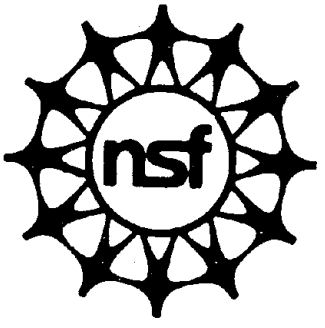
NSF/RA-790155

ENGINEERING AND APPLIED SCIENCE

RECENT RESEARCH REPORTS

October 1979



ENTRIES 844-948

DIRECTORATE FOR ENGINEERING AND APPLIED SCIENCE
NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C.

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Introduction

This report contains abstracts of new technical reports and other documents resulting from research supported by the Directorate for Engineering and Applied Science (EAS) of the National Science Foundation. These citations have been compiled to alert members of the scientific and technical community to current research results.

The Directorate for Engineering and Applied Science, which became effective July 1, 1979, replaced the former Directorate for Applied Science and Research Applications (ASRA) and the Division of Engineering, formerly located in the Directorate for Mathematical, Physical, and Engineering Sciences.

The Engineering and Applied Science Directorate (EAS) seeks to strengthen the U.S. engineering and applied science research base and enhance the links between research and applications in meeting selected national goals. This is accomplished by identifying and supporting basic research across a broad spectrum of the engineering sciences, and applied research and related activities that have the highest potential for contributing to the understanding and resolution of significant societal problems.

The Directorate for Engineering and Applied Science consists of the following six Divisions:

- Division of Electrical Computer, and Systems Engineering, Dr. Yoh-Han Pao, Director (formerly Electrical Science and Analysis Section);
- Division of Chemical and Process Engineering, Dr. Marshall M. Lih, Director (formerly Engineering, Chemistry, and Energetics Section);
- Division of Civil and Mechanical Engineering, Dr. Ronald L. Huston, Director (formerly Mechanical Sciences and Engineering Section and Environmental Engineering Section);
- Division of Applied Research, Dr. L. Vaughn Blankenship, Director (no change in title or function);
- Division of Intergovernmental Science and Public Technology Mr. William H. Wetmore, Director (no change in title or function);
- Division of Problem-Focused Research, Dr. Donald E. Senich, Director (formerly Division of Integrated Basic Research, Division of Problem-Focused Research Applications, and Office of Problem Analysis).

The Directorate for Mathematical, Physical, and Engineering Sciences (MPE) has been replaced by the Directorate for Mathematical and Physical Sciences (MPS).

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To receive proposal solicitations or to obtain further information on submitting proposals, please contact the appropriate EAS division, or:

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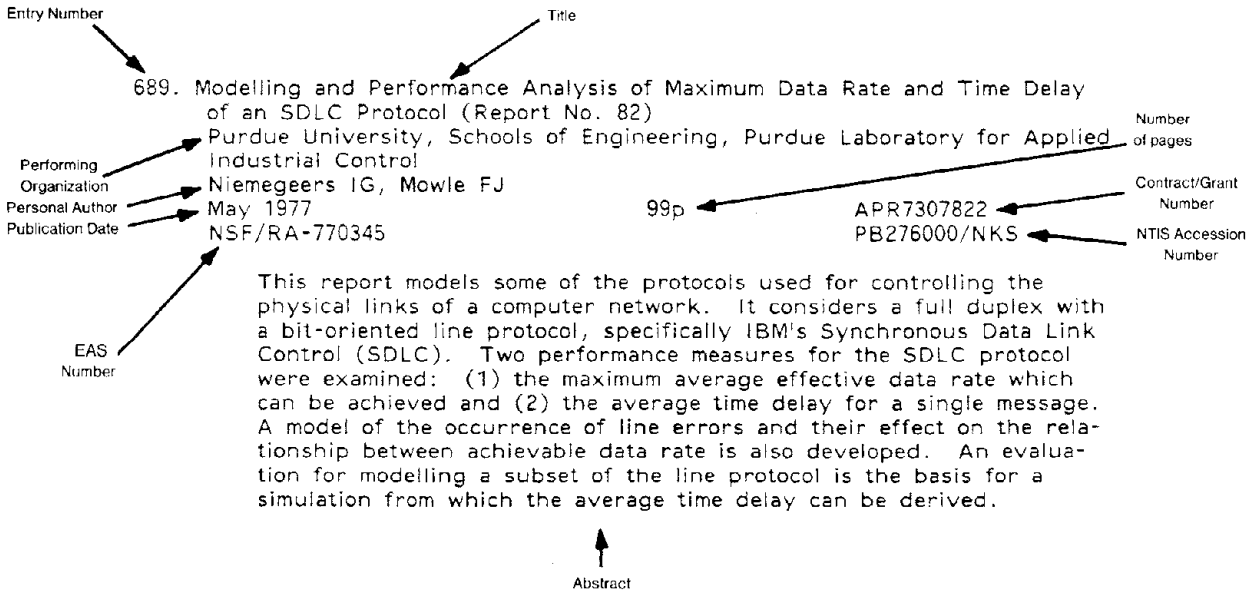

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EAS Information Resources
Room 1108
1800 G Street, NW
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Telephone (202) 634-4262

Citations are arranged in broad subject categories. Entry numbers are assigned consecutively beginning with the first issue published in October 1976. Indexes following the main body provide access by subject, performing organization, EAS number, contract/grant number, and author and refer to the entry number of the document.

RESEARCH REPORTS FROM CURRENT PROGRAMS

Applied Social and Behavioral Sciences

Public Policy and Regulation

844. How Blacks Use Television for Entertainment and Information
Booker T. Washington Foundation; Cablecommunications Resource Center-West
Carter E
March 1978 214p APR7501757
NSF/RA-780101 PB287704/NKS

Multiphase research was undertaken to provide information on the impact of television viewing on Black audiences. Specific questions asked were: 1) how well does television transmit an accurate portrayal of the life and cultural heritage of Blacks; 2) how much do Blacks rely on television for information and entertainment; and 3) how does television affect Blacks' knowledge and behavior in health maintenance and politics? It was estimated that America's 27 million Blacks spend approximately four hours each day watching television. Recommendations included: more minority input into programming decisions; a broader range of Black representation on television; and further research to determine effective program content and formats.

845. Effects of Public Regulation on the U.S. Copper Industry, Volume 2, Methodological Approaches
Massachusetts Institute of Technology, Center for Policy Alternatives
March 1978 342p APR7618529
NSF/RA-780102 PB288242/NKS

This volume presents a general methodology for evaluating the costs and benefits of government regulation on the copper wire industry. The material presented is intended to be a self-contained statement of the methodology including a case study appendix to illustrate how it might be applied in a specific context. This methodology is intended to respond to the task specified in the program solicitation for this research to develop ways of measuring regulation's costs and benefits and

identifying alternative regulatory regimes against which to make such measurements.

Note: Volume I will be available soon from NTIS.

846. Effects of Public Regulation on the U.S. Copper Industry, Volume 3, Analytical Tools and Data Base
Massachusetts Institute of Technology, Center for Policy Alternatives
March 1978 348p APR7618529
NSF/RA-780103 PB288755/NKS

This study evaluates the costs and benefits of government regulation on the copper wire industry. Volume 3 contains the analytical tools and measures, and a comprehensive, fully documented data base needed to utilize the methodologies presented in Volume 2. The analytical tools necessary for the assessment of biological impacts are discussed. Three models that can be used to assess economic impacts are presented. The data base included is organized according to the three flows (economic, legal, environmental/health) used in the Volume 2 methodologies.

