and characterize backflow events, thus countering terrorist activities. A variety of real-world venues and testing protocols were used to verify the efficacy of the system.

Cyanide Fishing and Cyanide Detection in Coral Reef Fish Using Chemical Tests and Biosensors
Mak, K.K.W. (Hong Kong Univ. of Science and Technology); H. Yanase (Tottori Univ., Tottori, Japan); Reinhard Renneberg (Hong Kong Univ. of Science and Technology).
Biosensors and Bioelectronics, Vol 20 No 12 , p 2581-2593, 15 June 2005

Cyanide fishing is a fast method to stun and collect fish that has been used in the Philippines for decades. Many analytical methods are available for the detection of cyanide in environmental and biological samples, but most of the techniques are time consuming, and some lack specificity or sensitivity. This paper offers an overview of cyanide fishing problem in southeast Asia and summarizes some of the methods for cyanide detection in biological samples, including a novel approach to detect cyanide in marine fish tissues.

Cyanide-Sensitive Fluorescent Probes
Badugu, Ramachandram, Joseph R. Lakowicza, and Chris D. Geddes, Univ. of Maryland, Baltimore.
Dyes and Pigments, Vol 64, p 49-55, 2005

Previous work has shown that boronic acid containing fluorophores can be used to sense aqueous cyanide through physiological safeguard levels. A newly developed sensing mechanism is not just specific to the recently reported probes, but is generic to the boronic acid moiety itself. A wide range of cyanide-sensitive probes can now be realized.
http://cfs.umbi.umd.edu/cfs/reprints/Cyanide-4-Dyes%20and%20pigments-2005.pdf

Data Processing Methods for Smart Instruments Based on Chemical Sensor Arrays
Sundic, Teodor, Ph.D. thesis, University of Barcelona, Spain. 280 pp, 2002

The main objective of this work is to evaluate different options of non-linear signal processing for the analysis of gases and aromas following two main lines of investigation: (1) Quantitative analysis of potentially dangerous gases (toxic or inflammable) using metal-oxide sensors, and (2) flavor analysis by fusing electronic nose and electronic tongue data. The first theme is directly related to the development of a low-cost combined detector for carbon monoxide and methane for domestic use. Chapter 1 introduces the instruments based on human senses of smell and taste, including their general conception, basic structure, biological inspiration, and applications. Chapter 2 is dedicated to the state of the art of signal processing algorithms and the problems that have to be solved with their application. Chapter 3 discusses intelligent gas alarms and the development of the combined carbon monoxide and methane detector. The complete process--sensor selection and test, detector design, test and functionality--will be covered. Chapter 4 discusses in detail alternatives in gas concentration estimation using different sensor arrays and signal processing algorithms. Chapter 5 covers the application of a mixed system based on an electronic nose and electronic tongue. The conclusion contains observations arising from this study.
http://isp.el.ub.es/uploads/_C-CdlDec4DX8j46coTZjA/Thesis_small.pdf

Demonstration of Two Long-Term Groundwater Monitoring Optimization Approaches
U.S. EPA, Office of Superfund Remediation and Technology Innovation, Washington, DC.
Report No: EPA 542-R-04-001a, 63 pp, Sep 2004

This report summarizes the results of a demonstration in which optimization techniques were used to improve the design of long-term groundwater monitoring programs. Two different approaches to optimizing groundwater monitoring programs were used: (1) the Monitoring and Remediation Optimization System (MAROS) software tool, developed by GSI for the Air Force Center for Environmental Excellence (AFCEE), and (2) a three-tiered approach applied by the Parsons Corporation. The report discusses the results of application of the two approaches to the evaluation and optimization of groundwater monitoring programs at three sites (Fort Lewis Logistics Center, WA, Long Prairie Groundwater Contamination Superfund Site, MN, and Operable Unit D, McClellan Air Force Base, CA), and examines the overall results obtained using the two monitoring program optimization approaches. The primary goals of the demonstration were to highlight current strategies for

applying optimization techniques to existing long-term monitoring programs, and to assist site managers in understanding the potential benefits associated with monitoring program optimization. The demonstration was conducted as part of an assessment of long-term monitoring optimization approaches initiated by U.S. EPA's Office of Superfund Remediation and Technology Innovation and AFCEE. The report with appendices (765 pages) is available at http://207.86.51.66/download/char/542-r-04-001b.pdf
http://207.86.51.66/download/char/542-r-04-001a.pdf

Demonstration/Validation of Long-Term Monitoring Using Wells Installed by Direct Push Technologies

Shinn, J.D., S.P. Farrington, and M.L. Gildea, Applied Research Associates, Inc., South Royalton, VT.
Report No: AFRL-ML-TYTR-2003-4533, NTIS: ADA413061, 78 pp, Apr 2003

The objective of this study was to demonstrate that long-term groundwater monitoring results from direct-push wells agree with those from conventionally drilled wells, the currently accepted baseline technology. Five field sites were included in the study to represent a variety of geological conditions, as well as a cross-section of regulatory domains (e.g., EPA regions and states). Direct-push wells were installed adjacent to, and paired with, existing conventional wells drilled via hollow stem anger. The following sites were part of this effort: the U.S. Army Corps of Engineers Cold Regions Research and Engineering Lab, Hanover, NH; Dover National Test Site, Dover AFB, DE; the Naval Facilities Engineering Services Center (NFESC), Port Hueneme, CA; Tyndall AFB, FL; and Hanscom AFB, MA. Five sampling runs were conducted over a 15-month period at each site. Target groundwater chemical analytes included tetrachloroethene (PCE), cis-1,2-dichloroethene (cis-DCE), trans-1,2-dichloroethene (trans-DCE), vinyl chloride (VC), benzene, toluene, ethylbenzene, o,m-xylene, p-xylene, 1,4-dichlorobenzene (DCB) trichloroethane (TCA), and methyl tert-butyl ether MTBE.
http://stinet.dtic.mil/cgi-bin/GetTRDoc?AD=A413061&Location=U2&doc=GetTRDoc.pdf

The Dependence of Sorbed Copper and Nickel Cyanide Speciation on Ion Exchange Resin Type

Leao, V.A., G.C. Lukey, and J.S.J. van Deventer (Univ. of Melbourne, Parkville, Victoria, Australia);
V.S.T. Ciminelli (Univ. Federal de Minas Gerais, Belo Horizonte, Brazil).
Hydrometallurgy, Vol 61 No 2, p 105-119, July 2001

The influence of functional group structure and resin matrix on the speciation of copper and nickel cyanides for two commercially available ion exchange resins: Imac HP555s, which has a polystyrene/divinylbenzene matrix, and Amberlite IRA958, a polyacrylic resin. Despite the presence of both Cu(CN)32- and Cu(CN)43- in solution, the Imac HP555s loads predominantly the Cu(CN)32- complex, whereas the Amberlite IRA958, sorbed significant amounts of both copper complexes. The speciation of nickel cyanide sorbed onto each resin was the same. Imac HP555s shows a higher sorption energy for nickel, while Amberlite IRA958 exhibits more sorption energy for copper. The parameter values of a recently developed mathematical model were correlated with the chemical features of each complex in solution and on the resins.

Design and Application of an Oligonucleotide Microarray for the Investigation of Compost Microbial Communities

Franke-Whittle, I.H., S.H. Klammer, and H. Insam, Univ. of Innsbruck, Innsbruck, Austria.
Journal of Microbiological Methods, Vol 62 No 1, p 37-56, July 2005

A microarray comprising oligonucleotide probes targeting variable regions of the 16S rRNA gene was designed and tested to investigate microbial communities in compost. Probes were designed for microorganisms that have been previously reported in the composting process, as well as for pathogens. The oligonucleotide probes were between 17 and 25 bp in length and included mostly species-specific sequences. The microarray was found to have a detection limit of 10(3) cells, although in compost spiking experiments, the detection limit was reduced to 10(5) cells. The study showed that the molecular tool supported screening for the presence or absence of different microorganisms within compost samples.

Detecting Heavy Metal Contamination in Soil Using Complex Permittivity and Artificial Neural Networks
Shang, J.Q., W. Ding, R.K. Rowe, and L. Josic.
Canadian Geotechnical Journal, Vol 41 No 6, p 1054-1067, Dec 2004

In an investigation of the use of complex permittivity (an intrinsic electrical property of materials) to detect the presence and type of heavy metals in soil, the soil specimens were prepared by mixing the soil with distilled and deionized water, NaCl solutions, and copper and zinc salt solutions and compacting at known water contents. The complex permittivities of the soil specimens were measured in the laboratory using a custom-developed apparatus. The data were incorporated into a database using data from both contaminated and uncontaminated soil specimens and including the soil water content, density, and pore-fluid salinity. Two artificial neural network (ANN) models were developed to identify whether the heavy metals are present in the soil, and if found, to distinguish the metal type, based on the complex permittivities measured on the soil specimens. This paper describes the results.

Detection and Decontamination of Residual Energetics from Ordnance and Explosives Scrap
Jung, C.M., D.A. Newcombe, D.L. Crawford, and R.L. Crawford, Univ. of Idaho, Moscow, ID.
Biodegradation, Vol 15 No 1, p 41-48, Feb 2004

The authors describe the use of an anaerobic microbiological system applied as a bioslurry to decontaminate decommissioned mortar rounds still containing explosives residue and the surfaces of metal scrap artificially contaminated with 2,4,6-trinitrotoluene. A portable ion mobility spectrometer was employed for the detection of residual explosives residues on the surfaces of the scrap. The mixed microbial populations of the bioslurries effectively decontaminated both the scrap and the mortar rounds. The ion mobility spectrometer provided an extremely sensitive field screening method for assessing decontamination and is a method by which minimally trained personnel can declare scrap clean with a high level of certainty.

Detection and Identification of Toxic Air Pollutants Using Airborne LWIR Hyperspectral Imaging
Williams, D.J., B.L. Feldman, T.J. Williams, D. Pilant, P.G. Lucey, and L.D. Worthy.
Multispectral and Hyperspectral Remote Sensing Instruments and Applications II. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5655, p 134-141, Jan 2005

Airborne longwave infrared (LWIR) hyperspectral imagery was used to detect and identify gaseous chemical release plumes at sites in southern Texas. The Airborne Hyperspectral Imager (AHI), developed by the University of Hawaii, was flown over a petrochemical facility and a confined animal feeding operation on a modified DC-3 in April 2004. Numerous plumes were detected at both sites, with preliminary results indicating the presence of benzene and ammonia and several other organic compounds. The technology shows promise for monitoring and inventorying facility emissions, perhaps as means to assist ground inspection teams to focus on actual fugitive emission points.

Detection of 2,4,6-Trinitrotoluene in Environmental Samples Using a Homogeneous Fluoroimmunoassay
Goldman, E.R., T.J. Cohill, C.H. Patterson Jr., G.P. Anderson, A.W. Kusterbeck, and J.M. Mauro, U.S. Naval Research Laboratory, Washington, DC.
Environmental Science & Technology, Vol 37 No 20, p 4733-4736, 15 Oct 2003

A simple homogeneous assay has been used to test soil and water samples for TNT. This assay is based on changes in fluorescence emission intensity when a fluorescently labeled TNT analog bound to an anti-TNT antibody is competitively displaced by TNT. This simple, rapid, sensitive, and homogeneous fluoroimmunoassay is amenable to high throughput screening and shows promise for near real-time evaluation of TNT contamination in environmental samples.

Detection of Acidithiobacillus ferrooxidans in Acid Mine Drainage Environments Using Fluorescent in Situ Hybridization (FISH)
Mahmoud, K.K. (Univ. of Western Ontario, London, ON, Canada); L.G. Leduc (Laurentian Univ., Sudbury, ON); G.D. Ferroni (Northern Ontario School of Medecine, Sudbury, ON).
Journal of Microbiological Methods, Vol 61, 33-45, 2005

Acidithiobacillus ferrooxidans is an important microorganism found in acid mine drainage (AMD) and bioleaching environments. The microbe oxidizes ferrous iron and generates ferric iron, an oxidant. Most investigations of the microbial aspects of sulfide mineral dissolution have focused on deciphering the physiological, metabolic, and genetic characteristics of A. ferrooxidans. A 16S rRNA oligonucleotide probe designated S-S-T.ferr-0584-a-A-18 and labeled at the 5V-end with indocarbocyanine dye (CY3) was used in a fluorescent in situ hybridization (FISH) procedure on pure cultures of isolates of A. ferrooxidans recovered from AMD and mine sites. The probe was used to detect cells of A. ferrooxidans, recovered from AMD samples, growing on FeTSB and FeSo solid media in a FISH procedure, as well the presence of cells of A. ferrooxidans in AMD from a site in Copper Cliff, Ontario, which was also analyzed using the FISH technique. The study showed that the probe hybridized effectively with cells of A. ferrooxidans recovered from pure cultures but failed to directly detect cells of A. ferrooxidans in the AMD site.
http://laurentian.ca/biology/LEDUC/Mahmoud%20et%20al.%202005.pdf

Detection of Cyanide Using Immobilized Porphyrin and Myoglobin Surfaces
Legako, J.A., B.J. White, and H.J. Harmon, Oklahoma State Univ., Stillwater.
Sensors and Actuators B, Vol 91 Nos 1-3, p 128-132, 1 June 2003

Copper-complexed meso-tetra(4-carboxyphenyl) porphine monoethylene diamine coupled to Traut's reagent immobilized onto a cellulose film shows a broad absorbance peak in the Soret region at 418 nm. Addition of NaCN solution to the immobilized porphyrin monolayer results in a loss in absorbance at 411 nm and an increase in absorbance at 421 nm as the porphyrin cyanide complex forms. Cyanide can be detected down to 1.6 ppb levels in less than 6 seconds.

Detection of Explosive as an Indicator of Landmines: BIOSENS Project Methodology and Field Tests in Southeast Europe
Crabbe, Stephen, Lars Eng, Peter Gardhagen, and Anders Berg.
Detection and Remediation Technologies for Mines and Minelike Targets X. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5794, p 762-773, June 2005

This paper presents sampling/collection technology developed, test methodology, and results from the IST-2000-25348-BIOSENS project for the detection of explosive from mines, including comparisons with dogs and soil sampling.

Detection of Gas Leaks in the Subsurface Environment
Ghandehari, Masoud, Gamal Khalil, and Fletcher Kimura.
Nondestructive Detection and Measurement for Homeland Security III. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5769, p 154-161, May 2005

A gas leak detection method has been developed based on continuous monitoring of the oxygen concentration surrounding a natural gas pipeline. Optical fibers coated with an oxygen-permeable polymeric film contain a luminescent sensor molecule. When the specialty fiber is illuminated by a light source that excites the luminophor, the functional cladding compound has the ability to detect and quantify leaks by measuring small changes in oxygen concentrations in the surrounding environment. This paper presents the results of leak detection in various environments. The technology is capable of long-term performance and of distributed sensing using fiber optic evanescent field spectroscopy. Results of leak detection applications and long-term system performance in various environments are reported.

Detection of Soil Pollution by Hydrocarbons Using Headspace-Mass Spectrometry and Identification of Compounds by Headspace-Fast Gas Chromatography-Mass Spectrometry
Perez Pavon, J.L., A. Guerrero Pena, C. Garcia Pinto, and B. Moreno Cordero, Univ. de Salamanca, Salamanca, Spain.
Journal of Chromatography A, Vol 1047 No 1, p 101-109, 20 Aug 2004

A screening tool for the rapid detection of soil pollution by petroleum hydrocarbons is proposed that is based on direct coupling of a headspace sampler with a mass spectrometer. The samples are subjected to the headspace generation process, with no prior treatment, and the volatiles generated are introduced directly into the mass spectrometer to obtain a fingerprint of the sample analyzed. Treatment of the signal by chemometric techniques allows unequivocal characterization of different types of sample.

Detection of Spores of Bacillus anthracis from Environment Using Polymerase Chain Reaction
Alam, S.I., G.S. Agarwal, D.V. Kamboj, G.P. Rai, and L. Singh, Defence R & Establishment, Gwalior, India.
Indian Journal of Experimental Biology, Vol 41 No 2, p 177-80, Feb 2003

A sensitive method for PCR-based detection of Bacillus anthracis (anthrax) spores in the environment was standardized. Extraction of DNA from spores purified from soil samples by an aqueous polymer two-phase system followed by partial germination and freeze-thaw treatment yielded the best results. Spores in spiked soil samples could be detected with this method.

Detection of Toxic Gases Using Cermet Sensors
Skubal, Laura R. and Michael C. Vogt.
Advanced Environmental, Chemical, and Biological Sensing Technologies II. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5586, p 45-53, Dec 2004

The application of voltammetry to cermet electrochemical cell microsensors shows promise for the discernment and quantification of gases. Miniature cermet cells fabricated from ceramic, metallic, and metal oxide components reacted uniquely with gases and mixtures in the atmosphere. The waveforms could be interpreted using neural net chemometrics algorithms to extract information about the presence and concentration of constituent gases. These sensors can correctly identify more than 30 electroactive gases (such as benzene, 1,3-butadiene, acrolein, and acetaldehyde in diesel exhaust) while showing a high tolerance for interferents. A single element sensor can determine gas concentrations from the ppm level to the percentage level, while arrays provide even better detection and discrimination.

Detector for Particulate Polycyclic Aromatic Hydrocarbons in Water
Levinson, J., C. Sluszny, Y. Yasman, V. Bulatov, and I. Schechter, Technion--Israel Inst. of Technology, Haifa, Israel.
Analytical and Bioanalytical Chemistry, Vol 381 No 8, p 1584-1591, Apr 2005

This paper proposes a new setup for direct sampling and quantification of suspended particulate PAHs in water based on a polymeric film that can dissolve PAH particulates coupled to a traditional laser-induced fluorescence probe. Two sampling modes were studied: bulk sampling, by immersing the probe in the water, and surface sampling, by placing the film on the water surface. The latter method shows more sensitivity; however, it is diffusion-limited. The authors conclude that analysis of PAH mixtures is likely to require multivariate analysis.

Determination of Atrazine and Four Organophosphorous Pesticides in Ground Water Using Solid Phase Microextraction (SPME) Followed by Gas Chromatography with Selected-Ion Monitoring
Tomkins, Bruce A. and Ralph H. Ilgner, Oak Ridge National Lab, Oak Ridge, TN.
Journal of Chromatography A, Vol 972 No 2, p 183-194, 4 Oct 2002

A rapid, sensitive, and convenient method was used for the determination of atrazine and four organophosphorus pesticides in small (10 ml) samples of groundwater. Samples were initially fortified with ethion (internal standard), then extracted without organic solvent using a 65-um thickness polydimethylsiloxane/divinylbenzene SPME fiber. The collected analytes were thermally desorbed in a heated gas chromatographic inlet, separated using a fused-silica capillary column, and detected using a mass selective detector in its selected-ion monitoring mode. The detection limits typically ranged between 2 and 8 ug/L for the analytes in an analysis time of approximately 30 minutes.

Determination of Cr(VI) in Ambient Airborne Particulate Matter by a Species-Preserving Scrubber-Sampling Technique
Metze, D., H. Herzog, B. Gosciniak, D. Gladtke, and N. Jakubowski, Inst. for Spectrochemistry and Applied Spectroscopy, Dortmund, Germany.
Analytical and Bioanalytical Chemistry, Vol 378 No 1, p 123-128, Jan 2004

A special procedure using a scrubber as sampling device was implemented to preserve Cr(VI) during the sampling of airborne particulate matter near a metallurgical plant. The scrubber solution (0.1 mol/L TRIS-buffer solution) was adjusted to a slightly alkaline pH of 8.6 to reduce the oxidation potential of Cr(VI) and to avoid possible oxidation of Cr(III) to Cr(VI). Cr(VI) was pre-concentrated on an anion-exchange material and eluted with aqueous 0.6 mol/L sodium perchlorate solution, after which a species-selective complex of Cr(VI) with diphenylcarbazide (DPC) was prepared and extracted into n-hexanol and quantified by UV-visible spectrophotometry.

Determination of Cyanide Using Flow-Injection Multisensor System
Ipatov, A., M. Ivanov, S. Makarychev-Mikhailov, V. Kolodnikov, A. Legin, and Y. Vlasov, St. Petersburg Univ., St. Petersburg, Russia.
Talanta, Vol 58 No 6, p 1071-1076, 6 Dec 2002

A flow-injection multi-sensor system comprising potentiometric sensors of different types was developed for determination of free cyanide activity in basic solutions for extraction of noble metals. The sensor system combines solvent polymeric membrane sensors based on metalloporphyrin and crystalline sensors, allowing determination of cyanide activity in process liquids. The system was able to analyze up to 20 samples per hour.

Determination of Organochlorine Pesticides in Ground Water Using Solid-Phase Microextraction (SPME) Followed by Dual-Column Gas Chromatography with Electron Capture Detection
Tomkins, Bruce A. and Angela R. Barnard, Oak Ridge National Lab, Oak Ridge, TN.
Journal of Chromatography A, Vol 964 No , p 21-33, 2002

A rapid, sensitive, and convenient method was used for the determination of 19 organochlorine pesticides (e.g., endrin and DDT) in 10-mL samples of groundwater. Samples were initially fortified with 2,4,5,6-tetrachloro-m-xylene (surrogate) and decachlorobiphenyl (retention time marker), then extracted with a 30-um thickness polydimethylsiloxane solid-phase microextraction fiber. The collected analytes were thermally desorbed in a heated gas chromatographic inlet, separated in independent fused-silica capillary columns, and identified using electron-capture detection. The detection limits typically ranged between 10 and 40 ng/L for these analytes.

Determining Organic Contaminant Transformation Rates in Groundwater
Field, J.A. and J.D. Istok (Oregon State Univ., Corvallis); P. Bennett (Geomatrix Inc., Oakland, CA); K. Hageman, M.E. Dolan, and L. Semprini (Oregon State Univ., Corvallis); M. Schroth (Swiss Federal Inst. of Technology); T.E. Buscheck (Chevron Research and Technology Company, Richmond, CA).
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. GEOC 92.

Fluorinated surrogates of trichloroethene (TCE) and vinyl chloride were used as reactive tracers in single-well push-pull tests to determine the in situ rate of reductive dechlorination in TCE-contaminated groundwater. The disappearance of parent products and formation of daughter products was monitored during single-well push-pull tests, and the field data were used to calculate rates of transformation. Trichlorofluoroethene, a fluorinated surrogate for TCE, was injected into the groundwater to determine the spatial variability of reductive dechlorination rates and the change in rates after the addition of the amendment fumarate. The trace also helped quantify rates in large-diameter permeable columns that received hydrogen, lactate, and zero-valent iron as part of a remedial pilot test. Chlorofluoroethene has also been tested as a surrogate for vinyl chloride in the lab and in the field.

Developing Guidelines for Bio-Trap Samplers to Evaluate ORC(R)-Enhanced Remediation of BTEX Contaminated Aquifers
Davis, G., D. Ogles, J. Streufert, and D. McElroy (Microbial Insights, Rockford, TN); S. Mullin (Regenesis, San Clemete, CA); S. Sittler (Handex, Indianapolis, IN); K. Sublette (Univ. of Tulsa, OK)
The 11th Annual International Petroleum Environmental Conference, 11-15 October 2004, Albuquerque, NM. The Integrated Petroleum Environmental Consortium (IPEC), Univ. of Tulsa, OK.]

Bio-Trap samplers combined with molecular based diagnostic tools, such as PLFA and real-time PCR (CENSUS), provide an effective way to monitor microbial response to a particular treatment. The authors are working to develop guidelines for the use of Bio-Trap samplers and the respective assays employed to ensure that the results obtained are meaningful. One study has focused on establishing guidelines in the evaluation of the microbial response to ORC(R) at a BTEX-contaminated site. The Bio-Trap samplers were analyzed for the abundance of specific microbial oxygenase genes involved in the biodegradation of aromatic hydrocarbons, and the results were used to establish preliminary guidelines on the most effective procedures for field applications.

Development and Testing of a Hyperspectral Imaging Instrument for Standoff Chemical Detection
Chamberland, M., V. Farley, J. Giroux, A. Villemaire, J.-F. Legault, and K.R. Schwantes.
Chemical and Biological Standoff Detection II. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5584, p 135-143, Dec 2004

Recent developments in long-wavelength infrared (LWIR) focal plane arrays combined with the mastering of Fourier-transform spectrometery technology have allowed the realization of an imaging spectrometer specifically designed for chemical imaging. The spectral and radiometric calibration of the instrument enables the processing of the data to detect chemicals with spectral signatures in the 8 to 12 um region. Spectral images are processed and the contrast between different pixels is used to map the chemicals. This paper presents a description and performance and field-test results for the sensor recently developed by Telops of Quebec, Canada.

Development and Use of a Novel Bioluminescent Biosensor for Assessing the Bioavailability of Organic Pollutants in Surfactant Solutions
Keane, A. (McGill Univ., Montreal, QC); P.C.K. Lau (National Research Council, Montreal, QC); S. Ghoshal (McGill Univ., Montreal, QC).
40th Central Canadian Symposium on Water Quality Research, 14-15 February 2005, Burlington, Ontario. Environment Canada, p 74, 2004

The whole-cell bioluminescent biosensor PpF1G4 was developed to meet the need for a direct measurement technique for microbial bioavailability. To create PpF1G4, bioluminescent reporter genes (lux) were placed under the control of the promoter region of the solvent efflux pump genes (sep) in Pseudomonas putida F1. PpF1G4 was used to evaluate how three nonionic surfactants (Triton X-100, Brij 30, and Brij 35) influence the bioavailability of three different organic pollutants (toluene, naphthalene, and phenanthrene) as individual compounds in solution, as well as the bioavailability of multiple solutes partitioned from nonaqueous phase liquid multi-component mixtures, such as coal tar and creosote. The increased bioluminescent response of PpF1G4 in micellar solutions of Triton X-100 and Brij 35 indicated higher intra-cellular concentrations of toluene, naphthalene, and phenanthrene compared to control systems with no surfactants present. In contrast, Brij 30 caused a decrease in the bioluminescent response to the test compounds. The effect of the micellar solutions on the toluene biodegradation rate was consistent with the bioluminescent response. For toluene, the bioluminescent response of PpF1G4 was an accurate indicator of bioavailability. All three surfactants--Triton X-100, Brij 35, and Brij 30--increased the bioavailability of solutes partitioned from creosote and crude oil. The suppression of bioluminescence in Brij 30 solutions containing single test compounds did not occur in Brij 30 solutions containing target multiple organic pollutants, which suggests that the locus of solubilization of organic pollutants within Brij 30 micelles might affect bioavailability. Nonionic surfactants may enhance bioavailability and biodegradation rates by increasing the mass flux of substrates present in the micellar pseudophase to the cells through mechanisms that do not involve visible changes to membrane permeability.

Development and Use of Field-Portable Digital Radiography for Nonintrusive Tank Inspections
Roney, T.J., T.A. White, D.J. Haley, and R.R. Piscitella, INEEL.
Proceedings of Waste Management 2004, 29 February - 4 March, Univ. of Arizona, Tucson. Paper WM-4509, 12 pp, 2004

Idaho National Engineering and Environmental Laboratory (INEEL) has developed a field-portable Digital Radiography System (DRS) for the nonintrusive examination of tanks, boxes, and piping. The equipment consists of a continuous high-output x-ray generator, an amorphous-silicon flat-panel area imager, and control hardware and software. All components act as an integral whole to allow near real-time radiographs to be viewed for components in the field. Though off-the-self equipment was used, it was a technical challenge to integrate the equipment into a single, portable unit that could be easily used by field technicians. Technical challenges included portability, a wide variation in object size and configuration, and software development for a user-friendly imaging interface. In field applications, conventional radiography collects single images that must be viewed independently. By using a small field-of-view digital x-ray imaging device and multiple exposures, multiple images can be pieced together to form a single, large field-of-view image that more clearly defines the objects of interest in relationship to other nearby objects. The field portability of the DRS allows for images to be collected in situ without transferring the object to a shielded x-ray cave. Use of an x-ray generator, rather than a radioactive source, provides a much greater margin of safety, eliminates a radioactive waste disposal problem, and provides high-resolution images. Digital imaging allows for images to be gathered and interpreted in the field without problems of chemical waste disposal or delay of film development. Current use of the DRS at INEEL has been limited to interrogation of pipes and tanks to determine if residual liquid remains. Future uses will cover waste characterization, suspect waste packages characterization, and package interrogation for enhanced security.
http://www.wmsym.org/abstracts/2004/pdfs/4509.pdf

The Development of a Flow Injection Analysis Method for the Quantification of Free Cyanide and Copper Cyanide Complexes in Gold Leaching Solutions
X. Dai, , M.I. Jeffrey and P.L Breuer, Monash Univ., Vic, Australia
Hydrometallurgy, Vol 76 Nos 1-2, p 87-96, Jan 2005

A flow injection analysis method has been developed for the quantification of free cyanide, Cu(CN)2- and Cu(CN)32-. The method utilizes a flow-through electrochemical cell containing silver and platinum electrodes. The basis of this method is that the measured charge due to either silver oxidation or copper reduction at an applied potential is related to the species concentration. At -150 mV potential, the measured charge due to silver oxidation is related to the free cyanide concentration, while silver oxidation at 100 mV and copper reduction at -650 mV were used for Cu(CN)32- and Cu(CN)2- analysis, respectively. For the solution containing both free cyanide and Cu(CN)32-, a two-step analysis technique was developed for the quantification of each of these species.

Development of a Genome-Wide Screening Method to Identify Gene Candidates Involved in the Degradation of Halogenated Hydrocarbons Using Ion Chromatography
Strycharz, Sarah and Lee Newman, University of Washington SBRP.
Superfund Basic Research Program 2004 Annual Meeting, Seattle, WA, 3-4 November 2004, Seattle, Washington.

In humans and other organisms, cytochrome P450s are involved in degradation of the common groundwater contaminant trichloroethene (TCE). TCE and ethylene dibromide (EDB) are both metabolized by the same primary enzyme in humans, cytochrome P450 2E1. Other potential enzymes that may be involved in TCE degradation in plants include additional cytochrome P450s, peroxidases, dehalogenases, laccases, and reductases. to screen for multiple enzyme types, an assay has been developed in which bacterial cultures expressing the cDNA library of a commercially purchased tobacco leaf (Nicotiana tabacum) can be examined for the ability to degrade EDB, a halogenated hydrocarbon. EDB is being used instead of TCE because bromide ion (Br-) is not prevalent in culture media, whereas chloride ion (Cl-) can be found at high levels. Degradation of EDB is measured by detection of Br- release using an ion chromatograph. The researchers hope to narrow the number of possible candidate genes by comparing the ability of cDNA library cultures to degrade EDB against the ability of a control culture expressing a gene known to degrade EDB.

Development of a Real-Time In-Situ Tritium Sensor for Vadose and Groundwater Zones
Levitt, D., T. Kendrick, B. Lowry, and A. Shumaker
Proceedings of Waste Management 2004, 29 February - 4 March, Univ. of Arizona, Tucson. Paper WM-4294, 13 pp, 2004

Tritium has been released into the subsurface at many sites across the DOE complex through the disposal of radioactive waste or the underground testing of nuclear weapons. In response to DOE's on-going regulatory need to monitor tritium concentrations, a real-time, in situ monitoring system for the detection and measurement of low levels of tritium in groundwater and the vadose zone has been developed. The prototype (Model 1) monitoring system was field-tested in both the vadose zone near a buried radioactive waste package and in the groundwater in a monitoring well at the Nevada Test Site. During the 2002 field tests, an innovative sparge sampling method that eliminated the need for the sensor to be deployed downhole was implemented. In 2003, a new sensor design (Model 2) with a larger measurement chamber to reach lower detection limits than could be achieved in 2002 was developed. Initial tests of the Model 2 indicate a stable response and a detection limit just less than 100,000 picocuries per liter (pC/L). In 2004, a mixing mechanism is planned for the Model 2 sensor to eliminate stratification of gases, which should enable the inclusion of a hydrogen generator into the sensor design and a subsequent detection limit at or near federal drinking water standards of 20,000 pCi/L.
http://www.wmsym.org/abstracts/2004/pdfs/4294.pdf

Development of an Immunoassay for Monitoring Environmental and Animal/Human Exposure to Persistent Organic Pollutant Polybrominated Diphenyl Ethers (PBDES)
Ahn, Ki Chang, Shirley J. Gee, Hsing-Ju Tsai, and Bruce D. Hammock, Univ. of California, Davis.
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. AGRO 15.

Researchers worked to develop a competitive indirect enzyme-linked immunosorbent assay (ELISA) to monitor environmental and biological samples exposed to polybrominated diphenyl ethers (PBDEs). 2,2',4,4'-Tetrabromodiphenyl ether (BDE-47), which is the most abundant PBDE congener in animal/human tissues and human breast milks, was selected as the target analyte. At optimized ELISA conditions, the detection range in the assay buffer ranged from 0.7 to 17 ug/mL at an IC50 value of 3.5 ug/L BDE-47, with little or no cross-reactivity measured to some other PBDEs, PCB, TCDD, and halogenated phenols.

Development of Ant Colony Optimization for Long-Term Groundwater Monitoring
Li, Yuanhai, Amy B. Chan Hilton, and Liang Tong, Florida State Univ., Tallahassee.
World Water Congress 2004: Critical Transitions in Water and Environmental Resources Management, 27 June - 1 July 2004, Salt Lake City, Utah.
ASCE Press, Reston VA. p 107, 2004

This paper presents the development of a methodology to optimize a long-term groundwater-monitoring network to maximize cost-effectiveness without compromising program and data quality. The proposed method combines ant colony optimization with a genetic algorithm and is inspired by the fact that ants are able to find the shortest route between the nest and a food source using pheromone trails as a form of indirect communication. Ant colony simulation techniques allow the number of monitoring locations in the sampling network to be minimized without significant loss of information during long-term monitoring (LTM).

