ENGINEERING

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ABSTRACTS

The Seismicity of Indiana and Civil Engineering Structures. William D. Kovacs, School of Civil Engineering, Purdue University, West Lafayette, Indiana 47907.——The earthquake history of the Indiana Area is reviewed to evaluate potential damage to transportation and other civil engineering structures. This review was made because of the increased seismic risk associated with the Indiana area as delineated by the Revised Seismic Risk Map published by the National Oceanographic and Atmospheric Administration (NOAA) (formerly the U.S. Coast & Geodetic Survey).

Based on the review of historical earthquakes and known and inferred faults in the Indiana Area, it is concluded that the Southwest quarter of Indiana has been and will continue to be subject to violent shaking. Records indicate the Southwest portion has experienced Intensities (the effect of an earthquake on man's structures) of VII through IX at the extreme southwest tip of the state. Intensity VII is considered to be the threshold of structural damage.

Two sources of future earthquakes will cause damage in Indiana. A magnitude 7 to 7¼ earthquake can be expected to occur in the future with its epicenter along the New Madrid (Missouri) fault system. Perhaps more important is that the Wabash River Fault System is expected to release a magnitude 6 to 6¼ earthquake within the 1970's. The 1971 San Fernando, California, earthquake magnitude was 6.5 and the total property loss may approach 1 billion dollars.

It is suggested that the information contained herein be used in a study that will enable seismic design provisions to be incorporated into an Indiana Building Code for highway structures and buildings. Presently there are no such provisions.

The Relationship between Ground Water Levels, Precipitation, and River Stages. John A. Spooner, A. Ramachandra Rao, and Bathala T. Chenchayya, School of Civil Engineering, Purdue University, West Lafayette, Indiana 47907.——Groundwater level data observed at three locations near the river in the Kankakee River basin aquifer system, the related precipitation and river stage data were analyzed to determine relationships existing among them. Some preliminary results of this analysis are presented herein. Groundwater level fluctuations and some anomalies observed in these fluctuations were analyzed by utilizing the geological and hydraulic characteristics of the aquifers. A regression analysis of the groundwater levels, precipitation data, and river stages was conducted to obtain a quantitative relationship between them. Finally, the transfer function relating the groundwater level fluctuations and river stages has been identified and verified. It is hoped that the final results of this study will help in a better understanding of groundwater levels as they affect agriculture within the basin.

Estimating 1973 Weekly Energy Use for Indiana Corn Drying by Simulation. ROBERT M. PEART, Department of Agricultural Engineering, JAMES E. NEWMAN, Department of Agronomy, SAMUEL PARSONS, Extension Agricultural Engineer, and WALTER L. STIRM, Advisory Agriculture Meteorologist, Purdue University, West Lafayette, Indiana 47907.——A computer program was developed to predict the weekly demand for LP gas and natural gas for corn drying. On September 3, a month before normal harvest begins, the program predicted a total need for 47 million gallons of LP fuel and 1.3 billion cubic feet of natural gas for drying Indiana's corn crop. This was based on 1973 weather to September 3, normal harvest weather, an average of 107 bushels per acre, and 80% of the crop requiring drying. The program took into account the actual weather and planting dates, the harvest capacity, average harvest weather, and corn drying patterns in each of the 9 crop reporting districts of the state. Results for each district gave the predicted demand for LP and natural gas for corn drying for each week from early September through December.

These estimates were possible because of data accumulated by the cooperative Purdue-USDA Statistical Reporting Service, the State Climatologist, NOAA Agricultural Weather Service, seed company data, and past research in the Agronomy and Agricultural Engineering Departments. The computer program was developed during the summer of 1973, but it would not have been possible without the tremendous reservoir of data and research that have been accumulated over many years.

A Mathematical Modeling of Ground Water Contaminant Decay.[1] G. AGUIRRE and J. E. LINDELL, Department of Mathematics, University of Notre Dame, Notre Dame, Indiana 46556.——Several researchers have reported noticeable impairment of ground water quality due to contamination of ground water with leachates emanating from sanitary landfills. These contaminants arise from the decomposition of organic matter in the refuse, dissolution and corrosion of metal and metal-containing wastes, and acidic leaching of water-soluble species from soil minerals in and below the landfill. The most significant of these pollutants are organic carbonaceous materials (as measured by the BOD or COD of the water); dissolved minerals, primarily calcium, magnesium, and iron; reduced chemical species, such as ammonia,

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sulfide and methane; total dissolved solids (or conductivity); and increased acidity (mostly as CO_2) with a concomitant depression of pH.

As the ground water contaminants are transported downstream from the landfill site with the ground water flow, concentrations are reduced via interaction with soil media and by dispersion mechanisms. The rate of decline of contaminant concentration with distance downstream from the landfill site is dependent on hydrogeologic characteristics of the area.

The purpose of this paper is to discuss a hydrogeologic investigation of a sanitary landfill in St. Joseph County, Indiana, and to relate it to the development of a mathematical model of the concentration decay of ground water contaminants. The significant hydrogeologic parameters under investigation are the ground water surface profile, soil permeability and dispersion coefficient. The significant water quality parameters used in the modeling are alkalinity, hardness, calcium and conductivity. A network of wells was placed in the area downstream from the landfill for the purpose of monitoring water quality and determining the water surface profile. Data from this network was used to verify the dispersion model. The model is used to predict contaminant concentrations and hence water quality recovery rate downstream from the sanitary landfill.

Biomedical Engineering and Health Care Delivery. PAUL E. STANLEY, Coordinator, Biomedical Engineering Center, Purdue University, West Lafayette, Indiana 47907.——Health care delivery has been of interest to mankind almost as long as his recorded history. For more than 200 years, physics and, more recently, engineering, has contributed to the practice of medicine providing a better understanding of many physiological functions. Since early in this century, and especially since World War II, great strides have been made in the application of electrical and electronic devices to health care delivery. This paper delineates some of these developments and reviews many of the interdisciplinary biomedical engineering research and development activities now in process at Purdue University.