

BOOK REVIEWS

*OPERATIONS RESEARCH UND SEINE ANWENDUNG IN DER
SIEDLUNGSWASSERWIRTSCHAFT (OPERATIONS RESEARCH AND THEIR
APPLICATION IN ENVIRONMENTAL SYSTEMS)*

Part I and II (in German); Vol. 5 [in:] Wasser und Abwasser in Farschung und Praxis, 1972, pp. 335, and Vol. 12 as above, 1976, pp. 266, Erich Schmidt Verlag Bielefeld, FRG.

The flood of technical literature and the traditional design methods used in tackling the environmental protection problems call for publications synthesizing the modern approach to the solution of water, air and soil pollution control dilemma. The two volumes, consisting of seminars conducted at the Institut für Siedlungswasserwirtschaft of the University of Karlsruhe, correspond to these requirements, bringing closer to the sanitary engineer the many aspects of the operations research.

The first chapter in Part I. presents the reader with principles of graphical and numerical solutions as well as linear programming in the optimization analysis. The first example shows the application of this analysis in the water pollution control field.

The second chapter is devoted to the non-linear optimization encompassing the methods of dynamic and geometric programming and the classical mini-max method. All these methods are illustrated with examples in the water-wastewater systems. The dynamic programming is used in the water pollution control, in the design and optimization of the water authorities, while geometric programming is applied to the design of water distribution systems.

The third chapter presents the sensitivity analysis and the methods of mathematical simulation and sensitivity studies.

In the 12-th volume in the series, which is the second on operations research, the reader will find further development of the problems outlined previously. Rather than dwelling on possible applications, practical analysis of models is presented. The authors are aiming at the development and popularization of operations research. This means the adoption of the new methods and new fields for their application.

This volume is the result of 3-years of work of the Institute. The volume is divided into three main topics: Wastewaters, Solid wastes and Water supply.

The systems analysis is becoming ever more popular, beginning with teaching, design and ending on the maintenance of completed plants. In all phases, the appropriate decision model should guide the engineer in optimizing the problem. The use of system analysis is indispensable in such an approach.

Both books have good readable outlay and well chosen examples joining theory with practice. It is very good that the modelling and math optimization is tied directly to the topic of the studies, i. e. environmental pollution control.

The two books may then be recommended to all those who want to think modern, think synthetically and economically, that is to all students of environmental and sanitary engineering, graduate and post-graduate students, designers, planners ordering regional solutions or working on regional planning.

Edward S. Kempa

LAND AS A WASTE MANAGEMENT ALTERNATIVE, Edited by Raymond C. Loehr, Ann Arbor Science Publishers Inc., Ann Arbor, Michigan, pp. XII+811, 1977.

The book contains proceedings of the 8-th Conference, in the well known series of Agricultural Waste Management Conferences, held at Cornell University, Ithaca, New York, and is perhaps the most complete work in exhausting a single leading topic in a conference report. The volume focuses on ways to appropriately use the land as an acceptor of wastes. The primary emphasis of the papers is on environmental impact of land disposal and on health aspects and pollutants transformations that occur in soil, however, the various case studies of the land application of municipal wastewaters, industrial wastes and sludges provide adequate information on the actual design of systems.

The book contains 44 papers arranged in six sections. The first section "*Regulatory and Fundamental Aspects*" covers the policy, regulations and guidelines for land application of wastes and sludges. Elements included in the guidelines are: loading rate, application system, buffer zone, monitoring, cover crop, storage, public access and effluent quality. An overview of practice in the 50 states in U S A indicates that the wastewater quality before application on land is regulated in respect to the required treatment and composition — the latter being confined usually to BOD₅, solids, pH, toxic elements, DO, nitrates, organics chlorine residual and pathogens. The factors included and types of other recommendations (e. g. site characteristics, type of wastes, weather, etc.) vary for states and for different countries. Subsequently the problem of land disposal is discussed from the standpoint of efficiency of waste treatment (as a best practicable waste treatment alternative — BPT), the effluent quality and efficiency of crop production.

The second section: "*Transformations of Nitrogen, Phosphorus and Heavy Metals*" encompasses transfer pathways of these compounds in the wastes — soil — plant — animal system, methods of monitoring for these compounds, and efficiencies of their removal or accumulation. Methods currently in use, that allow for prediction of the one dimensional water and solute transfer in soil are presented. The theoretical modelling incorporates infiltration of rainfall or irrigation water, evaporation, redistribution of water in the soil, and uptake of water by plant roots. The model is computerized for practical use.

The section provides examples of both laboratory, pilot and full-scale studies of the relationships and changes in both the nutrients and microelements content as a result of land disposal on different crops, soils and of varying application rates.

The third section "*Health aspects*" presents the reader with a fairly random discussion of this truly the most controversial topic. The presentation is limited to the pathogen carrying capacity of wastes applied to land, with general indication apparent from the papers, that there is enough indirect evidence that disease transmission is not a significant problem with municipal sludge and most of industrial wastes, provided certain precautions are undertaken. A broad description of the health hazards with vector transfer is presented with notions towards the not completely understood factors such as spore forming microorganisms, virus transfer and survival, wastewater disinfection in case of various land and crop uses. It is agreed that the wastes quantity should be limited on single sites, that extreme control is necessary with crops designed for raw consumption, that the site selection should take into account the vectors such as wind, insects and rodents and the proximity to human or animal high-density areas.

The fourth section "*Case Histories of Land Application of Sewage*" presents the working experience gathered during maintenance of land disposal systems for various municipalities in California, Washington, Michigan, New England and Alaska. The pilot study in Alaskan conditions, conducted in summer, proved the feasibility of slow infiltration land application of sewage with maximum doses up to 15 cm/week.

The fifth section "*Application of Sludge to Land*" summarize the long term experience and research on land — spreading and injection of sludges and waste slurries in United States and Canada and England. Various trends are distinguished: full scale soils enrichment projects, such as the testing of fodder crops and tree cultures in Cook Co., Illinois and research and development of the most economical travelling sludge subsurface injection systems for sludges and animal manures. It is interesting to note that the British research, with much less land available in Britain, is oriented towards the minimization of the sludge

volume — through mechanical dewatering, composting or drying and sale (or give-away) of the dried, packaged product to farmers. Such an approach seems to solve the problem of neighbor's negative attitudes toward the irrigation with sludge from distant locations — a problem noted by few authors.

The last section is devoted to "*Industrial and Agricultural Wastes*" and covers primarily the animal manure problems, with two papers on food processing wastes, and one on soil disposal of oily wastewaters. Economic potential and management considerations for land disposal systems are presented, together with principles of the whole watershed modelling of wastewater storage and land application, with respect to the environmental impact and crop benefits with inclusion of the public health aspects.

In summary, although the conference proceedings are seldom read with full interest throughout the whole book, the layout of chapters and selection of papers in this volume provide an easy to follow and engaging reading on the problems of ultimate disposal of wastes with full awareness of the associated hazards.

Jan A. Oleszkiewicz