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Chloroform in the Atmosphere Around Water Treatment Plants—Its Effect on Trace Analysis for Chloroform in Water Samples. HOWARD E. DUNN, JEFFREY ADLER, BERNARD DENNING, and LANA RADEMACHER, Chemistry Department, Indiana State University—Evansville, Evansville, Indiana.——The United States Environmental Protection Agency has observed that when surface water supplies are purified for drinking purposes by the addition of chlorine a certain amount of chloroform is produced. Since chloroform has been determined to be a carcinogen, regulations have been proposed to limit its presence in drinking water. Several water utilities located along the Ohio River have been setting up analytical labs to measure the amount of chloroform and other trace toxic organic chemicals in their water. We have found chloroform to be present not only in drinking water but also in the atmosphere in and around two Indiana water treatment plants that use the standard chlorination method of purification. We examined the possibility of this atmospheric contamination having an effect on the quantitative determination of trace amounts of chloroform in water samples.

Household Carbon Filters For Water Purification, Good or Bad? HOWARD E. DUNN, BERNARD E. DENNING, and JEFFREY ADLER, Chemistry Department, Indiana State University—Evansville, Evansville, Indiana.——In the past few years the United States Environmental Protection Agency has determined that almost all of the major drinking water supplies in the nation contain toxic and carcinogenic organic materials. Most water treatment plants are not equipped to remove these chemicals. In fact, when surface water supplies are chlorinated for the purpose of purification a carcinogenic chemical (chloroform) is formed.

The chloroform builds up in concentration as the water passes through the mains toward the ultimate consumer. As the public becomes increasingly aware of these problems, they have been purchasing the highly advertised carbon filters and attaching them to their home faucets. Environmental groups have claimed that the effectiveness of these filters has not been established. This study was undertaken to determine the effectiveness of one of the popular brands of carbon filters in removing chloroform from drinking water and to determine its useful life.

The Environmental Assessment of New Technology. PATRICK J. SULLIVAN, Department of Natural Resources, Ball State University, Muncie, Indiana.——This research describes the methodology which was developed to identify and assess potential environmental impacts of advanced mining technology as it moves from a generic concept to a more

precise systems definition. Two levels of assessment are defined in terms of the design stage of the technology being evaluated. The first level of analysis is appropriate to a conceptual design. At this level it is assumed that each mining process has known and potential environmental impacts that are generic to each mining activity. By using this assumption, potential environmental impacts can be identified for new mining systems. When two or more systems have been assessed, they can be evaluated by comparing potential environmental impacts. At the preliminary stage of design, a system's performance can be assessed again with more precision. At this level of system definition, potential environmental impacts can be analyzed and their significance determined in a manner to facilitate comparisons between systems. An important output of each level of analysis is suggestions calculated to help the designer mitigate potentially harmful impacts.

Modification of the Stream Reaeration Coefficient-Temperature Relationship. ROBERT H. L. HOWE, West Lafayette, Indiana.——A modification of the stream reaeration coefficient-temperature relationship is proposed. Some long time investigation and experimental data are presented. In this proposed modification, the author concludes that the reaeration coefficient K_2 decreases as temperature rises and it increases as temperature drops, in order to conform with all gas laws and environmental and physical facts. Also, it is demonstrated that the reaeration coefficient-temperature relationship is governed more by the dissolved oxygen solubility or concentration than by the rate of diffusion at the particular temperature, all other physical conditions being same.

A Study to Determine Effects of Elwood, Indiana, on the Water Quality of Big Duck Creek. TIMOTHY J. DECKER and HORST F. SIEWERT, Indiana State Board of Health and Department of Natural Resources, Ball State University, Muncie, Indiana.——Water quality of Big Duck Creek above and below Elwood was determined. Dissolved oxygen and suspended solid concentrations decreased as the water flowed through the city. The number of total coliform bacteria, the biochemical oxygen demand, and ammonia concentrations were higher below the city. Only minimal changes in pH were observed. The results of this study were compared to those of an investigation conducted in 1938. Although effluents from the sewage treatment plant and bypasses still contribute to some extent to the pollution of the river, the water quality has greatly improved over a forty year period.

Effects of Low PH Levels on Body Weight of Crayfish. JOHN BUCK, and HORST F. SIEWERT, Department of Natural Resources, Ball State University, Muncie, Indiana.——This study consisted of two phases. In Phase I crayfish were initially exposed to water at a neutral pH. Then the acidity was gradually increased until all crayfish died. Between pH 2.5 and 2.2 all animals expired. In Phase II crayfish were introduced into water with pH 7, 6, 5, 4, and 3 for 15 weeks. A positive correlation ($r = .96$) between pH and survival was observed. Weekly fluctuations in body weight of crayfish due to moulting were noted. These, however,

seemed not to be linked to specific acid concentration. A positive correlation between pH and cummulative body weight existed. At high pH levels larger weight gains occurred than at low pH concentrations.