Diffusion Sampler Information Center
Interstate Technology & Regulatory Council (ITRC) website.

The ITRC website hosts the Diffusion Sampler Information Center to provide a centralized location for the posting and exchange of information on the development and use of polyethylene diffusion bag (PDB) samplers, as well as other passive sampling devices. The ITRC Diffusion Sampler Team is working with the U.S. Air Force, U.S. Navy, U.S. EPA, USGS, and private industry to compile, analyze, and disseminate information on the deployment of PDBs on a national basis. Site users can view a current listing of deployments nationwide, news updates, and a searchable case study database. The site also offers a library (in pdf files) of several hundred technical and informational reports and presentations on passive sampler technologies. A recorded version of a 2-hour training module is available, as is a field training video on using PDBs. The key documents section is the place to access guidance documents published by the team.
http://diffusionsampler.itrcweb.org/homepage.asp

Dipole Flow and Reactive Tracer Test: Initial Experimental and Modeling Results
Mohamed, M.M.A., C. Berryman, D. McKnight, and S.A. Banwart (Univ. of Sheffield, UK); N. Thomson (Univ. of Waterloo, Canada); S. Thornton, R. Wilson, and D. Lerner (Univ. of Sheffield, UK).
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. GEOC 93.

The dipole flow test, which circulates groundwater between isolated injection (source) and extraction (sink) chambers within a single borehole, has been successfully used by others to characterize heterogeneous hydraulic properties in both highly permeable and fractured rock aquifers. Work is underway to extend this approach by adding a suite of reactive tracers into a dipole flow field to assess aquifer characteristics--e.g., geochemical properties and biodegradation potential--to provide a method to ascertain site-specific parameters for use in appropriate reactive transport models, and to support remedial technology selection and design. The project involves construction of a lab-scale physical model of a dipole probe to investigate the utility of this dipole flow and reactive tracer test for site assessment, field trials, and development of a stand-alone multi-phase reactive transport model for interpretation of the generated breakthrough curves. The authors report on the project's progress.

Direct Analysis in Real Time (DART): Chemical Agent Data and Background Physics
Laramee, J.A. (EAI Corporation, Abingdon, MD); H.D. Durst (U.S. Army, Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD); R.B. Cody (JEOL USA, Inc., Peabody, MA); J.M. Nilles (Geo-Centers, Inc., Aberdeen Proving Ground, MD).
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. ANYL 287.

The authors present the Direct Analysis in Real Time (DART) technology as a chemical warfare agent detector capable of fast analysis of condensed-phase chemicals on surfaces. No sample preparation is required. When installed on the JEOL AccuTOF(TM) time-of-flight mass spectrometer, the DART(TM) ion source provides improved selectivity and accurate elemental composition assignment through exact mass measurements. During its development and subsequent beta site testing at the Edgewood Chemical Biological Center in Maryland, DART successfully sampled hundreds of chemicals, including chemical agents and their signatures, pharmaceutics, metabolites, peptides and oligosaccharides, synthetic organics, organometallics, drugs of abuse, explosives, and toxic industrial chemicals. These chemicals were detected on a variety of surfaces such as concrete, human skin, currency, airline boarding passes, fruits and vegetables, body fluids, cocktail glasses, and clothing. The composition of drug capsules and tablets was directly analyzed. In one test, 788 nanograms of American VX was absorbed into concrete and held in front of the DART for a few seconds. The mass spectrum showed an intense protonated molecule.

Direct Automatic Screening of Soils for Polycyclic Aromatic Hydrocarbons Based on Microwave-Assisted Extraction/Fluorescence Detection and On-Line Liquid Chromatographic Confirmation
Criado, A., S. Cardenas, M. Gallego, and M. Valcarcel, Univ. of Cordoba, Cordoba, Spain.
Journal of Chromatography A, Vol 1050 No 2, p 111-118, 1 Oct 2004

An integrated screening and confirmation system for PAHs in soils comprises on-line microwave-assisted extraction of the selected pollutants, followed by continuous preconcentration and sample clean-up on RP-C18. The samples for which the total concentration is near or above the established threshold limit (10 ug/g) are subjected to liquid chromatographic separation for confirmation. The whole method (extraction/determination/confirmation) was validated using industrial soil and harbor sediment certified reference materials.

Direct Observation of Organic Contaminant Uptake, Storage, and Metabolism Within Plant Roots
Wild, Edward (Lancaster Univ., Lancaster, UK); J. Dent; G.O. Thomas; K.C. Jones.
Environmental Science and Technology, Vol 39 No 10, p 3695-3702, 15 May 2005

Two-photon excitation microscopy (TPEM) was used to visualize and track the uptake and movement of anthracene and phenanthrene from a contaminated growth medium into living unmodified roots of maize and wheat over a 56-day period. Plant and compound were observed unaltered, i.e., without staining or other manipulation. The authors discuss their observations of lateral and longitudinal chemical migration within the plants. The degradation of anthracene was also directly observed within the cortex cells of both species, showing degradation of anthracene to the partial breakdown products anthrone, anthraquinone, and hydroxyanthraquinone in the zones of root elongation and branching. The technique and observations have important applications to phytoremediation and agriculture.

Direct-Push Hydrostratigraphic Profiling: Coupling Electrical Logging and Slug Tests
Sellwood, S.M., J.M. Healey, S. Birk, and J.J. Butler Jr., Kansas Geological Survey, Univ. of Kansas, Lawrence.
Ground Water, Vol 43 No 1, p 19-29, Jan-Feb 2005

Spatial variations in hydraulic conductivity can greatly affect the transport of contaminants in ground water. A direct-push (DP) method, hydrostratigraphic profiling, has been developed to characterize the spatial variability of both electrical conductivity (EC) and hydraulic conductivity (K) in unconsolidated formations by coupling a dual-rod approach for performing slug tests in DP equipment with high-resolution EC logging. At an extensively studied site, a series of profiles was performed on a surface grid, resulting in a detailed depiction of the 3-D distribution of EC and K. Good agreement was found between K estimates obtained from this approach and those obtained using other methods. DP hydrostratigraphic profiling appears to be a promising method for obtaining detailed information about spatial variations in the subsurface without the need for permanent wells.

Domestic Preparedness Program: Evaluation of the TravelIR HCI(TM) Hazmat Chemical Identifier
Ong, K.Y.; F.C. Baldauf; D.C. St. Amant; L.F. Carey, EAI Corp Abingdon MD
Report No: ECBC-TR-355, DTIC: ADA421836, 37 pp, Nov 2003

A chemical and biological warfare agent detector, the TravelIR HCI(TM), is commercially available from SensIR Inc., Danbury, CT. The TravelIR instruments were tested against GA (Tabun), GB (Sarin), VX (methylphosphonothioic acid, and HD (sulphur mustard, or Yperite), and biosimulants contained in various mixtures. This report provides an overview of the substance identification capabilities of the TravelIR to those concerned with chemical agent detection.
http://handle.dtic.mil/100.2/ADA421836

Effective Contaminant Detection Networks in Uncertain Groundwater Flow Fields
Hudak, P.F., Univ. of North Texas, Denton.
Waste Management, Vol 21 No 4, p 309-312, 2001

A mass transport simulation model tested seven contaminant detection-monitoring networks under a 40 degrees range of groundwater flow directions. Each monitoring network contained five wells located 40 m from a rectangular landfill. The 40-m lag (distance) was measured in different directions, depending on the strategy used to design a particular monitoring network. Lagging the wells parallel to the central flow path was more effective than alternative design strategies. Other strategies allowed higher percentages of leaks to migrate between monitoring wells. Results of this study suggest that centrally lagged groundwater monitoring networks perform most effectively in uncertain groundwater-flow fields.

Effectiveness Monitoring of Soil Vapor Extraction with Rebound Testing and Formation of a Pathway to Closure
Switzer, C. and D.S. Kosson
Proceedings of Waste Management 2004, 29 February - 4 March, Univ. of Arizona, Tucson. Paper WM-4268, 14 pp, 2004

A pilot study was designed and installed at a small waste site in DOE's Savannah River facility to examine the effectiveness of soil vapor extraction (SVE) of trichloroethene (TCE) contamination in a layered vadose zone. The authors report on monitoring the effectiveness of this SVE system and provide the basis for establishing that the site closure criteria were met. The challenges encountered at this site included subsurface heterogeneity and an unknown initial contaminant distribution. These challenges were addressed by the development of a comprehensive subsurface soil gas TCE-concentration rebound testing program that became the basis for site closure. Over the course of four years of SVE operation, six rebound tests have been conducted at the site. The progression of rebound tests show declining soil gas TCE concentration rebound at nearly all of the SVE wells. Rebound has been observed at a few SVE wells and monitoring points, but the concentrations achieved at these locations were substantially lower than observed initial concentrations. These observations indicate that a substantial portion of the

available contaminant mass has been removed and that continued SVE operation would not recover much additional contaminant mass. Additional information from mass removal and diffusion modeling supported these observations, and the resulting decision was to transition the SVE system to passive operation.
http://www.wmsym.org/abstracts/2004/pdfs/4268.pdf

Effect of Additives on the Flow-Analysis Determination of Weak-Acid-Dissociable and Total Cyanide
Heckemann, H.J., B. Stadler, and D. Schulz, MLE Medizin- und Labortechnik Engineering Dresden GmbH, Radebeul, Germany.
Fresenius Journal of Analytical Chemistry, Vol 371 No 4, p 413-419, Oct 2001

The effect of reductants, complexants, and nitrite eliminators on the flow-analysis determination of weak-acid-dissociable and total cyanide has been studied for cyanide recovery from copper, nickel, and iron complexes; cyanide generation from the reagents in the presence of common interferents; and cyanide consumption by the reagents in the presence of those interferents. The UV-assisted recovery of total cyanide from the iron complexes (using a succinate buffer) was insufficient in the absence of additives. Arsenite and hypophosphite had no measurable effect on the recovery, and ascorbic acid resulted in total recovery, but under these conditions, nitrite and sulfite seemed to destroy cyanide. Citrate resulted in good recovery, but in the presence of nitrite, cyanide was formed. The researchers had to destroy nitrite by use of sulfamic acid. Nitrite, thiosulfate, and sulfite can be tolerated in the samples if a combination of EDTA, citrate, and sulfamic acid is used rather high concentrations of thiocyanate.

Effect of Transformer Oil and Petroleum Hydrocarbons as Interferences in Field Screening for PCB Contamination in Soil
Gaskill, Jr., Alvia , Environmental Reference Materials, Inc., Research Triangle Park, NC.
Proceedings of the MyTransfo Meeting, October 2002, Torino, Italy.

A study was conducted to determine the effect of transformer oil and petroleum hydrocarbons on the accuracy of field tests commonly used to determine PCBs in soil. Soil spiked with Aroclor 1242 over the range 0 to 100 ppm was tested at both varying and constant levels of transformer oil (0 to 10%), diesel fuel oil (0 to 4%) and gasoline (1%). Other interference studies were conducted to determine the effect of inorganic chloride on the accuracy of the field tests. Samples were analyzed using a method based on the L2000 PCB Chloride Analyzer(TM), gas chromatography, and SW-846 Method 4020. At Aroclor 1242 levels of 2 and 10 ppm, the L2000 and GC methods correctly determined whether each soil sample contained more than or less than the action levels, even in the presence of 2 to 10% transformer oil, 0.25 to 4% diesel fuel, and 1% gasoline. Method 4020 failed to correctly classify soil containing more than 2% transformer oil or 0.5% diesel fuel due to a negative interference caused by the hydrocarbons. The full extent of the class of compounds capable of causing this interference is unknown and should be the subject of future study. Both the L2000 method and Method 4020 were able to correctly classify soils containing up to 100% sodium and calcium chloride and 4 ppm Aroclor 1242 at the 2 ppm action level.
http://www.dexsil.com/pdf/DTR_14_03.pdf

An Effective Electrode Configuration for the Detection of DNAPLs with Electrical Resistivity Tomography

Goes, B.J.M. and J.A.C. Meekes, Netherlands Inst. of Applied Geoscience (TNO-NITG), Utrecht.

Journal of Environmental and Engineering Geophysics, Vol 9 No 3, p 127-141, Sep 2004

Electrical resistivity tomography (ERT) between boreholes can detect dense nonaqueous phase liquids (DNAPLs) because of their high electrical resistivity. Two case studies were examined to determine the best measurement schedule, with synthetic modeling used to compare the cross-hole tripole-pole electrode configuration against the more widely used circulating dipole-dipole and cross-hole dipole-dipole electrode configurations. The case studies involved ERT measurements between five boreholes at two polluted sites with unconsolidated sediments. The study showed that a cross-hole tripole-pole electrode configuration is more effective in locating DNAPLs than the other configurations, and the number of measurement points, and thus the measurement time, is less than half that of the other configurations. The ERT measurements of DNAPL locations have been confirmed with groundwater samples. Careful interpretation of the tomographic images is still required because ERT cannot distinguish DNAPLs from other high resistivity objects, and high-resistivity computational artifacts might be present that could be mistaken for DNAPLs.

Effects of Groundwater Velocity on Sampling Intervals for Contaminant-Detection Networks in Aquifers

Hudak, P.F., Univ. of North Texas, Denton.

Journal of Environmental Science & Health A, Vol 36 No 1, p 117-122, 2001

This paper presents an evaluation of how groundwater velocity affects the sampling interval of a groundwater monitoring network. When a computer model simulated the detection capability of a groundwater monitoring network in different groundwater velocity settings, a 0.4-m/d velocity registered a maximum sampling interval of four months, whereas decreasing the velocity to 0.04 m/d resulted in a 3-year maximum sampling interval. Assigning an arbitrary sampling interval that does not take into account a site's hydrogeology could waste financial resources or allow contaminants to reach a buffer zone boundary without being detected.

Electronic Nose Technology for the Detection of Microbial and Chemical Contamination of Potable Water

Canhoto, O. and N. Magan, Cranfield Univ., Silsoe, Bedford, UK.

Sensors and Actuators B, Vol 106 No 1, p 3-6, 29 Apr 2005

Two electronic nose systems employing conducting polymer sensor arrays were compared for early detection and discrimination between bacterial species, fungal spores, and trace amounts (ppb) of pesticides (DDT and dieldrin). Using PCA, DFA, and cluster analysis, it was possible to differentiate between the different bacterial and fungal species after 24 h incubation at 25 degrees C; however, 10 and 100 ppb of the pesticides could not be effectively discriminated from the controls.

Engineering of SERS Substrate Structure: Role of Micro- and Nanoporosity

Kuncicky, Daniel M., Steven D. Christesen, and Orlin D. Velev.

Chemical and Biological Point Sensors for Homeland Defense II. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5585, p 33-45, Dec 2004

The authors discuss the fabrication of highly active and stable substrates for surface-enhanced Raman scattering (SERS) using colloidal crystals to template gold nanoparticles into structured porous films. In the example, the structure-dependent performance of these SERS substrates was systematically characterized with cyanide in continuous flow millifluidic chambers. The Raman peak intensity was consistently highest for nanoporous substrates with 3-D ordered micropores, and decreased if the micropores were not ordered or templated. Receiver operating characteristic curve analysis for cyanide in water revealed a limit of detection of about 150 ppb based on a 5% probability of false alarm. This fabrication approach supports stable, reproducible, and highly active substrates for SERS-based chemical sensors with continuous sampling capability.

Enzyme Immobilization Procedures on Screen-Printed Electrodes Used for the Detection of Anticholinesterase Pesticides: Comparative Study
Nunes, G.S.; G. Jeanty; J.-L. Marty.
Analytica Chimica Acta, Vol 523 No 1, p 107-115, 2004

Pesticide toxicity can be measured using biosensors that contain acetylcholinesterase (AChE), an enzyme that hydrolyses the neuro-transmitter acetylcholine and is inhibited by pesticides. N-methylcarbamate (NMC) toxicity was measured in this way by comparing eight methods of enzyme immobilization onto a 7,7,8,8-tetracyanoquinodimethane (TCNQ)-modified graphite working electrode. AChE was cross-linked either with glutaraldehyde in the presence of bovine serum albumen protein or by photopolymerization with poly(vinyl alcohol) bearing styrylpyridinium groups (PVA-SbQ). AChE immobilization with glutaraldehyde produced robust and reproducible biosensors, but required a higher enzyme content of 80 mUA per electrode, compared with AChE immobilized by photopolymerization with PVA-SbQ, which required 0.7 to 1 mUA per electrode. The PVASbQ electrode enzyme immobilization resulted in limits of detection at 10% inhibition and varied from 0.2 to 1.5 ppb of NMC. Immobilization by photopolymerization is simpler than with glutaraldehyde and generates a fast response and reproducibility with good sensitivity to NMC.

Estimation of Anaerobic Biodegradation Rate Constants at MGP Sites
Lewandowski, G. and G. Mortimer, New Jersey Inst. of Technology, Newark.
Ground Water, Vol 42 No 3, p 433-437, May-June 2004

Field data at six former manufactured gas plant sites in New Jersey were used to estimate the biodegradation rate constants for the anaerobic processes naturally occurring within the groundwater contaminant plumes. Those rate constants turned out to be about an order of magnitude smaller than values reported for benzene and naphthalene at fuel sites.

Evaluating Vapor Intrusion from Groundwater and Soil to Indoor Air
Dawson, Helen E., U.S. EPA Region 7, Denver, CO.
EPA Brownfields Conference, 13 November 2002, Charlotte, NC. 25 pp, 2002

This PowerPoint presentation illustrates the problem of vapor intrusion, assessment of the intrusion pathway, and screening and monitoring, with a case study set at Lowry Air Force Base, CO.
http://www.brownfields2002.org/proceedings2002/PDFS/E14%20Dawson.pdf

Evaluation of a Former Landfill Site in Fort Collins, Colorado Using Ground-Based Optical Remote Sensing Technology
Modrak, M., R.A. Hashmonay, R. Varma, and R. Kagann, ARCADIS G&M, Inc., Durham, NC.
EPA 600-R-05-042, 54 pp, Apr 2005

With support from the 21M2 Initiative, EPA's Office of Research and Development used scanning open path Fourier transform infrared, tunable diode laser absorption, and ultra-violet differential optical absorption spectroscopy to determine if hazardous gases were passing through the cover of a closed landfill. The investigation, which was a first step in evaluating redevelopment options, did not find significant gas movement through the cover, but did detect a gasoline hotspot by a nearby building.
http://www.cluin.org/programs/21m2/spotlight/Ft_Collins_Report.pdf

Evaluation of the Reproducibility of Sampling and Analysis in a Large Scale Study on Dioxin-Like Chemicals in Soils in Australia
Mueller, J. (EnTox, Univ. of Queensland, Brisbane), R. Muller, K. Goudkamp, M. Shaw, M. Mortimer, D. Haynes, D. Burniston, R. Symons, R. Correll, and M.R. Moore.
DIOXIN 2004: 24th International Symposium on Halogenated Environmental Organic Pollutants and Persistent Organic Pollutants (POPs), 6-10 September 2004, Berlin, Germany.
Organohalogen Compounds, Vol 66, p 92-99, 2004

Australia's National Dioxin Program (NDP) worked to evaluate the background levels of dioxin-like chemicals in soils nationally. Due to financial and time constraints, the study required collection and analysis of about 80 representative samples to cover the Australian continent, which is about 20 times the size of the unified Germany and only around 20 % smaller than the United States. While the primary aim of the soil study was to evaluate concentrations of dioxin-like chemicals in Australian soil, a key element was an assessment of the accuracy and reproducibility of both the sampling scheme and analytical results, focusing on data that were unexpected in one way or another. A sub-project aim was therefore to evaluate the analytical accuracy and reproducibility, as well the overall reproducibility, of the sampling strategy. For inhomogeneous matrices such as soils, the sampling strategy can be the weakest point of a study.
http://www.measurement.gov.au/assets/documents/nmiinternet/p409_soils20050304073320.pdf

Evaluation of a Small Mechanical and Pneumatic Bladder Pump for Water Quality Sampling
McCall, Wesley.
Ground Water Monitoring & Remediation, Vol 25 No 2, p 142-153, 2005

A pneumatic bladder pump (PnBP) and a newly designed mechanical bladder pump (MBP) were evaluated under the U.S. EPA Environmental Technology Verification Program to assess their ability to provide representative water quality samples for several volatile organic compounds (VOCs) and major element cations. Since the MBP does not require compressed air to operate, the field logistics are simplified and cost of conducting low-flow sampling can be reduced. Replicate samples were collected at the test site from an above-ground standpipe spiked with selected VOCs and cations, and from six direct push (DP)-installed monitoring wells. Statistical analysis shows that the samples collected with the pumps provide precision comparable to that observed in the reference samples, with greater variability seen between the pump and reference samples collected from DP wells than during standpipe trials. Both the PnBP and MBP provided water quality samples comparable to the reference samples for the analytes investigated.

Evaluation of Fugitive Emissions at a Former Landfill Site in Colorado Springs, Colorado Using Ground-Based Optical Remote Sensing Technology
Modrak,Mark, Ram A. Hashmonay, Ravi Varma, and Robert Kagann
EPA 600-R-05-041, 54 pp, Apr 2005

With support from the 21M2 Initiative, EPA's Office of Research and Development used scanning open path Fourier transform infrared, tunable diode laser absorption, and ultra-violet differential optical absorption spectroscopy to determine if hazardous gases were passing through the cover of a closed landfill. The investigation, which was a first step in evaluating redevelopment options, found two methane hotspots that were major contributors to a 4.9 g/s methane flux emanating from the site.
http://www.clu-in.org/programs/21m2/spotlight/Colorado_Springs_Report.pdf

Evaluation of a Novel Malathion Immunoassay for Groundwater and Surface Water Analysis
Brun, E.M., M. Garces-Garcia, M.J. Banuls, J.A. Gabaldon, R. Puchades, and A. Maquieira, Univ. Politecnica de Valencia, Valencia, Spain.
Environmental Science & Technology, Vol 39 No 8, p 2786-2794, 15 Apr 2005

Malathion is an organophosphorus insecticide. Novel malathion haptens were synthesized to develop an ELISA screening method based on a conjugate-coated format that shows a limit of detection of 0.11 ng/ml, an IC50 of 1.58 ng/ml, a dynamic range between 0.23 and 10.94 ng/ ml, and a cross-reactivity of <2% with structurally related compounds. The developed ELISA has been used to quantify malathion in groundwater and surface water samples with good reference agreement and good recoveries achieved, even in surface water samples with a humic acid content up to 10 mg/l without sample pretreatment.

Evaluation of Geostatistics for Combined Hydrochemistry and Microbial Community Fingerprinting at a Waste Disposal Site
Mouser, Paula J. and Donna M. Rizzo, Univ. of Vermont, Burlington.
World Water Congress 2004: Critical Transitions in Water and Environmental Resources Management, 27 June - 1 July 2004, Salt Lake City, Utah.
ASCE Press, Reston VA. p 106, 2004

Traditional multivariate statistics and geostatistics were used to analyze groundwater hydrochemistry and microbial data collected from an aquifer contaminated by landfill leachate. Variograms and cross-variograms developed for principal components formed from hydrochemistry and rDNA correlation matrices showed spatial correlation between 30 m to 55 m. The principal components between hydrochemistry and microbiological data appear to complement each other, as hydrochemistry PC1 appears to separate sample locations vertically and bacterial PC1 separates sample locations horizontally. Combining these data with a multivariate-geostatistical approach may be useful for delineating leachate-contaminated zones at waste disposal sites.

Evaluation of Temporal and Spatial Trends of Groundwater Quality Alteration in the Area of Mining Waste Disposal Site
Kmiecik, E., S. Stefaniak, J. Szczepanska, and I. Twardowska.
Advanced Environmental, Chemical, and Biological Sensing Technologies II. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5586, p. 126-135, Dec 2004

Data from long-term monitoring studies carried out in a coal mining waste disposal site disclosed the extent and propagation of groundwater quality degradation that resulted from leaching of disposal site contaminants to the Quaternary aquifer, as well as major trends of the alteration to natural water quality. The evaluation of water quality alteration trends focused on two major constituents--chlorides and sulfates--to show significant changes in time and space. Geostatistical methods were applied. The spatial variability was assessed with use of the GeoEas and Surfer models. SigmaPlot was used for data aggregation and trend analysis. Preliminary data analysis was accomplished with Statgraphics Plus for Windows software. The hydrogeochemical background of the two analyzed compounds for each separate hydrogeochemical zone in the waste disposal area was simulated by a probabilistic method. The data gained thereby provided a basis for the long-term evaluation of the groundwater chemical composition and deterioration rate variability in the area of the mining waste disposal site.

Evaluation of Volatilization as a Natural Attenuation Pathway for MTBE
Lahvis, M.A., A.L. Baehr, and R.J. Baker, Shell Global Solutions (U.S.) Inc., Houston, TX.
Ground Water, Vol 42 No 2, p 258-267, Mar-Apr 2004

At a gasoline spill site in Laurel Bay, SC, rates of MTBE volatilization from groundwater downgradient from the source were estimated by analyzing the distribution of MTBE in the unsaturated zone above a solute plume. Volatilization rates of MTBE from groundwater determined by transport modeling ranged from 0.0020 to 0.0042 g/square m/year, depending on the assumed rate of groundwater recharge. Mass loss of MTBE was estimated as insignificant over the 230-m length of the solute plume. Based on this analysis, significant volatilization of MTBE from groundwater downgradient from source areas at other sites is not likely; however, volatilization coupled with diffusion to the atmosphere could be a significant mass loss pathway for MTBE in source areas where residual product resides above the capillary zone. Though not documented, mass loss of MTBE at the Laurel Bay site due to volatilization and diffusion to the atmosphere is predicted to be two to three times greater than mass loading of MTBE to groundwater due to dissolution and recharge, suggesting that volatilization in the source zone may be the critical natural attenuation pathway for MTBE at gasoline spill sites, given capillary zone limitations on volatilization of MTBE from groundwater and the relative recalcitrance of MTBE to biodegradation.

Excitation and Emission Wavelength Ratiometric Cyanide-Sensitive Probes for Physiological Sensing
Badugu, Ramachandram, Joseph R. Lakowicz, and Chris D. Geddes, Univ. of Maryland, Baltimore.
Analytical Biochemistry 327 (2004) 82–90

Three new fluorescent probes show both spectral shifts and intensity changes in the presence of aqueous cyanide, allowing for both excitation and fluorescence emission wavelength ratiometric and colorimetric sensing. The relatively high binding constants of the probes for cyanide enable visual observance of colorimetric change at as little as 10 uM cyanide. The response of the new probes is based on the ability of the boronic acid group to interact with the CN anion, changing from the neutral form of the boronic acid group to the anionic form, which is an electron-donating group.
http://cfs.umbi.umd.edu/cfs/reprints/Anal%20Biochem-cyanide-1-2004.pdf

Explosive Residue Detection by Laser Surface Photo-Fragmentation- Fragment Detection Spectroscopy, II: In Situ and Real-Time Monitoring of RDX, HMX, CL-20, and TNT, by an Improved Ion Probe
Sausa, R.C. and J.B. Cabalo, Army Research Lab., Aberdeen Proving Ground, MD.
Report No: ARL-TR-3478, 28 pp, Apr 2005

Trace concentrations of RDX, HMX, CL-20, and TNT were measured by surface-laser photo-fragmentation/fragment detection (SPF-FD) spectroscopy at ambient temperature and pressure. In

this technique, a low-power 248-nm laser photo-fragments the target molecule on the surface of a substrate, and a low-power 226-nm laser ionizes the resulting nitricoxide (NO) fragment with resonance- enhanced multi-photon ionization by means of its A-X (0,0) transitions near 226 nm. Two different probes collect the ions: one with miniature square electrodes mounted vertical to the substrate and the other with similar electrodes mounted horizontal to the substrate. The horizontal electrodes contain 2-mm holes for laser beam passage. Both probes were tested on the selected explosives and their electric field was modeled in the presence of a substrate with an ion optics simulation program. The results show that the horizontal probe is about ten times more sensitive than the vertical probe because its electric field is perturbed by the substrate to a lesser extent than is the electric field of the vertical probe. The limits of detection of the various explosives range from 1 to 15 ng/sq cm (S/N=3) at 1 atm and room temperature and depend mostly on the mechanism for NO formation. NO is formed with a Boltzmann rotational-vibrational population distribution at room-temperature. A UV absorption spectrum of CL-20 is presented with an extinction coefficient at 248 nm.
http://stinet.dtic.mil/cgi-bin/GetTRDoc?AD=A433690&Location=U2&doc=GetTRDoc.pdf

Explosive Chemical Signature-Based Detection of IEDs
Fisher, Mark, Nomadics, Inc., Stillwater, OK.
DTIC: ADA430111, 22 pp, Dec 2004

This report discusses work to (1) further characterize and understand the explosive chemical signature of improvised explosive devices (IEDs); (2) develop and adapt high-volume sampling methods for use against IEDs and for incorporation into a robotic platform; (3) modify and adapt the Fido sensor device to operation on a small robot; (4) integrate the Fido and high-volume sampling functions into a small footprint commensurate with operation of a small robot; and (4) test the integrated prototype in the laboratory and in the field. These objectives were achieved and demonstrated in a proof-of-concept test at the U.S. Army Yuma Proving Grounds countermine test facility from December 13 to 17, 2004. During these tests, a Fido vapor sensor modified to include high-volume sampling capability was deployed on a Dragon Runner robotic platform. The combined system was able to detect a range of IEDs throughout the course of the test. Nomadics personnel were able to quickly train an EOD technician and a Marine Corps Captain to operate the sensor and detect targets deployed along a roadway. These targets were detected by the integrated platform while providing substantial standoff between the system operator and IED. Targets concealed in vehicles also were detected. In related work, trace-level contamination on personnel who had handled explosives (i.e., EOD technicians), and trace contamination spread by persons who had handled explosives was demonstrated with the sensor when operated in a handheld mode. This report discusses work completed towards achieving each objective listed above, and provides suggestions for future work to enhance the capability of the system for the warfighter.
http://handle.dtic.mil/100.2/ADA430111

Explosives-Detecting Immunosensors: ESTCP Cost and Performance Report
Environmental Security Technology Certification Program (ESTCP), Arlington, VA.
CU-9713, 74 pp, Sep 2000

The Fast 2000 is a continuous flow immunosensor based on a displacement immunoassay, with the key components being antibodies specific for the analyte immobilized on a membrane support, fluorescent signal molecules similar to the analyte saturated on the immobilized antibodies, and a fluorescent detector. Upon injection of an explosive contaminated sample, fluorescent signal molecules

are released into the flow stream and detected by a detector. The FAST 2000 quantitates samples with minimal sample preparation and reagent addition. Analysis is complete within five minutes, with the fluorescent signal being proportional to the analyte concentration in the sample. Tests of the biosensors indicate that the instruments are promising field technologies requiring additional development before they are suitable for field use. The instruments were simple to use, required minimal sample preparation, were easily carried to the field, and generated minimal waste. Determinations of TNT and RDX levels in spiked water samples were accurate and precise down to 10 ug/L, with acceptable levels of false positive/false negative values; however, significant problems were encountered with respect to accuracy and precision in environmental sample measurements. In general, the biosensors were predictive and gave similar yes/no results as the direct injection protocol of U.S. EPA SW-846 Method 8330 (high performance liquid chromatography) at the field detection limit of 20 ug/L. Site-specific matrix effects produced a large scatter in data points, with a lower level of agreement to HPLC quantitative values for several data sets when compared to the field spike results. Of particular concern was the large number of false positive values for the TNT assay. Further development of the technologies will focus on improved assay performance in environmental matrices, sample preparation for low-end detection, and improved signal processing and instrument calculations to remove user bias.
http://www.estcp.org/documents/techdocs/199713.pdf

Fabrication of 3-D Ordered Nanoporous Gold for Chemical Sensors
Hung, David, Zhu Liu, Yaowu Hao, and Peter C. Searson, Johns Hopkins Univ., Baltimore, MD
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. COLL 159.

Nanoporous gold structures were fabricated by electrodeposition of gold into colloidal crystal templates formed by self-assembly. The structures are replicas of the colloidal crystal and have pore sizes and feature sizes that are dependent on the particle size. When the dimensions of a conductor are sufficiently small, the resistance is dominated by surface scattering. A prototype chemical nanosensor was created exploiting this architecture. Molecules with sulfhydryl or disulfide groups adsorb strongly to gold and can be monitored by the change in resistance.

Fast Volatile Organic Compound Recovery from Soil Standards for Analysis by Thermal Desorption Gas Chromatography
Meniconi Mde, F., R. Parris, and C.L. Thomas, Petrobras SA, Rio de Janeiro, Brazil.
Analyst, Vol 128 No 10, p 1232-1237, Oct 2003

A proof-of-concept study indicates how pressurized gas, i.e., carbon dioxide, can be used to recover reversibly-bound VOCs from soil into an adsorbent sampler; the VOCs are then analyzed by thermal desorption/gas chromatography. In a preliminary characterization study of the effects of the volume of the pressurized gas, the gas flow rate, and the mass of the soil sample on the recovery efficiency and breakthrough from the adsorbent trap, two approaches were identified. The first, a rapid screening approach, involved ventilation of the voids within the soil matrix to displace the soil-gas headspace. The second, a purge and trap approach, involved a more prolonged purge of the matrix to strip reversibly bound species into the gas phase and pass them into the adsorbent trap. The shortest possible sample processing time required to yield analytically useful responses was 5 s with the use of the headspace approach. Using the purge and trap variant enabled recovery efficiencies greater than 93% to be achieved with liquid spikes of n-octane onto soil samples. The study indicates that a system based on this approach would need to balance recovery efficiency, time, and analyte breakthrough from the adsorbent trap.

