ENVIRONMENTAL QUALITY

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ABSTRACTS

Water Quality in the Calumet Aquifer in a Highly Industrialized Region of Indiana. KONRAD J. BANASZAK and JOSEPH M. FENELON, U.S. Geological Survey, 5957 Lakeside Boulevard, Indianapolis, IN 46278.—Many sources of hazardous materials directly overlie the thin, water-table, low-hydraulic-gradient Calumet aquifer, whose water ultimately reaches Lake Michigan. Thirty-five stainless steel wells, including six pairs of nested wells, were sampled for 5 field characteristics and 112 laboratory constituents. Median pH was 7.3, but samples from three wells screened in slag had pH values above 11. Median specific conductance was 1,200 μS/cm (microsiemens per centimenter at 25 degrees Celsius), but six values exceeded 2,380 μS/cm. Of these six samples, three were from fresh slag and the other three were contaminated by petroleum products. Sixty-seven of the 88 organic chemicals analyzed for, including trichloroethylene, were not detected. Phenol, however, was found in samples from all 35 wells, and benzene was found in 17 of 35 samples. Medians of both chemicals in samples collected from wells in or near steel or petrochemical plants were significantly different (at the 95-percent confidence level) from medians in samples from all other wells.

The Effects of Zinc on Epilithic Communities in Artificial Streams. D. DEAN-ROSS, Indiana University-Purdue University at Fort Wayne, Fort Wayne, IN.—The effects of five concentrations of zinc on bacteria and algae colonizing surfaces in artificial streams were studied. Duplicate sets of streams received one of six treatments: no zinc supplement, 0.01, 01. 0.5, 1.0, or 10.0 ppm zinc. At weekly intervals surfaces were removed from the stream sand and assayed for total biomass, chlorophyll *a* content, total direct bacteria counts, total viable bacteria, and the abundance of resistant CFU. None of the measured parameters were significantly affected by 0.01 or 0.1 ppm zinc in comparison to the control. Zinc at a level of 0.5 ppm produced a 90% inhibition in total biomass and chlorophyll *a*, but only a 40% inhibition in total counts and viable CFU. Levels of 1.0 and 10.0 ppm zinc produced a 90% inhibition in all parameters. The bacterial community developed resistance to the concentration of zinc prevailing in the artificial streams, but were inhibited by concentrations in excess of the exposure concentration, with the exception of the community exposed to 1.0 ppm zinc, which demonstrated a tolerance to up to 10 ppm zinc. Zinc dependence developed in streams exposed to 0.5, 1.0, and 10.0 ppm zinc.

Evaporation of Liquid Chemical Spills: II. Computation of Downwind Concentrations and Plots of Evacuation Zones. HOWARD E. DUNN and BENJAMIN

P. MILLER, University of Southern Indiana, 8600 University Blvd., Evansville, IN 47712.—The atmospheric dispersion evaporative spill model we have developed can be used for doing risk assessments involving potential spills of toxic liquids. After inputting the name of the chemical, the length and width of the pool, the ambient temperature, the wind speed, and the weather stability class, the computer program can rapidly calculate the downwind concentration at selected points. There is provision for calculating concentrations at incremented distances, and for calculating and plotting evacuation zones. The plots can be drawn to an assigned scale on the computer monitor or produced by a plotter to the scale of a geological survey map. The isopleths can be drawn on a transparency which can be easily superimposed on a geological survey map at the site of the spill for the determination of the theatened area to be evacuated.

The Illinois-Indiana Sea Grant Program. BURNELL C. FISCHER, Department of Forestry and Natural Resources, Purdue University, West Lafayette, IN 47907.—The Illinois-Indiana Sea Grant Program has completed six years of operation. The program, which is the youngest of the nation's 31 Sea Grant Programs, is playing an ever increasing role in helping improve the environmental quality of Illinois-Indiana Lake Michigan shoreline through its research, extension, and communications programs. Our current activities center on environmental quality issues such as coastal recreation and tourism, high water levels and erosion problems, water quality, fisheries research, and marina development. In addition to program support for on-going staff efforts, we solicit research projects through a request for proposal process and provide quick response funds for preliminary research and special extension projects. The Illinois-Indiana Sea Grant Program is a joint effort between the University of Illinois at Champaign-Urbana and Purdue University at West Lafayette with principal funding support from the Office of Sea Grant, NOAA, U.S. Department of Commerce, Washington, D.C.