The Effect of Ozone on Hamster Tracheal Ring Explants. DOROTHY ADALIS and RICHARD RINGLESPAUGH, Department of Biology, Ball State University, Muncie, Indiana.——Preliminary studies were conducted to determine the effects of *in vivo* exposures to 0.5 ppm ozone for three hours times three days on hamster tracheas. Immediately following the exposure regimen, tracheas from sixteen randomly selected Syrian Golden Hamsters were aseptically excised, cut into rings 1 mm thick and placed in organ culture medium. Cilia beating frequency in beats per minute was determined by using an electronic stroboscope attached to an inverted microscope. The mean beating frequency for the control rings was 1143.9 beats per minute and 950.4 beats per minute for the ozone treated rings. An analysis of variance indicated a significant decrease ($P = 0.01$) in the ozone treated rings when compared with controls. Tracheal rings from control and exposed hamsters were fixed, sectioned at 4 μ, and stained with hematoxylin and eosin. A preliminary assessment of the histopathology in these sections indicated changes in the treated versus control rings. A decrease in the height of the ciliated epithelium, loss of cilia, and a disorganization of the cellular components were the major changes evident in ozone treated rings. Cloudy swelling and changes in the shape and position of the nucleii were also noted in the ozone treated rings.

Normal ciliary beat frequency and mucus transport are needed to insure proper clearance of inhaled harmful particles from the respiratory tract. If the normal ciliary activity is altered in animals exposed to ozone, an accumulation of both viable and non-viable harmful substances can occur which may in turn jeopardize the health of the host. Another change that may inhibit the clearance mechanism of the host is the loss of cilia that occurred as a result of inhaling ozone.

Field Investigations of Chloride Air Pollution Injury on Vegetation. THAD GODISH, Department of Natural Resources, Ball State University Muncie, Indiana.——Plant pathological surveys of alleged air pollution injury were conducted near industrial sources at three locations within the State of Indiana. Examination of injured plant leaves indicated that the typical symptom patterns of marginal and/or tip necrosis were caused by choloride pollution. Evaluation of process materials utilized indicated that chloride emissions were significant in each instance. At one survey location, hydrogen chloride gas and hydrochloric acid were the principal phytoxicants. Typical chloride injury was observed on 25 species; hydrochloric acid mist injury was observed on one species. The principal phytoxicant in the two other survey locations was particulate sodium chloride. Symptom patterns on leaves of injured vegetation were similar for both gaseous and particulate chloride pollution. Because of the continuous exposure to particulate chloride, severe defoliation and killing of sensitive tree species occurred. The most severe injury occurred on the plant face directly downwind of the pollution source.

The Impact of Air Pollutants on Crops in the Ohio River Basin. RICHARD W. MILLER*, ORIE L. LOUCKS, THOMAS V. ARMENTANO, ROLAND W. USHER (The Institute of Ecology, Butler University) and Larry Wong (Indiana University).——As a part of the Ohio River Basin Energy Study (ORBES), The Institute of Ecology has attempted to estimate loss of yield of crops due to the effects of air pollutants from coal-fired electric power generating stations. The study has concentrated on the effects of sulfur dioxide, ozone and oxides of nitrogen from both currently operating plants and those planned and projected until the year 2000. The affected area includes the states of Indiana, Illinois, Kentucky, Ohio, West Virginia and Pennsylvania.

The method used to estimate loss of yield has two components, determination of the area of impact around each power plant in the region and calculation of the loss of yield due to that impact. The area of impact was determined using American Electric Power monitoring data from several power plants to plot isopleths of SO_2 concentrations. The isopleths were generalized to form ellipses with the long axis parallel to commonly prevailing summer winds, i.e. southwest to northeast. The size of the elliptical isopleths was correlated with the stack height and sulfur emission rate of the plants, and this relationship was used to estimate comparable ellipses around other plants in the region.

Potential crop effects were calculated by developing an algorithm based on both field and laboratory experiments with various crops and pollutants. The loss of yield was correlated with pollutant concentration and this relationship was used to estimate crop losses within the impacted areas. Data will be summarized according to crop reporting districts, including total area of each crop affected by power plant emissions and potential loss of yield due to those emissions.

Assessment of Air Pollution Injury to Eastern White Pine in Indiana. ROLAND W. USHER, The Institute of Ecology, Butler University.—— Eastern white pine is known to be sensitive to gaseous air pollutants such as sulfur dioxide and ozone. Therefore, nine stands of white pine were chosen in various localities of the southern half of Indiana to attempt to determine the present day injury caused by: 1) "normal" background concentrations of ozone and/or other air pollutants; 2) source emissions of sulfur dioxide (coal-fired power plants) in conjunction with low and high concentrations of ozone; and 3) the air pollution associated with a major urban center, Indianapolis. Symptoms of air pollution recorded include: 1) degree of "flecking" (none, very slight, slight, moderate, severe); 2) tip chlorosis and tip necrosis (number of needles per tree and length); and 3) retention of previous season's needles. The least amount of air pollution injury was found near Bloomington, with moderate amounts being found at Alamo, Lizton, Petersburg, Prairie Creek and Madison. The worst air pollution injury was associated with Indianapolis. Factors other than amount of air pollution enter into the degree of injury noted within a stand and, hence, influence the placement of areas into low, medium and high air pollution zones. For instance, the surrounding topography and vegetation influence the

amount of injury caused by air pollution. By virtue of their location the stands at Madison and Petersburg showed less injury from air pollution than expected.