Fiber-Optic Chemical Sensor Using Polyaniline as Modified Cladding Material
Yuan, Jianming and Mahmoud El-Sherif.
IEEE Sensor Journal, Vol 3 No 1, p 5-12, Feb 2003

An intrinsic fiber-optic chemical sensor was developed by replacing a certain portion of the original cladding with polyaniline, a chemically sensitive material. Upon exposure to different chemical vapors, both the light absorption coefficient and the refractive index of the polymer change, which induces the optical intensity modulation of the transmitted optical signal. Sensor performance depends on the optical properties of the replaced cladding material, the cladding modification process, and the properties of the transmitted light within the optical fiber.

Fiber-Optic Microsensor Array Based on Fluorescent Bulk Optode Microspheres for the Trace Analysis of Silver Ions
Wygladacz, K., A. Radu, C. Xu, Y. Qin, and E. Bakker, Auburn Univ., Auburn, AL.
Analytical Chemistry, Vol 77 No 15, p 4706-12, 1 Aug 2005

An optical microsensor array achieves rapid analysis of silver ions at part-per-trillion levels based on the ionophore o-xylylenebis(N,N-diisobutyldithiocarbamate) (Cu-I), which shows excellent selectivity for silver ions. Ion-selective electrode (ISE) membranes were optimized and found to exhibit the lowest reported detection limit so far. A corresponding Ag+-selective fluorescent optical microsensor array for the rapid sensing of trace-level Ag+ was then developed and fabricated using plasticized PVC-based micrometer-scale fluorescent microspheres produced via a sonic particle casting device. The microarray was characterized by fluorescence spectroscopy at pH 7.4, with selectivity characteristics comparable to the corresponding ISEs and a response time of less than 15 min. The microsensor array was used to measure free silver levels in buffered pond water samples.

Field-Deployable Chemical Point Detection Network
Pennington, Charles, Luna Innovations Inc Blacksburg VA
DTIC: ADA419225, 52 pp, Oct 2003

Standoff and point detection devices, combined with effective collective and individual protective systems, can mitigate, even preclude an effective chemical or biological attack. The major technical challenges to chem/bio defense include minimization of false positive/negative alarms; size, weight, and power reduction of detectors; power generation and consumption; development of integrated biological and chemical detection systems; and the fusion of sensor data with mapping, imagery, and other data. Luna Innovations has focused development efforts on critical areas previously identified--system miniaturization, improved sensitivity and specificity, agent characterizations and range, decreased false alarm rate, and decreased operation/support costs--for the detection network described in this report.
http://handle.dtic.mil/100.2/ADA419225

Field Determination of Chloride in Salt Impacted Soils: Just Add Water!
Boyer, D.G., Safety and Environmental Solutions, Inc., Hobbs, NM.
The 11th Annual International Petroleum Environmental Conference, 11-15 October 2004, Albuquerque, NM. The Integrated Petroleum Environmental Consortium (IPEC), Univ. of Tulsa, OK. 11 pp, 2004

The standard method for determination of chloride in soils has been modified for quick determination of chloride in the field using commercially available chloride test strips instead of laboratory chemicals. The method utilizes a portable scale to obtain a weighted sample of dry material

that is placed in a 250 mL plastic bottle. Distilled water is added to the bottle, and it is shaken vigorously for several minutes. The mixture is allowed to settle for a few minutes to reduce turbidity and decanted into a funnel lined with a piece of filter paper. The filtered liquid is collected in a small jar or 40 mL vial that holds the chloride test strip. The strip requires only a few drops of the filtrate, which is absorbed by capillary action. A quick calculation converts the concentration shown on the strip to mg/Kg (ppm). The entire test takes less than ten minutes and results are comparable with laboratory results. The author presents field and lab results for several sites near Lovington, NM.
http://ipec.utulsa.edu/Conf2004/Papers/boyer.pdf

Field Tests of Nylon-Screen Diffusion Samplers and Pushpoint Samplers for Detection of Metals in Sediment Pore Water, Ashland and Clinton, Massachusetts, 2003
Zimmerman, M.J., D.A. Vroblesky, K.W. Campo, A.J. Massey, and W. Scheible, U.S. Geological Survey.
U.S. Geological Survey Scientific Investigations Report 2005-5155, 56 pp, 2005

Pushpoint and nylon-screen diffusion samplers are two complementary options for use in shallow groundwater-discharge areas (pore water) where metals may pose threats to aquatic organisms. The pushpoint sampler, a simple well point, is easy to insert manually and to use. Only 1 day is required to collect samples. The nylon-screen diffusion sampler is well suited for use in sediments that do not allow a pump to draw water into a pushpoint sampler. In this study, both types of devices were used in sediments suitable for the use of the pushpoint sampler. Sampling with the nylon-screen diffusion sampler requires at least two site visits: one to deploy the samplers in the sediment, and a second to retrieve the samplers and collect the samples after a predetermined equilibration period. Extensive laboratory quality-control studies, field testing, and lab analysis of samples collected at the Nyanza Chemical Waste Dump Superfund site in Ashland, MA, and at a Superfund site-assessment location on Rigby Brook in Clinton, MA, indicate that these two devices yield comparable results for most metals and should be effective tools for pore-water studies. The nylon-screen diffusion samplers equilibrated within 1-2 days in homogeneous, controlled conditions in the laboratory. Nylon-screen diffusion samplers that were not purged of dissolved oxygen prior to deployment yielded results similar to those that were purged. Further testing of the nylon-screen diffusion samplers in homogeneous media would help to resolve any ambiguities about the data variability from the field studies. Analyzing samples with high iron concentrations required sample dilution by factors of 2 or 10. Because these dilutions caused increases in the reporting levels by the same proportion, a substantial fraction of the data was censored. The results from undiluted samples, however, indicate that both devices should be useful for sampling ground water with metal concentrations close to reporting limits.
http://pubs.usgs.gov/sir/2005/5155/

Fingerprinting BTEX Sources in Groundwater
Sauer, Ted C. and Helder J. Costa, Blasland, Bouck & Lee, Inc., New Bedford, MA.
The 11th Annual International Petroleum Environmental Conference, 11-15 October 2004, Albuquerque, NM. The Integrated Petroleum Environmental Consortium (IPEC), Univ. of Tulsa, OK. 11 pp, 2004

Because aqueous solubility is predicted to be the controlling influence in the partitioning of hydrocarbons from NAPL to groundwater, a solubility-based approach to matching dissolved hydrocarbons in groundwater to their source NAPL has been developed. Aromatic diagnostic hydrocarbons, expressed in multiple pairs, from PIANO (gasoline-range hydrocarbons consisting of

paraffin, isoparaffin, (mono-) aromatic, naphthene, and olefin compounds) analysis were identified using analyte aqueous solubility and structure relationships, which were found to be useful in distinguishing the source(s) of hydrocarbons in groundwater. Gasoline and coal tar NAPLs and associated groundwater were chemically characterized at contaminated sites to confirm the diagnostic relationships that can link the BTEX present in remote offsite areas of groundwater to source hydrocarbons at a contaminated site.
http://ipec.utulsa.edu/Conf2004/Papers/sauer_costa.pdf

Fish as Sentinels of Persistent Organic Pollutants
NIEHS Superfund Basic Research Program, Research Brief 114, June 2004

Knowledge of polychlorinated biphenyls (PCBs) and polychlorinated dibenzo-p-dioxins and furans (PCDD/Fs) congener composition in environmental matrices can help in predicting and quantifying their toxicities. While only limited research has been conducted on PCDD/F contamination levels in sediments and biota of the Hudson River estuary, significant work has been done to determine the spatial distribution and temporal stability of PCBs in river sediments (see NIEHS Research Brief 108), the water column, and selected biota along the main-stem Hudson River. Dr. Isaac Wirgin at the New York University School of Medicine SBRP is examining PCB and PCDD/F totals and congener patterns in hepatic tissues young-of-the-year (YOY) and adult Atlantic tomcod collected from various sites in the main-stem Hudson River estuary. He and a team of researchers are investigating spatial and age-related variability in levels and patterns of PCBs and PCDD/Fs in tomcod from the area. This information may provide some insight into the dynamics and potential sources of these contaminants for Hudson River fishes. It may also help explain why tomcod from the Hudson River population are resistant to early life-stage toxicities and gene induction from exposure to these contaminants. The PCDD/F congener profile comparison between Newark/Hackensack and Hudson River revealed a distinct 2,3,7,8-TCDD source in the Newark/Hackensack location, which likely was due to the herbicide production facility that previously operated there. Because of the spatial variation in PCB and PCDD/F patterns in YOY tomcod, this species may serve as an effective time-integrated biomonitor of site-specific organochlorine contamination. Contact: Isaac Wirgin, 845-731-3548, wirgin@env.med.nyu.edu
http://www-apps.niehs.nih.gov/sbrp/researchbriefs/view.cfm?Brief_ID=114

FT-IR Microspectroscopy of RDX in Clay Soils
Colon, Y.M., C.M. Ramos, S.P. Hernandez, M.A. Munoz, and N. Mina.
Detection and Remediation Technologies for Mines and Minelike Targets X. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5794, p 729-737, Jun 2005

The chemical spectroscopic signature of the RDX in clay soil environments has been investigated by means of reflectance FT-IR microspectroscopy. The soil samples were treated using the textural mechanical method to separate the clay from all the other components in the soil. B3LYP/6-311G** calculations performed on the low energy conformers of RDX helped to determine its most stable conformations, symmetry, and vibrational spectra. The FT-IR technique confirmed the existence of two different RDX solid phases--alpha-RDX and beta-RDX, which have different symmetries--and revealed significant differences in their spectra. The IR microspectroscopic study showed that the RDX-clay mineral complex and its interactions can be detected using the FT-IR technique at a concentration of 1000 parts-per-million. Variations in the clay's pH revealed changes in the RDX-clay complex spectroscopic signature. The authors hypothesize that the electron donor nitrogen atoms from RDX are interacting with the electron acceptor oxygen atoms of the edge sites of the clay's surface.

Gas Tracer Methods for the Investigation of the Vadose Zone
Werner, D. (Univ. of Newcastle upon Tyne, UK); P. Hoehener (ENAC-ISTE-LPE, Swiss Federal Inst. of Technology, Lausanne, Switzerland); H.K. Karapanagioti (Univ. of the Aegean, Mytilene, Greece).
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. GEOC 94.

Vadose zone properties can be quantified by injecting gaseous tracers and monitoring the concentration change at the injection point or the breakthrough of diffusing tracers at a distance. Conservative tracers like CFCs or SF6 allow for a quantification of the effective gas phase diffusivity or tortuosity. By combining this approach with the simultaneous analysis of soil gas constituents, diffusive vapor fluxes can be quantified in the subsurface. Injection of a combination of conservative tracers and volatile organic chemicals (VOCs) allows determination of the solid-to-water partitioning coefficients. Apparent first-order biodegradation rates are also quantifiable by monitoring a conservative and a degradable tracer. The authors investigated the use of these novel techniques at an air base. This paper reports the merits and limitations of the techniques.

General Guidance for Selecting Petroleum Hydrocarbon Field Screening Methods
IT Corporation/U.S. Army Cold Regions Research and Engineering Lab.
Alaska Department of Environmental Conservation, Division of Spill Prevention and Response, Prevention & Emergency Response Program, Juneau, AK. 20 pp, June 1999

This document offers general guidance to responsible parties, project managers, and field technicians engaged in petroleum hydrocarbon assessment and remediation projects. The guidance is based upon data collected in a laboratory setting where variables affecting the performance of field screening technologies were controlled and monitored. Results from the laboratory phase of the evaluation were then used to design and perform a similar evaluation of field screening technologies under relatively uncontrolled conditions in the field. Lessons learned and general conclusions derived from the lab and field phases of the field screening methods evaluation are tabulated herein. This report is an informational presentation of field screening technologies and the selection and application of these technologies to meet site-specific needs.
http://www.dec.state.ak.us/spar/perp/r_d/proj_10.pdf

Geochemical Characterization of Water, Sediment, and Biota Affected by Mercury Contamination and Acidic Drainage from Historical Gold Mining, Greenhorn Creek, Nevada County, California, 1999-2001
Alpers, C.N., M.P. Hunerlach, J.T. May, R.L. Hothem, H.E. Taylor, R.C. Antweiler, J.F. De Wild, and D.A. Lawler.
U.S. Geological Survey Scientific Investigations Report 2004-5251, 293 pp, 2005

In 1999, the U.S. Geological Survey initiated studies of mercury and methylmercury occurrence, transformation, and transport in the Bear River and Yuba River watersheds of the northwestern Sierra Nevada. Because these watersheds were affected by large-scale, historical gold extraction using mercury amalgamation beginning in the 1850s, they were selected for a pilot study of mercury transport. This report presents data on methylmercury (MeHg) and total mercury (THg) concentrations in water, bed sediment, invertebrates, and frogs collected at 40 stations during 1999-2001 in the Greenhorn Creek drainage, a major tributary to Bear River. Results document several mercury contamination hot spots that represent potential targets for ongoing and future remediation efforts at abandoned mine sites in the study area. Total mercury concentrations in sediment were determined by laboratory and field methods. Total mercury concentrations (determined by laboratory

methods) in ten samples from eight stations ranged from about 0.0044 to 12 ug/g. Methylmercury concentrations in these samples ranged from less than 0.00011 to 0.0095 ug/g. A field panning method was used to determine the concentration of liquid elemental mercury in 22 samples from 14 stations. Measured quantities of elemental mercury recovered by panning ranged from a trace amount estimated at 100 milligrams per kilogram (equivalent to parts per million) to 45,000 milligrams per kilogram (equivalent to 4.5%, by weight). The data from this reconnaissance sampling effort have been used by land-management agencies in selecting abandoned mine sites for remediation. The Forest Service has remediated the Sailor Flat site, and the Bureau of Land Management has initiated plans to remediate the Boston Mine drainage tunnel.
http://pubs.usgs.gov/sir/2004/5251/

Geochemical Conditions in Buried Transuranic Waste Monitored Using In Situ Degradation of Chlorinated Solvents
Hull, L.C. and A.J. Sondrup, Idaho National Engineering and Environmental Laboratory (INEEL).
Proceedings of Waste Management 2004, 29 February - 4 March, Univ. of Arizona, Tucson. Paper WM-4490, 14 pp, 2004

In the late 1960s, drums containing sludge generated during the machining of plutonium metal were buried in the INEEL radioactive waste Subsurface Disposal Area. The sludge consists of carbon tetrachloride (CT) mixed with lubricating oil, contaminated with plutonium, and solidified with calcium silicate. The release and migration of transuranic elements from these drums is of concern, but predicting their long-term mobility requires information on the biogeochemical conditions in the waste. Vapor samples have been collected from soil gas above the waste disposal pits, in the vadose zone beneath the waste, and from vapor ports installed into waste. Gas samples consistently show very high concentrations of CT and chloroform. Though chloroform is not known to have been disposed of in the disposal area, it is a known CT degradation product that is readily formed under anaerobic conditions. Other known degradation products, such as methylene chloride, are detectable in the pits at low concentrations. The relative abundance of halogenated aliphatic compounds, degradation products, and other gases provides a method for evaluating the redox potential of the buried waste. The mobility of transuranic elements is sensitive to redox conditions, and the gas-phase chemistry can provide data to assess the mobility and fate of the transuranic elements.
http://www.wmsym.org/abstracts/2004/pdfs/4490.pdf

Geophysical Imaging and Photographic Documentation from Kites of Salt Contaminated Soils
Bauman, P., Komex International Ltd., Calgary, AB, Canada.
The 41st Annual Alberta Soil Science Workshop, Lethbridge, AB (Canada), 17-19 Feb 2004. Abstracts. Agriculture and Agri-Food Canada, Main Lethbridge, Alberta, Canada. [OSTI: DE20588041]

Costs associated with drilling, soil sampling, and analytical chemistry to characterize salinized soils are proportional to the volume of polluted soil. This paper describes innovative geophysical methods that can be used to image subsurface chloride and sulfate pollution. 2- and 3-D electrical resistivity tomography is shown to be a cost-effective tool for providing volumetric images of soils polluted with salts from flare pits, drilling sumps, injection wells, pipeline breaks, tank leaks and tanker spills. Photodocumentation of such sites is useful during site characterization and remediation. Because sites polluted with salts are amenable to low-level, high-resolution aerial photographic techniques, high-resolution, small-format aerial photography from kites, balloons, and masts are being used in their characterization. Subsurface geophysical data can be merged with high-resolution aerial photography using digital photogrammetric methods. An example is provided of a 3-D rendering of subsurface salt pollution overlaid by a high-resolution base map.

Geophysical Monitoring of Gas Production During Biostimulation
Hubbard, S. and K. Williams, Lawrence Berkeley National Laboratory, Berkeley, CA.
Proceedings of Waste Management 2004, 29 February - 4 March, Univ. of Arizona, Tucson. Paper WM-4029, 12 pp, 2004

Seismic, radar, and electrical geophysical methods have potential for providing information about dynamic and coupled subsurface processes in a non-invasive and high-resolution manner. An improved ability to monitor dynamic subsurface processes that occur during remediation and over a variety of spatial scales could reduce the uncertainty associated with the efficacy of many remediation treatments. An understanding of the relative sensitivities of the geophysical attributes to the transformation products in the presence of hydrogeological heterogeneity is necessary before these data can be used in a quantitative manner to monitor remediation processes. In a study, biogenic gas generated during a controlled, column-scale biostimulation experiment was seen to influence electromagnetic wave travel time and amplitude measurements collected using a time domain reflectometry (TDR) system. Both radar velocity and amplitude data were used to indicate the onset of denitrification in an originally water-saturated sand column. Radar velocities were used within a petrophysical mixing model to obtain spatially-and temporally variable estimates of the percent of the pore space that was replaced by N2 gas. At the end of the experiment, the radar velocity data suggested that the average gas saturation in the column was 24.6%, which agreed well with the estimate of 23.3%, obtained with column weight-loss measurements. Hydraulic conductivity decreased during the experiment by 55% due to pore clogging by the generated gas bubbles. The experiment illustrated how radar data can be used at the laboratory scale to monitor gas evolution caused by microbial activity during biostimulation.
http://www.wmsym.org/abstracts/2004/pdfs/4029.pdf

Global Uncertainty Associated with the Analysis of PCBs and Chlordanes in Drinking Water by Headspace-SPME-GC/MS/MS
Herbert, P., A. Alves, and L. Santos, Univ. do Porto, Porto, Portugal.
International Journal of Environmental Analytical Chemistry, Vol 85 Nos 4-5, p 267-280, 10 Apr 2005

Using headspace solid-phase microextraction (HS-SPME) and GC-MS/MS, it was possible to reach low ng/L levels of quantification in drinking water for 7 marker polychlorinated biphenyls (PCBs) and two chlordane isomers, with a relative global uncertainty associated with the results of all contaminants ranging from 11 to 38%. Though the assessed relative uncertainties of the results can be considered acceptable and may be further improved at higher concentration ranges, they may have considerable importance for levels close to the method detection limits, where they may represent more than 100% of variation for the stated result.

Groundwater Monitoring of VOCs with an Interferometric Optical Waveguide Sensor
Campbell, Daniel P., David S. Gottfried, and Janet M. Cobb-Sullivan, Georgia Tech Research Institute.
Advanced Environmental, Chemical, and Biological Sensing Technologies II. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5586, p 136-143, Dec 2004

A cost-effective planar waveguide interferometer sensor system has been designed for the detection and measurement of volatile organic compounds to monitor groundwater quality. Planar waveguides have evanescent fields sensitive to index of refraction changes in the volume immediately above the waveguide surface. These fields extend up to 5,000 angstroms (500 millimicrons) above the surface. Placing a chemically sensitive polymer film within this region provides the basis for a chemical sensor. Polymer-analyte interactions change the index of refraction causing the propagating light velocity to change in a direction opposite to that of the index change. To measure this change, a reference propagating beam, adjacent to the sensing beam, is optically combined with the sensing beam creating an interference pattern of alternating dark and light fringes. When chemical or physical changes occur in the sensing arm, the interference pattern shifts. Real-time Fourier transform signal processing converts the time-dependent pattern to phase shift which is a measure of total analyte absorbed. Different polymer detection layers have been used in the lab to selectively measure chlorinated hydrocarbons in water (TCE<100 ppb, PCE<25 ppb). The interferometric sensor has also been tested at groundwater well sites contaminated with ppm levels of TCE. Results were compared to independent sampling and laboratory analysis (EPA 8260). This sensor appears to fit the need for real-time, in situ groundwater (or surface water) monitoring of VOCs and other compounds.

Groundwater Monitoring Plans at Small-Scale Sites--an Innovative Spatial and Temporal Methodology
Ling, M., H.S. Rifai, C.J. Newell, J.J. Aziz, and J.R. Gonzales.
Univ. of Houston, Houston, TX
Journal of Environmental Monitoring, Vol 5 No 1, p 126-34, Feb 2003

An innovative methodology for improving existing groundwater monitoring plans at small-scale sites incorporates three stand-alone methods that allow calculations for spatial redundancy reduction, well-siting for adding new sampling locations, and sampling frequency determination. The spatial redundancy reduction method uses an optimization process that minimizes the errors in plume delineation and the average plume concentration estimation. The well-siting method locates possible new sampling points for an inadequately delineated plume via regression analysis of plume centerline concentrations and estimation of plume dispersivity values. The sampling frequency determination method recommends the future frequency of sampling for each sampling location based on the direction, magnitude, and uncertainty of the concentration trend derived from representative historical concentration data. The proposed methodology is illustrated by application to a small petroleum hydrocarbon-contaminated site with a network of 12 monitoring wells

A Guide to the Proper Selection and Use of Federally Approved Sediment and Water-Quality Samplers
Davis, Broderick E. and the Federal Interagency Sedimentation Project.
U.S. Geological Survey Open-File Report 2005-1087, 26 pp, 2005

The purpose of this report is to provide (1) a general understanding of sediment sampling equipment and technology, (2) guidance for the selection of the appropriate equipment, and (3) an introduction to new sampling equipment approved by the Federal Interagency Sedimentation Project.
http://water.usgs.gov/osw/pubs/OFR_2005_1087/OFR_2005-1087.pdf

Hadamard Transform Time-of-Flight Mass Spectrometry
Massick, Steve, Southwest Sciences Inc., Santa Fe, NM.
Report No: R03-14-4, DTIC: ADA429458, 15 pp, Nov 2004

The Hadamard transform method was applied to atmospheric pressure ion mobility separation (IMS) for the analysis of trace species. Target applications include chemical and biological agent detection, as well as protein sequencing and identification. The Hadamard transform approach improves sensitivity by increasing sample throughput, yet requires only minimal modification to the existing

hardware. Commercially available DSP electronics that operated an existing IMS were programmed in Phase I for Hadamard transform modulation and collected ion signals synchronous with higher rates than the Hadamard modulation sequence. This strategy allows for parsing of the analog signal to avoid noise associated with the pulsing of the Bradbury Nielson ion gate, as well as for easy comparison of various modulation rates and sequence lengths.
http://handle.dtic.mil/100.2/ADA429458

Hazardous Liquid Leak Detection Techniques and Processes
Liou, J.C.P., R.J. Hall, and M.C. McMahon, General Physics Corporation, Elkridge, MD.
U.S. DOT, Research and Special Programs Administration, Office of Pipeline Safety, Report No: DTRS56-02-D-70037-01, 47 pp, Apr 2003

This report identifies the range of practical internal and external methods used to detect leaks in hazardous liquid pipelines. The report presents a brief description of each method, its limitations, relative precision, practicality, and swiftness characteristics. The information presented is based on a literature search performed to identify proven technologies used by pipeline companies to detect leaks. This report is intended to be used by pipeline inspectors as an aid in assessing leak detections systems installed to comply with the integrity management rule (49 CFR 195.452).
http://primis.phmsa.dot.gov/iim/pdfs/LeakDetectionReport_Final_Apr03.pdf

Heavy Metal Ion Detection Using Peptide-Modified Hydrogel Layers on a Quartz Crystal Microbalance
Shepard, Jackie, Venkat Bhethanabotla, and Ryan Toomey, Univ. of South Florida, Tampa.
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. POLY 581.

The authors present a class of peptide/poly(N-isopropylacrylamide) (NIPAAm) hybrid thin films that combines both sensing and signal amplification at the material level. The feasibility of using these materials in the detection of heavy metal ions is demonstrated. The hybrid films communicate a binding event in the peptide sequences through a change in the lower critical solution temperature of the NIPAAm network. Detection is accomplished by monitoring the viscoelasticity of the film. A complete sensing platform using such films has been coupled with the quartz crystal microbalance.

Hg2+-Selective Chemosensor Derived from 8-Hydroxyquinoline Having Benzothiazole Function in Aqueous Environment
Youk, Jin-Soo, Young Hee Kim, Eun-Jin Kim, Na Jin Youn, and Suk-Kyu Chang, Chung-Ang Univ., Seoul, Korea.
Bulletin of the Korean Chemical Society, Vol 25 No 6, p 869-872, 2004

Newly synthesized 8-hydroxyquinoline based benzothiazole derivative no. 2 showed distinctive Hg2+-selectivity over other transition metal ions in aqueous solution. The fluorescence emission at 455 nm of derivative 2 was completely quenched upon interaction with Hg2+ ions in a dioxane/water system. An Hg2+ concentration-dependent fluorescence-quenching profile was observed in the presence of common interfering metal ions as background. The fluorescence behavior of derivative 2 suggests that the prepared compound could be used as a fluorescent signaling sub-unit for the construction of new Hg2+-sensitive "on/off" type supramolecular switching systems.
http://newjournal.kcsnet.or.kr/main/j_search/j_download.htm?code=B040621&e=11028&mr=75_

Highly Sensitive Picomolar SPR/Potentiometric Sensing of Nerve Agents Using Electrochemically Cosslinked PAMAM Dendrimer/Cu Ion Complexes
Advincula, Rigoberto C., Prasad Taranekar, and Akira Baba, Univ. of Houston, Houston, TX.
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. ANYL 253.

New methods of sensing of nerve agents were explored using a combined surface plasmon resonance (SPR) technique and a potentiometric sensor assembly by which both electrochemical and optical response can be monitored simultaneously. Electro-generated ultrathin films based on electroactive carbazole-modified polyamidoamine (PAMAM) dendrimers loaded with Cu+ were used as sensor materials to anchor nerve agent analogs onto the films. The carbazole to amine ratio was optimized to ensure that enough free primary amines were left to interact with the analyte. The dendrimer was complexed with Cu+ (which forms strong non-covalent bonds upon exposure to nerve agent bearing phosphonyl groups) to introduce selectivity. The instrument achieved high picomolar sensitivity.

High Resolution Seismic Reflection to Characterize and Plan Remediation at Hazardous Waste Sites: ESTCP Cost and Performance Report
Environmental Security Technology Certification Program (ESTCP), Arlington, VA. CU-9601, 40 pp, Oct 1999

This report presents cost and performance data for a 3-D seismic reflection survey technique that was used to generate a high-resolution, 3-D imaging of subsurface geologic, subsurface hydrogeologic, and subsurface dense nonaqueous phase liquid (DNAPL) contaminant source areas at four selected DoD sites. Seismic reflection imaging is based on the principle that acoustic energy (sound waves) will bounce or "reflect" off the interfaces between layers within the earth's subsurface. These interfaces are subsurface anomalies that provide possible pathways and traps for DNAPL. The investigators believed that interfaces between the DNAPLs and surrounding materials can cause a reflection anomaly recognizable with this seismic technique. A 3-D seismic survey uses multiple points of observation. In a 3-D survey, a grid of geophones and seismic source impact points are deployed along the surface of the site. The result is a volume, or cube, of seismic data that is sampled from a range of different angles (azimuth) and distances (offset). The data are a high-resolution, distortion-free representation of the subsurface. A complete seismic survey consists of the following components: 1) site research and generation of a geologic model, 2) vertical seismic profile (VSP) generation to obtain a velocity model for the site's subsurface stratigraphy, 3) land survey for proper position of important site features and data collection points, 4) 3-D seismic reflection survey surface geophysical data collection activities, 5) 3-D data processing and interpretation, 6) attribute analysis to delineate anomalies that may represent fractures and/or DNAPL, and 7) confirmation drilling, sampling and analysis.
http://www.estcp.org/documents/techdocs/199601.pdf

Hydrocarbon Contamination of Aquifers by SNMR Detection
Shushakov, O.A. and V.M. Fomenko (ICKC SB RAS); V.I. Yashchuk and A.S. Krivosheev (YMHE); E. Fukushima and S.A. Altobelli (New Mexico Resonance); V.S. Kuskovsky (UIGGM SB RAS).
Proceedings of Waste Management 2004, 29 February - 4 March, Univ. of Arizona, Tucson. Paper WM-4566, 7 pp, 2004

Surface nuclear magnetic resonance (SNMR) can be used to unambiguously detect subsurface water in suitable geological formations to a depth of 100 meters and more depending on the presence of natural and cultural electromagnetic noise. Mathematical routines yield depth distributions of the liquid,

provided that the liquids are present in horizontal layers and not in pores that are too small to be detectable. Determination of pore size distributions is now possible with relaxation time measurements. Experiments were performed at shallower depths to detect signals from deposits of subsurface gasoline and diesel fuel near Abakan, Siberia. Surface NMR signals were observed with multiple T2* spin relaxation times at sites containing both gasoline and water. The identification of gasoline and water signals were made on the basis of making measurements much farther from the apparent source of contamination and obtaining only one T2* component, presumed to be water.
http://www.wmsym.org/abstracts/2004/pdfs/4566.pdf

Hydrocarbon Vapor Workshop, January 28-29, 2004, Brea, California
Petroleum Environmental Research Foundation (PERF) website, 2004

This workshop was sponsored by U.S. DOE and PERF and hosted by Unocal. The objectives of the workshop were to highlight the important biological, geological, chemical and physical factors that control or affect the movement of hydrocarbon gases in the vadose zone leading to possible vapor intrusion in overlying structures. The intent of the workshop from DOE and PERF's point of view was to discuss the problems that affect hydrocarbon vapor intrusion estimates and to derive consensus about some of the issues that exist surrounding the regulatory strategies that are used at contaminated sites. An expanded summary of the workshop appears in the September 2004 issue of Environmental Forensics. The agenda for the workshop, the presentations, and a brief summary can be viewed on the PERF website.
http://www.perf.org/index.php?act=workshop_2004-01

Hyperspectral TRWIS III Data to Delineate the Kam Kotia Mine Tailings Areas (Ontario, Canada)
Richter, Nicole, Hermann J. Kaufmann, and Karl Staenz.
Remote Sensing for Environmental Monitoring, GIS Applications, and Geology IV. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5574, p 214-223, Oct 2004

Rehabilitation of the Kam Kotia Mine tailings areas began in 2001, when a monitoring program based on remote sensing was initiated using airborne hyperspectral TRWIS III imagery. Data pre-processing consisted of the retrieval of surface reflectance and corrections of radiometric and spectral errors. After application of a destriping procedure, surface reflectances were retrieved, indicating a varying across-track wavelength shift, known as the spectral smile. The detection and correction of this phenomenon used an algorithm based on the comparison of measured and modeled at-sensor radiance data within certain wavelength regions. Sensor calibration problems required a scene-based radiometric calibration performed on the destriped and spectrally corrected reflectance data. The subsequent spectral unmixing analysis included an iterative error analysis technique to automatically extract endmembers from the data. The resulting fraction images were grouped into areas of vegetation, vegetation residues, and oxidized tailings. The tailings area was further subdivided into four distinct zones for rehabilitation status monitoring.

Hyperspectral Partial Unmixing Technique for Oil Spill Target Identification
Salem, Foudan and Menas Kafatos, George Mason Univ., Fairfax, VA.
Geo-Imagery Bridging Continents: 20th ISPRS Congress, 12-23 July 2004, Istanbul, Turkey. International Society for Photogrammetry & Remote Sensing and Spatial Information Sciences, 4 pp, 2004

Advanced techniques for oil spill detection and oil spill type identification using hyperspectral AVIRIS data are presented. Spectrally complex areas are highly dimensional and are consequently difficult to fully unravel. The Spectral Linear Unmixing (SLU) technique has previously shown many

limitations for operational applications because signatures for all the target materials in the scene must be spectrally identified. A new methodology emphasizes the ability to distinguish oil slicks from the background using the Partial Unmixing (PU) technique. Both the data reduction and the pixels projection methods are used for distinguishing thick, slick oil from dispersed oil; moderate and thin oil sheens; polluted water; and tarry oil. The method was developed in part to partially un-mix the oil target pixels from the background mixed pixels. It improves on the SLU technique because it dose not require prior knowledge of the background material spectral signatures. The analysis applies to oil spill targets with the assumption that all pixels are pure and are not mixed with background materials. The method is discussed in relation to the specific case of the Santa Barbara coastal zone event of March 2002.
http://www.isprs.org/istanbul2004/comm7/papers/250.pdf

Identifying Connections in a Fractured Rock Aquifer Using ADFTs
Halihan, T., A. Love, and J.M. Sharp Jr., Oklahoma State Univ., Stillwater.
Ground Water, Vol 43 No 3, p 327-335, May-June 2005

In an area dependent on a fractured-rock aquifer, investigators evaluated the ability of steady-state asymmetric dipole-flow tests (ADFTs) to determine the connections between a test well and a set of piezometers. The procedure involves dividing a test well into two chambers using a single packer and pumping fluid from the upper chamber to the lower chamber. By conducting a series of tests at different packer elevations, an input signal is generated in fracture zones connected to the test well. By monitoring the output response of the hydraulic dipole field at piezometers, the connectivity of the fractures between the test well and piezometers can be determined. Results indicate the test well used in this study is connected in a complex 3-D geometry, with drawdown occurring above and below areas of potentiometric buildup. The ADFT method shows that the aquifer evaluated in this study cannot be modeled effectively on the well scale using continuum flow models.