Mold Level Variation in the Air of Unoccupied Houses. C. GUINDON and T. GODISH, Indoor Air Quality Research Laboratory, Ball State University, Muncie, IN 47306.—Air samples for mold use were collected daily in an unoccupied stick-built house and a mobile home over periods of 9-12 months using a viable particle sampler. Total mold counts were reported as colony forming units/cubic meter (CFU/m^3). Significant differences in total mold counts were observed between the two structures. Significant day-day variations were also observed. The removal and reapplication of carpeting had a significant effect on mold levels in the mobile home. A significant increase in mold levels was observed when cabinetry which had been stored in a nonclimate-controlled space was introduced into the mobile home.

Microbial Respiration in Fly Ash-Amended Soil. JOHN R. PICHTEL, Department of Natural Resources, Ball State University, Muncie, IN 47306.—Coal fly ash, a by-product of the power generating industry, is produced in large quantities and requires land disposal. Little is known regarding its effects on the activity of the microbial population within soils. Acidic and alkaline fly ash were applied at 5, 10, and 20% (wt/wt) to two soils and incubated for 42 days. Microbial activity of the soils as indicated by CO_2 evolution was measured. The 10 and 20% ash treatments experienced a significant reduction in respiration, with reduction most pronounced using the alkaline ash. The pH and electrical conductivity of the treated soils were positively correlated with inhibition of respiration.

Scavenging of Urban Atmospheric Species by Dew. I. Within-Event Atmosphere and Dew Sampling Methodology. ROBERT A. PRIBUSH, JEFFREY R. FOSTER, BRADLEY H. CARTER, JENNIFER L. WAUGH, and COLLEEN O'DONNELL, Department of Chemistry and the Holcomb Research Institute, Butler University, Indianapolis, IN 46208.—While acid deposition has been widely studied in recent years, chemical inputs by dry deposition to ecosystems remains the least understood chemical deposition pathway. In this study, dew was used as a naturally occurring scavenging agent for gaseous and aerosol atmospheric species at the Butler University Environmental Preserve and a second sampling site near the center of Indianapolis. Since dew forms as pure water and then scavenges atmospheric species in its immediate vicinity on calm nights, the source of species found in dew is thought to be mainly local. Hence dew is an excellent medium for the study of local source-receptor relationships. Methodology used for sampling ambient atmospheric species and relating the concentrations of these species to dew species concentrations found in within-event studies is discussed. The use of dew in integrated monitoring-modeling studies to enhance the accuracy of estimated ambient chemical species concentrations and deposition rates in local assessment studies will also be demonstrated.

Scavenging of Urban Atmospheric Species by Dew. II. Results of Within-Event Atmosphere and Dew Sampling in an Urban Environment. ROBERT A. PRIBUSH, JEFFREY R. FOSTER, BRADLEY H. CARTER, JENNIFER L. WAUGH, and COLLEEN O'DONNELL, Department of Chemistry and the Holcomb Research Institute, Butler University, Indianapolis, IN 46208.—Ambient levels of SO_2, NO_2, HNO_3, O_3, NH_3, and particulates were sampled at intervals during the time of dew formation and compared to levels of corresponding species, SO_3^{2-}, SO_4^{2-}, NO_2^-, NO_3^-, and NH_4^+, found in dew collected sequentially during the same night at two urban sampling sites in Indianapolis. Other species (F^-, Cl^-, Na^+, K^+, Mg^{2+}, Ca^{2+}, and organic acids) in dew were also monitored in an attempt to better understand the chemistry involved at the dew-atmosphere interface and within the dew itself. Comparisons will be made with previous dew studies in Indianapolis, Warren, Michigan, Allegheny Mountain, Pennsylvania, and Claremont, California. As in earlier studies, the dew pH in Indianapolis had a neutral or slightly basic pH in contrast to acidic rains and fogs sampled at the same location. The dew chemistry was found to be dynamic throughout the night, suggesting the need for the development of a non-equilibrium model to explain the scavenging of atmospheric species by dew.