847. Effects of Public Regulation on the U.S. Copper Industry, Volume 4, Background Information and Analysis
Massachusetts Institute of Technology, Center for Policy Alternatives
March 1978 396p APR7618529
NSF/RA-780104 PB288255/NKS

This volume is intended to provide basic background information and analysis upon which methodologies for the assessment of regulatory impacts on the copper industry can be built and subsequent actual measurements of those impacts made. Although much of the work contained herein pre-dates that contained in Volumes 2 and 3, it is presented last because logically it represents the building blocks rather than the final work product of this project's research. In this volume are presentations of the technology, economic structure, and regulatory framework of the copper industry. Although the three analyses in this volume were developed so as to be consistent with the approach in the evaluative methodology (Volume 2) and specific analytical models (Volume 3), their mode of presentation should allow them to be equally useful to the development of other such methodologies or as a basic reference volume about the copper industry.

848. Applied Research on the Benefits and Costs of Public Regulation of the Copper Wire Industry, Bibliography
Harbridge House, Inc.; Massachusetts Institute of Technology, Center for Policy Alternatives
August 1977 313p APR7618529
NSF/RA-780105 PB284902/NKS

This bibliography is a comprehensive, annotated, indexed survey of the relevant published material in the field of public regulation of the copper wire industry. The 871 items are listed alphabetically and include standard bibliographic information, plus references and the business affiliations of the author where available. Abstracts are included for all entries and consist of original abstracts by the researchers or verbatim abstracts provided by the documents listed. Fifteen keywords were used to index the bibliography and also appear in the body of the text to provide the browsing user with a "sense" of what is contained in each entry.

849. Children's Conceptions of Proprietary Medicines, the Role of Television Advertising
University of Pennsylvania, the Wharton School, Center for Research on Media and Children
Robertson TS, Rossiter JR, Gleason TC
1978 163p APR7621130
NSF/RA-780258 PB287551/NKS

This project is designed to assess the effects of televised medicine advertising on children. The sample comprised 673 children between the ages of eight and thirteen years old and their parents. The sample composition includes boys and girls and spans a socioeconomic range from disadvantaged to upper-middle class. The project objective is to provide an analysis of the relationship between proprietary medicine advertising and children's beliefs, attitudes, and behavior toward proprietary medicines. Results suggest that televised medicine advertising performs only a limited role in the formation of children's beliefs and attitudes toward medicines. In the short run, it produces a modest increase in beliefs and attitudes. In the long run, this increase is overshadowed by a significant decline in children's attitudes and beliefs as a function of age, and thus cognitive development and experience. Further, the study indicates a lack of relationship between advertising and usage (which is controlled by parents) and finds no support that children abuse proprietary medicines. Usage levels are moderate and the extent to which parents allow children to self-administer medicines is relatively low.

Public Service Delivery and Urban Problems

850. Options to Provide Local Public Service Delivery, an Evaluation, Executive Summary
Midwest Research Institute, North Star Division
Sparks TL
June 1978 27p ISP7712751
NSF/RA-780155 PB285979/NKS

This program was designed to evaluate a cooperative project undertaken by two Minneapolis-based organizations, the Upper Midwest Council and the Citizens League. The joint-venture project, known as Public Service Options (PSO), was involved in the development of new options in the delivery of public services. The project was seen as a convenient vehicle through which to evaluate the effectiveness of the two parent organizations in bringing about institutional changes within local government. The evaluation was designed to measure not only the degree to which institutional changes occurred, and the relationship of these changes to the joint-venture effort, but also whether any apparent effectiveness of this approach was related to unique characteristics of the Twin Cities environment, population, or history that would make successful replication in another location infeasible. The evaluation involved the collection of two types of information: 1) primary data from potential PSO contractors, using a before-and-after design, in order to study governmental involvement in the purchase of services; and 2) secondary data obtained by monitoring important and relevant PSO meetings.

851. Public Pension Plans, Fundamentals of Design, Funding, and Reporting
Howard E. Winklevoss and Associates
Winklevoss HE, McGill DM, Allison GD, et al
May 1978 476p APR7619254
NSF/RA-780181 PB288025/NKS

A comprehensive survey of public pension plans is presented in three parts: plan design, plan funding, and financial reporting and analysis. The retirement systems operated by the states, municipalities, and other public authorities are examined from the standpoint of classes of employees covered, level of administration, legal form, collective bargaining, legal commitment of the plan sponsor, Social Security coverage, and source of contributions. Several types of plan benefits and means of protecting their purchasing power are discussed. The financial practices of public pension plans, their various funding methods, and an empirical analysis of alternative funding methods are described. Measurement of the financial status of a pension plan,

actuarial assumptions, actuarial reports, an explanation of financial disclosure of proposed benefit changes, and the adoption of new pension arrangements are included.

852. Evaluation of Changes in House Prices within Urban Housing Submarkets, A Method of Testing for the Effects of Local Growth Control Systems (Project on Monitoring Growth Management Systems, Working Paper No. 5)
University of Minnesota, Hubert H. Humphrey Institute of Public Affairs
Adams JS
March 1978 52p AEN7606857
NSF/RA-780281 PB288111/NKS

This study develops and applies a simple technique for describing whether the average housing values in the tracts within areally defined housing submarkets in the Minneapolis and suburban area maintained their relative rankings compared to other tracts in the same submarkets, gained in rank, or lost their position. The paper demonstrated how to use census data, or assessor's data, or data from multiple listing services of the Minneapolis Area Board of Realtors in computing the annual average housing values for each census tract in each submarket. The average values are ranked within each submarket for a specific year, then the process is repeated for a subsequent year. The tracts' ordinal rankings in the first year are then compared to the tracts' rankings in the second year to permit comparison of whether each tract gained, lost, or maintained rank. Data from 1960 through 1976 are used. Applications are suggested for evaluating the housing market consequences of local growth control systems.

853. Effects of an Urban Growth Management System on Public Services and Public Service Costs (Project on Monitoring Growth Management Systems, Working Paper No. 3)
University of Minnesota, Hubert H. Humphrey Institute of Public Affairs
Gleeson ME
March 1978 37p AEN7606857
NSF/RA-780283 PB288035/NKS

By concentrating physical development geographically, urban growth management systems seek to hold down public service costs or reduce service deficiencies resulting from rapid growth. This study tests the expectation that such systems can concentrate development and reduce public service costs without reducing level of services. The site for the study is Brooklyn Park, Minnesota, one of the nation's longest-operating growth

management systems. Findings indicate that the system has had a concentrating effect and has produced significant savings in capital sanitary sewer, water, and storm sewer facilities (some 40%), without affecting output or impact of service. Several measurement and methodological issues also are discussed.

854. Effects of an Urban Growth Management System on Land Values (Project on Monitoring Growth Management Systems, Working Paper No. 4)
University of Minnesota, Hubert H. Humphrey Institute of Public Affairs
Gleeson ME
March 1978 35p AEN7606857
NSF/RA-780284 PB288110/NKS

It can be argued that urban growth management systems segment a land market into distinct submarkets--those parcels of land which are developable at a particular point in time as distinct from those which are not developable due to public action. They do so by adding timing to the traditional control of type and location of development. This paper tests and confirms the expectation that segmenting a land market through operation of a growth management system leads to a divergence in land values between the developable and undevelopable portions. Conditions under which divergence occurs, and rival explanations for its occurrence also are explored.

855. Design of State, Regional, and Local Development Management Systems, Volume 1, Technical Report
University of Minnesota, Hubert H. Humphrey Institute of Public Affairs
Einsweiler RC, Freilich RH, Gleeson ME
March 1978 392p ENV7606857
NSF/RA-780285 PB287324/NKS

This study developed information on the following four identified critical gaps in development management systems: 1) statement of an enlarged concept of development management systems that could encompass efforts in growth and decline settings at all governmental levels; 2) identification of Federal and state government constraints on lower level governments; 3) identification of considerations in the selection of a system and techniques; and 4) decisions on how to monitor a system. The study addresses in Volume One the ways of thinking about development management that are useful for design and policy making. The term development management is used to encompass the conscious public decision to restrain, accommodate or induce development in any geographic setting and at any governmental level.