Imaging Prestige Fuel Layers below Sand Using in Situ Radar Sensors
Cimadevila, Henrique Lorenzo, Pedro Arias, Fernando Rial, and Manuel Pereira.
Remote Sensing for Environmental Monitoring, GIS Applications, and Geology IV. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5574, p 351-360, Oct 2004

Many months after the breakup of the fuel oil tanker Prestige just off the coast of Spain in November 2002, layers of fuel contamination still appear at different depths in the sand of the beaches, varying from a few centimeters to 1 to 2 meters. The lateral extent of the contamination also varies from mere centimeters to more than 1 meter. Radar sensors could be used in situ to detect and imaging fuel layers below sand in inland areas that are under the influence of high winter tides but remain out of the influence of salt water from the sea during spring and summer. This paper discusses tests carried out on the affected beaches with a ground-penetrating radar system operating with 500 & 800 MHz nominal frequency antennas, as well as a case study of the beach of Carnota (Galicia), where it was possible to detect a buried fuel layer 6 months after the breakup of the tanker.

Improvement to UVIF to Detect Hydrocarbon Contamination
The UofA Geotechnical Centre 2004 Report. Univ. of Alberta Geotechnical Centre, p 11, Dec 2004

A study has been initiated in collaboration with Conetec Investigation Ltd. (Vancouver, Canada) to improve their existing CPT ultra-violet-induced fluorescence (UVIF) module for delineation of free-phase hydrocarbons in the subsurface. The system is based on the concept that aromatic compounds in hydrocarbons (i.e. those with benzene-ring based compounds) will fluoresce in the presence of UV light. The current system uses a high-intensity UV light projected through a sapphire window into the surrounding soil and a photo multiplier tube sensor to record the fluorescence in the surrounding soil. The signal from the photo multiplier tube, measured in volts (V), is relayed through the electrical CPT cable to a data processing system in the CPT rig. The current UVIF system is useful to determine the presence of aromatic hydrocarbons, but it is unable to resolve concentrations or particular compound types. To improve the capabilities of the current CPT-UVIF technology to provide comprehensive insight into the contaminant types, concentrations, and distribution, a research program began with a comprehensive literature review of the chemical and physical principles behind the fluorescence phenomenon of aromatic compounds. Further research was conducted to investigate the uniqueness of the fluorescence spectrum of the compounds and the potential to use the fluorescence spectrum as a signature or fingerprint for various compounds. Every petroleum hydrocarbon compound, under controlled conditions, has a unique fluorescence spectrum with well-defined peaks at certain wavelengths and defined area under the spectral curve (quantum yield). The challenge is to develop a system that can be placed downhole to resolve spectral signatures and transmit the information in an electronic form to the surface. An exploration of different fluorescence measurement techniques indicates that synchronous and time-resolved fluorescence measurements seem to be potentially viable options that can be used effectively with an acceptable accuracy. These measurement techniques are currently under investigation in the lab to assess their applicability to contaminated soil samples and to study future adaptations for in situ site characterization.

Improving Site Characterization and Classifying Attenuation Processes Using Microbiological Profiles, Geochemistry, and Artificial Neural Networks from Landfill-Leachate Contaminated Groundwater
Mouser, Paula J. and Donna M. Rizzo, Univ. of Vermont, Burlington.
World Water and Environmental Resources Congress 2005, 15-19 May 2005, Anchorage, Alaska. ASCE Press, Reston, VA. p 371, 2005

In a shallow aquifer contaminated by municipal landfill leachate in northeastern New York, polymerase chain reaction of the 16S rDNA molecule and sequencing was used to identify organisms associated with clean and leachate-contaminated monitoring wells. A principal component analysis of general water quality parameters, metals, and inorganic and organic compounds revealed three groups of samples: highly contaminated, leachate-influenced, and uninfluenced groundwater monitoring locations. Microorganisms could also be classified into three groups. The combined use of principal component scores and microorganism community analysis for depicting the zone of leachate influence permits a better estimate of the extent of contamination and attenuation processes. The authors present an artificial neural network that can be trained to predict the geochemistry based on the microbiological profile, thereby improving site characterization using multiple types of data.

In-Situ Aerosol Chemical Characterization Using Particle-into-Liquid-Sampler and Ion Chromatography Yu, Xiao-Ying, Colorado State Univ., Fort Collins.
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. GEOC 110.

The Particle-Into-Liquid-Sampler (PILS) is a novel aerosol collector that enables fast, in situ aerosol chemical characterization coupled with modern analytical instrumentation, such as ion chromatography (IC). Major inorganic aerosol species, such as nitrate, sulfate, chloride, sodium, ammonium, potassium, calcium, and magnesium, have been characterized with a 15-min time resolution on the ground. PILS-IC provides temporal measurement of important aerosol species compared to denuder/filter-pack techniques, as was seen in strong diurnal and seasonal effects observed in San Gorgonio, CA, in spring and summer. The author details the results of numerous applications of PILS-IC for fast, in situ aerosol chemical characterization.

In Situ Determination of Sorption and Bioavailability of PAHs in Sediments with Solid-Phase Micro Extraction Fibers
Jonker, M.T.O., S.A. Van der Heijden, T.L. Ter Laak, and J.L.M. Hermens, Utrecht Univ., Utrecht, The Netherlands.
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. GEOC 95.

Solid-phase micro extraction (SPME) was originally developed as an analytical tool to extract liquid-like samples without the use of solvents. The device consists of a small glass fiber coated with a hydrophobic polymer. The technique has been applied for the extraction of organic chemicals from various samples, including wastewater and soil or sediment pore water, and researchers recently have used SPME fibers to mimic uptake of chemicals in organisms to support risk assessment studies. The authors exposed fibers in situ with aquatic worms (in enclosures) to three PAH-contaminated sediments for four weeks. The data were used to quantify in situ sorption of PAHs and to compare the fiber concentrations with effects on the worms.

In-Situ Microchemical Sensors for Long-term Monitoring of Subsurface Contaminants
Ho, C.K., L.K. McGrath, J.L. Wright, and S.S. Collins, Sandia National Labs, Albuquerque, NM.
Proceedings of Waste Management 2004, 29 February - 4 March, Univ. of Arizona, Tucson. Paper WM-4061, 13 pp, 2004

An in situ chemiresistor sensor has been developed that can continuously monitor volatile organic compounds in air, soil, and water. The chemiresistor consists of a conductive polymer deposited onto a microfabricated circuit that changes its electrical resistance in the presence of volatile organic compounds. The change in resistance can be calibrated to known concentrations of analytes, and arrays of chemiresistors can be used on a single chip to aid in discrimination. A rugged, waterproof housing was constructed to allow the chemiresistor to be emplaced in monitoring wells or immersed in water, and a cable connects the sensor to a surface-based, solar-powered data logger employing wireless telemetry. This system has been deployed at Sandia's Chemical Waste Landfill, where in situ sensor data are posted continuously to a web site. The monitoring system at the landfill has two chemiresistors to detect trichloroethene (TCE) and other sensors to monitor environmental changes at the site. This system has been operating continuously since March 2003.
http://www.wmsym.org/abstracts/2004/pdfs/4061.pdf

In-Situ Probing of Subsurface Microbial Activity with Stable Isotopes
Conrad, Mark E., Lawrence Berkeley National Laboratory, Berkeley, CA.
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. GEOC 154.

Isotopic measurements of subsurface microorganisms, their metabolic substrates, and byproducts in soil, pore gas, and groundwater samples can be used to monitor in situ microbial activity. Isotopic measurements of carbon dioxide and biomass produced by organisms can provide clues about the extent and type of microbial activity. Isotope ratios of methane and other hydrocarbon compounds can be used to identify microbial processes affecting their abundance. Clues about the roles of specific groups of subsurface organisms can be gained by analyses of the carbon isotope compositions of compounds extracted from microbial biomass. Microbial degradation of halogenated organic compounds (e.g., TCE) causes distinctive shifts in the carbon isotope composition of the compounds. The author discusses sampling and analytical techniques for detecting these processes.

In Situ Voltammetric Measurements in Coastal Marine Sediments
Taillefert, Martial, Gwendolyn Bristow, Jennifer Schur, Stephanie Chow, and Deidre Meiggs. Georgia Inst. of Technology, Atlanta
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. GEOC 98.

The recent development of voltammetric microelectrodes has not only improved the spatial resolution of chemical profiles in sediments, but has also provided the capability to measure in situ dissolved O2, Mn2+, Fe2+, H2S, as well as other intermediate compounds involved in the cycling of natural organic matter (NOM). A study to better understand the mechanisms regulating the transformation of NOM in estuarine and continental shelf sediments combines state-of-the-art in situ voltammetry and mathematical modeling. In situ measurements conducted in estuarine sediments are reported.

Indices for Bioavailability and Biotransformation Potential of Contaminants in Soils
Braida, W.J. (Connecticut Agric. Exp. Station, New Haven); J.C. White; J.J. Pignatello.
Environmental Toxicology and Chemistry, Vol 23 No 7, p 1585-1591, July 2004

Bioavailability is an important consideration in both risk assessment of soil contaminants and in the selection of appropriate remediation technologies for polluted sites. Researchers examined the bioavailability and biodegradation potential of phenanthrene with respect to a pseudomonad in 15 different soils through separate measurements of mineralization, transformation, and desorption to a polymeric infinite sink (Tenax(TM)) after 180-d sterile pre-equilibration with phenanthrene. Fractions strongly resistant to desorption and mineralization at long times were evident in all cases. After correcting for bioconversion (moles mineralized per mole transformed) determined in aqueous particle-free soil extracts, a correlation was found between the biotransformation-resistant fraction and the Tenax desorption-resistant fraction. Indices are proposed to assess bioavailability and biotransformation potential of a compound in a soil based on parallel desorption and degradation studies over a selected period. The combination of the two indices provides insights regarding the relationship between physical availability (desorption) and biological processes (biotransformation kinetics, toxicity, other soil factors) that occur during biodegradation and are suggested to represent the remediation potential of the chemical. The method was applied to an assessment of contaminated silt at Wurtsmith Air Force Base
http://entc.allenpress.com/entconline/?request=get-document&doi=10.1897%2F03-162

Indirect Determination of Cyanide Ion and Hydrogen Cyanide by Adsorptive Stripping Voltammetry at a Mercury Electrode
Safavi, A. (Shiraz Univ., Shiraz, Iran); N. Malekia and H. R. Shahbaazia (Chemical & Manufacturing Pakshoo Co., Tehran).
Analytica Chimica Acta, Vol 503 No 2, p 213-221, 9 Feb 2004

An indirect voltammetric method can determine cyanide ions and hydrogen cyanide, using the effect of cyanide on cathodic adsorptive stripping peak height of Cu-adenine. The method is based on competitive Cu complex formation reaction between adenine at the electrode surface and CN- ions in solution. The method was applied to the determination of cyanide in various industrial waste waters, such as electroplating wastewater, and hydrogen cyanide in air samples.

Industrial Test Systems, Inc., Cyanide ReagentStrip(TM) Test Kit: Environmental Technology Verification Report
James, Ryan, Amy Dindal, Zachary Willenberg, and Karen Riggs, Battelle.
ETV Advanced Monitoring Systems Center, 51 pp, April 2005

The Cyanide ReagentStrip(TM) test kit is designed to detect free cyanide in water by converting cyanide in water to cyanogen chloride, which produces a color change in the presence of isonicotinic and barbituric acids that can be detected visually or with a colorimeter. Depending upon the data needs of the user, results can be determined by three methods: (1) A semi-quantitative result in increments ranging from <0.1 mg/L to >10 mg/L is obtained in approximately 1 minute by comparing the color change on ReagentStrip(TM) #2 to a color chart; (2) a semi-quantitative result for an expanded range of 0 mg/L to >200 mg/L may also be obtained in 10 minutes by visually comparing the color of the water sample in a microcuvette with a separate color chart designed for use with microcuvettes; and (3) a quantitative determination can be obtained in 10 minutes when the microcuvette is inserted into the optional ReagentStrip(TM) CO7500 colorimeter (also identified as the ReagentStrip(TM) Reader), and the intensity of the color is measured quantitatively. The Reader generates a result in absorbance units that are converted to concentration units using the reference table provided by Industrial Test Systems, Inc. The kit includes one bottle each of Cyanide ReagentStrip(TM) #1 and #2, one graduated pipette, 20 microcuvettes, one microcuvette holder, one ReagentStrip(TM) Reader, two semi-quantitative visual color charts, one ReagentStrip(TM) Reader absorbance reference chart, one instruction sheet, and one material safety data sheet. ReagentStrip(TM) #1 and #2 for additional tests can be purchased separately. No functional aspects of the Cyanide ReagentStrip(TM) test kit were compromised by performing the analyses in the field; however, performing analyses under cool conditions negatively affected the performance of the reagents as was evidenced by the large negative biases for the samples analyzed outdoors. The Cyanide ReagentStrip(TM) test kit was easy to operate. The written instructions provided were clear, and the accompanying instructional video (lasting less than five minutes) was detailed and easy to understand. Because the required reagents were transferred into the test sample entirely by the repeated dipping of the two types of ReagentStrips(TM), there was no measuring or mixing. The strips, microvettes, and Reader were easy to use, and cleanup was minimal. The analysis of a set of approximately 10 samples, including sample preparation and reaction time, took 30 to 40 minutes.
http://www.epa.gov/etv/verifications/vcenter1-23.html

Influence of Hydrogeochemical Processes on Zero-Valent Iron Reactive Barrier Performance: A Field Investigation
Liang, L., G.R. Moline, W. Kamolpornwijit, and O.R. West, Oak Ridge National Lab, Oak Ridge, TN.
Journal of Contaminant Hydrology, Vol 78 No 4, p 291-312, Aug 2005

A permeable reactive barrier (PRB) containing zero-valent iron was installed at the Oak Ridge Y-12 site to remove uranium from groundwater that also contained high levels of nitrate. Geochemical and mineralogical changes in the PRB were evaluated to assess barrier performance over a 5-year period. Pore water monitoring data showed that the iron remained reactive where increases in pH and the removal of certain ionic species persisted; however, coring revealed varying degrees of cementation, with porosity reduction of up to 41.7% noted in core samples after 3.8 years of treatment. Tracer tests indicated deterioration of hydraulic performance: under the influence of interfacial cementation, a large portion of water was diverted around the reactive zone and transported outside the PRB. Geochemical modeling predicted a maximum of 49% porosity loss for 5 years of operation and showed a spatial distribution of mineral precipitate volumes. This work indicates that water quality monitoring, coupled with hydraulic monitoring and geochemical modeling, can provide a low-cost method for assessing PRB performance.

Initial Results of Continuous Monitoring of Dioxins Surrogate Using Laser Mass Spectrometry
Ma, Jing, Li Fang, H.Y. Zheng, Lei Ding, X.J. Gu, and W.J. Zhang.
Optical Technologies for Atmospheric, Ocean, and Environmental Studies. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5832, p. 342-349, May 2005

Because the concentration of dioxins in flue gas are beyond the detection limits of today's on-line methods, researchers looking for more sensitive monitoring systems are using surrogate dioxin compounds in their studies. Chlorobenzenes (monochlorobenzene and some polychlorinated benzenes) appear to be suitable surrogates for on-line measuring of dioxins in flue gas by laser mass spectrometry. The 1+1 two-photon Resonant Enhanced Multiphoton Ionization (REMPI) spectra of monochlorobenzene in the range 240 to 250 nm was examined. Measurement showed that monochlorobenzene has the highest ionization efficiency excited at 248.6 nm in this wavelength range. The REMPI-MS properties of monochlorobenzene in this wavelength range provide useful information in practical measurements of mixtures.

Integrated Automated Analyzer for Monitoring of Explosives in Groundwater
Lin, Y. (Pacific Northwest National Lab); G. Collins (Naval Research Lab); J. Wang (New Mexico State Univ.).
Report No: PNNL-14463, 42 pp, Nov 2003

The authors have successfully fabricated capillary electrophoretic (CE)-microchips on both glass and polymer substrates and integrated the CE-microchips with an electrochemical detector. They have systematically optimized the separation and detection processes and demonstrated the analytical performance for fast separation and detection of explosive mixtures (<2 minutes). Electrochemical detectors have already proven to be well suited for microchip CE systems. The microchip systems are particularly attractive because of their high sensitivity and selectivity, inherent miniaturization, portability, and low cost. An automated microscale SPE system has been developed and optimized for preconcentration of explosives from well water into acetonitrile. The minimized eluted volume (2 to 5 uL) is compatible with the microchip CE. Large concentration enhancements (200 to 100 times) have been realized. Characteristics such as portability, good detection accuracy, high concentration enhancement factors, low eluate volume requirements, and fast analysis, make the microscale system potentially suitable for field applications. One prototype interface device was designed and fabricated for an automated on-line SPE/microchip-CE system. The initial testing demonstrates that the on-line sample introduction provides excellent reproducibility between plug to plug. The results are promising for further development of a microanalytical system based on the on-line coupling of the SPE/microchip CE for monitoring explosives. The preliminary study of in situ/on-chip SPE has also begun. Two methods for packing a micro-SPE column inside a separation channel have been developed. The first method used hydrogel-positioned C-18 coated silica beads. The second method used C-18 coated paramagnetic beads. The proof-of-principle of two in situ/on-chip micro-SPE methods has been

successfully demonstrated. In summary, the proof-of-principle results from this SERDP Exploratory Development (SEED) project indicate that the microanalytical system based on the integration of an on-line or in situ/on-chip SPE with CE-microchip/ECD has a great potential to meet the need for onsite groundwater monitoring of explosives.
http://www.pnl.gov/main/publications/external/technical_reports/PNNL-14463.pdf

Integrated Microfluidics/Electrochemical Sensor System for Monitoring of Environmental Exposures to Lead and Chlorophenols
Lin Y., C.A. Timchalk, D.W. Matson, H. Wu, and K.D. Thrall, Pacific Northwest National Lab., Richland, WA.
Biomedical Microdevices, Vol 3 No 4, p 331-338, Dec 2001

A new integrated microfluidics/electrochemical sensor system is presented that comprises a microfluidic platform, fluidic microchannels, and individual components such as microfabricated, piezoelectrically actuated pumps and a microelectrochemical cell. The individual components are designed as plug-ins that can be readily attached to (or removed from) the microfluidic platform, allowing rapid change-out and repair of individual components. Successful detection of lead and chlorophenols with the system demonstrated the capabilities of the technology for on-site environmental characterization and real-time, non-invasive biomonitoring of toxic chemical mixtures.

An Integrative Approach for Monitoring Water Movement in the Vadose Zone
Yeh, T.-C.J. (Univ. of Arizona); S. Liu (Burgess & Niple).
Proceedings of Waste Management 2004, 29 February - 4 March, Univ. of Arizona, Tucson. Paper WM-4193, 18 pp, 2004

Electrical resistivity tomography (ERT) has emerged as a potentially cost-effective, non-invasive tool for imaging changes of moisture content in the vadose zone, though the accuracy of ERT surveys has been the subject of debate. An integrative inverse approach for ERT based on a stochastic information fusion concept has been developed to derive the best unbiased estimate of moisture content distribution. Unlike classical ERT inversion approaches, this new approach assimilates both prior information about the geological and moisture content structures in a given geological medium, and sparse point measurements of the moisture content, electrical resistivity, and electric potential. Using these types of data and considering the spatial variability of the parameters in the resistivity-moisture content relation, the new approach directly estimates 3-D moisture content distributions, rather than simple changes in moisture content in the vadose zone. Results show that the integrative approach can produce accurate estimates of the moisture content distributions and that incorporating sparse measurements of the moisture content is essential to enhance the estimate.
http://www.wmsym.org/abstracts/2004/pdfs/4193.pdf

Intracavity Raman Spectroscopy for Industrial Stack Gas Analysis
Francisco, Troy W. and Ronald R. Rich.
Advanced Environmental, Chemical, and Biological Sensing Technologies II. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5586, p 68-75, Dec 2004

A multi-gas analyzer based on intracavity Raman scattering has been evaluated and its performance compared with traditional industrial emission monitoring techniques for SO2, CO, CO2, N2, and O2. The authors discuss the basic theory of operation, sampling system considerations, results of the calibration effort, typical performance parameters, limitations of the technology, and how this analyzer fits in a typical industrial application.

Ion Pairing HPLC Method for the Determination of Nitrate and Nitrite in Natural Water Samples
Zuo, Yuegang and Thuan Van, Univ. of Massachusetts, Dartmouth.
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. ANYL 231.

An ion-pairing HPLC technique was developed for the determination of nitrate and nitrite with ultraviolet (UV) detection at a wavelength of 205 nm. Analyses were carried out using a mobile-phase phosphate buffer (3 mM and 3 mM tetrabutylammonium hydrogen sulfate) and acetonitrile (83:17; v/v), on a C18 column (150 x 2.0 mm i.d., 5 micron) at flow rate of 0.5 ml/min. Nitrite was found in rainwater at the sub-ppm level and in rain, river, pond, and tap water in the range of 0.18 to 3.0 ppm.

It's Elemental: Detecting Toxicity in a Controversial Fuel Additive: U.S.-German Team Develops New Analytical Technique
National Science Foundation (NSF) News Release, 27 Jan 2005

The fuel additive methylcyclopentadienyl manganese tricarbonyl (MMT) was approved for limited use in leaded gasoline as an octane-boosting, anti-knocking agent from 1977 to 1995 in the U.S. In 1995, the manufacturer of MMT challenged the limitation in court and won, thereby opening the door for MMT to be marketed for use in unleaded gasoline as well. Until recently, relatively easy, cost-effective methods for isolating and identifying specific compounds of manganese were not available. In a collaborative effort funded by NSF, Dr. David Butcher of Western Carolina University teamed with Dr. Kay Niemax and Dr. Michail Bolshov from the University of Dortmund, Germany, to develop an efficient method for identifying and quantifying the combustion products of MMT, undertaking speciation studies to determine how much of each chemical form of manganese is present in a sample, because different levels of toxicity exist in each of the various manganese compounds. To analyze the compounds in the combustion products of MMT, including its nonmethylated derivative, cyclopentadienyl manganese carbonyl (CMT), the team devised their new technique by coupling high performance liquid chromatography (HPLC) with diode laser atomic absorption spectrometry (DLAAS). The new instrumentation streamlined the process of identifying and quantifying manganese compounds from among the hundreds of compounds contained in gasoline. It also improved on analysis time compared to previous methods, bringing it down to 3 minutes per sample, and improved on the analytical performance of previous methods with increased sensitivity. It is also far less complicated to use, making it a more practical technique for real-world applications. The usefulness of the technique for real sample analysis was further verified by the accurate determination of MMT in spiked gasoline, urine, and water samples.

"Lab-on-a-Chip" Devices with Electrochemical Detection for Field Monitoring of Organic and Ionic Explosives
Wang, Joseph, Arizona State Univ., Tempe.
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. ANYL 345.

A variety of microchip-based protocols and devices for detecting nitroaromatic and ionic explosives have been developed, such as the "lab-on-a-chip" in which liquids are manipulated in a microchannel network. Microchip technology allows conversion of large and sophisticated instruments into powerful field-deployable analyzers offering a high degree of integration, high performance, fast response, and versatility, including the possibility of performing multiple assays simultaneously. Self-contained capillary-electrophoresis microchips, based on electrochemical detection, are extremely attractive for on-site environmental applications, and the inherent redox activity of nitroaromatic explosives make them ideal candidates for electrochemical monitoring. This presentation discusses the prospects, challenges, and applications of microfluidic devices with amperometric and conductivity detectors, as well as developments such as disposable sensor strips and submersible sensors for on-site electrochemical measurements of TNT.

Laser-Induced Fluorescence (LIF) Spectroscopy and Laser-Based Ion Mobility (IM) Spectrometry for In-Situ Analysis of Contaminated Soils
Lohmannsroben, Hans-Gerd, Univ. of Potsdam, Potsdam-Golm, Germany.
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. GEOC 109.

This paper presents the results of investigations of LIF spectroscopy and IM spectrometry for the in situ analysis of soils contaminated with aromatic compounds and petroleum products (oils). These studies encompassed reference materials, actual site soils, and field tests, with examples given of subsurface LIF measurements, monitoring of biodegradable oils, and IM spectrometric detection of hazardous chemicals. Calibration procedures for quantitative analysis and analytical figures of merit are described.

LC-MS Analysis in the Aquatic Environment and in Water Treatment Technology--a Critical Review. Part II: Applications for Emerging Contaminants and Related Pollutants, Microorganisms and Humic Acids
Zwiener, C. and F.H. Frimmel, Univ. Karlsruhe (TH), Karlsruhe, Germany.
Analytical & Bioanalytical Chemistry, Vol 378 No 4, p 862-8674, Feb 2004

The authors provide examples of applications of LC-MS techniques for a variety of water pollutants, e.g., pesticides (and their transformation products), pharmaceuticals, estrogens, degradation products of surfactants, algal and cyanobacterial toxins, disinfection byproducts, and metalloids.

LIBS System for Elemental Analysis of Soil Samples
Owsik, Jan, Jacek Janucki, Karol Jach, Robert Swierczynski, Viacheslaw S. Ivanov, Andrei F. Kotyuk, and Michael V. Ulanovski.
Nonlinear Frequency Generation and Conversion: Materials, Devices, and Applications IV. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5710, p 138-148, Mar 2005

A correlation-based method of laser-induced breakdown spectrometry for soil contamination is presented with a description and examples of application of a portable laser-emission spectro-analyzer for analysis of chemical composition of soil samples.

LUST On-Line Calculator Introduction
Weaver, Jim, U.S. EPA, National Exposure Research Laboratory, Athens, GA.
RevTech: Cleaning Up Contaminated Properties for Reuse and REVitalization: Effective TECHnical Approaches and Tools--After Action Information, 22-24 July 2003, Pittsburgh, PA. Abstracts, p 25.

EPA has developed a suite of on-line calculators to assist in performing site assessment and modeling calculations for leaking underground storage tank sites. The calculators are divided into four types: parameter estimation, models, scientific demos, and unit conversions. Parameter estimation calculators are used to estimate gradients, chemical parameters, retardation factors, multiphase partitioning and effective solubilities. Simple models are included to perform transport analyses, which include transport of contaminants to receptors, diving of plumes due to recharge, and estimates of

uncertainty in model outcomes. Scientific demos illustrate concepts concerning subsurface flow and transport, including for example the effects of borehole dilution on observed concentrations. Unit conversions for parameters unique to this field (hydraulic conductivity, Henry's law constants, rate constants) are included as aids to correct site assessment and analysis. Since their beginning in 1999, the calculators have proven to be a useful tool as evidenced by steady increase in their usage. EPA is currently adapting the calculators to address a wider variety of problems by including parameter values for more chemicals and by developing a model for chlorinated solvent transport and transformation.
http://www.epa.gov/athens/onsite

MAROS: a Decision Support System for Optimizing Monitoring Plans
Aziz, J.J., M. Ling, H.S. Rifai, C.J. Newell, & J.R. Gonzales, Groundwater Services Inc., Houston, TX.
Ground Water, Vol 41 No 3, p 355-367, May-June 2003

MAROS, the Monitoring and Remediation Optimization System, is a decision-support software developed to assist in formulating cost-effective long-term monitoring plans for groundwater. The software provides site managers with a strategy for formulating appropriate long-term groundwater monitoring programs that can be implemented at lower costs. MAROS is a decision support tool based on statistical methods applied to site-specific data that accounts for relevant current and historical site data, as well as hydrogeologic factors (e.g., seepage velocity) and the location of potential receptors (e.g., wells, discharge points, or property boundaries). Based on this site-specific information, the software suggests an optimization plan for the current monitoring system to efficiently achieve the termination of the monitoring program. This public domain software was developed for the Air Force Center for Environmental Excellence through a Broad Agency Announcement (BAA) contract with Groundwater Services Inc. of Houston, TX, and the University of Houston. MAROS addresses groundwater contaminants such as fuels, solvents, and metals; allows import of various data formats; and is designed for continual modification of long-term monitoring plans as the plume or site conditions change over time.

Mass and Flux Distributions from DNAPL Zones in Sandy Aquifers
Guilbeault, M.A., B.L. Parker, and J.A. Cherry, Univ. of Waterloo, Waterloo, ON, Canada.
Ground Water, Vol 43 No 1, p 70-86, Jan-Feb 2005

Investigators characterized three industrial sites contaminated with tetrachloroethene (PCE) and trichloroethene (TCE) as dense nonaqueous phase liquids (DNAPLs) in persistent source zones of dissolved contaminant plumes. Characterization of the subsurface involved exceptionally detailed, depth-discrete, groundwater sampling performed using a direct-push sampler along cross sections of the dissolved-phase plumes, immediately downgradient of the DNAPL source zones. Even though the sand aquifers of the three sites are nearly hydraulically homogeneous, extreme spatial variability of the mass discharge occurs. The investigators noted that spacing no greater than 15 to 30 cm was needed at some locations to identify high concentration zones, and aqueous VOC concentrations varied as much as four orders of magnitude across 30 cm vertical intervals.

Method for Rapid Screening of Pesticide Mineralization in Soil
Rasmussen, J., P.H. Jensen, P.E. Holm, and O.S. Jacobsen, Geological Survey of Denmark and Greenland (GEUS), Copenhagen, Denmark.
Journal of Microbiological Methods, Vol 57 No 2, p 151-156, May 2004

In a new method for the analysis of C-14 labeled carbon dioxide evolution from the mineralization of C-14 labeled organic compounds in soil samples, (14)CO(2) is trapped in filter paper held in the lid of a 20 ml glass vial by surface tension. Ca(OH)(2) (the trapping solution) fixates carbon dioxide in the filter paper, and the lids are placed in a 32-well holder and exposed to a phosphor screen prior to scanning for trapped (14)CO(2) in a Cyclone(TM) scanner. Comparison of results from the new filter method against results obtained using the traditional method show good agreement but the interval between sampling has to be shorter using the filter method when carbon dioxide development is high due to a smaller capacity for carbon dioxide with the filter method. The detection limits for the filter method are higher than for the traditional method.

A Micro-Chemiluminescence Determination of Cyanide in Whole Blood
Lv, Jiagen, Zhujun Zhang, Jindong Li, and Lirong Luo, Shaanxi Normal Univ., Xian, China.
Forensic Science International, Vol 148 No 1, p 15-19, 10 Feb 2005

A reactant volume self-controlled micro-device was applied to flow injection chemiluminescence (CL) for determination of cyanide in whole blood. A fluidic control platform with air driving was fabricated, as well as a mini distiller for cyanide extraction from blood samples with extraction efficiencies of cyanide 98% or better. This easily fabricated device was applied to the analysis of cyanide in blood samples, and the results agreed well with those obtained from the official method.

Microfluidic Capillary Electrophoresis and Multiplex PCR for the Rapid, Sensitive Detection of Bioterrorism Agents
Guthrie, E.J. and E. Ubil
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. ANYL 49.

When compared to other methods, multiplex polymerase chain reaction (PCR) assays allow greater specificity for single organism detection, or greatly reduced analysis cost for rapid screening and/or detection of multiple organisms. The multiplex PCR methods presented include amplification of multiple loci within individual target organisms and amplification of single loci within multiple organisms. End-point multiplex PCR is used to detect individual genetic markers for B. anthracis, Y. pestis, orthopox virus, and F. tularensis. The PCR assays make use of Platinum(R) Taq DNA polymerase for functionality and uracil DNA glycosylase (UDG) for elimination of post-PCR cross-contamination. When compared to other PCR techniques, the use of microfluidic format capillary electrophoresis for the detection of PCR amplification products allows positive results to be further discriminated on the basis of amplicon length.

Mine Waste Contamination Limits Soil Respiration Rates: a Case Study Using Quantile Regression
Ramsey P.W. (Univ. of Montana, Missoula, MT); M.C. Rillig; K.P. Feris; J.N. Moore; J.E. Gannon.
Soil Biology and Biochemistry, Vol 37 No 6, p 1177-1183, 2005

A statistical approach, quantile regression (QR), can be used to identify trends in soil processes otherwise masked by spatial and temporal variability. Researchers quantified in situ soil respiration, pH, and heavy metal concentrations across a mine waste contamination gradient in a range of metal concentrations greater than an order of magnitude. In two years of monitoring site respiration values, QR to show that soil respiration was limited with respect to both heavy metals and pH, and that increased metals and increased acidity constrained variation in soil respiration values. QR allows an exploration of factors that limit a process, recognizing that not all of the factors contributing to a soil function will be measured. An application of QR to the evaluation of a mine waste remediation procedure is also discussed.

Mitigation of Atmospheric Uncertainty for Improved Trace-Gas Remote Sensing
Shanks, Joseph G. and Andrey Dudkin.
Multispectral and Hyperspectral Remote Sensing Instruments and Applications II. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5655, p 142-153, Jan 2005

A general approach for using spectral sub-space projection is proposed and applied to the problem of trace-gas detection and quantification for environmental monitoring. The approach can be applied to data collected by ground, aircraft, or space-based sensors. The authors discuss the collection of hyperspectral off-nadir simulated imagery with a high-altitude aircraft, simulated HSI data, and detection/quantification performance using matched filters for common pollutants with and without sub-space projection. The matched filters add the benefit of quantitative ranking of the spectral weight of measurements for a given trace gas.

