film thickness was 240–280 μm. Using this performance data in the mathematical model, the authors predicted an effective biofilm thickness of about 80 μm. The study concluded that availability of oxygen determined biofilm thickness. (*Biotechnol. Bioeng.* **1997**, *53*(3), 259–66)

GREEN CHEMISTRY

Castor oil plastics

Renewable resources such as plant oils are potential substitutes for petrochemicals in the production of plastics. P. Nayak and co-workers reported that the synthesis of several polyurethanes from castor oil reacted with hexamethylene diisocyanate. The authors then reacted the polyurethanes with 2-hydroxyethyl methacrylate to form interpenetrating polymer networks (IPNs). The resulting IPNs were resistant to acid but not to alkali and were partly soluble in common solvents. Analysis of the mechanical properties indicated that the plastics were hard and brittle. The authors used a novel Lotus package to calculate the kinetic parameters. Results showed that all of the IPNs were thermally degradable. Thermal degradation occurred in three stages, and the most significant degradation occurred above 400 °C. (*J. Appl. Polym. Sci.* **1997**, *63*, 671–79)

HEALTH

Wood smoke and asthma

Residential wood burning in fireplaces remains largely unregulated, despite its established contribution to outdoor air pollution in some regions. M. Lipsett and colleagues studied the relationship between air pollution and hospital visits for asthma. The study was conducted with data from Santa Clara County, Calif., a region where residential wood combustion is the single largest source of winter PM10. A significant association was found between levels of PM10 and emergency room visits for asthma. These results suggest that exposure to residential wood smoke can exacerbate asthma. (*Environ. Health Perspect.* **1997**, *105*, 216–22)

Sediment-dwelling worms and solute transport

Burrowing, feeding, excreting, and other activities of sediment-dwelling animals can have significant effects on the transport of solutes across the sediment–water interface. X. Wang and G. Matisoff studied the effects of a burrowing worm, *Branchiura sowerbyi*, in a laboratory apparatus. The study used living worms collected from Lake Erie and ^{22}Na radionuclide tracers. For a worm population density of 8000/m^2, typical of natural conditions, ^{22}Na diffusion was 4.78 times greater than in the absence of worms. Solute transport rates also increased with population density. Worms also transported large quantities of reduced sediment to the surface, creating a surface layer of high-porosity material. (*Environ. Sci. Technol.*, this issue, 1926–33)

Lifetime ozone effects

The long-term health effects of ozone exposure are poorly understood because of the difficulties in conducting reliable studies. N. Kunzli used an innovative design to evaluate long-term effects of ozone exposure. Kunzli developed a lifetime ozone exposure profile for 130 college freshmen by combining lung function data, residential history, and lifestyle information. Lifetime 8-h average ozone concentrations ranged from 16 to 74 ppb. A strong relationship existed between several lung function measures and estimated lifetime ozone exposure. The link between ozone and certain lung function parameters was consistent with biological models of ozone effects. These results provide evidence supporting a long-term effect of ozone exposure on lung function. (*Environ. Res.* **1997**, *72*, 8–23)

Lung function studies

Studies have linked air pollution with reduced lung function in children, but it has been difficult to determine whether the impact is reversible. D. Horstman and colleagues compared pulmonary function of children living in a region of Bohemia with high PM10 and compared SO_2 levels with children in a less polluted area. Children living in the more polluted region had significantly lower lung function compared with the other group. These differences were not associated with urban or rural residence, parental smoking, or other indicators of indoor air quality. Further, the lung function of children from the polluted region did not improve after a four-week period of low-pollution exposure, a result suggesting a chronic lung function decrement in these children. (*Arch. Environ. Health* **1997**, *52*, 56–62)

MEASUREMENTS

PAHs in surface water

The transport and fate of organic compounds in natural water depend on the phase distribution between particle-bound and dissolved fractions. K. E. Gustafson and R. M. Dickhut compared three methods for determining the dissolved fraction concentration of polycyclic aromatic hydrocarbons (PAHs) in Chesapeake Bay surface waters. Because of sampling artifacts, gas sparging significantly overestimated the concentration of dissolved PAHs. Kinetic limitations in semi-permeable membrane devices limited detection to PAHs with four or more rings. Filtration with sorption of PAHs on XAD-2 resin proved the most reliable method. The authors used the filtration procedure to determine particulate-bound and dissolved PAHs. Both fractions were near equilibrium at urban and rural sites during all seasons. (*Environ. Toxicol. Chem.* **1997**, *16*(3), 452–61)

SPME for carbon isotopes

Solid-phase microextraction (SPME) is a highly sensitive, simple method for rapid extraction of organic compounds from aqueous samples. R. F. Dias and K. H. Freeman reported that SPME can be used with an isotope ratio-monitoring GC/MS system to determine carbon isotope ratios for a series of low molecular weight organic compounds in water. Some fractionation takes place during the extraction process, but this can be minimized and calibrated. An organic-phase SPME determined the carbon isotope ratios for toluene, hexanol, and methylcyclohexane at aqueous concentrations as low as 45 ng/mL, 4 μg/mL, and 24 ng/mL, respectively. With a Carbowax SPME phase, the SPME fiber determined