Volume Two undertakes a critique of existing systems to obtain insight on the gaps and to apply ideas generated. Two of the case studies presented, Lexington, Kentucky, and Twin Cities, Minnesota, are examples of the land allocation approach. The case study on Ramapo, New York, discusses the support systems or budget approach. Another development management system controls the amount of rate of growth by housing unit allocation. Petaluma, California, another case study, addresses both growth and decline areas by employing the numerical type of allocation together with land allocation.

856. Design of State, Regional, and Local Development Management Systems, Volume 2, Technical Report
University of Minnesota, Hubert H. Humphrey Institute of Public Affairs
Einsweiler RC, Freilich RH, Gleeson ME
March 1978 345p ENV7606857
NSF/RA-780286 PB287325/NKS

See entry 855 for abstract.

857. Aging and Social Policy, Leadership Planning
University of Southern California
Kasschau PL
1978 443p APR7521178
NSF/RA-780470

This book surveys the way in which a cross section of the decision-making community responsible for developing and implementing programs to assist the elderly collectively define the problems of growing old and assess the parameters for social policy intervention. Structured interviews averaging nearly two hours were conducted with legislators, agency administrators and program heads, supervisory service delivery personnel, corporate directors of personnel, union local presidents, and advocates for the aged. The subject matter of those interviews covers income maintenance, health care, housing, transportation, employment, and retirement. Analysis of the interview data focuses upon the way in which a decision-maker's perspectives on aging and social policy are influenced by: 1) his position in the policy process; and 2) his bibliographical background. The decision-maker's perspectives on aging and social policy are compared with the perceptions and policy recommendations offered by the elderly themselves. The text monitors whether decision-makers prefer to make minor modifications in existing programs in lieu of major overhauls in program design or operation.

Note: Available from Praeger Publishers, 383 Madison Avenue, New York, New York 10017. Price $21.95.

858. State and Local Government Finance and Financial Management, a Compendium of Current Research
Municipal Finance Officers Association
Petersen JE, Spain CL, Laffey MF
August 1978 700p APR7720340
NSF/RA-780532

The first part of this report contains a series of sixteen essays authored by experts in the field of state and local government finance, each essay dealing with a major area of research. The second part is the inventory of research, with descriptions of the individual projects appearing in sections that correspond to the functional items of activity and topical areas. Each description contains, in addition to a brief abstract, ten separate items of classified information relating to the prinicipal investigators, products, sponsors, intended users, and research methodologies. The information for the research inventory was compiled from the survey responses of individuals who have shown a research interest in public finance, particularly as it relates to state and local government. Of the survey responses received, 910 projects were chosen as appropriate for inclusion in the inventory. In many cases, these projects involved more than one principal investigator. An index of principal investigators at the end of the volume includes the names of the 697 individuals whose works are listed in the inventory.

Note: Available from Municipal Finance Officers Association, 180 North Michigan Avenue, Chicago, Illinois 60601. Price $18.00.

859. Community and Economic Development, 1978 Workshop Considering Problems Identified by the Intergovernmental Science, Engineering, and Technology Advisory Panel (Elkridge, Maryland, November 1978)
American Association for the Advancement of Science, Intergovernmental Research and Development Project
1979 187p OPA7824464
NSF/RA-790042 PB294593/NKS

A workshop on community and economic development considered problems identified by the Intergovernmental Science, Engineering, and Technology Advisory Panel (ISETAP). Members of the workshop were divided into three groups, each considering one of three problem areas: analysis and evaluation of state and local growth and adjustment patterns; neighborhood development and stability; and central city business development. Followed by a summary of conclusions and recommendations by the three working groups, the problem areas are described in terms of problem statement, problem restatement by the planning group,

and report from the working group. Included in the appendices are a list of workshop participants and workshop planning group members, the workshop agenda, information on ISETAP, an overview of the task of the workshop, and three background papers.

860. Health and Human Resources, the Elderly, 1978 Workshop Considering Problems Identified by the Intergovernmental Science, Engineering, and Technology Advisory Panel (Warrenton, Virginia, December 1978)
American Association for the Advancement of Science, Intergovernmental Research and Development Project
1979 260p OPA7824464
NSF/RA-790043 PB294598/NKS

The workshop was designed to contribute to an understanding of the role of science and technology in addressing the problems facing the elderly. The problem areas considered were: alternatives to institutionalization for the care of the aged, housing organization and designs for the elderly, effective transportation services for the elderly, and the elderly as an economic resource. Although workshop members worked in four groups, each considering one of those four areas, they stressed the need to recognize these problems as interrelated and to develop integrated research programs. Use of this report by the Intergovernmental Science Engineering and Technology Advisory Panel (ISETAP) provides a basis for research program recommendations to the Office of Science and Technology Policy, appropriate Federal agencies, and the Office of Management and Budget. A summary of conclusions and recommendations precedes problem statements and reports in each of the aforementioned problem areas. Appendices include a list of members of the workshop and workshop planning group, the workshop agenda, information on ISETAP, and several background papers concerned with each problem area.

Industrial Organizations and Markets

861. Hearth and Home, Images of Women in the Mass Media
Institute for Scientific Analysis
Daniels AK, Benet J, Tuchman G
1978 344p ERP7420802
NSF/RA-780072

The papers included were presented at a conference held in April 1975 which focused on both the portrayal of women in the media and the place of women in media production. The

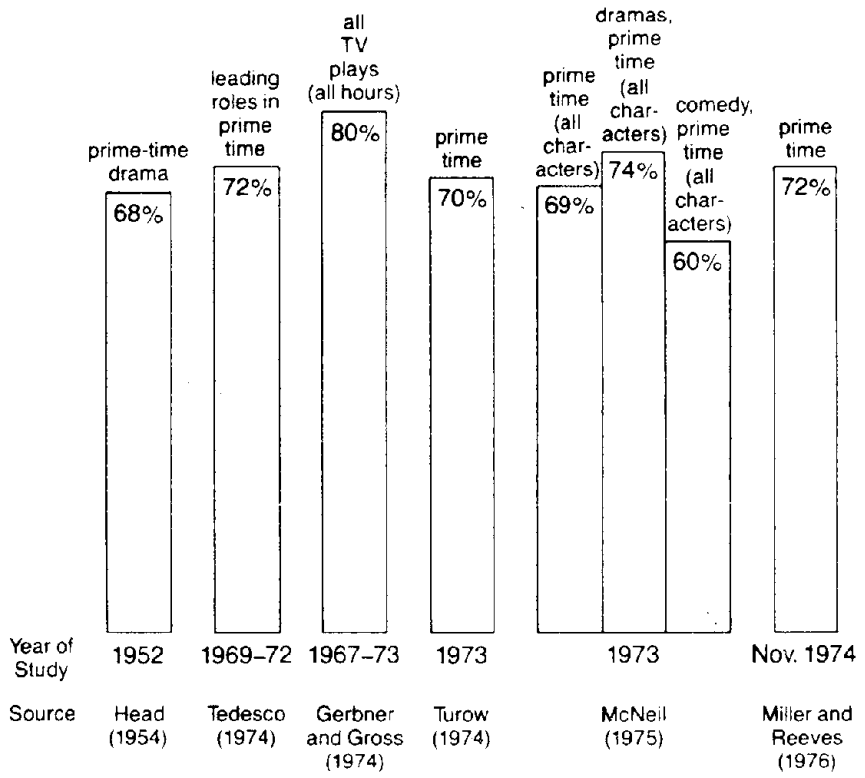


Figure 1.1. Percentage of Males in TV Programs, 1952–1974.