Modeling Groundwater Flow and Contaminant Transport in Fractured Aquifers
Bordas, Jason M., Master's thesis, Air Force Inst. of Technology, Wright-Patterson AFB, OH.
Report No: AFIT/GEM/ENV/05M-02, NTIS: ADA435202, 119 pp, Mar 2005

The hybrid discrete fracture network/equivalent porous medium (DFN/ EPM) model was selected for analysis and application to simulate a contaminated site. The model was selected because it appeared to have the potential to aid decision-making by remedial project managers at contaminated DoD fractured aquifer sites by using characterization data that are typically available while also incorporating the important processes relevant to describing contaminant transport in a fractured medium. The model was applied to simulate the operation of a pump-and-treat remedial action at a trichloroethene-contaminated fractured aquifer at Pease AFB. The model was able to simulate the salient characteristics of hydraulic and contaminant data collected at the site during operation of the pump-and-treat system. The model was then used to evaluate the impact of various pump-and-treat system designs on contaminant containment at the site. Based on these model simulations, the potential benefits to site managers of using the DFN/EPM approach to model groundwater flow and contaminant transport at fractured aquifer sites were demonstrated.
http://handle.dtic.mil/100.2/ADA435202

Molecular Plasmonics for Ultrasensitive Biosensing
Van Duyne, Richard P., Northwestern Univ., Evanston, IL
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. ANYL 20.

The fabrication of size-tunable silver and gold nanoparticles using nanosphere lithography, electron beam lithography, and chemical synthetic approaches has lead to the development of new platforms for ultrasensitive biosensing, such as single nanoparticle sensors based on localized surface plasmon resonance (LSPR) spectroscopy and sensors suited for glucose monitoring and anthrax detection based on surface-enhanced Raman spectroscopy (SERS).

Molecular-Scale Characterization of Uranium Sorption by Bone Apatite Materials for a Permeable Reactive Barrier Demonstration
Fuller, C.C., J.R. Bargar, and J.A. Davis.
Environmental Science and Technology, Vol 37 No 20, p 4642 -4649, 2003

EXAFS spectroscopy and synchrotron source XRD measurements were used to investigate uranium binding to bone charcoal and bone meal apatite materials in the laboratory, as well as to examine pelletized bone-char apatite recovered from a permeable reactive barrier (PRB) at Fry Canyon, UT. EXAFS spectra of bone char samples recovered from the Fry Canyon PRB were comparable to laboratory samples in the presence of dissolved carbonate where U(VI) sorption occurred by surface complexation. The study results indicate that U(VI) probably occurs in the PRB as molecular complexes adsorbed onto the surfaces of apatite instead of by precipitation of uranyl phosphate phases under the groundwater conditions found at many U-contaminated sites. Additional information on this research is available on line in another 2003 paper by Fuller, et al., "Remediation of Uranium-Contaminated Water at Fry Canyon, Utah," at http://www-ssrl.slac.stanford.edu/research/highlights_archive/u_ha_prb.html

Monitoring of Redox Conditions with Redox-Indicator Based Sensors in Soil Columns and Microcosms Bioaugmented with Reductive Dehalogenating Bacteria
Ruiz-Haas, Peter and James D. Ingle, Oregon State Univ., Corvallis.
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. ENVR 135.

Redox conditions during the dechlorination of tetrachloroethene (PCE) to ethene in soil columns and microcosm bottles containing an enriched chlororespiring culture (Evanite culture) were monitored with the redox indicators Thionine (Thi) and Cresyl Violet (CV) immobilized on transparent films. The films were placed in specially constructed flow cells for spectrometric analysis of indicator speciation, and Evanite culture solution was circulated through them with a modified peristaltic pump, thereby providing a new technique to monitor effective concentrations of reductants in solution.

Monitoring Permeable Reactive Barriers Using Electrical Resistance Tomography
Bratton, W.L., J.W. Maresca, Jr., and W.C. Dickerson (Vista Engineering Technologies, LLC); W.D. Daily and A.L. Ramirez (Lawrence Livermore National Lab).
Proceedings of Waste Management 2004, 29 February - 4 March, Univ. of Arizona, Tucson. Paper WM-4185, 10 pp, 2004

An electrical resistivity tomography (ERT) method is being evaluated as a measurement tool to determine the integrity of permeable reactive barriers (PRBs) during and after construction of the barrier and as a monitoring tool to determine the long-term operational health of the barrier. The electrodes are inserted directly into the barrier itself. Numerical modeling calculations indicate that the ERT method can detect flaws (voids) in the barrier as small as 0.11 square m (0.33 m x 0.33 m) when the aspect ratio of the electrodes are 2:1. Laboratory measurements indicate that the change in resistance over time of the iron-filling mixture used to create the PRB is sufficient for ERT to monitor the long-term health of the barrier.
http://www.wmsym.org/abstracts/2004/pdfs/4185.pdf

Multi-Species Gas Sensing Using Monolithic Widely Tuneable Laser Diodes
Phelan, R., M. Lynch, J. F. Donegan, and V. Weldon.
Opto-Ireland 2005: Optical Sensing and Spectroscopy. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5826, p 449-459, June 2005

Widely tuneable laser diodes operating in the 1520 to 1570 nm range were characterized and compared for use as sources for tuneable laser diode gas absorption spectroscopy. Hydrogen cyanide, ammonia, and acetylene gases with overlapping absorption features within the 50 nm tuning range of the devices were targeted, employing wavelength modulation spectroscopy with second harmonic detection.

Natural Attenuation and Enhanced Bioremediation of Organic Contaminants in Groundwater
Scow, Kate M. and Kristin A. Hicks, Univ. of California, Davis.
Current Opinion in Biotechnology, Vol 16 No 3, p 246-253, June 2005 [Special Issue]

The authors discuss recent studies of biostimulation, bioaugmentation, and/or natural attenuation of organic contaminants in ground water that have focused on the reductive dechlorination of chlorinated solvents, the degradation of the fuel additive methyl tert-butyl ether, and the removal of long-term hydrocarbon contamination. These studies have been facilitated by measurement technologies, i.e, stable isotope analysis used to demonstrate in situ bioremediation and push-pull tests in which isotopes are injected into aquifers and then quickly retrieved and analyzed to measure in situ activity. Quantitative polymerase chain reaction (or PCR), the detection of mRNA expression, and numerous DNA fingerprinting methods are molecular tools that also have proved valuable for identifying and sometimes quantifying environmentally important organisms or changes in communities. Methods to track bacteria and tools to characterize bacterial attachment properties have also offered insight into bacterial transport in situ.

A Near-Real-Time Air Monitoring System for Chemical Warfare Agents
Crabtree, James H. and Bruce Quimby, Agilent Technologies, Anaheim, CA.
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. ANYL 257.

A current homeland security need is the ability to monitor for the presence of airborne chemical warfare agents (particularly nerve agents and mustard) at very low concentrations, reliably, while minimizing false positives and false negatives. A gas chromatography system has been configured to monitor for all of the significant V and G-type nerve agents and HD from existing global stockpiles at STEL in 10-minutes NRT. The system consists of an air concentrator/thermal desorption sampling system connected to a gas chromatograph with two columns coated with different stationary phases and both connected to flame photometric detectors (FPD). An air sample (usually several liters) is drawn through a sorbent trap to concentrate any CWAs. The CWAs are thermally desorbed from the trap and injected onto both columns, where they are selectively detected by the FPDs. The presence of an agent is confirmed by a peaks at the correct retention times on both columns. This minimizes false positives.

NEMC 2004: the 20th Annual National Environmental Monitoring Conference, 19-21 July 2004, Washington, DC. Proceedings. 379 pp, 2004

The Annual National Environmental Monitoring Conference is managed by the Independent Laboratories Institute (ILI) in association with the American Council of Independent Laboratories (ACIL) and Instant Reference Sources, Inc. under a cooperative agreement with the U.S. Environmental Protection Agency. The symposium series was established as a means of fostering a partnership among the regulated community, its supporting laboratories and consultants, and state and federal regulators. Over 100 technical presentations were made at NEMC 2004 that cover all aspects of environmental monitoring in all media (i.e., water, air, soil and wastes). Participants include experts from private industry, public agencies engaged in environmental monitoring (e.g., EPA, DOE, DoD, and states) and academia.
http://nemc.us/associations/1654/files/2004proceedings.pdf

A Neural Network Model for Predicting Aquifer Water Level Elevations
Coppola, E.A. Jr (NOAH, LLC, Lawrenceville, NJ), A.J. Rana, M.M. Poulton, F. Szidarovszky, and V.W. Uhl.
Ground Water, Vol 43 No 2, p 231-241, Mar-Apr 2005

Artificial neural networks (ANNs) were developed for accurately predicting potentiometric surface elevations (monitoring well water level elevations) in a semiconfined glacial sand and gravel aquifer under variable state, pumping extraction, and climate conditions. This paper presents a study in which the ANNs used the initial water level measurements, production well extractions, and climate conditions to predict the final water level elevations 30 d into the future at two monitoring wells. Unlike traditional physical-based models, ANNs do not require explicit characterization of the physical system and related physical data; instead, ANN predictions are made on the basis of more easily quantifiable, measured variables, rather than physical model input parameters and conditions. This study illustrates the capacity of ANNs for providing prediction capability and sensitivity analyses to support appropriate groundwater management strategies.

New and Versatile Optical-Immunoassay Instrumentation for Water Monitoring
Willard, D., G. Proll, S. Reder, and G. Gauglitz, Univ. of Tubingen, Tubingen, Germany.
Environmental Science and Pollution Research International, Vol 10 No 3, p 188-191, 2003

The authors review new and versatile optical-immunoassay instrumentation for water monitoring developed through two European Union projects, RIver ANAlyser (RIANA) and Automated Water Analyser Computer Supported System (AWACSS). Both projects utilize immunoassay techniques to isolate the analytes and total internal reflection fluorescence (TIRF) to quantify them.

New Bioassay Technique Unveiled Using Bioluminescence Properties of Marine Bacteria
U.S. EPA Region 8.
Sustainable Practices 2005: Innovations, Technologies, and Products Coming Soon to a World Near You, 15 Apr 2005

A new bioassay technique, Bioluminex(TM), has been unveiled by ChromaDex Corporation's Boulder, CO, laboratories. The new technology couples thin-layer chromatography with the luminescent properties of the marine organism Vibrio fischeri, a bacterium commonly used for toxicity screening of water. The bioluminescence indicates the metabolic status of the bacterium and a reduction in luminescence indicates the presence of a toxin. The degree of toxicity is proportional to the luminescence. ChromaDex has targeted the technology for special application in toxicity screening of complex mixtures such as wastewater, food and beverage samples, and natural product extracts. Bioluminex(TM) overcomes the limitations of current approaches by specifically assigning biological activity to single components of mixtures. As such, it represents a versatile and rugged method with high sample throughput.

The New Role for LC/MS and LC/MS/MS in Explosives Investigations
Penfold, L., Severn Trent Laboratories, Inc.
Proceedings of Waste Management 2004, 29 February - 4 March, Univ. of Arizona, Tucson. Paper WM-4533, 7 pp, 2004

Liquid chromatography/mass spectrometry (LC/MS) is an instrumental technique that has been applied to the analysis of explosives for many years. Older LC/MS instruments provided detection limits comparable to the conventional HPLC/UV method (EPA Method 8330) and were more selective.

Because of the comparatively higher cost, the primary role for LC/MS was confirmation of samples in which interfering chemicals made interpretation of HPLC/UV results difficult; however, advances in LC/MS instrumentation afford limits of detection 10 to 20 times lower than before. Combined with lower risk-based preliminary remediation goals, new regulatory concerns, and encroachment of communities into the immediate vicinity of military sites, technological advances have created a new role for LC/MS as the primary method for definitive analysis in some explosives investigations. Recent examples are presented in which a common military site contaminant and biogenic substances that created analytical difficulties were effectively resolved by LC/MS and LC/MS/MS.
http://www.wmsym.org/abstracts/2004/pdfs/4533.pdf

Non-Destructive Analytical Methods Using the Radioactive Emissions of Cesium-137 for Thickness Gauging with Possible Applications for the Determination of Depth Profiles of Contamination
Fugate, G.A., T.A. DeVol, and J.D. Navratil (Clemson Univ., Anderson, SC); S.L. Hoeffner (Clemson Univ., Clemson, SC).
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. ANYL 377.

Electron and gamma-ray spectroscopic methods were used to characterize the density thickness and resolution measurement limits for selected emissions of cesium-137. For electron spectroscopy, peak shift is directly correlated with energy loss as the electron traverses the material. For gamma-ray spectroscopy, multiple photopeak ratios indicated the average thickness of a material. Depending on the method and monitored emissions, thicknesses were obtained on the scale of micron to centimeter in aluminum or mylar absorbers.

A Novel Flow-Through Microdialysis Separation Unit with Integrated Differential Potentiometric Detection for the Determination of Chloride in Soil Samples
Miro, M. and W. Frenzel, Univ. of the Balearic Islands, Illes Balears, Spain.
Analyst, Vol 128 No 10, p 1291-1297, Oct 2003

A novel, miniaturized, flow-through, dialysis-based potentiometric detector is proposed for the determination of chloride in soil samples. In this design, analyte isolation from matrix constituents is integrated via membrane separation with differential potentiometric detection. Two identical tubular all-solid-state Ag/AgCl ion selective electrodes (ISEs) are assembled respectively at the inlet and outlet of the acceptor channel. Thus, as a consequence of the continuous forward flow of solutions through the microdialyser, the outlet tube becomes the indicator electrode for the analyte diffusate, while the nested tube at the entrance serves as reference electrode. The effect of physical and chemical parameters on the mass transfer efficiency is discussed in detail and compared with conventional configurations involving downstream detection. The miniature size, low-reagent consumption, and high analytical throughput (25 to 40/h) support the applicability of this detector to field monitoring or screening.

A Novel Mobile Multipole System (MUCEP) for Shallow (0-3 m) Geoelectrical Investigation: the 'Vol-de-Canards' Array
Panissod, C., M. Dabas, A. Jolivet, and A. Tabbagh.
Geophysical Prospecting, Vol 45 No 6, p 983-1002, Nov 1997

The authors point out the advantages of multipoles for the exploration of the very near subsurface (0 to 3 m) by continuous profiling. A new geometry is proposed with eight poles for a MUltipole Continuous Electrical Profiling (MUCEP) measuring system, where the array has a V-shape and is called 'Vol-de-canards.' A series of criteria including 3D numerical simulations are performed (direct and inverse modeling) to determine the optimal geometry and to compare its performance (in terms of depth of investigation and resolution of the geometry of the targets) with the other arrays (quadrupoles or rectangular-type multipoles). This multipole is combined with a real-time acquisition system. The multidepth maps obtained confirm the characteristics predicted by numerical simulations.

Occurrence and Community Composition of Fast-Growing Mycobacterium in Soils Contaminated with Polycyclic Aromatic Hydrocarbons
Leys, N.M.; A. Ryngaert; L. Bastiaens; P. Wattiau; E.M. Top; W. Verstraete; D. Springael, Flemish Inst. for Technol. Research, Mol, Belgium.
FEMS Microbiology Ecology, Vol 51 No 3, p 375-388, 1 Feb 2005

A culture-independent fingerprinting method based on polymerase chain reaction (PCR) combined with denaturing gradient gel electrophoresis (DGGE) was developed to study the natural role and diversity of the Mycobacterium community in contaminated soils. New PCR primers were selected that specifically targeted the 16S rRNA genes of fast-growing mycobacteria, and single-band DGGE profiles of amplicons were obtained for most Mycobacterium strains tested. Using the PCR-DGGE method, different species could be individually recognized in a mixed Mycobacterium community. This approach was used to rapidly assess the Mycobacterium community structure of several soils of diverse origin affected by polycyclic aromatic hydrocarbons (PAHs). Mycobacteria are considered essential members of the PAH-degrading bacterial community.

The Occurrence of Cyanide Formation in Six Full-Scale Publicly Owned Treatment Works
Zheng, A., D.A. Dzombak, R.G. Luthy, M.C. Kavanaugh, R.A. Deeb, Carnegie Mellon Univ., Pittsburgh, PA.
Water Environment Research, Vol 76 No 2, p 101-112, Mar-Apr 2004

An intensive monitoring program was implemented at six full-scale publicly owned treatment works (POTWs) to investigate the fate and formation of cyanide in wastewater treatment processes. Historical monitoring data for cyanide species in these POTWs were also reviewed. Though the monitoring data showed evidence of cyanide formation during the 1-year monitoring effort, cyanide formation pattern varied significantly from one plant to another and among seasons. These monitoring data and lab study results suggest that the chlorination of thiocyanate (SCN-) is the most important mechanism for the formation of cyanide in wastewater treatment processes, especially in chlorination and dechlorination. POTWs can monitor SCN in influent and secondary effluent to identify its presence and adjust chlorine dose appropriately.

Oil Spill Detection Using RBF Neural Networks and SAR Data
Topouzelis, K. and V. Karathanassi (National Technical Univ. of Athens); P. Pavlakis (National Centre for Marine Research, Greece); D. Rokos.
Geo-Imagery Bridging Continents: 20th ISPRS Congress, 12-23 July 2004, Istanbul, Turkey. International Society for Photogrammetry & Remote Sensing and Spatial Information Sciences, p 724-729, 2004

Synthetic Aperture Radar (SAR) images are extensively used for the detection of oil spills in the marine environment, as they are not affected by local weather conditions and cloudiness; however, radar backscatter values for oil spills are very similar to backscatter values for very calm sea areas and other ocean phenomena because dampening capillary and short gravity waves are caused by the presence of

an oil spill. Most of the studies conducted on oil spill detection rely on the detection of dark areas, which are objects with a high Bayesian probability of being oil spills. The use of Neural Networks (NNs) in remote sensing has increased significantly as NNs can simultaneously handle non-linear data of a multidimensional input space, nor do NNs require an explicitly well-defined relationship between input and output as they determine their own relationships based on input/output values. This paper compares the Radial Basis Function (RBF) neural network against the Multilayer Perceptron (MLP) for use in oil spill detection, examining several topologies and evaluating performance for both networks. MLPs appear to be superior than RBFs in detecting oil spills on SAR images.
http://www.isprs.org/istanbul2004/comm7/papers/142.pdf

On-Line Tools for Assessing Petroleum Releases
Weaver, James W., National Exposure Research Laboratory, Athens, GA.
EPA 600-R-04-101, 81 pp, Sep 2004

The Internet tools described in this report provide methods and models for evaluation of contaminated sites. Two problems are addressed by models. The first is the placement of wells for correct delineation of contaminant plumes. Because aquifer recharge can displace plumes downward, the vertical placement of well screens is critical to obtain proper characterization data. The second is the use of models where data are limited. In the second case, some form of uncertainty analysis is necessary to evaluate transport behavior. The remainder of the report describes a series of tools for estimating various model input parameters. Available at
http://www.epa.gov/athens/learn2model/part-two/onsite/doc/EPA600R04-101OnlineTools.pdf

Optical Fiber Gas Sensor for Remote Detection of CH4 Gas in Underground Mines
Li, Sanguo, Zhanxiong Wei, Zhifan Yin, and Hong-Liang Cui.
Advanced Sensor Technologies for Nondestructive Evaluation and Structural Health Monitoring. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5770, p 205-212, May 2005

A gas sensor based on optical fibers has been developed and tested for real-time monitoring of CH4 gas. A long-distance silica fiber link with compact single-path or multi-path gas cells is used in conjunction with a wavelength-tunable InGaAsP DFB laser diode at 1.64um (at the R(6) absorption peak of methane) for highly sensitive remote interrogation of CH4 with potential application in mining complexes.

Optical Materials and Device Fabrication for Chemical Sensing on the Nanoscale
Nocera, Daniel G. (Massachusetts Inst. of Technology, Cambridge); Aetna W. Wun (Univ. of California, San Diego); Preston Snee; Becky Somers.
Report No: AFRL-SR-ARTR-05-0299, NTIS: ADA435965, 14 pp, July 2005

This proposal seeks to unite the areas of optical chemo/bio-sensing (CB sensing) and nanoscience. As the advancement of chemical sensing systems progresses toward small-length scales, sensitivity and performance are compromised because there are simply too few sensing active sites on the micro- and nano-patterned structures to permit detection of species. This proposal seeks to develop strategies to increase CB sensor response by replacing the linear, single-photon response of present sensors with extremely nonlinear optical responses. To achieve this objective, a multi-prong approach that combines materials chemistry, engineering, and optical science is presented in which the light emitting molecular centers of conventional optical chemosensors are substituted with a mesoscopic

optical laser cavity of distributed feedback structures and spherical cavity resonators exhibiting whispering gallery modes. By tuning the frequency of the resonator to a specific property of the target biomolecule, the laser response can be interrupted upon recognition of the target at the surface of the resonator. In this way, a large change in nonlinear laser signal is easily detected upon target recognition.
http://handle.dtic.mil/100.2/ADA435965

Optimizing Groundwater Long-Term Monitoring Networks Using Delaunay Triangulation Spatial Analysis Techniques
Ling, Meng (Retec, Houston, TX); Hanadi S. Rifai (Univ. of Houston, TX); Charles J. Newell (Groundwater Services Inc., Houston, TX).
Environmentrics, Vol 16 No 6, p 635-657, 2005

Long-term monitoring (LTM) of groundwater is a costly activity. Existing LTM networks may need to be optimized to reflect changes in site conditions and to increase their effectiveness in defining the plume. The authors present a spatial analysis method using Delaunay triangulation techniques that was developed to eliminate redundant monitoring points and to locate new wells where additional data are needed. This method enables triangulation of the monitoring network for site discretization and assessment of the concentration estimation error at each monitoring location to judge its relative contribution to the spatial plume characterization. Redundant monitoring locations are identified where the concentration estimation error is small; new monitoring locations are identified where the projected concentration estimation errors are high.

A Passive-Discrete Water Sampler for Monitoring Seepage
Salve, R., Lawrence Berkeley National Laboratory, Berkeley, CA.
Ground Water, Vol 43 No 1, p 133-137, Jan-Feb 2005

A passive-discrete water sampler (PDWS) has been developed to facilitate investigations of flow partitioning in fractured rocks. The PDWS continuously isolates seeping water into discrete samples while monitoring the seepage rate. The PDWS was tested in a flow and transport experiment that investigated fracture-matrix interactions using a mix of conservative tracers introduced along a fault in fractured tuffs. Water seeping through the lower end of the fault was collected by the PDWS and analyzed for tracer concentrations. Preliminary results show that samples of effluent captured by the PDWS effectively retained temporal changes in the chemical signature while providing seepage rates.

Passive Infrared Imaging Sensor for Standoff Detection of Methane Leaks
Cosofret, B.R., W.J. Marinelli, T.E. Ustun, C.M. Gittins, M.T. Boies, M.F. Hinds, D.C. Rossi, R.L. Coxe, S.D. Chang, B.D. Green, and T. Nakamura.
Chemical and Biological Standoff Detection II. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5584, p 93-99, Dec 2004

An imaging sensor for remote detection of natural gas (methane) leaks that comprises an IR focal plane array-based camera that views the far field through a rapidly tunable Fabry-Perot interferometer has been developed. The interferometer functions as a wavelength-variable bandpass filter that selects the wavelength illuminating the focal plane array. System tests at 200 m distance from sensor to leak location indicate probability of detection greater than 90% for methane column densities above 1000 ppmv-m and better than 2K thermal contrast between the air and the background. The probability of false alarm is less than 0.2% under these detection conditions.

Passive Treatment of Mn-Rich Mine Water: Using Fluorescence to Observe Microbiological Activity
Johnson, K.L. (Univ. of Durham, Durham, UK); A. Baker; D.A.C. Manning.
Geomicrobiology Journal, Vol 22 Nos 3-4, p 141-149, 2005

The authors compared the ability of seven different Permian carbonate rocks, both limestone and dolomite, for promoting manganese oxidation in real mine waters over an 8-h period. The substrates were characterized using thermogravimetric analysis, X-Ray diffraction, and scanning electron microscopy. By using fluorescence spectrophotometry to monitor any changes in the dissolved organic matter concentration in the water as manganese was removed, they determined that there is no statistically significant correlation between manganese removal and the proportion of calcite, or between manganese removal and substrate surface roughness. Fluorescence spectrophotometry revealed a distinct change in the observed spectra in the water during manganese removal, indicating a positive and statistically significant correlation between manganese removal and the production of a tyrosine-like substance (up to 150 ppb in 8 h). The substance fluoresces at 270 to 280 nm excitation wavelength and 300 to 310 nm emission wavelength, suggesting that microbial activity is an important factor in promoting manganese removal within dolomite passive treatment systems. The authors speculate on the possibility of using fluorescence spectrophotometry to monitor for microbial activity in passive treatment systems.

Performance Level of an Autonomous System of Continuous Monitoring of Radioactivity in Seawater
van Put, P., A. Debauche, C. De Lellis, and V. Adam, Institut National Des Radioelements, Metrology, and Environment Radioprotection, Fleurus, Belgium.
Journal of Environmental Radioactivity, Vol 72 Nos 1-2, p 177-86, 2004

The authors describe the development of an automatic monitoring network to measure radioactivity in seawater. The network is fully autonomous, consumes little power (supplied with solar panels), communicates via wireless means (satellite, GSM, radio), and is very sensitive (a few Bq/m3).

A Pesticide Surface Water Mobility Index and Its Relationship with Concentrations in Agricultural Drainage Watersheds
Chen, W., P. Hertl, S. Chen, and D. Tierney, Syngenta, Greensboro, NC.
Environmental Toxicology & Chemistry, Vol 21 No 2, p 298-308, Feb 2002

An index to benchmark pesticide mobility relevant to surface water runoff and soil erosion (surface water mobility index, or SWMI) has been derived based on two key environmental fate parameters: degradation half-life and organic carbon-normalized soil/water sorption coefficient. The authors describe the development and evaluation of the proposed SWMI. The ability of the SWMI to discriminate pesticide runoff mobility and its correlation with surface water monitoring data can be significant in the development of screening methodologies and data-based models for government agencies and/or practitioners in general facing increasing pressure to assess pesticide occurrence in aquatic environments.

Plant-Based Plume-Scale Mapping of Tritium Contamination in Desert Soils
Andraski, B.J., D.A. Stonestrom, R.L. Michel, K.J. Halford, and J.C. Radyk, U.S. Geological Survey.
Vadose Zone Journal, Vol 4 No 3, p 819-827, 2005

Plant-based techniques were tested for field-scale evaluation of tritium contamination adjacent to a low-level radioactive waste (LLRW) facility in the Amargosa Desert, NV. Plant sampling of

creosote bush required one-fifth the time of soil water vapor sampling. Regression equations based on plant tritium explained 96 and 90% of the variation in root-zone and sub-root-zone soil water vapor concentrations, respectively. The equations were combined with kriged plant-water concentrations to map subsurface contamination. Mapping showed preferential lateral movement of tritium through a dry, coarse-textured layer beneath the root zone, with concurrent upward movement through the root zone. Analysis of subsurface fluxes along a transect perpendicular to the LLRW facility showed that upward diffusive-vapor transport dominates other transport modes beneath native vegetation. Plant-based monitoring provided a noninvasive, cost-effective approach to map subsurface tritium migration in a desert area.
http://nevada.usgs.gov/adrs/andraski-et-al_2005_vzj-v4-p819-827.pdf

Portable Analyzer Based on Microfluidics/Nanoengineered Electrochemical Sensors for In-Situ Characterization of Mixed Wastes: DOE-EMSP Project Report FY 04
Lin, Y., G. Fryxell, W. Yantasee, and Z. Wang (Pacific Northwest National Lab); J. Wang (New Mexico State Univ.).
PNNL-14924, 9 pp, Nov 2004

This project is aimed at the development of electrochemical sensors, specific to toxic transition metals, uranium, and technetium, that can be integrated into portable sensor systems. System development will include fabrication and performance evaluation of electrodes, as well as developing understanding of electrochemically active sites on the electrodes specifically designed for detection of toxic metals, e.g., uranium and technetium. These advanced measurement units will be incorporated into a microfluidic prototype specifically designed and fabricated for field-deployable characterizations of such species. The electrochemical sensors being investigated are based on a new class of nano-engineered sorbents, Self-Assembled Monolayer on Mesoporous Supports (SAMMS). SAMMS are highly efficient sorbents due to their interfacial chemistry, which can be fine-tuned to selectively sequester a specific target species. Adsorptive stripping voltammetry (AdSV) will be performed on two classes of electrodes: the SAMMS modified carbon paste electrodes and the SAMMS thin film immobilized on microelectrode arrays. Interfacial chemistry and electrochemistry of metal species on the surfaces of SAMMS-based electrodes will be studied. This fundamental knowledge is required for predicting how the sensors will perform in the real wastes, which contain many interferences/ligands and a spectrum of pH levels. The best electrode for each specific waste constituent will be integrated onto the portable microfluidic platform. Efforts will also be focused on testing the portable microfluidics/electrochemical sensor systems with selected MW and TRU waste samples at the Hanford site. The outcome of this project will lead to the development of a portable analytical system that will greatly reduce costs and accelerate throughputs for in situ characterization of MW and TRU wastes.
http://www.pnl.gov/main/publications/external/technical_reports/PNNL-14924FY04.pdf

Portable Remote Sensor of Methane Leakage Using near-IR Diode Laser
Huang, W., X. Li, X. Gao, H. Fan, W. Li, T. Huang, S. Pei, J. Shao, L. Deng, and W. Zhang.
Optical Technologies for Atmospheric, Ocean, and Environmental Studies. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5832, p 325-332, May 2005

A portable sensor based on a tunable diode laser has been developed for remote sensing of methane (CH4) leakage via wavelength-modulated spectroscopy at a wavelength of 1.65 um. The sensor can detect a 10 cubic cm/min city gas leak with a sensor output equivalent to the range-integrated concentration over 100 ppm-mn

Practical Handbook of Groundwater Monitoring, Second Edition
Nielsen, David M., Nielsen Ground-Water Science, Galena, OH.
CRC Press, Boca Raton, FL. ISBN: 1566705894, 1,328 pp, 2005

This second edition emphasizes the practical application of current technology. It covers environmental site characterization and ground-water monitoring in great detail, from the federal regulations that govern environmental investigations, to the various direct and indirect methods of investigating and monitoring the subsurface, to the analysis and interpretation of complex sets of environmental data. The book discusses new information on applications of methods for detecting LNAPLs and DNAPLs and includes citations for new ASTM standards for advanced environmental site characterization, as well as ASTM methods for well design and construction, hydraulics testing, and groundwater sampling.

Plume and Lithologic Profiling with Surface Resistivity and Seismic Tomography
Watson, D.B., W.E. Doll, T.J. Gamey, J.R. Sheehan, and P.M. Jardine, Oak Ridge National Laboratory, Oak Ridge, TN.
Ground Water, Vol 43 No 2, p 169-177, Mar-Apr 2005

Surface-based multi-electrode resistivity methods and tomographic seismic refraction techniques were used to image from the surface to a depth of approximately 30 m at the Natural and Accelerated Bioremediation Research Field Research Center on DOE's Oak Ridge Reservation. Bioremediation studies are being conducted on nitrate, uranium, technetium, tetrachloroethene, and other contaminants that contaminate the saprolite, shale bedrock, and groundwater at the site. Geophysical methods were effective in imaging the high-ionic strength plume and in defining the transition zone between saprolite and bedrock zones. The geophysical data were used to help select the location and depth of investigation for field research plots. The surface geophysical studies were verified by drilling, borehole geophysics, and groundwater sampling.

Portable Raman Integrated Tunable Sensor (RAMiTs) for Environmental Field Monitoring
Wabuyele, M.B., M.E. Martin, F. Yan, D.L. Stokes, J. Mobley, B.M. Cullum, A.L. Wintenberg, R. Lenarduzzi, and T. Vo-Dinh.
Advanced Environmental, Chemical, and Biological Sensing Technologies II. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5586, p 60-67, Dec 2004

A self-contained portable Raman instrument consists of a 830-nm diode laser for excitation, an acousto-optic tunable filter (AOTF) for wavelength discrimination, and an avalanche photodiode for detection. Software has been developed using C programming language for controlling the instrument. The performance of this instrument is compared to that of a conventional Raman system. The authors also discuss potential applications of the instrument to trace detection of hazardous chemicals using the Raman Integrated Tunable Sensor (RAMiTs) coupled with surface-enhance Raman scattering process.

Precise Differentiation of Toxic and Nontoxic Metal Cyanide Complexes in Environmental Waters by Ion Chromatography with UV Absorbance Detection
Thomas, D.H., S.M. Drop , R.S. Ghosh , J. Rohrer
PITTCON 2004, Abstracts.

There are no EPA-approved methods capable of differentiating and quantifying single, aqueous-chemical forms of cyanide. The authors present an improved ion chromatography (IC) method that has been subjected to a joint ASTM/EPA interlaboratory collaborative study to validate the use of IC for the analysis of metal cyanide complexes in environmental waters. Various metal (Ag, Au, Cu, Ni, Fe, and Co) cyanide complexes were separated on an anion exchange column and quantified by measuring their absorbance at 215 nm. Compared to a direct injection, sensitivity for most of the metal cyanide complexes is improved by better than two orders of magnitude by preconcentrating the complexes from a large sample volume onto a trap column before separation. The method was evaluated for reproducibility, linearity, accuracy, precision, and spike recovery from diverse environmental water matrices.