Sulfate levels from acid mine drainage

Sulfate contamination from acid mine drainage has major environmental impacts. Sulfate can sorb to oxyhydroxides and precipitate, but it is not known whether this constitutes a permanent sink for sulfate. S. Rose and A. M. Ghazi reported on removal of sulfate from sediments with iron/sulfate ratios of 6.6 to 8.6. Under acidic conditions, 60–70% of the sulfate was retained in the presence of monovalent ligands such as chloride, bicarbonate, and nitrate. Sulfate desorption increased with pH. At neutral pH, up to 50% was released, whereas up to 100% was released at pH 11 (without dissolution of iron). The results suggest that neutralization methods used to stabilize acid mine drainage may have the unwanted effect of raising sulfate levels in associated watersheds. (*Environ. Sci. Technol.*, this issue, 2136–40)

acetic, propionic, and valeric acids at 41 μg/mL, 30 μg/mL, and 3 μg/mL, respectively. (*Anal. Chem.* **1997**, *69*(5), 944–50)

MODELING

Leaching of mine wastes

Existing geochemical models have great difficulty in predicting release of contaminants from mining waste rock heaps. N. Eriksson and G. Destouni used a probabilistic Lagrangian transport model to describe copper leaching from such wastes. The model incorporated primary copper dissolution kinetics (chalcopyrite, $CuFeS_2$), flow heterogeneity, and pH-dependent precipitation and dissolution of secondary copper-bearing minerals. It identified flow heterogeneity (preferential flow paths) as the dominant process influencing releases. Because of heterogeneity of particle sizes in waste rock heaps, flow channeling was the dominant mechanism of water transport. The findings suggest that, although copper concentrations in mine waste drainage waters may be relatively low, releases will continue for long periods. The process appears relatively insensitive to the nature of the primary dissolution kinetics. (*Water Resour. Res.* **1997**, *33*(3), 471–83)

Site-specific risk uncertainty

EPA is embracing probability-based models to evaluate uncertainties in risk assessments. These models have focused on uncertainties in analyzed concentrations and variability in the exposed population. P. A. Labieniec and co-workers reported development of a model to examine the effect of site-specific variability. A sensitivity analysis identified site characteristics with the greatest effect on fate and transport of subsurface organic contaminants. Variations in unsaturated zone volumetric flux rate, dispersivity, Darcy velocity, and fraction organic carbon had the greatest effect on calculated risk uncertainty. Uncertainty at the study site was highest for compounds with the greatest mobility and the least biodegradability. (*J. Environ. Eng.* **1997**, *123*(3), 234–43)

REMEDIATION

Liming mobilizes arsenic

The use of lime to remediate contaminated soils and mine wastes has the potential to mobilize arsenic (As), because its sorption decreases with increased pH. C. A. Jones and colleagues studied the effects of liming on As mobility in copper smelter pond tailings and reprocessed tailings to identify the mechanisms involved. The tailings had As concentrations 10 to 400 times greater than background soils. Lime additions resulted in increases of 4 orders of magnitude in tailing pH and a 100-fold increase in soluble As. Soluble As levels were correlated not with total As but with pH of the soil solution. The authors conclude that remediation of As-contaminated soils with lime should be closely evaluated to assess the potential of As leaching to groundwater. (*J. Environ. Qual.* **1997**, *26*, 433–39)

RISK

Cell phones and cancer

Public concern about a possible link between the use of cellular telephones and brain cancer led the cellular phone industry to fund a $25 million study. Nine research groups reported on progress in the effort, organized by Wireless Technology Research, an independent agency. They focused on cellular phone use and other wireless technology and negative health effects such as brain cancer and disruption of implanted heart pacemakers. The reports explore methods of measuring cellular phone emissions, mechanisms by which those emissions might cause cancer, and other topics. They establish the framework for a comprehensive health-risk assessment of wireless technology based on epidemiological, toxicological, and clinical data. These data are currently being gathered. (*Hum. Ecol. Risk Assess.* **1997**, *3*, 1–6)

SOILS

Trace metals in fertilizers

Fertilizers often contain trace amounts of heavy metals and other inorganic constituents, some of which are priority pollutants. Concern exists over toxic accumulation of these components in the environment. K. P. Raven and R. H. Loeppert reported an evaluation of the trace element and heavy metal composition in 24 fertilizers and soil amendments to assess the potential accumulation of these compounds. The test materials included animal manures, commercial sludge product such as Milorganite, and 14 commercial fertilizers. Commercial liming materials and nitrogen and potassium fertilizers contained the lowest concentrations of trace metals. Rock phosphates, phosphate fertilizers, and sewage sludges had the highest amounts, and researchers concluded that a higher priority should be placed on assessing the potential environmental impacts of these materials. (*J. Environ. Qual.* **1997**, *26*, 551–57)

PCP photolysis

The biocide pentachlorophenol (PCP), used to preserve wood products, is a common contaminant in soils at wood treatment facilities. PCP, transported to sunlit soil surfaces by capillary action, can be transformed through a photochemical reaction. S. G. Donaldson and G. C. Miller applied PCP to soils to