See Entry 861.

papers are organized under the four main topics of television, women's magazines, women's pages in newspapers, and television's effects on children and youth. The conference addressed the depiction of sex roles in the mass media and the effect of that portrayal on American girls and women. The book presents itself as an example and a suggestion to encourage others to study problems and collect information on the interaction between the media and public opinion in the press for equality between the sexes.

Note: Available from Oxford University Press, 200 Madison Avenue, New York, New York 10016. Price $4.95.

Applied Physical, Mathematical, and Biological Sciences and Engineering

Physical, Mathematical, and Engineering Applications

862. Theory for Determining KIc from Small, Non-LEFM Specimens, Supported by Experiments on Aluminum
Terra Tek, Inc.
Barker LM
February 1978 34p
NSF/RA-780080 PB287085/NKS

It has been shown that the radius of the plastic zone around a crack tip in plane strain is approximately $(K_{Ic}/ays)^2$ where K_{Ic} is the plane strain critical stress intensity factor (the fracture toughness) and ays is the yield strength in tension. A rationale is presented for measuring K_{Ic} using much smaller specimens than those required by conventional test methods. Two main points are involved: (1) the use of specimen configurations for which the material along the crack tip is better constrained to the plane-strain state, and (2) the measurement and elastic-plastic analysis of the load displacement curve (including at least two unloading slopes) to determine the energy per unit crack area of the propagating crack. The elastic-plastic analysis produces a very simple result which is easily applied in practice. The rationale is tested by the measurement of K_{Ic} of 6061-T651 aluminum using short rod specimen size for diameters as small as 0.9 $(K_{Ic}/ays)^2$, the smallest tested. The K_{Ic} of this study compares satisfactorily with published data on 6061-T651 aluminum.

863. Short Bar Specimens for Klc Measurements
Terra Tek, Inc.
Barker LM
February 1978 23p
NSF/RA-780081 PB287010/NKS

A new short rod fracture toughness specimen has been recently introduced. The advantages of testing for the plane strain critical stress intensity factor K_{Ic} with the short rod specimen include its simple geometry, its economical use of specimen material, the fact that a stable crack is obtained in the specimen as a matter of course during the test for K_{Ic}, the dependence on K_{Ic} on the peak load alone (no measurement of crack length is necessary), the simplicity of the data reduction, and the applicability of the specimen to both ductile and brittle materials. Careful comparison testing of short rod and short bar specimens of aluminum, aluminum oxide, and fused quartz has shown no experimentally significant difference in the geometrical constant. The short bar fracture toughness specimen with its rectangular cross section has thus been calibrated and is ready for use.

864. Compliance Calibration of the Short Rod Fracture Toughness Specimen
Terra Tek, Inc.
Barker LM, Guest RV
April 1978 25p
NSF/RA-780082 PB287009/NKS

A laser interferometer measurement of the compliance versus the crack length curve for the short rod fracture toughness specimen is reported. The measured data are used to calculate the constant which relates the peak load in a short rod test to the fracture toughness. The compliance measurement technique is described and the results are presented. The compliance data produced a calibration constant, A, which is significantly higher than the calibration constant derived from previous comparison tests. Analysis of the difference between the A calibrations led to a detailed comparison of the ASTM K_{Ic} and the short rod K_{Ic} measurements. An examination of the reasons for this difference, the relationship between the fracture toughness as measured by ASTM Standards and by the short rod method, has been clarified, and explains part of the discrepancy. A probable cause for the balance of the discrepancy may be the finite slot thickness in short rod specimens which allows a region of nonplane strain to influence test results in the more ductile metals. Additional research is required to fully evaluate this effect.

865. Micro-Isotope Tool Wear Detector Phase 1, Final Report
Amtech, Inc.
May 1978 86p DAR7719517
NSF/RA-780124 PB284699/NKS

During Phase I the feasibility of the Micro-Isotope Tool Wear Detection System was evaluated as an industrial tool wear monitor, particularly for use with automated machining systems. A field evaluation test was conducted at the General Electric, Small Aircraft Engine Operation, plant in Lynn, Massachusetts, on tungsten carbide milling cutters used on computer-controlled turbomachinery milling operations. The first round of testing was not conclusive due apparently to insufficient isotope implant integrity. This is not believed to be a fundamental problem since improved implants were subsequently made and successfully demonstrated on two different machines in a laboratory environment. An attractive design concept was developed for a universal implant fixture that should allow tools to be implanted with micro-isotope particles in an industrial environment by typical tool sharpening personnel producing accurate results at moderate cost. Thus, it seems that this part of the system can be adapted to the industrial environment. Investigations into possible barriers to implementation due to the use of radioactive material revealed that potential users would need an exemption from Nuclear Regulatory Commision user licensing requirements. The application for an exempt status must be pursued and resolved before this potential barrier can be assessed adequately.

866. Multiple Borehole Radar, Subsurface Site Investigation by Radar, Phase 2, Final Report, Volume 1
Ensco, Inc., Earth Sciences and Systems Division
Rubin LA, Fowler JC, Marino GG
June 1978 108p APR7603300
NSF/RA-780149 PB288073/NKS

This report covers Phase 2 of a projected five-phase program to develop new techniques for subsurface site investigation by remote sensors in boreholes and tunnels. The objective of the overall program is to evaluate the benefits of advanced computer-based geophysical methods as supplements to other pre-excavation site investigation methods. This grant covered the development and initial field evaluation of a short pulse electromagnetic borehole radar system. The borehole antenna(s) can acquire data from either a single or a cross-hole mode. Single-hole measurements are obtained by a transmit-receive antenna, whereas cross-hole data are acquired with a transmitter and receiver in separate holes. The principal energy of the radar antenna is in the range of from 50 MHz to 150 MHz. The borehole radar system was field evaluated at two sites in rock. One

test site featured an array of four subvertical boreholes on a line about 15' to 50' apart and about 250' deep. The measured geologic profile was of weathered to unweathered quartz mica schist to gneiss. Both single and cross-hole measurements were correlated to the core data. At the other test site three close spaced (8' to 20') subhorizontal holes were drilled to a depth of 100'. Here a detailed geologic map of the rock volume included was developed. The rock mass was an unweathered diabase. Field measurement results are strongly correlated to specific known rock structures.

867. Advanced Industrial Robot Control Systems (First Report, July 1, 1977 - January 1, 1978)
Purdue University, School of Electrical Engineering
Paul R, Luh J, Bender J, et al
January 1978 87p APR7714533
NSF/RA-780167 PB287273/NKS

The major goal of this research program is to develop industrial robot control schemes to improve the performance of currently available robots. The need to extend the flexibility and usefulness of current industrial robots and to provide a solid base for future advanced systems based on computer control techniques and dynamic manipulation models is examined. This report describes the work performed during the first six months since the project's inception. Tasks include a joint motion control scheme capable of working on moving assembly lines with a reduction in computer power of an order of magnitude over cartesian coordinate tracking schemes; the model-based optimization of straight line segment robot trajectories resulting in a significant reduction of execution time; and the development of the equation of motion of a manipulator utilizing a moving coordinate system and Newton-Euler equations. This approach results in a reduction of the computation of two orders of magnitude over the standard Lagrangian approach.

868. Shaped Pulse Rotary Percussion Drilling, Phase 1, Final Technical Report
Exotech, Inc.
Clipp LL
May 1978 64p APR7516367
NSF/RA-780228 PB286030/NKS

A combination of rotary-percussive drilling could significantly reduce drilling costs in mining and related industries; but rapid failure, due to high peak stresses of hammer blows, has impeded its use. A method is described to develop a fluid-pulse-shaping device to be interposed between the percussive

hammer and the tricone drill bit to (1) limit peak stresses below bit failure stresses (but above the stresses needed to break hard rock), and (2) extend the energy pulse in time to ensure efficient energy transfer. Phase I focuses on laboratory experiments to determine the effectiveness of pulse shaping in stress limiting and efficiency energy transfer. The bulk of this report comprises a detailed description of tasks developed to achieve these objectives. They cover areas of design, seal evaluation, manufacture and assembly, laboratory and evaluation, and controlled field tests. The results of the final test runs conducted in Houston, Texas, are presented. Potential users of shaped pulse rotary percussion drilling were identified by a set of screening criteria. It was estimated that several thousand percussion drilling operations might benefit from this new technology.