Preparation of Biocatalytic Nanofibers with High Activity and Stability via Enzyme Aggregate Coating on Polymer Nanofibers
Kim, B.C., S. Nair, J. Kim, J.H. Kwak, J.W. Grate, S.H. Kim, and M.B. Gu.
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. COLL 35.

The authors describe a unique approach for the fabrication of enzyme aggregate coatings on the surfaces of electrospun nanofibers that employs covalent attachment of seed enzymes onto nanofibers consisting of a mixture of polystyrene and poly(styrene-co-maleic anhydride), followed by a glutaraldehyde treatment that crosslinks additional enzyme molecules and aggregates from solution onto the covalently-attached seed enzyme molecules. This approach of enzyme coating on nanofibers creates a useful biocatalytic enzyme system with potential applications in bioconversion, bioremediation, and biosensors.

Pressurised Liquid Extraction--Comprehensive Two-Dimensional Gas Chromatography for Fast Screening of Polycyclic Aromatic Hydrocarbons in Soil
Ong, R., S. Lundstedt, P. Haglund, and P. Marriott, RMIT Univ., Melbourne, Australia.
Journal of Chromatography A, Vol 1019 No 1-2, p 221-232, 26 Nov 2003

Pressurized liquid extraction (PLE) was applied to the extraction of polycyclic aromatic hydrocarbons (PAHs) from contaminated soils. The extraction step was followed by conventional gas chromatography (GC), comprehensive 2-D gas chromatography (GC x GC) (both with flame ionization detection), and gas chromatography-quadrupole mass spectrometry (GC-MS) analysis. Qualitatively, results from all chromatographic analyses are in good agreement, and PLE provides a reliable extraction technique with all PAHs extracted in one extraction step, without carryover. Some variability in PAH quantification was noted, with better agreement in PAH concentrations for GC and GC x GC measurement, as compared to GC-MS. GC-MS results compare reasonably with GC x GC for low-molecular mass PAHs but not for high-molecular mass PAHs, which GC-MS results are consistently higher than those for GC x GC. Since PLE-GC x GC is proposed as a broad screening tool, the demand for precise quantification may be relaxed for this use.

Profiling the Depth and Extent of Contamination of a Ship Channel Using the P450RGS Cell-Based Assay for Dioxins and Related Compounds
McFarland, V.A., L.S. Inouye, C.H. Lutz, and C. Yaw.
Dredging '02: Key Technologies for Global Prosperity (Proceedings of the Third Specialty Conference on Dredging and Dredged Material Disposal, 5-8 May 2002, Orlando, Florida).
ASCE Press, Reston, VA. ISBN: 0-7844-0680-4, 2003

The P450RGS assay, a rapid and sensitive cell-based screening assay for dioxin equivalences (TCDD EQs) in dredged sediments, employs a transgenic human hepatoma cell line in which the firefly luciferase gene, luc, has been stably inserted as a reporter. EPA has promulgated the assay as EPA Method 4425 in update IVA of EPA SW-846. Modifications to the method include a combined extraction/cleanup procedure using accelerated solvent extraction with a sulfuric acid/silica gel packing in the extraction cell, and a 96-well microtiter plate format for the assay. These modifications substantially increase the volume of sample throughput and reduce the cost of the assay. Assays in which TCDD EQs are reported are typically less than one-tenth the cost of dioxin analysis using GC/MS, and have comparable sensitivity.

Progress in Reducing Size and Cost of Trace Gas Analyzers Based on Tunable Diode Laser Absorption Spectroscopy
Frish, M.B., R.T. Wainner, B.D. Green, J. Stafford-Evans, M.C. Laderer, and M.G. Allen.
Advanced Environmental, Chemical, and Biological Sensing Technologies II. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5586, p 76-82, Dec 2004

Trace gas analysis by near-infrared tunable diode laser absorption spectroscopy (TDLAS) has been refined to the point where complete TDLAS analyzers are now available in lightweight, battery-operated packages, similar to a smoke detector, that cost a few thousand dollars. This paper summarizes the current state of the art in near-IR TDLAS sensors, focusing on miniature low-cost devices.

Pushpoint Sampling for Defining Spatial and Temporal Variations in Contaminant Concentrations in Sediment Pore Water near the Ground-Water/Surface-Water Interface
Zimmerman, M.J., A.J. Massey, and K.W. Campo.
U.S. Geological Survey Scientific Investigations Report 2005-5036, 70 pp, 2005

During four periods from April 2002 to June 2003, pore-water samples were taken from river sediment within a gaining reach (Mill Pond) of the Sudbury River in Ashland, MA, with a temporary pushpoint sampler to determine whether this device is an effective tool for measuring small-scale spatial variations in concentrations of volatile organic compounds and selected field parameters (specific conductance and dissolved oxygen concentration). The pore waters sampled were within a subsurface plume of VOCs extending from the nearby Nyanza Chemical Waste Dump Superfund site to the river. Samples were collected from depths of 10, 30, and 60 centimeters below the sediment surface along two 10-meter-long, parallel transects extending into the river. Twenty-five VOCs were detected at concentrations ranging from less than 1 ug/L to hundreds of ug/L. The most frequently detected compounds were either chlorobenzenes or chlorinated ethenes. Many of the compounds were detected only infrequently. Quality-control sampling indicated a low incidence of trace concentrations of contaminants. Additional samples collected with passive-water-diffusion-bag samplers yielded results comparable to those collected with the pushpoint sampler and to samples collected in previous studies at the site. The results demonstrate that the pushpoint sampler can yield distinct samples from sites in close proximity; in this case, sampling sites were 1 meter apart horizontally and 20 or 30 centimeters apart vertically. The pushpoint sampler was able to draw pore water when inserted to depths as shallow as 10 centimeters below the sediment surface without entraining surface water. The simplicity of collecting numerous samples in a short time period (routinely, 20 to 30 per day) validates the use of a pushpoint sampler as a highly effective tool for mapping the extent of contaminated subsurface plumes, determining their constituents and loadings, and performing technical studies that may be relevant to bioremediation and other activities.
http://water.usgs.gov/pubs/sir/2005/5036/

Quantifying Chlorinated Ethene Degradation During Reductive Dechlorination at Kelly AFB Using Stable Carbon Isotopes
Morrill, P.L.; G. Lacrampe-Couloume; G.F. Slater; B.E. Sleep; E.A. Edwards; M.L. McMaster; D.W. Major; B.S. Lollar, Univ. of Toronto, Toronto, ON, Canada.
Journal of Contaminant Hydrology, Vol 76 Nos 3-4, p 279-293, 2005

During a bioaugmentation pilot test at Kelly Air Force Base (AFB) in San Antonio, TX, a mixed microbial enrichment culture, KB-1(TM), was added to the pilot test area to reduce chlorinated ethenes to non-toxic ethene. The most compelling evidence of biodegradation was the substantial carbon isotope enrichment in (13)C(cDCE). Fractionation factors obtained in previous laboratory studies were used with isotope field measurements to estimate first-order cDCE degradation rate constants of 0.12/h and 0.17/h at 115 days post-bioaugmentation. Analysis of stable carbon isotopes can provide not only a sensitive means for early identification of the effects of biodegradation, but an additional means to quantify the rates of biodegradation in the field.

Quantifying Enhanced In Situ TCE Biodegradation
NIEHS Superfund Basic Research Program (SBRP), Research Brief 109, 7 Jan 2004

Researchers from the Oregon Health & Science University's SBRP are working to develop and evaluate technologies for monitoring and enhancing in situ trichloroethene (TCE) biodegradation in anaerobic groundwater. (1) The team developed a new field method, "push-pull" field tests. Push-pull tests are conducted by injecting (pushing) an aqueous test solution containing a nonsorbing, nonreactive tracer and one or more reactants into the saturated zone of an aquifer via a monitoring well. Samples of the test solution/groundwater mixture are extracted (pulled) from the same well over time and analyzed for tracer, reactant, and product concentrations. (2) TCFE is reductively dechlorinated under anaerobic conditions to dichlorofluoroethene, chlorofluoroethene, and fluoroethene by a pathway analogous to that of TCE. The researchers found that TCFE can be used as a surrogate to determine the rate and extent of TCE transformation. (3) The team found that a correlation existed between TCFE reductive dechlorination and fumarate reduction to succinate; injection of fumarate can be used to screen TCE-contaminated groundwater for dechlorinating microbial activity. Because fumarate reacts more rapidly than TCE, this new technique represents a quick in situ method to screen TCE-contaminated groundwater for dechlorinating activity. (4) Forced mass balance, a novel data processing technique to estimate in situ transformation rates, removes the effects of transport processes such as advection, dispersion and sorption, allowing for determination of in situ transformation when sorbing reactants and their products formed in situ are not transported identically. Coupling push-pull tests with forced mass balance data analysis makes it possible to estimate in situ transformation rates of sorbing chemicals. (5) The researchers have shown that acetylene can be added to inhibit reactions and then removed to permit reactions to proceed, which makes it a powerful tool for investigating the enzymes responsible for reductive dechlorination in TCE-contaminated groundwater. Contact: Jennifer A. Field, Oregon State Univ., Corvallis, 541-737-2265, jennifer.field@oregonstate.edu

A Quantitative Infrared Spectral Library of Vapor Phase Chemicals: Applications to Environmental Monitoring and Homeland Defense
Sharpe, Steven W., Timothy J. Johnson, and Robert L. Sams.
Chemical and Biological Standoff Detection II. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5584, p 77-84, Dec 2004

Pacific Northwest National Laboratory has been building a library of pure, vapor-phase chemical species for the last four years. This infrared spectral library currently contains over 300 chemicals and is expected to contain over 400 chemicals at completion. The library spectra are based on a statistical fit to many spectra at different concentrations, allowing for rigorous error analysis. The contents of the library are focused on atmospheric pollutants, naturally occurring chemicals, toxic industrial chemicals, and chemical warfare agents. This presentation discusses applications, limitations, and technical details of the spectral library.

Raman Microspectroscopy and FTIR Crystallization Studies of 2,4,6-TNT in Soil
Manrique-Bastidas, Cesar A., Nairmen Mina, Miguel E. Castro, and Samuel P. Hernandez-Rivera.
Detection and Remediation Technologies for Mines and Minelike Targets X. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5794, p 1358-1365, June 2005

TNT exhibits a series of characteristic bands that allow its detection in soil with spectroscopic techniques. As determined with Raman microspectroscopy and Fourier transform infrared (FTIR) spectroscopy, the spectroscopic signature of neat TNT was dominated by strong bands about 1380 and 2970/cm, whereas the intensity and position of these bands was found to be remarkably different in soil samples spiked with TNT, with the 1380/cm band split into a number of bands in that region, the 2970/cm reduced in intensity, and new bands observed at about 2880/cm. The results are consistent with a different chemical environment for TNT in soil as compared to neat TNT. This information is relevant to the development of improved technologies for the detection of landmines and other devices that incorporate TNT.

Rapid Screening of Complex Mixtures by TLC-Bioluminescence
Verbitski, S.M., G.T. Gourdin, L.M. Ikenouye, and J.D. McChesney, BioLuminex, ChromaDex Analytics, Boulder, CO.
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. ANYL 3.

BioLuminex(TM) is a kit system designed to support material identity, detect adulterations, identify potential bioactive compounds, and control manufacturing procedures. Bioluminescence coupled to thin-layer chromatography (TLC) provides an effective way of monitoring complex mixtures. After complex mixtures are separated by TLC, the TLC plate is coated with bioluminescent bacteria, which identifies single toxic compounds as dark zones on a luminescent background. Results occur within seconds and can be documented by video imaging or photographically and quantitated directly on TLC chromatograms. Typical limits of detection for toxic substances are in the picomol range. Bioluminex(TM) can be used for screening complex mixtures such as wastewater, food and beverage samples and natural product extracts.

Real-Time, Laser-Based Sensors for Military and Civilian Applications
Sausa, R.C. and J. Cabalo.
Proceedings for the Army Science Conference (24th), 29 November - 2 December 2004, Orlando, FL. DTIC: ADA431577, 9 pp, Dec 2004

The authors report on a novel laser-based technique coined surface laser photofragmentation-fragment detection (SPF-FD) spectroscopy for detecting explosives residues, chemical warfare agents, and other hazardous materials on surfaces in real time at ambient conditions. The technique utilizes one or two lasers to both photolyze the target species and to facilitate the detection of the characteristic photofragments by resonance-enhanced multiphoton ionization, laser induced fluorescence, or both. Its analytical utility was demonstrated on explosives RDX, HMX, CL-20,

and TNT, and the effects of laser photofragmentation wavelength and energy, delay between photofragmentation and probe lasers, and electrode orientation on signal intensity are reported here. Signal-to-noise analyses yield limits of detection in the range of 1 to 15 ng/square cm (S/N=3) at 1 atm and 298K.
http://stinet.dtic.mil/cgi-bin/GetTRDoc?AD=A431577&Location=U2&doc=GetTRDoc.pdf

Reducing Online Contaminant Monitoring Uncertainty Using a Bayesian Belief Network
Dawsey, W.J., B.S. Minsker, and V.L. VanBlaricum.
American Society of Civil Engineers (ASCE) Environmental & Water Resources Inst. (EWRI) World Water & Environmental Resources Congress 2005 & Related Symposia, Anchorage, AK, 2005.

A positive sensor detection can often be validated by pieces of evidence observed in a distribution system. This paper illustrates how Bayesian belief networks (BBNs) can be used to represent distribution system contamination scenarios. A framework was developed that integrated sensor data with other validating evidence of a contamination event. The framework was used to express causality between the events and observed evidence that comprise contamination scenarios. This paper details a study that demonstrates that BBNs are capable of expressing complex causal relationships among the events and observations that comprise contamination scenarios in water distribution systems. The scenarios can be better understood when explicitly visualized in a graphical probabilistic model, such as a BBN. This approach has the potential to be incorporated into both security planning and real-time response to contaminant detection.
http://cee.uiuc.edu/emsa/conference/dawsey-2005-01.pdf

Reference Handbook for Site-Specific Assessment of Subsurface Vapor Intrusion to Indoor Air
Electric Power Research Institute (EPRI), Palo Alto, CA. Report No: 1008492, Mar 2005

Subsurface vapor intrusion is only one of several possible sources for volatile and semi-volatile chemicals in indoor air. This report provides guidance on the site-specific assessment of the significance of subsurface vapor intrusion into indoor air. Topics covered include theoretical considerations, sampling and analysis considerations, recommended strategies and procedures, interpretive tools, mitigation measures, and suggestions for future research. This document reflects a comprehensive understanding of the current scientific knowledge in this field.

Remote Site Monitoring For Long Term Stewardship: An Application of Machine Vision at the DOE Miamisburg Closure Project, Mound Site, Ohio
North-Abbott, M., F. La Forest, D. Reichhardt, and M.T. Dunstan, MSE Technology Applications, Inc.
Proceedings of Waste Management 2004, 29 February - 4 March, Univ. of Arizona, Tucson. Paper WM-4275, 5 pp, 2004

MSE Technology Applications, Inc. is demonstrating machine vision technology for automated remote site monitoring at DOE's Miamisburg Closure Project, the Mound Site in Miamisburg, OH. The machine vision system will monitor soil intrusion and or disturbances, erosion, and subsidence, as well as part of a remediation activity. The demonstration has two parts: design and installation of the hardware and development and optimization of the machine vision algorithms. The machine vision hardware installed at Mound comprises three digital cameras, a secure wireless data transfer network, and a computer for image processing, storage, and retrieval. A 120-volt ac electrical power and a 12-volt dc solar panel and battery system provide power for the system. The machine vision image-processing algorithm subtracts one image from another image to identify regions where change has occurred. The image-processing algorithm can provide the image coordinates where the change occurred and magnitude of the area on the image that has changed. If the identified change meets some

pre-defined criteria, the algorithm can initiate a response (i.e., a phone call or automated email). MSE is working to improve the detection of relevant change(s) and reduce the number of false alarms generated by the machine vision system due to changes that occur because of irrelevant factors or noise (e.g., insects on camera lenses, variable lighting due to clouds and/or changing positions of the sun, and variations in weather).
http://www.wmsym.org/abstracts/2004/pdfs/4275.pdf

Respirometry for Assessing the Biodegradation of Petroleum Hydrocarbons
Plaza G. (Inst. for Ecol. of Industrial Areas, Katowice, Poland); K. Ulfig; A. Worsztynowicz; G. Malina; B. Krzeminska; R.L. Brigmon.
Environmental Technology, Vol 26 No 2, p 161-169, 2005

The Micro-Oxymax(R) respirometer was applied to evaluate the bioremediation potential of hydrocarbon-contaminated soils in two biopiles at an oil refinery. Enhanced (engineered) bioremediation was being implemented in pile 1, and intrinsic biodegradation was being monitored in pile 2. The biodegradation of petroleum hydrocarbons was evaluated on the basis of CO2 production and O2 uptake as calculated from the slopes of cumulative curve linear regressions. The results confirmed the hydrocarbon biodegradation process in both biopiles, though in biopile 2 the process was more effective than in biopile 1. In biopile 2, the O2 consumption and CO2 production means were 3.37 and 2.4 ml/kg soil (dry weight) per minute, respectively, whereas in biopile 1, the O2 consumption and CO2 production means were 1.52 and 1.07 ml/kg soil (dry weight) per minute, respectively. The mean biodegradation rate for biopile 2 was two times higher--67 mg hydrocarbons kg/d.w./day compared with biopile 1, in which the mean was 30 mg hydrocarbons kg/d.w./day. The results were correlated with petroleum hydrocarbon concentrations and microbial activity measured by dehydrogenase assay.

Rhizon In Situ Sampler (RISS) for Pore Water Sampling from Aquatic Sediments
Seeberg-Elverfeldt, J. (Alfred Wegener Inst. for Polar and Marine Research, Bremerhaven, Germany); M. Koelling (Univ. of Bremen, Bremen, Germany); M. Schluter and T. Feseker (Alfred Wegener Inst.).
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. GEOC 99.

The newly developed Rhizon In Situ Sampler (RISS) is a non-destructive tool for in situ porewater sampling. In a benthic chamber, the RISS allows studies of benthic fluxes and pore-water profiles in the same location with negligible effect on the incubated sediment/water interface, thus allowing improved modeling of transport and reaction processes. Long-term deployments of the RISS and repetitive pore-water sampling will support future studies of the seasonal variation of benthic processes. The authors assessed RISS for pore-water sampling via field experiments, tracer studies, and numerical modeling.

Roadmap to Long-Term Monitoring Optimization
U.S. EPA, Office of Superfund Remediation and Technology Innovation, Washington, DC.
Report No: EPA 542-R-05-003, 48 pp, May 2005

This roadmap focuses on optimization of established long-term monitoring (LTM) programs for groundwater. Tools and techniques discussed concentrate on methods for optimizing the monitoring frequency and spatial (three-dimensional) distribution of wells (i.e., physical program optimization). Other LTMO methods focusing on areas such as the list of analytes, the sampling and analytical methods, and data management are important items for consideration, but are not detailed in this document. The LTMO techniques discussed here can be described as qualitative or quantitative or some

combination of these techniques. Qualitative LTMO evaluations rely on the use of professional judgment to assess the adequacy of the monitoring network and sampling frequency, whereas quantitative LTMO approaches use numerical and statistical approaches to recommend changes. There are advantages to both.
http://www.clu-in.net/download/char/542-r-05-003.pdf

Room Temperature Phosphorimetric Determination of Cyanide Based on Triplet State Energy Transfer
Fernandez-Arguelles, M.T., J.M. Costa-Fernandez, R. Pereiro, and A. Sanz-Medel, Univ. of Oviedo, Oviedo, Spain.
Analytica Chimica Acta, Vol 491 No 1, p 27-35, 1 Sep 2003

The determination of cyanide ions in water samples by room temperature phosphorescence (RTP) detection is based on the measurement of the RTP emission of a-bromonaphthalene (BrN). The principle involves energy transfer from the BrN phosphor molecule insensitive to the presence of cyanide (acting as a donor) to a cyanide-sensitive dye (acceptor). The RTP emission spectrum of BrN overlaps significantly with the absorption spectrum of the complex formed between copper and Cadion 2B, giving rise to a non-radiative energy transfer from the phosphor molecules to the metal complex. The sensing of cyanide ions is based on the displacement by cyanide of the copper ions from its complex with Cadion 2B. An increase in the concentration of cyanide causes a decrease on the concentration of the Cadion 2B/copper complex (acceptor), with the subsequent decrease of the absorbance in the overlapping region with the RTP spectra resulting in higher RTP emission signals measured. A detection limit of 3 ug/L CN was achieved under optimal reaction conditions and pH 11. The method has been successfully applied to the determination of trace levels of labile cyanide in spiked drinking water samples.

Semi-Automated Genetic Analyses of Soil Microbial Communities: Comparison of T-RFLP and RISA Based on Descriptive and Discriminative Statistical Approaches
Hartmann, M., B. Frey, R. Kolliker, F. Widmer, Agroscope FAL Reckenholz, Swiss Federal Research Station for Agroecology and Agriculture, Zurich, Switzerland.
Journal of Microbiological Methods, Vol 61 No 3, p 349-360, June 2005

Cultivation independent analyses of soil microbial community structures are based on direct extraction of total soil DNA followed by polymerase chain reaction (PCR) amplification of selected marker genes and subsequent genetic fingerprint analyses. Terminal restriction fragment length polymorphism (T-RFLP) and ribosomal intergenic spacer analysis (RISA) are semi-automated genetic fingerprinting techniques that yield high-resolution patterns of highly diverse soil microbial communities and hold great potential for use in routine soil quality monitoring in situations where rapid high throughput screening for differences or changes is more important than phylogenetic identification of organisms affected. Profound statistical analyses were performed to evaluate the cultivation independent approach and the consistency of results from T-RFLP and RISA in a model system containing two different heavy metal-treated soils. Bacterial T-RFLP and RISA profiles of 16S rDNA were converted into numeric data matrices for detailed statistical analysis, which revealed that soil DNA contents were significantly correlated with soil microbial biomass in the system. T-RFLP and RISA yielded highly consistent and correlating results and both allowed the four treatments to be distinguished with equal significance. RISA presents a fast and general fingerprinting method of moderate cost and labor intensity, while T-RFLP is technically more demanding but offers the advantage of phylogenetic identification of detected soil microorganisms.

Screening and Monitoring of Metal Contamination in Soils of Environmental Disaster Areas: Available Techniques and Needs
Twardowska, Irena, Krystyna Janta-Koszuta, Sebastian Stefaniak, and Joanna Kyziol.
Advanced Environmental, Chemical, and Biological Sensing Technologies II. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5586, p 116-125, Dec 2004

New monitoring and assessment techniques are needed to enable metal partitioning with respect to susceptibility to migrate. The area impacted by the catastrophic flood of 1997 in the Odra River valley in Poland was screened for metals in soils and sediments. Metals mobility in the affected area was assessed in view of potential risk to the receptors. The work involved positioning sampling cells by GPS, assessing the post-flood changes in metal spatial distribution with a Geographical Information System (GIS), and evaluating binding strength and major chemical forms of metals via sequential extraction analysis. The sequential extraction analytical procedure was conducted manually and thus was very labor-intensive. Automation of metal partitioning and assessment of bioavailable forms by the diffusive gradients in thin films (DGT) technique would have provided valuable information and reduced the time needed for analysis.

A Screening Model for Evaluating the Degradation and Transport of MTBE and Other Fuel Oxygenates in Groundwater
Sun, Y. and X. Lu, Lawrence Livermore Natl. Laboratory, Livermore, CA.
Transport in Porous Media, Vol 60 No 1, p 75-88, 2005

The authors present a closed-form analytical solution that can be applied as a screening tool to better envision the transport and transformation processes when considering bioremediation as option for the cleanup of methyl tert-butyl ether (MTBE) in groundwater.

SEDD: Experiences in Programming and Implementation with Real-World Projects
Wilson, Buddy, Promium, Bothell, WA.
NEMC 2004: The 20th Annual National Environmental Monitoring Conference, 19-23 July 2004, Washington, DC. Book of Abstracts, No. 62.

The SEDD (Staged Electronic Data Deliverable) specification provides a common structure and data element dictionary to report a wide variety of data to multiple customers. The SEDD specification is program-neutral and allows for reporting of data in a single deliverable format that contains results ranging from simple sample concentrations (Stage 1) all the way to a CLP (Contract Laboratory Program) type data package (Stage 3). Because of the potential and flexibility of the SEDD format, Promium has actively worked with the EPA and Army Corps of Engineers to support the use of the format by laboratories with Promium's Laboratory Information Management (LIM) system when they perform testing for projects that must be reported to those agencies. Experiences with real-world projects and the SEDD format have brought issues to light that are likely to become more significant as use of the format expands within the environmental testing industry. One issue that has seen significant improvement is the consolidation of multiple Document Type Definitions (DTDs) into a limited number of generic DTDs that are applicable to most project method scopes. The most significant changes expected in the format involve incorporation of valid values into the production of the deliverable so that SEDD data can be used by legacy programs that require specific nomenclature for test method, analytes, matrices, and other important fields. Also important is the need for a widely available tool to allow generators and users of the format to quickly check the format and data consistency of submitted files. Because the SEDD format is almost always more flexible than legacy data system file formats, agencies wishing to incorporate SEDD data into their legacy systems must either develop conversion utilities that can reduce the scope of some of the allowable SEDD variables or manage their projects so that laboratories generating SEDD files can feed legacy systems directly.

A Self-Adaptive Hybrid Genetic Algorithm For Optimal Groundwater Remediation Design
Espinoza, F., Ph.D. thesis, Univ. of Illinois, 165 pp, 2003

A large body of research has demonstrated that coupling optimization models with simulation models can aid in identifying effective remediation designs. The simple genetic algorithm (SGA) is a heuristic technique capable of solving these types of problems. Unfortunately, the solution of these complex problems is generally computationally intensive. A hybrid genetic algorithm (HGA) method combines the use of SGA with local search to solve a groundwater remediation problem. The inclusion of local search helps to speed up the solution process and to make the solution technique more robust. The result of this research is a highly reliable numerical tool, the enhanced self-adaptive hybrid genetic algorithm (e-SAHGA), to more efficiently and effectively solve problems using SGAs. With this tool, the designer can evaluate different solution alternatives in a more timely fashion. A step-by-step methodology has also been developed for evaluating the optimal parameters for using the algorithm. This methodology, together with the adaptive nature of the algorithm, reduces the need for trial-and-error experiments to determine the optimal set of parameters for the algorithm. The application of the e-SAHGA algorithm to a hypothetical groundwater remediation design problem showed 90% reliability in identifying the solution faster than the SGA, with average savings of 64% across 100 runs with different random initial populations. Finally, e-SAHGA was tested on a field-scale remediation design problem, a re-evaluation of the remediation system for Umatilla Army Depot, where it gave computational savings between 30 and 60%, and for one solution method found a solution that was 4% better than the one found by the SGA.
http://cee.uiuc.edu/emsa/documents/fespinoz-2003-01.pdf

Self-Assembled Carbon Nanotubes in a Microtrap for Chemical Sensing and Chromatography
Saridara, Chutarat (Rajamangala Univ. of Technology, Thanyaburi, Thailand); R. Brukh, Z. Iqbal, and S. Mitra (New Jersey Inst. of Technology, Newark).
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. ENVR 207.

Chemical vapor deposition is a convenient method for the catalytically-driven self-assembly of carbon nanotubes (CNTs) on a variety of surfaces. The authors report on the first application of self-assembled CNTs inside a steel capillary to fabricate a microtrap for the nanoscale adsorption and desorption of organic molecules. The CNT-coated microtrap functions as a nanoconcentrator that can be used for sensing and analytical-scale separation, such as by gas chromatography (GC). The CNTs deposit as a thin film on the walls of the capillary from either CO or C_2H_4 carbon precursors. Trace-level (ppm) small organic molecules, such as hexane and toluene, are adsorbed and then rapidly desorbed from the CNT film inside the capillary. The desorption pulse provides a concentrated injection for the detector and for GC separation.

Selective Molecularly Imprinted Polymers for Fluorophosphonate Nerve Gases: Proof of Concept
Green, B.S. (Semorex Inc, North Brunswick, NJ); A. Strikovsky, I. Pergament, R. Arad-Yellin, and Y. Ashani (Semorex Technologies Ltd, Ness Ziona, Israel).
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. POLY 623.

A new approach for molecularly imprinted polymers (MIPs) was devised that creates selective binding sites containing a nucleophile close to the F-P bond of the bound agent, accelerating reaction.

Using p-nitrophenyloxy analog substrates, distinct MIP selectivity was observed in EGDMA-based MIPs prepared with complementary cavities for sarin, soman, cyclosarin, and diisopropyl fluorophosphates (DFP). Effective field sensors for selective toxin identification are possible for a variety of applications, such as water monitoring, using the MIP approach.

Sensing Superfund Chemicals with Recombinant Systems
Deo, S.K., X. Xu, D. Ghosh, A. Rothert, J. Feliciano, X. Guan, E. D'Angelo, L.G. Bachas, and S. Daunert, Univ. of Kentucky, Lexington.
Superfund Basic Research Program 2004 Annual Meeting, Seattle, WA, 3-4 November 2004, Seattle, Washington. PowerPoint presentation, 33 pp, 2004

Genetically engineered bacteria-based sensing systems have been developed for the detection of environmental pollutants. Heavy metals (e.g., arsenic and antimony) and polychlorinated organics (e.g., PCBs and chlorocatechols) have significant effects on human health, so there is a need for simple analytical techniques to monitor directly the levels of these toxicants. The sensing system takes advantage of microorganisms that have developed resistance mechanisms to survive in contaminated environments. The resistance to arsenic and antimony is conferred on bacteria by the ars operon, which codes for proteins that help bacteria in extruding these toxicants out of the cell. Biosensing systems for arsenic/antimony by genetically designing bacteria can be developed in a way that couples the natural regulatory mechanisms of Escherichia coli with the expression of reporter genes. In such systems, the level of expression of the reporter protein can be related to the concentration of the target compound(s) present in the environment. The whole-cell biosensing systems developed for chlorocatechols and polychlorinated biphenyls using reporter gene technology are also discussed. Cell-based biosensing systems have not yet found field applications despite their simplicity to operate, ease of production, and low cost. Two strategies to adapt these whole-cell sensing systems for field applications have been proposed: an inexpensive sensing strip and a centrifugal microfluidic platform in the shape of a compact disc. The sensing strips are a simple way to detect environmental contamination without the need of expensive instrumentation and trained personnel. In contrast, the microfluidic platform offers high throughput and multiplexing capabilities. Both systems offer complete portability, which allows them to be used as field sensors.
http://www-apps.niehs.nih.gov/sbrp/2/annualconfreport/agenda.html

Sensors and Biosensors Based on Clay-Modified Electrodes: New Trends
Mousty, Christine, Univ. Joseph Fourier, Grenoble, France.
Applied Clay Science, Vol 27 Nos 3-4, p 159-177, Dec 2004

In this review of the use of clay-modified electrodes (CLMEs) for electroanalytical purposes, the author first describes the structure of cationic and anionic clays, electron transfer occurring at CLME, and different modes of preparation of CLMEs. The analytical applications reported for CLME range from the preconcentration method applied to the detection of cationic species (metal cations) or organic molecules (water pollutants and drugs), to electrocatalytic sensors involving intercalated redox mediators in the electrochemical detection process, to amperometric and potentiometric biosensors. Several enzymes have been immobilized within clay matrices, and amperometric biosensors based on CLME are presented following the three modes of detection referred to as first, second, and third generation of biosensors, depending on the nature of the enzymes.

Sensor System for the Rapid, Sensitive Detection of Toxins
Edberg, H.C., M.G. Warner, B.P. Dockendorff, R. Ozanich, J. Grate, N.C. Anheier Jr., C.R. Batishko, T.L. Stewart, and C. Bruckner-Lea, Pacific Northwest National Laboratory, Richland, WA.
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. ANYL 443.

High affinity reagents and sensor configuration can enable rapid mass transport and be combined for rapid, sensitive biodetection in a system that includes a renewable surface immunoassay. The immunoassay involves on-column detection of a fluorescently labeled secondary antibody in a sandwich immunoassay. A rotating rod renewable surface microcolumn was used to form a microliter-sized column containing microbeads functionalized with a capture antibody. The authors are also developing nanoparticle-functionalized affinity reagents for next-generation sensors that will utilize the fluorescent nanoparticles to achieve low detection limits.

A Silicon-Polymer Heterostructure for Sensor Applications
Laranjeira, J.M.G., H.J. Khoury, W.M. de Azevedo, E.A. de Vasconcelos, and E.F. da Silva Jr., Univ. Federal de Pernambuco, Pernambuco, Brazil.
Brazilian Journal of Physics, Vol 32 No 2a, p 421-423, 2002

High quality polyaniline-silicon heterojunction diodes have been selected for use as gas and/or ionizing radiation sensors. Polyaniline thin films 40 nm thick are an active part of the junction structure, which presents excellent electrical characteristics. The devices are very sensitive to g-radiation up to 6,000 Gy and to vapors, such as those from ammonia, nitric acid, and trichloroethene. The sensitivity of the diodes is observed through shifts of the current-voltage curves, which can be easily monitored to provide a calibration curve of the sensor either as a radiation dosimeter or as a gas sensor.
http://www.scielo.br/scielo.php?pid=S0103-97332002000200050&script=sci_arttext&tlng=en

Simultaneous Estimation of Diffusive Volatile Organic Compound (VOC) Fluxes and Non-Aqueous Phase Liquid (NAPL) Saturation in the Vadose Zone
Werner, David, Mette Broholm, & Patrick Hohener.
Ground Water Monitoring & Remediation, Vol 25 No 2, p 59-67, 2005

By combining soil-gas monitoring with natural gradient tracer methods, diffusive VOC contaminant fluxes can be measured in situ, and NAPL can be detected and roughly quantified. To locate emplaced NAPL contamination at a field site in Denmark, soil-gas probes with a low dead volume were installed at 1-m depths in the sandy vadose zone, and a small volume of gas containing conservative and partitioning tracers was injected. Subsequently, soil-gas samples were analyzed simultaneously for VOCs and tracers. Tracers detected the NAPL reliably, and the combined data allowed for a close delineation of the source zone. The calculated NAPL saturation, however, deviated by up to a factor of 3 from soil core analyses.