Studies on the Phototoxicity of Hydrocarbon Fractions in Grand Calumet River Sediments. ANNE SPACIE, Dept. of Forestry and Natural Resources, Purdue University, W. Lafayette, IN 47907 and Richard Davenport, School of Life Science, University of Illinois, Urbana, IL 61801.—The Grand Calumet River in northwest Indiana receives large inputs of hydrocarbon pollutants derived from petroleum, steel-making, and other industrial and urban activities. Several polyaromatic hydrocarbons from such sources are known to bioaccumulate in aquatic organisms and to be carcinogenic to fish. Much less recognized is the potential for photoinduced toxicity of these same hydrocarbons. Sediments from the Grand Calumet have been collected, extracted, and tested in bioassays designed to assess phototoxicity and photomutagenicity in aquatic organisms. Sediment elutriates from some collection sites were significantly more toxic following exposure to UV light or natural sunlight. Several methods to characterize the complex organic fractions

and to relate toxicity to specific fractions have been tested. Based on this research, it appears that dredging or other disturbance of river and harbor sediments could lead to important releases of phototoxic hydrocarbons.

A Survey for Organochlorine Chemicals, Polynuclear Aromatic Hydrocarbons, and Inorganic Compounds in Biota near a Landfill in Fulton County, Indiana. DONALD W. STEFFECK, U.S. Fish & Wildlife Service, 718 North Walnut Street, Bloomington, IN 47401.—The Four County Landfill is a 61.5 acre hazardous waste landfill that has been in operation since the early 1970's. Numerous complaints and alleged violations at Four County Landfill have been made by local citizens and State and Federal Agencies. The landfill has numerous wetlands and associated fish and wildlife resources nearby, including King Lake and the Tippecanoe River. In the spring and summer of 1987, the U.S. Fish & Wildlife Service collected several varieties of aquatic and terrestrial biota from areas suspected of receiving runoff from Four County Landfill. These organisms were analyzed for organochlorine pesticides including total PCB's, polynuclear aromatic hydrocarbons, and 14 inorganic compounds. Organic contaminants were not found in most biota near the landfill. Several inorganic compounds were found to be prevalant over background levels including manganese, aluminum, zinc, cadmium, mercury, and nickel. These compounds are present in waste disposed at Four County Landfill and have been documented at elevated levels in the groundwater and surface water near the site. The maximum concentrations found in the biota are at levels considered elevated, and at least cautionary for consumption by predators.

Geohydrology of the Calumet Aquifer, Northwestern Indiana. LEE R. WATSON and JOSEPH M. FENELON, U.S. Geological Survey, 5957 Lakeside Boulevard, Indianapolis, IN 46278.—The Calumet aquifer underlies a highly industrialized region of northwestern Indiana. This water-table aquifer is composed of fine to medium beach and dune sand less than 65 feet thick. The water table generally is less than 8 feet below land surface. The geohydrologic characteristics of the Calumet aquifer were defined so that a network of ground-water observation wells could be properly installed for a subsequent water-quality study. Maps of the water table and aquifer geometry were prepared, aquifer/stream interactions were monitored, and finite-difference digital models were constructed. The water table has broad, low-gradient mounds that generally lie between the major surface-water drains. Aquifer/stream interactions are complex and are dependent on the stage of Lake Michigan. In the 70-square-mile modeled area, the aquifer discharges about 5 to 10 $feet^3/s$ (cubic feet per second) of water to the Grand Calumet River/Indiana Harbor Canal, which subsequently drains to Lake Michigan. Less than 5 ft^3/s of water discharges directly to Lake Michigan along 20 miles of shoreline. In addition, 20 to 25 ft^3/s of ground-water discharges to leaky sewer systems.