869. Approaches for the Acquisition of Mass Spectral Data for Inclusion in the NIH/EPA/MSDC Mass Spectral Data Base (Final Report, October 31, 1977 - March 31, 1978)
Fein-Marquart Associates, Inc.
Martinsen DP
1978 33p AEN7719673
NSF/RA-780242 PB285868/NKS

The purpose of this project was to investigate ways in which mass spectral data, particularly those being generated with the support of government funds, could be made available for addition to the NIH/EPA/MSDC Mass Spectral Data Base. Several different approaches were studied: (1) the producers of mass spectral data were contacted directly regarding the submission of their spectra to the data base; (2) the government agencies that sponsor research in which mass spectral data are generated were contacted to see if some policies could be enacted to encourage or require investigators to submit their spectra to the data base; and (3) the scientific journals were examined as a source of mass spectral data to be included in the data base. The findings of these studies indicate that contacting the producers directly is the most fruitful method to acquire spectra. Possible means of locating the producers are discussed. Trying to establish policies governing the reporting of data under government research grants seems an almost impossible task. Obtaining spectra directly from the primary journals is not worthwhile in most cases; however, the journals do seem to be a good source of the identity of the producers of mass spectra.

870. General Methods to Enable Robots with Vision to Acquire, Orient, and Transport Workpieces (Fourth Report, August 15, 1977 - July 15, 1978)
University of Rhode Island
Birk J, Kelley R, Wilson L, et al
1978 237p APR7413935
NSF/RA-780260 PB287199/NKS

The methods developed are intended to assist in increasing the range of industrial applications to which robots can be applied. Alternative approaches to the problem of feeding machines with workpieces supplied unoriented in containers are described. A major subdivision exists between using some mechanical means to form workpieces into a stream versus having a robot acquire pieces directly from the container in which the parts are stored or transported. An experimental robot is described which uses vision to acquire arbitrarily oriented workpieces from a bin and to compute workpiece orientation in the hand, and then transports the piece so that it assumes a predetermined pose at a goal site. The experimental system is operational although many ideas to improve performance need to be tested. Papers presented at conferences on the following topics are discussed in the appendices: workpiece transportation by robots using vision; image feature extraction using diameter limited gradient direction histograms; identification of object symmetry from multiple views; acquiring workpieces; URI Mark IV Arm, three axis rotary joint wrist and Anorad XYZ Tables; kinematic equations for the URI Mark IV Arm and the arm joint solution; surface adapting vacuum gripper; camera alignment; gauge for measuring workpiece pose; software descriptions; proposed solution to the continuous pose estimation problem; and breakaway system. Appendices constitute the bulk of the text.

871. Generalized Manufacturing Simulator (GEMS), A Management Perspective and Examples (GEMS-6-78)
Texas A and M University, Department of Industrial Engineering
Heisterberg RJ, Phillips DT, Dharia VK, et al
June 1978 104p APR7622610
NSF/RA-780261 PB287430/NKS

This report describes progress in the application of the Generalized Manufacturing Simulator (GEMS) to factory and warehouse management problems. The use of simulation and associated management perspectives is also presented. GEMS modeling concepts are discussed in terms of the modular and hierarchical nature of the simulation language. The impact of material handling on manufacturing logistics problems provides a framework for discussion of fundamental GEMS material flow network models. Examples of using GEMS to study the

operation of mobile vehicles, conveyors, and cranes are described. A complete simulation case study of an example factory illustrates the use of GEMS to analyze: 1) machine requirements and balancing; 2) alternative material handling control policies; and 3) predicted AS/RS and driverless tractor train system performance.

872. Users Manual for GEMS, A Generalized Manufacturing Simulator (Second Report, December 1, 1977 - June 1, 1978, GEMS-7-78)
Texas A and M University, Department of Industrial Engineering
Phillips DT, Handwerker M, Piumsomboon P
June 1978 138p AER7502747
NSF/RA-780262 PB287094/NKS

This report is a complete user's manual for GEMS, a generalized manufacturing simulator. The language is problem oriented towards application programs. The GEMS simulator currently consists of a small main program and 65 subroutine and function subprograms which interact to execute four phases: input, control, simulation, and output. The manual is divided into five sections: an overview of the GEMS program's organization and operation; GEMS network concepts and notation; data input variables and structure; examples; and warning and error messages. Provided are operational examples for simulations involving a single service queuing system, a two server queuing system with batch generation, a priority processing system, a selector box and service activities utilizing resources as applied to a situation where a central processor routes work in process to four machines, and a use of cost problem where a single queue feeds three non-identical servers where it is of interest to determine the cost of operation.

873. Representations in the PADL-1.0/N Processor, the Drawing File (PADL/SD - 14)
University of Rochester, College of Engineering and Applied Science, Production Automation Project
Hunt WA
July 1978 68p APR7601034
NSF/RA-780294 PB288516/NKS

A Drawing File is a Part and Assembly Description Language (PADL)-standard representation of an engineering drawing; it serves as the interface between the PADL system's Graphic Output Generator and the specialized post-processor programs that drive particular plotters. The main purpose of this document is to specify a structure for Drawing Files which captures the logical organization inherent in mechanical engineering drawings. The representations discussed attempt to reflect the structure exhibited by engineering drawings in current practice.

A PADL-standard Drawing File may also be used to represent drawings produced by other systems. Drawing Files are defined in Section 2 of this document as "mathematical" representations which may be implemented for computational purposes in many different ways. Section 3 describes the specific implementation used in the PADL-1.0/2.n system.

874. Processes in the PADL-1.0/N Processor, the Drawing File Processor (PADL/SD - 15)
University of Rochester, College of Engineering and Applied Science, Production Automation Project
Hunt WA
August 1978 35p APR7601034
NSF/RA-780295 PB288483/NKS

The Drawing File Processor (DFP) produces standard engineering drawings from PADL-standard Drawing Files. It does this by translating Drawing Files into sequences of plotter-specific commands, which may be saved on files or executed immediately to produce drawings. The current DFP, which is an independent FLECS/FORTRAN program containing some thirty-five subroutines, drives a Versatec 2160A plotter under the DEC PDP-11/RT-11 operating system. Other plotters, computers, and operating systems may be accommodated by modifying or replacing various low-level procedures within the DFP. This document describes the structure and current status of the DFP and suggests procedures for customizing and commissioning it.

875. Design for Manufacturability, the Implementation and Usage of PADL on a PDP-11/34 Computer, Along with a Survey of Languages for Geometric Modeling and a Computer Aided Design Program for the Coding of Small Parts by Their Feeding and Orienting Characteristics, Report No. 1
University of Massachusetts, Department of Mechanical Engineering
Laiosa JP, Murch LE
August 1978 194p APR7710197
NSF/RA-780296 PB288323/NKS

A review of computer graphics languages available for the geometric modeling of mechanical parts is presented. The review is used for comparison in choosing a language for use in engineering design. The PADL processor was chosen and purchased from the Production Automation Project of the University of Rochester as a result of this review. The PADL processor was implemented on a PDP-11/34 DECLAB, and an outline of the dissemination procedure is included along with a description of the problems and an example of the PADL processor in operation. In addition, an interactive computer program is developed to

aid a designer in determining the three-digit part code for feeding and orienting small parts according to the UMass Coding System. An example of this program is provided along with the flowcharts and program listings.