Simple Screening Models of NAPL Dissolution in the Subsurface
Zhu, J. and J.F. Sykes, Texas A&M Univ., College Station, TX.
Journal of Contaminant Hydrology, Vol 72 No 1-4, p 245-58, Aug 2004

Three simple screening models of nonaqueous phase liquid (NAPL) dissolution in the subsurface are proposed based on the NAPL mass conservation and the assumption of proportionality between the residual NAPL source zone concentration and the remaining residual NAPL mass. The models are designed to predict the solute concentration in the zone of the residual NAPL as a result of dissolution. The predicted source zone concentration decrease is used to simulate and account for the decrease of dissolution rate with time. The proposed simple NAPL dissolution models enable the pseudo-equilibrium formulation to be used and therefore the numerical simulations for field application problems can be simplified compared to the non-equilibrium counterpart.

Site Characterization Utilizing the FIELDS Tools
Cooper, Brian, John Bing-Canar, and Charles Roth, U.S. EPA Region 5, Chicago, IL.
RevTech: Cleaning Up Contaminated Properties for Reuse and REVitalization: Effective TECHnical Approaches and Tools--After Action Information, 22-24 July 2003, Pittsburgh, PA. Abstracts, p 24.

The innovative FIELDS software tools have been developed and applied in EPA Region 5 to characterize contamination in soils and sediment. The FIELDS Tools are a set of ArcView extensions: Sample Design, Database Query, Modeling (geospatial analysis), Human Health Risk Assessment, Ecological Risk Assessment, and Decision Analysis. The goal of this software development is to provide decision support tools useable to most technical staff at minimum cost. The Sample Design module allows a user to design statistically-based sample designs (random, stratified random, and gridded) and upload these designs to a GPS unit to navigate to sample locations. Once the samples are collected and analyzed, the FIELDS Tools' Database Query module allows the user to import data from a FIELDS-defined data table or a STORET, EQuIS, or NOAA Query Manager database. If a user has field names or types that do not match the FIELDS format, an interactive GUI allows users to match their field names with the FIELDS-required names. The queried data can be contoured to create estimates at unsampled locations using various algorithms. The contoured values can be used to estimate the mass of contaminant (e.g., pounds of PCB) and the volume of contaminated material (e.g., sediment > 10 ppm) using the Mass/Volume module. The Tools also include a Remediation module that allows users to determine areas to remediate to meet a cleanup goal either in block-based remediation or for the entire site. The Tools are undergoing a two-phased peer-review process and have been used extensively for EPA Region 5 Superfund sites to create sample designs, estimate contaminate values and contaminant mass and volume, and generate remediation scenarios. The FIELDS extensions for ArcView (Spatial Analyst is required) are freely available on line.
http://www.tiem.utk.edu/~fields/

Slurry-Phase Experiments as Screening Protocol for Bioremediation of Complex Hydrocarbon Waste
Hettiaratchi, J.P.A., P.L. Amatya, E.A. Jordan, and R.C. Joshi, Univ. of Calgary, Calgary, Canada.
Practice Periodical of Hazardous, Toxic, and Radioactive Waste Management, Vol 5 No 2, p 88-97, Apr 2001

Wastes in oil and gas industry flare pits (FPs) usually contains high levels of hydrocarbons, metals, and salts. Bioremediation by land application is the most common method practiced by the oil and gas industry to treat FP waste, while high-rate slurry-phase and solid-phase biotreatment methods are viable alternatives. A biotreatability screening tool is needed to assess the viability of each treatment method. An investigation of the effects of salinity, nutrient, soil type, and temperature on the ultimate biotreatability of FP waste in 2-L slurry reactors showed differences in biodegradation for the parameters tested; however, the primary effect of waste composition was highly significant, with higher soil clay content resulting in lower biodegradation. Petroleum concentrations initially decreased, but biodegradation decreased or ceased with time, leaving recalcitrant compounds. The majority of saturated hydrocarbons degraded to low levels within a week. Results indicate that slurry-phase experiments might serve as a screening tool, though the authors note that slurries do not contain some of the microflora found in the solid phase.

SmartData Solutions: An Integrated Approach for the Collection, Processing and Delivery of Field Measurement and Sensor Data
Tillman, Ned and John Sohl, Columbia Technologies, LLC
RevTech: Cleaning Up Contaminated Properties for Reuse and REVitalization: Effective TECHnical Approaches and Tools--After Action Information, 22-24 July 2003, Pittsburgh, PA. Abstracts, p 106.

One way to manage digital, high-density data in the field is a system called SmartData Solutions(TM). This patent-pending process enables any high collection rate technology to have its output rapidly reviewed, krigged into high-definition 3D imagery, and delivered to appropriate parties on a daily basis. The program allows interactive webcasts in which field results are simultaneously critiqued by all participants and optimized to better communicate salient points. By having the results available to all of the knowledgeable site experts on a daily basis, conceptual site models can be vetted, questions can be addressed, and decisions made prior to the site assessment teams leaving the field. The process allows timely use of data for rapid site assessment and remedial decisions. SmartData Solutions(TM) has been used for directing fieldwork, selecting optimal locations for sampling, setting wells, targeting remedial efforts, and monitoring the performance of in situ chemical treatment. Rapid data processing is key to the successful implementation of dynamic work plans, as in the Triad Approach for performing site assessments. A dynamic work plan can only work effectively if there is a method to ensure that the data collected are reliable and available for timely decision-making. The system automates quality control procedures and facilitates integration of supporting data sets.

Solid State Potentiometric Sensor at Medium Temperatures (150-300 degrees C) for Detecting Oxidable Gaseous Species in Air
Alberti, G., A. Carbone, and R. Palombari, Univ. di Perugia via Elce di Sotto 8, Perugia, Italy.
Sensors and Actuators B: Chemical, Vol 75 No 1-2, p 125-128, 30 Ap 2001

The development of a solid state potentiometric sensor able to work up to 300 degrees C is based on a very thin membrane of -zirconium acid phosphate, obtained by colloidal dispersion of exfoliated -Zr(HPO4)2 and acting as a proton conductor, that is interposed between a catalytic electrode (platinum) and a solid state reference electrode (a silver disk anodically coated with Ag2O). The sensing electrode became more active with increasing temperature. The sensor's emf apparently depends on the partial pressure of oxygen. When used in air at 200-300 degrees C, the sensor can detect gaseous species, such as hydrocarbons and alcohols, at sensitivities of a few ppm.

Soil Characterization by Energy Dispersive X-Ray Fluorescence: Sampling Strategy for In Situ Analysis
Custo, G., S. Boeykens, L. Dawidowski, L. Fox, D. Gomez, F. Luna, and C. Vazquez, Comision Nacional de Energia Atomica, San Martin, Buenos Aires, Argentina.
Analytical Sciences, Vol 21 No 7, p 751-756, July 2005

A sampling strategy that allows the use of portable EDXRF (energy dispersive X-ray fluorescence) instruments for in situ soil analysis was applied to a soil characterization study in the area of Campana, Argentina. The data gained from an EDXRF spectrometer were evaluated with a radioisotope excitation source. In situ EDXRF methodology is a powerful analytical modality with the advantage of providing data immediately, allowing a fast general screening of soil composition.
http://wwwsoc.nii.ac.jp/jsac/analsci/pdfs/a21_0751.pdf

Soil and Environmental Analysis: Modern Instrumental Techniques, Third Edition
Smith, Keith & Malcolm S. Cresser.
CRC Press (previously by Dekker). ISBN: 0824709918, Books in Soils, Plants, and the Environment: Vol 97, 700 pp, 2003

Evaluating traditional and recent analytical methods according to speed, sensitivity, and cost-efficiency, this reference supports specialists in the selection of effective analytical techniques and equipment for the study of soils, soil contaminants, and environmental samples--illustrating the advantages, limitations, range, and challenges of the major analytical approaches utilized in modern research laboratories. New chapters address the measurement of organic pollutants in the environment and gas fluxes between the land surface and atmosphere. Expanded discussions are provided on analytical techniques for heavy metal contaminated soils, waters, and sediments; recent applications in absorption and flame emission spectrometry, inductively coupled plasma spectrometry, continuous-flow and injection analysis, ion chromatography, and x-ray fluorescence spectrometry; applications in the study of the biogeochemical cycles of carbon, nitrogen, and sulfur; the measurement of organic pollutants such as PCBs and aromatic hydrocarbons; dissolved C and N in water; and current methods of electroanalysis and the measurement of radioisotopes and ionizing radiation.

Soil-Lead Contamination Screening Tool
Marin, Maria S., Lance Franklin, and Carol J. Miller.
EWRI 2005: Impacts of Global Climate Change (Proceedings of the 2005 World Water and Environmental Resources Congress, May 15-19, 2005, Anchorage, Alaska).
ASCE Press, Reston, VA. ISBN: 0-7844-0792-4, 2005

This study reviews existing lead contamination data for surficial soils, surface water, and river sediments in the Detroit metropolitan area and evaluates the sources and the impacts of the contamination on human health and the environment. An efficient field testing method for soil lead determination has been developed to further investigate the frequency, significance, and sources of urban soil lead contamination.

Spatial Interpolation Methods for Nonstationary Plume Data
Reed, P.M., T.R. Ellsworth, and B.S. Minsker, Pennsylvania State Univ., University Park.
Ground Water, Vol 42 No 2, p 190-202, Mar-Apr 2004

The goal of groundwater plume interpolation is to maximize the accuracy in estimating the spatial distribution of the contaminant plume, given the data limitations associated with sparse monitoring networks with irregular geometries and the tendency of contaminant concentration fields to be heterogeneous, anisotropic, and nonstationary. High-resolution simulation data of perchloroethene (PCE) contamination in a highly heterogeneous alluvial aquifer were used to generate three test cases that vary in the size and complexity of their contaminant plumes, as well as in the number of data available to support interpolation. Overall, the variability of PCE samples and preferential sampling controlled how well each of six interpolation schemes performed, with quantile kriging showing the least bias from both of these factors. This study illustrates the opposing theoretical perspectives, ease of implementation, and effectiveness of the different plume interpolation methods.

Spectroscopic Investigation of Mercury-Contaminated Sediments: Adapting Restoration Goals to Mechanistic Research
Slowey, Aaron J. and Gordon E. Brown Jr., Stanford Univ., Stanford, CA.
The 230th ACS National Meeting, Washington, DC, Aug 28-Sep 1, 2005. GEOC 82.

An investigation of the phase-distribution, speciation, sorption, and dissolution of Hg in sediments employed X-ray absorption fine structure spectroscopy at the Hg L, Fe K, and sulfur K edges on Hg-contaminated riparian and estuarine sediments, with preliminary results indicating the accumulation of Hg in sulfidic muds in the form of cubic HgS. Chemical gradients were applied to Hg-bearing constituents (e.g., sulfidization of Hg adsorbed to goethite) in laboratory flow reactors. Sulfide was found to cause desorption of Hg, resulting in precipitation of cubic HgS at higher loadings. Sulfide was oxidized primarily to elemental sulfur under all conditions investigated, while goethite was partially converted to FeSx at higher sulfide loadings.

Stable Isotope Evidence for Biodegradation of Chlorinated Ethenes at a Fractured Bedrock Site
Chartrand, M.M.G. (Univ. of Toronto, Toronto, ON, Canada); P.L. Morrill; G. Lacrampe-Couloume; B.S. Lollar.
Environmental Science and Technology, Vol 39 No 13, p 4848-4856, 1 July 2005

At a fractured bedrock site contaminated with TCE, a DNAPL, investigators performed stable carbon isotope analysis of chlorinated ethenes and ethene to examine the progress of a bioaugmentation treatment. A pilot treatment area was bioaugmented with a culture of KB-1(TM), a natural microbial consortium known to completely reduce TCE to nontoxic ETH. Ongoing dissolution of TCE from DNAPL in the fractured bedrock and variable hydraulic gradients interfered with the concentration profiles of dissolved TCE and its degradation products cis-DCE, VC, and ETH, and the investigators could not convincingly confirm biodegradation of the chlorinated ethenes. Isotopic analysis of cis-DCE and VC offered the investigators assurance that biodegradation was occurring in the pilot treatment area, as the isotope values of cis-DCE and VC became significantly more enriched in C-13 over time. Quantification of the extent of biodegradation in the pilot treatment area using the Rayleigh model indicated that the decrease in cis-DCE and VC concentrations could be attributed to the effects of biodegradation during this time period, while within each well, the isotope profile of TCE remained relatively constant from continuous input of undegraded TCE due to DNAPL dissolution.

Stable Isotope Probing Shows Flow of Pollutant Carbon Through a Soil Microbial Community
Madsen, E.L., C.M. DeRito, and G. Pumphrey, Cornell University.
Superfund Basic Research Program 2004 Annual Meeting, Seattle, WA, 3-4 November 2004, Seattle, Washington. [poster presentation]

Researchers used a molecular technique, stable isotope probing (SIP), to identify biodegrading microbial populations by following the flow of carbon from (13)C-phenol into soil DNA and through to the active populations in a soil microbial community. The overall approach sought to link field respiration to microbial populations with and without prior exposure to phenol. The field-based assay involved the release of (13)C-labeled phenol and unlabeled phenol to soil plots and the subsequent analysis of (13)CO(2) respiration by gas chromatography/mass spectrometry (GC/MS). Key treatments included eleven 20-mL doses (either (13)C or unlabeled 10,000 ppm phenol) applied to 5.3 square cm plots at 1-day intervals prior to a final (13)C-phenol dose. Significant (13)CO(2) production (>4 times background) was observed from the soil with no prior phenol exposure. (13)CO(2) release was boosted by a factor of 20 (to 2.15 mmoles) when multiple additions of unlabeled phenol had been previously applied to the soil. As expected, the greatest mass of (13)CO(2) released was found in plots where all doses of phenol were (13)C-labeled. Following DNA extraction from the soil plots, cesium chloride density gradient centrifugation was employed to separate (13)C-labeled soil DNA from the (12)C-DNA pool. 16S rRNA genes were amplifiable by PCR from the (13)C-DNA fractions in only the (13)C treatments (not those that received unlabeled phenol). Sequencing of 16S rRNA clone libraries prepared from the (13)C-DNA fraction showed distinctive microbial populations in treatments with prior exposure to (12)C- and (13)C-labeled phenol. Adapted populations differed from unadapted populations. The patterns also revealed the identities of primary- and secondary- degrading soil populations comprising food chains involved in system carbon flow.

Status of SEDD: Implementation, Production, and Review Software
Mudambi, Anand R. (U.S. EPA, Washington, DC) and Joseph F. Solsky.
NEMC 2004: The 20th Annual National Environmental Monitoring Conference, 19-23 July 2004, Washington, DC. Book of Abstracts, No. 60.

SEDD (Staged Electronic Data Deliverable) is a program-neutral format for the delivery of analytical data. It supports multiple users' needs depending on the level of analytical requirements. The main advantage of SEDD is that once implemented, laboratories do not have to completely overhaul their Electronic Data Deliverable (EDD) generating systems as data requester needs become more complex, but can simply add additional elements to their current system. Using SEDD as the basis of electronic delivery of analytical data will decrease costs by reducing the number of EDDs laboratories currently have to support and ease data exchange between various programs and agencies. Different levels or Stages for SEDD have been developed based on the complexity of data reporting requirements. SEDD files are delivered as XML (eXtensible Markup Language) files. Sponsored by the World Wide Web Consortium (W3C), XML is a license-free, platform-independent, recommended standard that encapsulates structured data in text files and well supported by freely available third-party tools. Delivery of analytical data in the SEDD format is becoming a requirement in EPA contracts with other agencies formalizing SEDD requirements in policy documents. SEDD is also being evaluated by private sector parties as a uniform format for web-based delivery of analytical data from laboratories. This presentation reports on SEDD advantages, status, software, inter-agency efforts, future developments (including delivery of instrument data in XML), and implementation of SEDD by private parties.

Strategies for Quantitative and Rapid Measurements of Arsenic in Water
NIEHS Superfund Basic Research Program (SBRP), Research Brief 113, 5 May 2004

Collaborating researchers are taking varied approaches to developing and validating reliable, field-applicable analytical tools for arsenic that are sensitive, fast, portable and easy to use by untrained personnel. (1) Dr. Sylvia Daunert's team (University of Kentucky) has developed a set of whole-cell bacterial biosensors for testing groundwater. A genetically engineered nonpathogenic laboratory strain of Escherichia coli produces specific fluorescent proteins upon recognition of the target chemical. While other bacterial sensors detect only arsenite and their sensitivity is hampered by high levels of background noise, the new biosensor detects both arsenite [As(III)] and arsenate [As(V)] in the range of 5 to 100 ug of As/L. (2) "Dipsticks" have been prepared by drying sensor cells on a paper matrix. When the paper strips are placed in a tube with 1 milliliter of an aqueous sample for 30 minutes, then taken out and treated with a substrate, blue spots appear, the intensity of which is proportional to the arsenite concentration. These biosensors have been used to determine arsenic contamination in field samples from Bangladesh. They could cost as little as 2 cents to produce. (3) Dr. Yan Zheng's team (Queens College) with Columbia University has developed a sensitive electrochemical method for quantification of inorganic arsenic. A differential pulse cathodic stripping voltammetry (DPCSV) methodology has been optimized to detect arsenic at levels below 1 ug/L, differentiate between arsenite and arsenate, and

function in both lab and field. (4) Dr. Alexander van Geen (Columbia University) with scientists in Dr. Zheng's lab has modified a classic colorimetric method to assay dissolved arsenic, reducing the both the detection limit (from ~20 ug/L to ~2 ug/L) and reaction time (from > 1hour to 10 minutes). The method can be used to determine the proportion of As(III) and As(V) in a sample, and U.S. and international patents and a commercial test kit are in progress. (5) Dr. van Geen's team has also developed and tested an inexpensive groundwater sampling device involving a 10-gauge 18"-long needle that allows sampling of groundwater before a well is installed.
http://www-apps.niehs.nih.gov/sbrp/researchbriefs/view.cfm?Brief_ID=113

Support Vector Machines (SVMs) for Monitoring Network Design
Asefa, T. (Utah State Univ., Logan), M. Kemblowski, G. Urroz, and M. McKee.
Ground Water, Vol 43 No 3, p 413-422, May-June 2005

Support vector machines (SVMs) are a hydrologic application of a new statistical learning methodology based on minimization of a bound on the generalized error (risk) model, rather than just the mean square error over a training set. This paper illustrates the use of SVMs to reproduce the behavior of Monte Carlo-based flow-and-transport models that are in turn used in the design of a groundwater contamination detection monitoring system. Application of the method at a generic site to maximize the probability of detecting contaminants above a certain level while minimizing cost (i.e., number of monitoring wells) showed a rather promising performance, which suggests that SVMs could be successfully employed in other areas of hydrology.

Systematic Approach to Capture Zone Analysis for Pump-and-Treat Systems
Vanderpool, Luanne (U.S. EPA, Region 5); Rob Greenwald and Yan Zhang (GeoTrans, Inc.).
Proceedings: Accelerating Site Closeout, Improving Performance, and Reducing Costs Through Optimization, June 15-17, 2004, Dallas, Texas.

This presentation provides an overview of a systematic approach for the evaluation of capture zones at pump-and-treat systems, and highlights a document on the topic being developed by EPA's Office of Superfund Remediation and Technology Innovation and Office of Research and Development in conjunction with the U.S. EPA Groundwater Forum. The presentation defines "target capture zones" and explains their use during capture-zone analysis, particularly for sites requiring containment. The steps associated with a systematic approach for capture zone analysis are outlined: (1) Review site data, site conceptual model, and remedy goals; (2) Define site-specific target capture zone(s); (3) Interpret water levels; (4) Perform appropriate calculations (flow budget calculation, capture zone width calculation and/or modeling); (5) Evaluate concentration trends at monitoring wells (and potentially tracer tests); and (6) Interpret actual capture and compare to target capture zone(s) and assess uncertainties and data gaps. The use of "converging lines of evidence" and the iterative nature of the systematic approach are explained.
http://207.86.51.66/siteopt/ataglance.htm

Technical Rationale and Sampling Procedures for Assessing the Effects of Subsurface Volatile Organic Contaminants on Indoor Air Quality
Wong, T.T., J.G. Agar, and Scott Digel
56th Canadian Geotechnical Conference, 8 pp, 2003

Potential indoor air quality impacts can be assessed by collecting air samples indoors and submitting them for chemical analyses; however, because indoor air quality is often affected by volatile organic chemical (VOC) vapors released indoors by cigarette smoke, building materials, and common household solvents and cleaners, indoor air samples may not be a reliable indicator of the impact due to

subsurface contamination. Some Canadian and U.S. environmental regulatory bodies have accepted a method of indirect assessment that consists of soil gas sampling near the basement or ground-floor slab of a building and VOC vapor transport modeling to estimate soil gas flow rates and VOC flux into a building. The VOC flux concentration can then be used to evaluate the potential human exposure to soil- or groundwater-derived VOCs and to estimate the associated human health risks. The authors have designed a shallow vapor sampler and sampling procedure specifically for collecting representative soil gas samples in the zone adjacent to a building basement or a ground-floor slab. This paper presents the results of numerical modeling and the technical rationale for designing a soil gas sampling program for various soil types. The influence of soil type, depth to groundwater, and sampling well construction are discussed as they relate to soil gas sampling programs and human health risk evaluations.
http://www.oconnor-associates.com/papers/2003-Soil-Gas-Sampling.pdf

Technologies for Monitoring & Measurement of Dioxin and Dioxin-like Compounds in Soil and Sediment: Xenobiotic Detection Systems, Inc., CALUX(R) by XDS
U.S. EPA, National Exposure Research Laboratory, Las Vegas, NV.
Report No: EPA 540-R-05-001, 109 pp, Mar 2005

The Xenobiotic Detection Systems, Inc., CALUX(R) by XDS, is an aryl hydrocarbon-receptor bioassay that individually reports the total toxicity equivalents (TEQ) of dioxins/furans and polychlorinated biphenyls (PCBs) in the sample. As part of the performance evaluation, the technology results were compared to TEQ results generated by a reference laboratory using EPA Methods 1613B and 1668A. The CALUX(R) by XDS generally reported data higher than the certified PE and reference laboratory values for TEQD/F and total TEQ, but were generally lower for TEQPCB. The estimated method detection limit was similar to what was reported by the developer (0.53 to 0.63 pg/g TEQD/F). No statistically significant matrix effects were observed by matrix type (soil vs. sediment vs. extract) or polynuclear aromatic hydrocarbon concentration. 21% of the CALUX(R) by XDS results from replicate sample sets that were analyzed in the laboratory and in the field showed a significant statistical difference, and only total TEQ value showed a statistically significant effect due to sample type (performance evaluation vs. environmental vs. extract). The technology had a fairly high rate of false positive and false negative results around 1 pg/g TEQPCB (15 and 23%, respectively), but it had significantly fewer false positives and false negatives for total TEQ (4 and 1%, respectively) and TEQD/F (6 and 0%, respectively). When comparing XDS results to the reference laboratory for samples above and below 50 pg/g TEQ, all of the false positive and false negative rates for all TEQ types were less than 10%. These data suggest that the XDS technology could be an effective tool to screen for samples above or below 1 pg/g TEQ for TEQD/F and total TEQ, and that it could be effective for all three types of TEQ values to determine results above or below 50 pg/g TEQ, particularly considering that both the cost ($89,564 vs. $398,029) and the time (six weeks vs. eight months) to analyze the 209 demonstration samples were significantly less than that of the reference laboratory.
http://www.epa.gov/ORD/SITE/reports/540r05001/540r05001.htm

Technologies for Monitoring & Measurement of Dioxin and Dioxin-like Compounds in Soil and Sediment: Wako Pure Chemical Industries, Ltd., Dioxin ELISA Kit Wako (for Environmental)
U.S. EPA, National Exposure Research Laboratory, Las Vegas, NV.
Report No: EPA 540-R-05-002, 102 pp, Mar 2005

The Wako Pure Chemical Industries, Ltd. Dioxin ELISA Kit Wako (for environmental) is an immunoassay technology that reports total dioxin/furan concentration in a sample. The sample units are in pg/g 2,3,7,8- tetrachlorodibenzo-p-dioxin (TCDD) equivalents (EQ). While the kit is most reactive to

2,3,7,8-TCDD, it is responsive to all dioxin/furans at some level. In summary, results from the Dioxin ELISA Kit Wako were biased both positively and negatively relative to certified and reference laboratory results. No statistically significant matrix effects were observed by sample type (PE vs. environmental vs. extract), matrix type (soil vs. sediment vs. extract), or polynuclear aromatic hydrocarbon concentration. Wako completed all 209 sample analyses in the field within a 9-day period. The estimated method detection limit (83 to 201 pg/g 2,3,7,8-TCDD EQ) was significantly higher than was reported by the developer (20 pg/g 2,3,7,8-TCDD EQ), but PE samples with TEQ concentrations in the precisely appropriate range for evaluation of this technology's detection limit were not available, so these calculated values should be considered a rough estimate. The kit had a false positive rate of 10% and a false negative rate of 13% around 20 pg/g TEQ. The kit had the same false positive rate around 50 pg/g (10%), but fewer false negatives (8%). These data suggest that the Wako kit could be an effective screening tool for determining sample results above and below 20 pg/g TEQ, and even more effective as a screen for samples above and below 50 pg/g TEQ, particularly considering that the cost to analyze the 209 demonstration samples was significantly less than that of the reference laboratory ($150,294 vs. $213,580). All samples were analyzed on site in 9 days (in comparison to the reference laboratory, which took 8 months to report all results).
http://www.epa.gov/ORD/SITE/reports/540r05002/540r05002.htm

Technologies for Monitoring & Measurement of Dioxin and Dioxin-like Compounds in Soil and Sediment: Abraxis LLC, Coplanar PCB ELISA Kit
U.S. EPA, National Exposure Research Laboratory, Las Vegas, NV.
Report No: EPA 540-R-05-003, 98 pp, Mar 2005

The Abraxis LLC Coplanar PCB ELISA Kit is an immunoassay technology that reports the total toxicity equivalents (TEQ) of coplanar polychlorinated biphenyls (PCBs) in the sample. The Abraxis kit reported data higher and lower than the certified PE values. Abraxis generally reported data that were higher than the reference laboratory TEQPCB values, with the exception of ultra-high level PCB samples [> 10,000 pg/g TEQ] where Abraxis reported values lower than the reference method. The technology's estimated MDL was 6 to 31 pg/g TEQPCB; the developer's reporting limit was 6.25 pg/g TEQPCB. No statistically significant matrix effects on precision were observed by sample type (performance evaluation vs. environmental vs. extract), matrix type (soil vs. sediment vs. extract), or polynuclear aromatic hydrocarbon (PAH) concentration. One result (5% of total) from replicate sample sets that were analyzed in the laboratory and in the field showed a significant statistical difference, but the one sample was a PE sample that was spiked with only PAHs and no PCBs. The kit had a false positive rate of 35% and a false negative rate of 7% around 6.25 pg/g TEQPCB (the reporting limits of the technology). Abraxis reported significantly fewer false positives (8%) and false negatives (3%) around 50 pg/g TEQPCB. This evaluation indicates that the Abraxis kit could be an effective screening tool for screening sample concentrations above and below 50 pg/g TEQPCB, particularly considering that the cost ($22,668 vs. $184,449) and the time to analyze the 209 demonstration samples were significantly less than those of the reference laboratory.
http://www.epa.gov/ORD/SITE/reports/540r05003/540r05003.htm

Technologies for Monitoring & Measurement of Dioxin and Dioxin-like Compounds in Soil and Sediment: CAPE Technologies LLC, DF1 Dioxin/Furan Immunoassay Kit and PCB TEQ Immunoassay Kit
U.S. EPA, National Exposure Research Laboratory, Las Vegas, NV.
EPA 540-R-05-004, 110 pp, Mar 2005

The CAPE Technologies DF1 Dioxin/Furan and PCB TEQ Immunoassay kits are immunoassay techniques that report the total toxicity equivalents (TEQ) of dioxin/furans and polychlorinated

biphenyls (PCBs), respectively. In summary, the CAPE Technologies kits generally reported data higher than the certified PE and reference laboratory values. The technology's estimated method detection limit (12 to 35 pg/g) was higher than what was reported by the developer (1 pg/g TEQ). The CAPE Technologies TEQD/F results that were generated in the laboratory and in the field for replicate samples were statistically different for 19% of the samples, and of these samples, CAPE Technologies laboratory results were more comparable to the reference laboratory results. No significant effect was observed for the reproducibility of CAPE Technologies results by matrix type (soil vs. sediment vs. extract) or by sample type (PE vs. environmental vs extract). A slight effect was observed for total TEQ values by PAH concentration, but the effect was not statistically significant for TEQD/F or TEQPCB. The technology had a rate of false negative results of 3 to 5% around 20 pg/g TEQ, with false positive rates ranging from 11 to 14%. However, CAPE Technologies' false positive and false negative rates around 50 pg/g were generally lower for all three TEQ types, ranging from 4 to 10%. These data suggest the CAPE Technologies kits could be an effective screening tool for determining sample results above and below 20 pg/g TEQ and even more effective as a screen for samples above and below 50 pg/g TEQ, particularly considering that both the cost ($59,234 vs. $398,029) and the time (three weeks vs. eight months) to analyze the 209 demonstration samples were significantly less than those of the reference laboratory.
http://www.epa.gov/ORD/SITE/reports/540r05004/540r05004.htm

Technologies for Monitoring & Measurement of Dioxin and Dioxin-like Compounds in Soil and Sediment: Hybrizyme Corporation, AhRC PCR Kit
U.S. EPA, National Exposure Research Laboratory, Las Vegas, NV.
EPA 540-R-05-005, 100 pp, Mar 2005

The Hybrizyme Corporation AhRC PCR™ Kit reports the concentration of aryl hydrocarbon (Ah) receptor binding compounds in a sample, and the units are reported as Ah Receptor Binding Units (AhRBU). Because the technology measures an actual biological response, it is possible that the technology may give a better representation of the true toxicity from a risk assessment standpoint; hence, the test results were compared to the HRMS D/F and PCB data as well as PAH data in terms of ranking sample concentrations from low to high, rather than in a quantitative fashion of AhRBU vs TEQ. PAH concentrations included in the comparison were a selected target list for this demonstration and likely do not include all of the PAHs that are responsive to this kit. The HRMS reference D/F and PCB data were generated using EPA Methods 1613B and 1668A. Sample concentrations that were ranked by Hybrizyme from low to high were compared to the PE-certified concentration and reference laboratory data, including contributions from PAHs where PAH data were available. The Hybrizyme ranking agreed with the certified values for higher concentration samples, but was inconsistent for lower concentration samples. The Hybrizyme technology's concentration ranking was consistent with the reference laboratory ranking for the environmental samples 70 to 90% of the time. The calculated estimated method detection limit was 71 AhRBU. A significant effect was not observed for the reproducibility of Hybrizyme results by matrix type (soil, sediment, extract) or by PAH concentration, but a significant effect was observed for sample type (PE vs. environmental vs. extract) with the PE samples having a significantly higher mean RSD value (44%) compared to the environmental (19%) and the extract (14%) samples. The data generated and evaluated during this demonstration showed that the Hybrizyme technology could be used as an effective tool to rank sample concentrations from low to high AhR activity within a particular environmental site, particularly considering that the cost ($35,023 vs. $398,029) and the time (< two weeks vs. eight months) to analyze the 209 demonstration samples was significantly less than that of the reference laboratory.
http://www.epa.gov/ORD/SITE/reports/540r05005/540r05005.htm

Technology Status Assessment: Realtime Monitoring of Pipelines for Third-Party Contact
Burkhardt, G.L. and A.E. Crouch, Southwest Research Inst., San Antonio, TX.
U.S. DOE, National Energy Technology Lab, Morgantown, WV. 7 pp, Dec 2003

Third-party contact with pipelines (typically caused by contact with a digging or drilling device) can result in mechanical damage to the pipe. Because this type of damage often goes unreported and can lead to eventual catastrophic failure of the pipe, a reliable, cost-effective method is needed for monitoring and reporting third-party contact events. Since over half of subsurface damage results from third-party infringement, the capability for detecting contact and locating encroachment would be greatly beneficial. Several methods exist, or are being investigated, for monitoring and reporting third-party contact or activity near the pipeline. These include acoustic monitoring devices, continuous fiber-optic sensors buried alongside the pipe, satellite surveillance, cathodic protection monitoring, and methods that rely on telephone calls prior to digging. Because all of these methods have inherent limitations or are undesirable under certain conditions, the current project was initiated to investigate an alternate monitoring method. This method, impressed alternating cycle current (IACC), is capable of directly and continuously monitoring pipelines for third-party contact. Implementation of this method is relatively straightforward, and it can be retrofitted to existing pipelines without the need for excavating the pipeline. The purpose of this technology assessment document is to describe the state of the art of pipeline monitoring (based on a literature survey), including positive and negative characteristics of existing technologies, and to present a comparison to the IACC technology being developed in the current project.
http://www.netl.doe.gov/scngo/NaturalGas/TD&S/Status_Assessments/10211TechStatusAssess-Final.pdf

Terrestrial Avoidance Behaviour Tests as Screening Tool to Assess Soil Contamination
Loureiro, S., A.M. Soares, and A.J. Nogueira, Univ. of Aveiro, Aveiro, Portugal.
Environmental Pollution, Vol 138 No 1, p 121-131, Nov 2005

A rapid and sublethal avoidance behavior test was used as a screening tool with the earthworm (Eisenia andrei) and the isopod (Porcellionides pruinosus). The organisms were exposed during 48 h to several chemicals (lindane, dimethoate, and copper sulphate, for isopods, and carbendazim, benomyl, dimethoate, and copper sulphate for earthworms). Both species were also exposed to soils from an abandoned mine. Isopods and earthworms were able to perceive the presence of toxic compounds and escape from contaminated to clean soil. This avoidance behavior can serve as a sensitive soil screening tool.

Thin Film Trichloroethylene Electrochemical Sensor
Chen, M.H., C.C. Liu, and T.C. Chou, National Cheng Kung Univ., Tainan, Taiwan.
Biosensors and Bioelectronics, Vol 20 No 1, p 25-32, 30 July 2004

Pt-Ti and Pb-Pt-Ti thin films were deposited on alumina substrates by sputtering in Ar gas to prepare an electrodeposited Pb-modified Pt-Ti thin film working electrode. Optimal sensing conditions were found to be -2.10 V sensing potential, 250 rpm agitation rate. At room temperature, the response time was 15 seconds (90% response time). The correlation of sensing response current (id) and trichloroethene (TCE) concentration (CL) is id = 2.86CL in the range from 100 to 700 ppm TCE.

Time-of-Flight Mass Spectroscopy Measurements of TNT and RDX on Soil Surfaces
Osorio, Celia, Lewis M. Gomez, Samuel P. Hernandez, and Miguel E. Castro.
Detection and Remediation Technologies for Mines and Minelike Targets X. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5794, p 803-811, Jun 2005

The kinetic energy distribution of NO as a product of photo-fragmentation of nitro-compounds like TNT and RDX on soil substrates surfaces was established using femtosecond laser pulses for molecular dissociation and subsequent mass spectrometry measurements as a function of time. NO TOF measurements were successfully performed on TNT deposits photo-decomposed with 130-femtosecond laser pulses with a 400-nm wavelength.

Tools for Assessing N-Nitrosodimethylamine (NDMA) Biodegradation by Monooxygenase Enzymes
Sharp, J.O. and L. Alvarez-Cohen, Univ. of California.
Superfund Basic Research Program 2004 Annual Meeting, Seattle, WA, 3-4 November 2004, Seattle, Washington. [poster presentation]

The water contaminant N-nitrosodimethylamine (NDMA) is a probable human carcinogen introduced into the environment by the release of rocket fuels and through chlorine-based disinfections of water and wastewater. Previous studies have indicated that bacteria expressing monooxygenase enzymes with relaxed substrate specificity have the potential to biodegrade this compound. Microbial degradation of NDMA has been found to result from expression of (1) the soluble methane monooxygenase (sMMO) in Methylosinus trichosporium OB3b, (2) the propane monooxygenase (PMO) in Mycobacterium vaccae JOB-5, and (3) the para toluene monooxygenases (T4MO and TpMO) found respectively in Pseudomonas mendocina KR1 and Burkholderia pickettii PKO1. Recombinant Escherichia coli containing wild-type derived T4MO and TpMO plasmids can also metabolize this compound. This poster describes two simple tools that can be used to screen for relevant monooxygenase activity. The first involves a colorimetric naphthol-diazo assay that has commonly been used to assess the viability of sMMO enzymes. The second tool involves the temporary exposure of the bacteria to a small amount of acetylene gas to serve as an inactivator of monooxygenase activity. Strains OB3b, JOB-5, KR1, and PKO1 were all able to oxidize naphthalene to naphthol as indicated by the colorimetric assay. In each of these cases, this oxidation, as well as the oxidation of NDMA, was inhibited by the addition of acetylene gas.

Toxicological Profile for Cyanide, Chapter 7: Analytical Methods [Draft for Public Comment]
Agency for Toxic Substances and Disease Registry, p 205-222, Sep 2004

This chapter describes the analytical methods that are available for detecting, measuring, and/or monitoring cyanide, its metabolites, and other biomarkers of exposure and effect. The intent is not to provide an exhaustive list of analytical methods, but to identify well-established methods that are used as the standard methods of analysis. Many of the analytical methods used for environmental samples are the methods approved by federal agencies and organizations such as EPA and the National Institute for Occupational Safety and Health. Other methods presented in this chapter are those that are approved by groups such as the Association of Official Analytical Chemists and the American Public Health Association. Additionally, analytical methods are included that modify previously used methods to obtain lower detection limits and/or to improve accuracy and precision.
http://www.atsdr.cdc.gov/toxprofiles/tp8.html

Trace Metal and Mineral Speciation of Remediated Wastes Using Electron Microscopy
Klich, I., L. Wilding, and L. Drees, Univ. of Puerto Rico, Mayaguez
Analytical and Bioanalytical Chemistry, Vol 372 No 3, p 436-443, 2002

In metal-bearing contaminated soil and industrial wastes solidified and stabilized with Portland cement, electron microscopic techniques (scanning electron microscopy, transmission electron microscopy, and electron probe microanalyses) were used to evaluate metal species and mineralogical phases. The investigators found arsenic, barium, cadmium, chromium, copper, lead, nickel, and zinc. They also noted mineral alterations and weathering features (e.g., freeze-thaw cracking, cracking caused by the formation of expansive minerals, carbonation, movement of metals from waste aggregates into the surrounding cement matrix) that affect the durability and containment of metals in aged remediated wastes. Although the extent of degradation after 6 years is considered slight to moderate, evaluations of durability and permanence of metals containment cannot be based on leaching and bulk chemistry analyses alone. The use of electron microscopic analyses is vital in studies that evaluate trace metal and mineral species and that attempt to predict the long-term performance of metal containment in solidified and stabilized wastes.

Transport of Explosives II: Use of Headspace-SPME/GC u-ECD and TEEM GC/MS for Detection of TNT Vapors from Sand Buried Samples
Baez, Bibiana, Sandra N. Correa, and Samuel P. Hernandez-Rivera.
Detection and Remediation Technologies for Mines and Minelike Targets X. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5794, p 1263-1271, June 2005

Two methods were examined for explosive vapor detection: GC-uECD and GC/MS coupled to a tunable electron energy monochromator (TEEM-GC/MS). Both methods use solid phase microextraction (SPME) in headspace (HS) mode to collect vapors above the samples. Soil samples containing crystals of TNT were analyzed under varying environmental conditions (temperature and water content) using both methods over a period of one month. The samples exhibited primarily TNT and 2,4-DNT. In a comparison of results from both techniques, TEEM GC/MS and HS-SPME coupled with GC uECD both exhibited excellent selectivity and sensitivity.

Trends in Gas Sensors with Tunable Thin Films
Domash, Lawrence, Mitchell Cohen, and Matthias Wagner.
Infrared Systems and Photoelectronic Technology. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5563, p 149-155, Oct 2004

A new family of miniature nano-tunable narrowband infrared filters has been developed based on the thermo-optic properties of thin film semiconductors. At the 3-5 um range, very compact tunable filters can be developed with passbands on the order of 0.5% of center wavelength and tuning ranges up to 4% of center wavelength. Two applications are described: a prototype carbon monoxide sensor testbed capable of detecting less than 20 ppm of CO, and a new family of ultra-low-cost integrated tunable IR emitters. In the second application, nano-tunable thin film filters are integrated with miniature blackbody sources to create the integrated tunable IR emitters. Designated 'Firefly' and packaged in TO cans, the devices enable precision detection of carbon dioxide, carbon monoxide, sulphur dioxide, hydrogen cyanide, water vapor, nitric oxide, or methane.

Trichlorofluoroethene: A Reactive Tracer for Evaluating Reductive Dechlorination in Large-Diameter Permeable Columns
Field, J.A., R.L. Reed, J.D. Istok, L. Semprini, P. Bennett & T.E. Buscheck.
Ground Water Monitoring & Remediation, Vol 25 No2, p 68-77, 2005

In a pilot study to examine the effectiveness of hydrogen, lactate, and zero-valent iron for remediating TCE-contaminated groundwater, trichlorofluoroethene (TCFE) was used as a reactive tracer to determine the in situ rate of reductive dechlorination in three large-diameter permeable columns (LDPCs) installed in the treatment zones. The rate of TCFE reductive dechlorination and the distribution of transformation products was determined in each LDPC by means of push-pull tests conducted in each treatment layer. The results of field and laboratory studies show good agreement between the rates and transformation product profiles for TCFE and TCE. Because TCFE and its transformation products are not found in the background groundwater at contaminated sites, its use as a tracer allows unambiguous and sensitive detection of the lesser chlorinated products, such as CFE and FE.

A "Turn-On" Fluorescent Sensor for the Selective Detection of Mercuric Ion in Aqueous Media
Elizabeth M. Nolan and Stephen J. Lippard, Massachusetts Inst. of Technology, Cambridge, MA.
Journal of the American Chemical Society, Vol 125 No 47, p 14270-14271, 2003

A water-soluble turn-on fluorescent sensor for Hg(II) incorporates soft thioether donors into an aniline-derived ligand framework that can be linked to a fluorescein platform. Sensor MS1 shows an approximate 5-fold increase in integrated emission upon addition of 1 equiv of Hg(II). The authors discuss the synthesis and metal-binding properties of MS1 and its ability to detect environmentally relevant concentrations of Hg(II).

Uncertainty Based Multi-Objective Optimization of Groundwater Remediation at the Umatilla Chemical Depot
Singh, A., and B.S. Minsker.
American Society of Civil Engineers (ASCE) Environmental & Water Resources Inst. (EWRI) World Water & Environmental Resources Congress 2004 & Related Symposia, Salt Lake City, UT, 2004.

This paper presents the application of a robust multi-objective optimization method on a field-scale pump-and-treat design problem at the Umatilla Chemical Depot site at Hermiston, OR. A simple methodology is used to establish plausible realizations of hydraulic conductivity that are then efficiently sampled within the optimization framework using Latin Hypercube sampling. A noisy multi-objective genetic algorithm, developed and tested earlier on a hypothetical aquifer, is then applied to this field-scale case to come up with a set of robust and Pareto-dominant design solutions for the cleanup of RDX and TNT in the groundwater. Interactions between the various trade-offs and the inherent uncertainty at the site are analyzed. The authors demonstrate that by using such robust multi-objective optimization schemes, it is possible to increase robustness of the optimal remediation solutions without significant increases in costs.
http://cee.uiuc.edu/emsa/conference/asingh8-2004-02.pdf

Use of Airborne Hyperspectral Data to Estimate Residual Heavy Metal Contamination and Acidification Potential in the Guadiamar Floodplain Andalusia, Spain after the Aznacollar Mining Accident
Kemper, Thomas and Stefan Sommer.
Remote Sensing for Environmental Monitoring, GIS Applications, and Geology IV. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5574, p 224-234, Oct 2004

Field and airborne hyperspectral data were used in a spectral-mixture modeling application to map residual contamination after a mining accident. At the Aznalcollar Mine in southern Spain, an accident distributed metal-bearing sludge from a tailings pond over large areas of the flood plain. Though sludge and contaminated topsoil were removed from the affected area, a large amount of pyritic material remains on the ground. In two consecutive years, soil samples were collected for geochemical and spectral laboratory analysis in parallel to the acquisition of spectral field measurements with the HyMap sensor. A variable multiple endmember spectral mixture analysis (VMESMA) tool was used to provide possibilities of multiple endmember unmixing to estimate the quantities and distribution of the remaining tailings material. The sludge abundances obtained by unmixing the hyperspectral spectral data were confirmed by the field observations and measurements. The unmixing of the second-year images allowed identification of secondary pyrite minerals as indicators of pyrite oxidation and associated acidification.

Use of a Real-Time Sensor System to Reduce the Costs of Environmental Restoration
Campbell, D.P., D.S. Gottfried, and K.C. Caravati, Georgia Inst. of Technology, Atlanta.
Proceedings of Waste Management 2004, 29 February - 4 March, Univ. of Arizona, Tucson. Paper WM-4234, 6 pp, 2004

The Georgia Tech Research Institute (GTRI) has pioneered applications of sensor technology through the research and development of a cost-effective environmental sensor system for field detection and measurement of chlorinated and aromatic compounds and other aqueous chemical and biological monitoring data. The sensor, an integrated optic planar waveguide interferometer, is designed to collect real-time, chemical-specific data from gases and liquids. Selection of suitable polymer films allows for the detection of virtually any environmental contaminant. Field tests have detected low part-per-million levels of trichloroethene (TCE) from groundwater samples within minutes of sample collection. The data correlate well with laboratory results obtained from gas chromatography/mass spectrometer methods. In lab calibration measurements of the sensor, projected detection limits for the sensor are in the low parts per billion. Initial and per-sample costs for this sensor system are low, and it exhibits speed, sensitivity, and the ability to detect multiple analytes simultaneously. Systems can be designed for mobile, on-site field analysis with instant results or for in situ monitoring with automatic data logging and communication to a base site.
http://www.wmsym.org/abstracts/2004/pdfs/4234.pdf

Use of Dissolved and Vapor-Phase Gases to Investigate Methanogenic Degradation of Petroleum Hydrocarbon Contamination in the Subsurface
Amos, R.T., Mayer, K.U., Bekins, B.A., Delin, G.N., and Williams, R.L.
Water Resources Research, Vol 41 No 2, 2005

Dissolved and vapor-phase gas data collected at a site contaminated with petroleum hydrocarbons near Bemidji, MN, demonstrate that naturally occurring nonreactive or relatively inert gases, such as Ar and N2, can be used to quantify physical and chemical processes related to methanogenic activity in the subsurface. Regions of Ar and N2 depletion and enrichment in the vadose zone are indicative of methanogenic and methanotrophic zones, and concentration gradients between the regions suggest that reaction-induced advection can be an important gas transport process. In the saturated zone, dissolved Ar and N2 concentrations are used to quantify degassing driven by methanogenesis. Slight but discernable preferential depletion of N2 over Ar in both the saturated and unsaturated zones near the free-phase oil suggests reactivity of N2. This interpretation is consistent with other evidence indicating that nitrogen fixation by microbial activity is taking place at the site.

The Use of Functional Assays for Assessing Contaminated Lands

Siciliano, S. (Univ. of Saskatchewan, Saskatoon); G. Stephenson (ESG International Inc., Guelph, ON, Canada).

24th Annual Meeting of the Society of Environmental Toxicology and Chemistry, 9-13 November 2003, Austin, Texas. Abstract 126.

At a 2003 Toxicity Test Method Workshop organized by Environment Canada to evaluate the state of the science of terrestrial test method development for contaminated sites, participants were charged with the task of determining the role of functional assays in the assessment of contaminated soils. Functional assays are defined as assays that assess the direct and indirect effects of contaminants to biologically-mediated processes in soil. The inclusion of functional assays in a test battery for site soil assessment can reduce the uncertainty associated with extrapolating from single-species-level effects to community-level effects. Multiple species are involved in functional assays, hence processes are mediated by consortia of species, and the results are indicative of species or consortia interactions. Functional assays tend to increase confidence in the results of the test battery by reducing false positives and providing information on ecological services. Functional assays can be used as either a screening tool (e.g., carbon respiration) or for higher tier assessments (organic matter decomposition). Because functional assays integrate impacts on individual species and species interactions, in some instances they are likely to be less sensitive than tests with single species. The authors discuss the use of functional assays as a test battery component for assessment of site soils.

The Use of Microbial Bioassays and Activity Measurements for the Evaluation of Metal-Contaminated Soil Quality

Frey, B. & S. Zimmermann (Swiss Fed. Rsch. Inst., Birmensdorf); M. Stemmer (Univ. of Agricultural Sciences, Vienna, Austria); J. Luster (Swiss Fed. Rsch. Inst.); B. Nowack (Swiss Federal Inst. of Technol., Zurich); F. Widmer (Swiss Federal Rsch. Station for Agroecology & Agriculture).

Proceedings of the 7th International Conference on the Biogeochemistry of Trace Elements (7th ICOBTE), 15-19 June 2003, Uppsala, Sweden. Book of Abstracts. Vol 1-IV, p 176-177, 2003

Analytical chemical measurements do not provide direct information regarding the biological effects of toxic compounds; however, the possible presence of toxic compounds as well as their biological and ecological risks can be determined by use of toxicity tests and biosensors. This presentation describes the results of research to estimate metal bioavailability in a metal-contaminated soil using microbial biosensors and to assess adverse effects on soil microorganisms in relation to metal bioavailability.

Use of O2 Consumption and CO2 Production in Kinetic Cells to Delineate Pyrite Oxidation/Carbonate Buffering and Microbial Respiration in Unsaturated Media
Lee, Eung Seok and M. Jim Hendry (Univ. of Saskatchewan, Saskatoon, SK, Canada); P. Hollings (Univ. of Tasmania, Hobart, Tasmania, Australia).
Journal of Contaminant Hydrology, Vol 65 Nos 3-4, p 203-217, Sep 2003

A kinetic cell technique was used to measure rates of O2 consumption and CO2 production in low sulfide, low inorganic carbon, gneissic waste rock and associated organic-rich lake sediment and forest soil collected from the Key Lake uranium mine in Saskatchewan, Canada. Solid chemistry, stable carbon isotope, porewater sulphate concentration data, and stoichiometric considerations indicated that O2 consumption and CO2 production were limited by microbial respiration in the lake sediment and forest soil and by pyrite oxidation/carbonate buffering in the waste rock. Mean ratios of molar CO2 production to O2 consumption rates were 0.5 for lake sediment, 0.7 for forest soil, and 0.2 for waste rock. The different O2/CO2 ratios suggest that O2/CO2 monitoring may provide a practical tool for identifying the zones of microbial respiration and pyrite oxidation/carbonate buffering in mine waste-rock piles.

The Use of Rapid Bioassessment Protocols for Long-Term Monitoring on Department of Defense Installations
Lee, A.A. (U.S. Army Engineer Research and Development Center, Vicksburg, MS); R. Kelley (SoBran, Inc., Cincinnati, OH); M.R. Kress (U.S. Army Engineer Research and Development Center).
Federal Facilities Environmental Journal, Vol 16 No 1, p 109-120, Spring 2005

Identifying the appropriate metrics for long-term monitoring of an ecosystem, such as can found on a DoD facility, can be a challenge. Streams are good candidates because they integrate impacts to the biotic, chemical, and physical components of a watershed and thus represent watershed integrity. Rapid bioassessment protocols (RBPs) can be used to assess stream quality, as well as for long-term monitoring. Because RBPs are utilized at the state and federal levels, they are appropriate candidates for DoD installations. Examples of RBP programs in four southeastern states are discussed.

The Use of Sensor Arrays for Environmental Monitoring: Interests and Limitations
Bourgeois, W., A.-C. Romain, J. Nicolas, and R.M. Stuetz.
Journal of Environmental Monitoring, Vol 5 No 6, p 852-860, 2003

This paper discusses the ability and performance of low-cost, non-invasive chemical sensor arrays for in situ monitoring of air, soil, and water under realistic conditions. Promising results have been reported, despite limitations associated with both the sensor technology itself and its application in ever-changing ambient conditions. In research, the main challenge associated with the use of non-specific sensor arrays lies in establishing a relationship between the measured multivariate signals and the standard metrics that are traditionally used for quality assessment of the medium and analyte(s) being investigated. For instance, odor monitoring requires calibration against olfactometric measurements, while investigations of wastewater samples need to be correlated with organic pollution parameters. In the field, the utility of sensor arrays used as simple alarm devices or as early warning systems based on a general air/water quality index has been readily demonstrated.

Use of the In Situ, Inc. MP Troll 9000 to Locate Fractures Contributing to Ground Water Flow in Bedrock Wells
Robert Sernoffsky and Gary Robbins, Univ. of Connecticut; Remo Mondazzi, U.S. Geological Survey
Proceedings: 2004 U.S. EPA/NGWA Fractured Rock Conference: State of the Science and Measuring Success in Remediation, Portland, Maine, 13-15 September 2004. p 341-349, 2004

The In Situ, Inc. MP Troll 9000 is a multimeter capable of the simultaneous measurement of depth below water, temperature, pH, ORP, conductivity and dissolved oxygen. The instrument was used in two bedrock wells to evaluate its ability to identify fractures that contribute to groundwater flow. The wells were bored through 280 feet of crystalline metamorphic bedrock to a total depth of about 310 feet. Prior to deploying the MP Troll 9000, the wells were logged using both conventional and advanced borehole geophysical methods (i.e., caliper logging, gamma logging, fluid-resistivity logging, fluid/temperature logging, and both optical- and acoustic-televiewer logging). The wells were also logged under ambient and pumping conditions (<1 gpm) using a heat-pulse flow meter to locate fractures that contribute to flow and estimate associated discharge rates and the direction of vertical flow in the open borehole. The logs were used to corroborate the results of the vertical water quality profiles obtained using the MP Troll 9000. Preliminary results reveal that the wells exhibited obvious water quality anomalies that can be associated with the fractures contributing to flow as identified by the other borehole logging techniques. The MP Troll 9000 may be a cost-effective means to help locate these fractures. Because the MP Troll 9000 measures water quality parameters, it has the additional advantage of being able to potentially detect which fractures are contributing contamination to a well. Further research is currently being conducted to evaluate how water quality parameters change under higher pumping rates, and with slight augmentation, the tool's use as an effective flow meter.
http://www.clu-in.org/products/siteprof/2004fracrockconf/cdr_pdfs/indexed/group1/341.pdf

Using Laser Technology to Detect Lead in Soil
NIEHS Superfund Basic Research Program (SBRP), Research Brief 127, 6 July 2005

Lead is a naturally occurring metal with no known biological benefits to humans and serious health effects--especially for young children. Sensitive and rapid lead analytic techniques are needed for site and exposure assessments and to evaluate the progress of remediation efforts. Dr. Catherine Koshland and Dr. Don Lucas at the University of California, Berkeley, SBRP lead a team of researchers working with laser spectroscopy techniques to develop a quick, sensitive method to detect lead in soil and on surfaces. The researchers are applying excimer laser fragmentation fluorescence spectroscopy (ELFFS) technology. Their method uses high-energy photon beams to transform lead atoms to excited atomic states that emit a detectable fluorescence signal. The team has shown that the fluorescence signal is proportional to the concentration of lead in the soil sample. This method is unique in that the sample surface is photolyzed at laser fluences (energy/area) below the threshold where plasma formation occurs. This significantly improves the signal-to-noise ratio. The detection limit for the method (defined as 3 times the standard deviation of the background) is approximately 200 ppm--half the EPA regulatory standard for the presence of lead in soil. The fluorescence lifetime falls within the range of nanoseconds, and results are obtained in seconds. Minimal sample preparation is required prior to analysis: a soil slurry is placed into the sample well and dried. Background emissions from soil samples are small--that is, they do not contain any obvious distinct peaks--and are easily corrected in the analysis. The method is easier to interpret and quantify than current laser-based methods, such as laser induced breakdown spectroscopy. Contact: Catherine Koshland, Berkeley, 510-642-8769, ckosh@berkeley.edu.
http://www-apps.niehs.nih.gov/sbrp/researchbriefs/view.cfm?Brief_ID=127

Using Natural Distributions of Short-lived Radium Isotopes to Quantify Groundwater Discharge and Recharge
Krest, James M. and Judson W. Harvey.
Limnology and Oceanography, Vol 48 No 1, p 290-298, 2003

In situations where groundwater recharge or discharge is significant, the rate of vertical water flow through wetland sediment can be determined from the radium disequilibrium by a combined model of transport, production, decay, and exchange with solid phases. The authors have developed and tested this technique at three sites in the freshwater portion of the Everglades by quantifying vertical advective velocities in areas with persistent groundwater recharge or discharge and estimating a coefficient of dispersion at a site that is subject to reversals between recharge and discharge. This technique should be easily applicable to any wetland system with different production rates of the isotopes in distinct sedimentary layers or surface water.
http://aslo.org/lo/toc/vol_48/issue_1/0290.pdf

Using Photoacoustic Infrared Spectroscopy (PAS) For Monitoring MultiGas
Pollution Online, 8 Feb 2005

The California Analytical Instruments, Inc., Model 1412 Photoacoustic Multigas Monitor can measure up to five gases (e.g., ammonia, carbon dioxide, carbon monoxide, nitrous oxide, methane, sulfur dioxide, oxides of nitrogen) simultaneously, plus water vapor. The instrument has an extremely wide dynamic range and minimum detection limits for all of these compounds down in the mid-to-low ppb range. The analyzer is easy to use and requires minimal maintenance, with calibrations about once a year and no support gases. Because PAS is a non-destructive measurement technology, the samples can be re-circulated, which is critical in many flux chamber applications. Its size and optional battery pack allow it to be used in both portable and stationary applications. Model 1412 and Model 600 CLD, Chemiluminescent NO/NOx analyzer, have been integrated with the Multipoint Sampler to provide complete turnkey systems. These instruments are currently being used for the monitoring of animal feed operations and soil gas flux measurement applications. These applications require the system to monitor extremely low concentrations of NH3, CO2, N2O, CO, CH4, H2O, NO, and NOX from multiple points around a feeding area/barn or a laboratory environment on a continuous basis.
http://www.pollutiononline.com/content/news/article.asp?docid=%7B383FEC2A-B8E9-4A88-BD15-16C91C9284ED%7D

Using SEDD Deliverables and Automated Data Assessment Software to Meet Project Specific Electronic Data Management Goals
Denzer, Scott M. (Laboratory Consultants, Carlsbad, CA); Pam A. Wehrmann (U.S. Army Corps of Engineers, Sacramento District, Sacramento, CA).
NEMC 2004: The 20th Annual National Environmental Monitoring Conference, 19-23 July 2004, Washington, DC. Book of Abstracts, No. 63.

This presentation discusses the use of Staged Electronic Data Deliverable (SEDD) files and automated data quality assessment software to meet project-specific electronic data management goals. The software applications, Automated Data Review (ADR) and Environmental Data Management System (EDMS), were developed under contract to the Army Corps of Engineers Sacramento District. These applications assist with defining project-specific electronic data deliverable requirements and automating the review and data quality assessment processes. Project electronic deliverable requirements, including specific analytical method and analyte requirements, are developed as a library within ADR and electronically transferred to the laboratory. This information is used by the laboratory to ensure the contents of a SEDD file meet project electronic deliverable requirements as well as by the data user to perform an automated review of the data.

Utilization of Salmonid Eggs as Bioindicators of Organohalogen Pollutants in Lake Ontario
Pagano, James J., State Univ. of New York at Oswego.
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. ENVR 185.

Study results suggest that salmon eggs make effective time-integrated biomonitors of critical and emerging contaminants found in the Lake Ontario ecosystem. Significant qualitative and quantitative correlations are seen at the congener-specific PCB level between eggs and muscle tissue for chinook and coho salmon. Though these results are based on a relatively small sample size, the monitoring of spawning-run salmonid eggs has the potential to provide a practical and inexpensive bioindicator of the overall health of the Lake Ontario ecosystem.

Versatility of Ion Mobility Time-of-Flight Mass Spectrometry (IM(tof)MS) for the Detection of Chemical Warfare Agent Simulants and Degradation Products
Steiner, Wes E. and Herbert H. Hill, Washington State Univ., Pullman, WA.
The 230th ACS National Meeting, Washington, DC, Aug 28-Sept 1, 2005. ANYL 288.

The main advantage of IM(tof)MS technology over ion mobility spectrometry (IMS) or mass spectrometry (MS) technology alone is its ability to provide rapid 2D data acquisition spectra with the capacity to electronically couple and decouple collision-induced dissociations to generate ion fragmentation patterns. The employment of the technology in both positive and negative ion monitoring mode can dramatically increase the detection capacity (accuracy, precision, and robustness) used for complex aqueous-, vapor-, and aerosol-phase mixtures of chemical agent simulants or their degradation products.

Vertical Cross Contamination of Trichloroethylene in a Borehole in Fractured Sandstone
Sterling, S.N., B.L. Parker, J.A. Cherry, J.H. Williams, J.W. Lane Jr., and F.P. Haeni.
Univ. of Waterloo, Waterloo, ON, Canada.
Ground Water, Vol 43 No 4, p 557-573, July-Aug 2005

Boreholes drilled through contaminated zones in fractured rock create the potential for vertical movement of contaminated ground water between fractures. This paper presents a study from which investigators conclude that transfer of contaminant mass (trichloroethene) to the matrix by diffusion can cause severe cross-contamination effects in sedimentary rocks. They found that purging does not necessarily eliminate cross-contamination, and these effects generally are not identified from information normally obtained in fractured-rock investigations, resulting in potential misinterpretation of site conditions.

Visualization and Tomographic Analysis of Chemical Vapor Plumes via LWIR Imaging Fabry-Perot Spectrometry
Cosofret, Bogdan R., Christopher M. Gittins, and William J. Marinelli, Physical Sciences, Inc.
Chemical and Biological Standoff Detection II. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5584, p 112-121, Dec 2004

Near real-time visualization of chemical vapor plumes has been demonstrated via LWIR imaging Fabry-Perot Spectrometry. Tomographic analysis of the 2-D chemical images produced by each spectrometer are achieved via simultaneous viewing of the plume from orthogonal lines of sight to enable estimation of the 3-D plume concentration profile. This paper describes results of field experiments where a controlled release of sulfur hexafluoride was viewed by two Adaptive Infrared Imaging Spectroradiometers (AIRIS) located about 1 km from the plume release point. The tomographic algorithm is capable of generating 3-D density distributions of the chemical cloud that are consistent with atmospheric model predictions, even with the limitation of using only two sensors to view the chemical plume. Each AIRIS unit provides a 64-pixel x 64-pixel image with an angular resolution of approximately 5.5 mrad/pixel.

Water Monitoring System for Oil Contamination Using Polymer-Coated Quartz Crystal Microbalance Chemical Sensor
Ueyama, S., K. Hijikata, and J. Hirotsuji
Water Science Technology, Vol 45 No 4-5, p 175-180, 2002

A water monitoring system with a new chemical sensor for oil contamination has an organic polymer film on a quartz crystal microbalance (QCM). The organic film is a hydrocarbon polymer with high affinities for the organic compounds of petroleum products, such as gasoline, kerosene, diesel oil and fuel oil. The monitoring system combines sampling, purging, humidity control, and a sensor. When this system was tested using river water artificially contaminated with oils, the sensitivity remained steady for longer than 6 months with 400 detections of diesel oil and heavy oil. The type of oil could be discriminated in less than 5 min, with varying detection time depending on the type of oil.

Water Pollution Monitoring Using a Hyperspectral Imaging Spectropolarimeter
Homma, K., M. Shibayama, H. Yamamoto, K. Sugahara, and H. Shingu.
Multispectral and Hyperspectral Remote Sensing Instruments and Applications II. Proceedings of SPIE--The International Society for Optical Engineering, Vol 5655, p 419-426, Jan 2005

In conventional multispectral analysis, each pixel includes much mixed spectral radiometric information, so it is difficult to obtain high classification accuracy in the analysis. To address this problem, the authors have been investigating some experimental analysis schemes using a hyperspectral imaging spectropolarimeter with selectable plane of polarization developed by the Japan Aerospace Exploration Agency. Use of this method to observe polluted water in laboratory models and field experiments has indicated the possibility of applying the imaging spectropolarimeter to wide area environmental observation. This paper describes preliminary experiments for detecting concentrations of suspended solids in water using the hyperspectral imaging spectropolarimeter with multi-polarization. The authors also presents hyperspectral analysis schemes for detecting water pollution with analysis of the observation data.

X-Ray Fluorescence Based Multi-Metal Continuous Emission Monitor: Technology Demonstration
Hay, K.J.; V.M. Boddu; B.E. Johnsen; J.A. Cooper, Engineer Research and Development Center, Champaign, IL.
Report No: ERDC/CERL-TR-05-9, NTIS:ADA433778, 136 pp, Mar 2005

Army demilitarization incinerators will need to comply with the Hazardous Waste Combustor National Emission Standard for Hazardous Air Pollutants that will regulate metals and metal compounds listed under the Clean Air Act Amendments. A large problem for these incinerator operations is limited knowledge of the type and quantity of emitted metals, so that compliance can be determined only through trial burn emission tests. A continuous emission monitor (CEM) for multi-metals will provide the emission data, a tool to help meet compliance requirements, and the opportunity to adjust burn strategies for increased production. A user-friendly multi-metal CEM that uses x-ray fluorescence (XRF) as the analytical method and an automated sampling system that provides extractive batch sampling onto a filter tape (XCEM) was demonstrated at the 1236 Deactivation Furnace at Tooele Army Depot, UT. The unit was compared to EPA Reference Method 29 during two separate tests in 2001 and 2002. The second test was performed after improvements were made to the sample transport and system calibrations. The results indicate that the XCEM has met the proposed Performance Specification 10 for multi-metal CEMS except for relative accuracy requirements for 4 to 9 metals. Its failures are attributed mostly to inadequacies in the reference method. The monitor is proving useful at Tooele and is ready for implementation at other Army demilitarization incinerators. http://handle.dtic.mil/100.2/ADA433778