876. Computer-Aided Injection Molding System (Progress Report No. 5, September 1, 1977 - August 31, 1978)
Cornell University, College of Engineering, Injection Molding Project
Wang KK, Shen SF, Cohen C, et al
September 1978 100p APR7411490
NSF/RA-780307 PB288283/NKS

This project attempts to build a scientific base for injection molding, a primary manufacturing process of polymeric materials. The research results in the past year include further improvements of computational methods. The finite-element/finite-difference cavity-filling simulation program has been significantly extended by implementing a scheme which employs the streamfunction and temperature, rather than pressure and temperature, as primary computational variables. A new simulation program for cavity filling with asymmetric cooling conditions was also developed in this period to analyze an interesting industrial molding problem in which one surface of the cavity is Bakelite and the other steel. Little experimental data are presently available for verification, but more experiments are planned for the near future. An independent investigation has been made into predicting and measuring the pressure drop in cold runners of various cross sections. Another objective of this investigation is to determine the possibility of applying the circular runner theory to non-circular runners on the basis of the equivalent hydraulic radius. Encouraging results have been obtained to date, but further experimental work is needed. The effort in building up the mold design program during this period has been concentrated on implementing the current TIPS-based program in a mini-computer environment.

Biological and Ecological Applications

877. Affinity Cross-Linking Agents for Enzyme Stabilization and Immobilization (Final Report, August 15, 1974 - January 31, 1978)
Midwest Research Institute
Guire PE
May 1978 50p AER7408152
NSF/RA-780127 PB287343/NKS

The project was designed for the development of reagents and technology needed for the stabilization of enzymes and enzyme-cofactor catalytically active complexes in solution and immobility. The synthesis is reported of 18 stepwise thermophotochemical crosslinking reagents containing the thermally stable photoreactive 4-azido-2-nitrophenyl group. The usefulness of many of these reagents was tested and demonstrated for the production of superior photoreactive carrier derivatives for enzyme immobilization and the preparation of soluble biochemically active photoreactive protein derivatives. The latter were used successfully for photocoupling of active enzymes to living cells, photoimmobilization of proteins under gentle conditions to polystyrene and numerous other carrier materials in the dry or wet state, development of portable chromogenic enzyme monitored immunoassay systems, enzyme stabilization, and the preparation of photoreactive soluble ferredoxin-hydrogenase complex which remains fully active in hydrogen generation after photolysis with presumed stable crosslinking between cofactor and enzyme.

878. Improved Utilization of Immobilized Enzymes Using Fluidized Bed Reactors, Final Report
Lehigh University, Department of Chemical Engineering
University of Connecticut, Department of Chemical Engineering
Charles M, Coughlin RW
June 1978 65p AER7203546
NSF/RA-780163 PB285986/NKS

The objectives of this study were to demonstrate the use of fluidized-bed technology for processing with immobilized enzymes and to develop such an immobilized-enzyme process for the hydrolysis of lactose in cheese whey, thereby enhancing the economic value of a cheese-manufacturing by-product. Cheese whey has a potentially great nutritional value owing to the excellent-quality protein it contains. The objectives were accomplished simultaneously by initial bench-scale experiments, by design-development based on the bench-scale experiments and, subsequently, by the construction and operation of a scale-up facility based on the design. In addition, an approximate preliminary economic analysis was made of various processing schemes for cheese whey employing enzymatic hydrolysis.

The results were in terms of return-on-investment for various case studies of different process configurations. Patents are also included in this report.

879. Utilization of Earthworms and Microorganisms in Stabilization, Decontamination and Detoxification of Residual Sludges from Treatment of Wastewater (Final Report, June 1, 1976 - May 31, 1978)
State University of New York at Syracuse, College of Environmental Science and Forestry
Hartenstein R, Mitchell MJ
1978 34p ENV7706994
NSF/RA-780171 PB286018/NKS

Findings are presented of studies determining the role of invertebrates in sludge disposal management using four secondary-treatment domestic sludges including an aerobic digest and anaerobic digests from three separate wastewater treatment plants. Data previously unavailable on the chemical content of the organic matter in sludge residues are disclosed. Anaerobic sludges are shown to be toxic to earthworms when the normal electrode potential is low. Functional moisture and temperature relationships are established for sludge conversion into feces by earthworms and isopods. Earthworms placed into aerobic sludge drying beds cause accelerated sludge stabilization and enhance aerobic decomposition production when moisture is held below a critical level. Moisture content is the major determinant of whether an aerobic or anaerobic decomposition pathway is taken. Earthworm feeding activity is shown to stimulate an increase in nematode population density which promotes an observed bacterial turnover hastening sludge decomposition and stabilization. Data on the effect of heavy metals and the presence or absence of certain enzymes are discussed. Additional studies on enzymes and decomposition processes are reported in abstract form.

880. In Vitro Detection of Allergy Using Human Head Hair, Phase 1, Extraction of Immunoglobulin E from Hair and Development of an Immunofluorescence Test for Allergy Detection (Final Report, October 1, 1977 - April 30, 1978)
IRT Corporation
Caravaca-Trujillo J, Williams CB
April 1978 43p APR7719721
NSF/RA-780235 PB285649/NKS

This report deals with research to develop simple, accurate, reproducible, and commercially viable routine clinical laboratory

methods for the assay of immunoglobulin (IgE) and IgE antibodies using human head hair. An immunofluorescence technique (IFT) is potentially a diagnostic procedure that could greatly reduce the cost, risk, and inconvenience of allergy testing, thereby making such testing much more broadly applicable and available. Research/analysis objectives and accomplishments, including preparation and characterization of fluorescein conjugates of Bermuda grass and western ragweed, and immunofluorescence test (IFT) on hair for IgE antibodies and allergy detection, are discussed. The report also examines the specificity and reproducibility of IFT as well as the extraction of IgE from human head hair. Conclusions and plans for the utilization of results are given.

881. Utilization of Soil Organisms in Sludge Management (Proceedings, June 15-19, 1978, Syracuse, New York)
State University of New York, College of Environmental Science and Forestry
Hartenstein R
June 1978 175p
NSF/RA-780245 PB286932/NKS

Converting sludge into one or more marketable commodities is the most important problem in sludge management today. There has been a trend away from destructive methods of sludge management at wastewater treatment plants. Composting, a quasi-conservational method, is gradually displacing incineration and/or landfilling practices. Although the composted product is a soil amendment with a low value of nitrogen, phosphorus, and potassium, and with little market value, the procedure is nonetheless an improvement over incineration and/or landfill alternatives. Likewise, subsurface injection of liquid sludges into soils has proven to be a beneficial practice in some areas. Another potential solution to this sludge management problem is vermi composting, a procedure which produces a valuable organic soil amendment or fertilizer, and a rich source of protein (the latter in the form of earthworms). In addition to yielding two commodities, the process itself should result in a reduction in costs of purifying water at the treatment plant. These conference papers deal with all aspects of sludge management including vermiculture and earthworm ecology.

882. Utilization of Waste Heat in a System for Management of Animal Residuals to Recover and Recycle Nutrients, Final Report
Oregon State University at Corvallis, Department of Soil Science
Boersma LL, Gasper E, Miner JR, et al
April 1978 299p AEN7414960
NSF/RA-780250 PB285977/NKS

Major findings of an investigation into the concept of nutrient and energy recovery from a swine waste management system are reported. Algae and bacteria were used to convert swine manure into methane-rich fuel gas and supplemental protein for animal feed. Waste heat from electricity generating plants was simulated to test its value in enhancing the biological recovery of nutrients and energy. The anaerobic digestion of the manure solids removed 55 percent of the total solids. The destruction of the volatile solids was 56 percent, and the COD was reduced by 41 percent. The daily gas production averaged 1.06 m /kg VS removed. The gas contained 68 percent v/v CH and 32 percent v/vCO . The necessity to dilute the swine waste with large volumes of water in order to make the liquid phase of the manure suitable for algal growth, and the potentially high cost of harvesting and processing the algae, prompted the consideration of other management systems for the recovery of nutrients and energy from swine manure, including the culturing of yeast, microfungi, and fish. Architectural perspectives and plan views were developed for each management system together with schematic diagrams showing the flow of energy and materials through each system, based on the feed and energy needs and the waste discharge of 100 pigs.

Geophysical and Environmental Applications

883. Investment in the Iron Ore Industry, Final Report
Pennsylvania State University, College of Earth and Mineral Sciences
Hollister JB, Vogely WA
July 1978 260p AGR7505003
NSF/RA-780135 PB285641/NKS

This report evaluates the operation of iron ore markets and develops hypotheses to explain the recurring wide discrepancies between capacity and demand at prevailing prices. Ownership, demand and capacity are discussed, as are steel and iron ore technology. Investment history is covered, and financial and economic analyses are discussed. The important role of independent iron ore companies, a technical description of the

effect of different iron ores in blast furnace ironmaking, and financial descriptions of contemporary iron ore investment are given. The report concludes with a discussion of current problems in the iron ore industry.

884. Impact of Recovered Sulfur on the Structure and Performance of the North American Sulfur Industry, Final Report
Pennsylvania State University, College of Earth and Mineral Sciences, Department of Mineral Economics
Beukes TE, Vogely WA
July 1978 461p AER7505003
NSF/RA-780153 PB286562/NKS

This study traced the effect of the by-product recovered sulfur on the structure and performance of the North American elemental sulfur industry. A firm-by-firm investment history based on interviews and the trade literature provided the basis for identification of the major factors that influenced investment. Through the adoption of more restrictive sulfur dioxide anti-pollution measures and elemental suifur price controls, the government has significantly influenced investment in the sulfur industry. The increased demand for energy raw materials resulted in increased prices, particularly natural gas prices, and the increased utilization of sulfur contaminated sources of supply. The impact on primary produced Frasch process sulfur was to make it a higher cost source of elemental sulfur while concomitantly increasing the supply of by-product recovered elemental sulfur. This volume presents: (1) a discussion of the producers, the sulfur mines, the market shares, and the structure of the industry; (2) a general overview of the elemental sulfur industry behavior over the time period 1950-1977; (3) a history of the major Frasch sulfur producers in the United States and Mexico; (4) a discussion of sulfur industry investment categories and structure; and (5) the implications of the changed structure for investment, costs, and price behavior. A close look at major sulfur consumers and a detailed list of interview respondents form the appendices accompanying the text.

885. Application of Plate Tectonics to the Location of New Mineral Targets in the Appalachians, Second Semiannual Progress Report
American University
Kutina J, Rabchevsky G
June 1978 154p AER7681807
NSF/RA-780218 PB287899/NKS

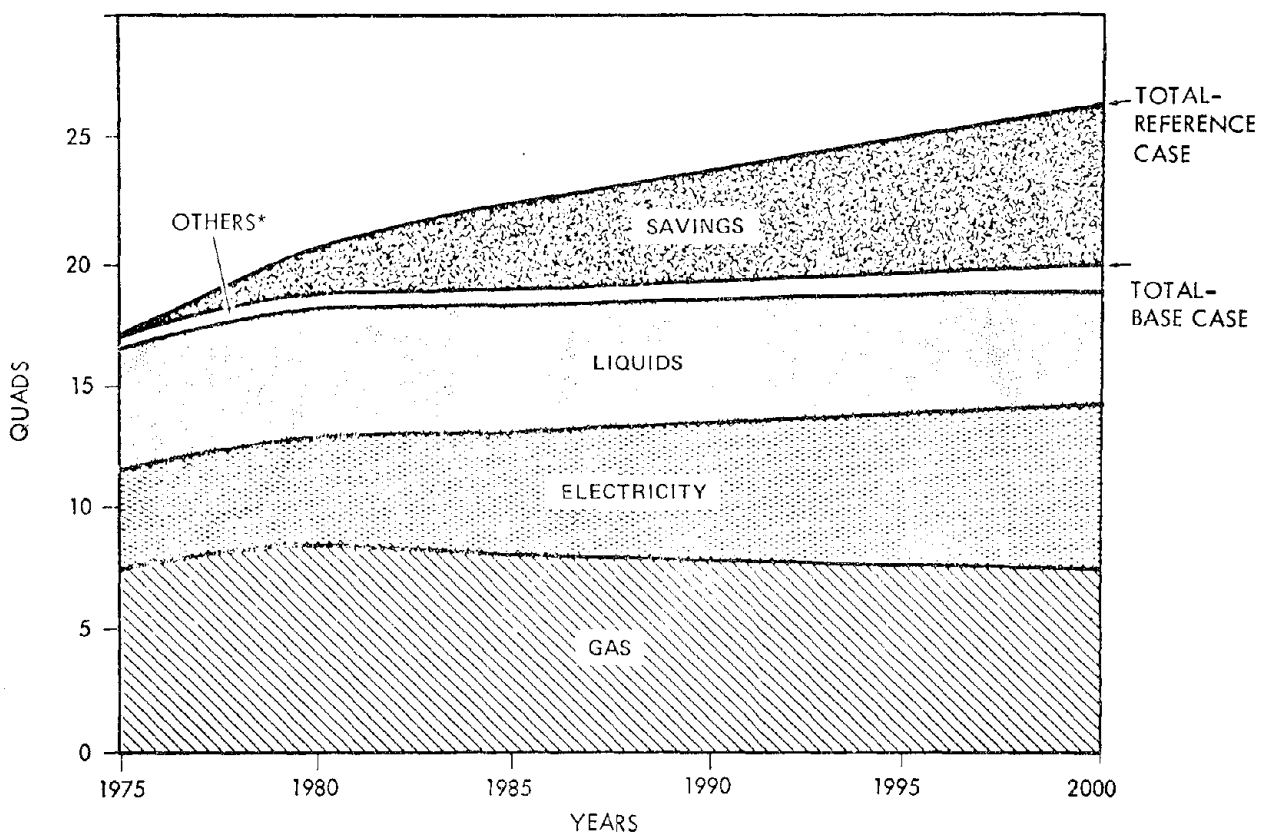
The report discusses the application of plate tectonics to the location of new mineral targets in the Appalachians. These results provide a new structural-geological framework for a metallogenic study by: recognizing a block structure of broad

territory extending westward from the Appalachian folded belt; finding a relationship between the curvature of the Appalachian folded belt and the boundaries of blocks of the Precambrian basement; and postulating the presence of three major lineaments, extending east-westerly along southern and northern boundaries of major basins and uplifts which are supposed to reflect major fracture zones of the Precambrian basement. The spacing between the east-west lineaments was of the same order of magnitude as spacing between the transfer faults which displace the crest of the Mid-Atlantic Ocean Ridge. This may represent relics of basement fractures of the plates that moved away from the rift zone. These findings have led to a study of the distribution and occurrence of deposits of the individual metals superimposed on the new structural base. The distribution of epigenetic uranium is presented in Part A. Part B includes two manuscripts describing work completed in remote sensing studies.

886. Mineral Economics Symposium "Mineral Policies in Transition" 1977 Proceedings (Washington, DC, November 8-9, 1977)
American Institute of Mining, Metallurgical, and Petroleum Engineers
Deyoung JH Jr
1979 214p DAR7805136
NSF/RA-790033 PB294070/NKS

Proceedings of the third annual Mineral Economics Symposium, presented in this report, provide a forum for the presentation of 12 papers describing current research and views on the application of mineral economic analysis to policy making with special emphasis on the subjects of mineral development on Federal lands and government energy planning. The conference report is divided into four sections based on sessions which contain a panel discussion on government involvement with mineral industry structure, and papers on applied mineral economic analysis, mineral accessibility on public lands, and new energy thrusts.

Figure 5. -- Residential/Commercial Sector Delivered Fuel Requirements



*Includes Coal, Solar, Geothermal, Biomass and other Technologies

See Entry 886.

Earthquake Hazards Mitigation

Design

887. Mitigation of Seismic Hazards in Existing Unreinforced Masonry Wall Buildings, Performance of Undesigned and Modified Elements, Evaluation of Modification Methods
Kariotis, Kesler, and Allys
March 1978 34p 7719651
NSF/RA-780130 PB278927/NKS

This investigation attempts to ascertain if mitigation of seismic hazards posed by existing structures using unreinforced masonry walls can be accomplished by simple methodology. Subtopics of this investigation include performance of the undesigned elements that participate in structural response and evaluation of current modification methods applied to these undesigned elements. Interviews with technical personnel were conducted, and a survey of existing masonry buildings was made in representative areas of the United States that may be subjected to ground motion varying from moderate to severe. This survey indicates commonality of building construction methods, range of building dimension, and use of masonry materials. Analytical studies of a representative structure with a flexible horizontal diaphragm were made by typical design procedures and simplified mathematical models subjected to various ground motions. The studies indicate that structural response of vertical and horizontal elements can be defined for analysis purposes by simple parameters. Prior and current research into material properties of masonry was reviewed to extract general data applicable to reinforced masonry. It concludes that development of a methodology for mitigation for seismic hazards in unreinforced masonry buildings is feasible.

888. Methodology for Mitigation of Seismic Hazards in Existing Unreinforced Masonry Buildings, Phase 1
Agbabian Associates, Engineers and Consultants
Adha S, Ewing RD
March 1978 93p AEN7719829
NSF/RA-780131 PB287898/NKS

A multiphased program is initiated to develop a methodology for the mitigation of seismic hazards in existing unreinforced masonry

(URM) buildings. The present research, part of Phase 1, identifies trends in the seismic response of the components of URM buildings and determines what studies and testing are necessary to arrive at a methodology that can be used nationwide. The response of plywood, diagonal-sheathed, and straight-sheathed diaphragms, represented by lumped-mass mathematical models was studied. Experimental data on static loading and unloading were used. Both local and distant earthquake ground motions were used as inputs. The results show a strong dependence of the diaphragm response on the long-period content of the input. The response of masonry walls subjected to in-plane earthquake ground motion was also studied. The analytical results show that the model used can reasonably predict the response of the wall as a function of its height-to-width ration and of the stiffness of the supporting soil. The report evaluates methods for selecting earthquake ground-motion input at a site in the United States and describes analysis methods that can be used to determine the response of URM buildings to earthquake forces.

889. Methodology for Mitigation of Seismic Hazards in Existing Unreinforced Masonry Buildings, Phase 1
S. B. Barnes and Associates
Barnes SB, Johnson AW, Pinkham CW
March 1978 69p 7719523
NSF/RA-780132 PB287478/NKS

Unreinforced masonry buildings are studied in order to determine appropriate methods to deal with hazard mitigation and to study methods of retrofit so that design methods can be established. These design methods are to be devised with consideration of the particular structural conditions of unreinforced masonry construction, their earthquake response, the seismicity of the particular location, and the economics of retrofit. Phase I has studied the state of the art of hazard mitigation and retrofit in order to determine those concerns requiring additional testing and analysis not currently available to complete the design methodology. An outline of the design methodology has been established, and each item in the methodology has been discussed in sufficient depth to determine further study items. A set of suggested criteria has been proposed with omission of those items where additional work is required. Finally, a summary of these further study items has been included so that the work to be performed in Phase II can be identified.

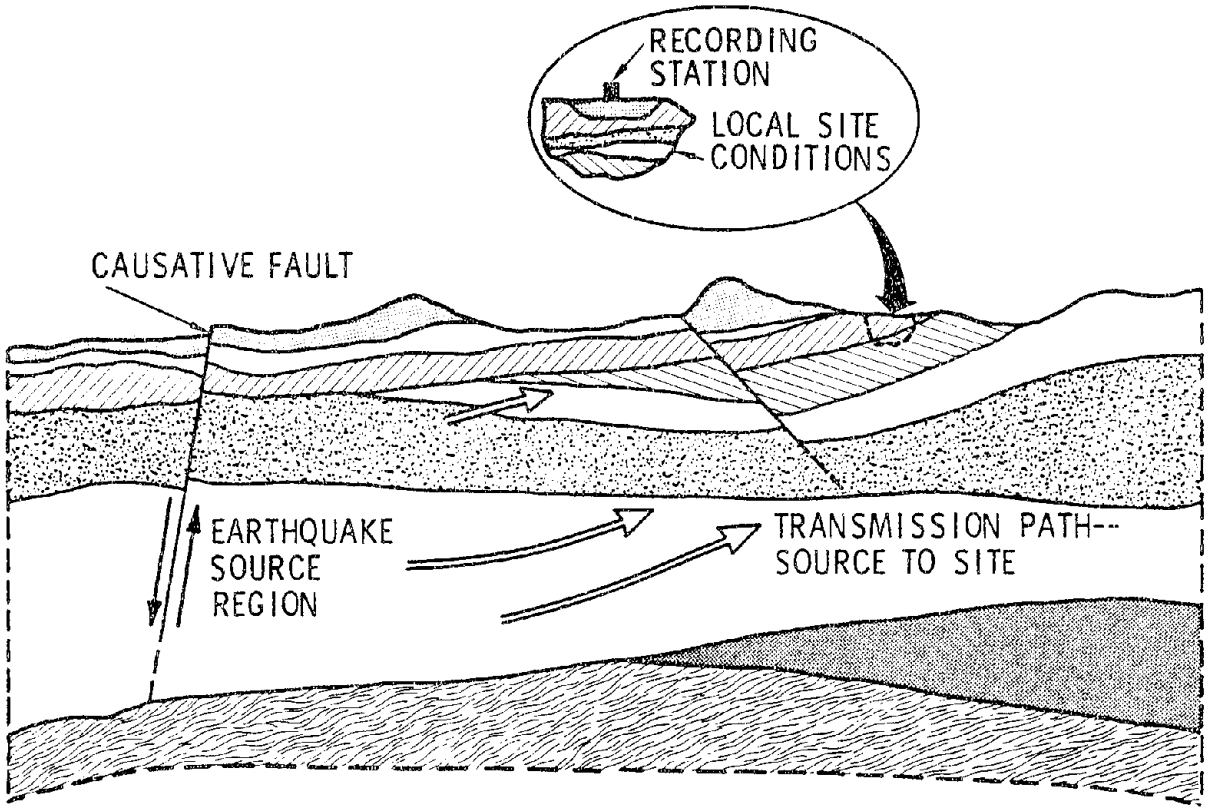


FIGURE 3-3. GENERATION AND TRANSMISSION OF SEISMIC WAVES
(Adapted from Ref. 31)

See Entry 889.

890. Shear Transfer in Thick Walled Reinforced Concrete Structures Under Seismic Loading, Final Report
Cornell University, Department of Structural Engineering
White RN, Gergely P
May 1978 248p ATA7303178
NSF/RA-780168 PB285970/NKS

The project had three major goals: (1) to understand the mechanism of cyclic shear stress transfer in cracked thick-walled reinforced concrete structures; (2) to incorporate mathematical models of the shear transfer mechanism into computer-based analysis methods for determining structural response to earthquakes; and (3) to provide experimental and analytical background material for formulation of improved design procedures that would result in better and less costly designs without sacrificing safety. Experiments on large specimens of cracked concrete were conducted. Various types of shear transfer were studied for a wide range of variables. It was found that the behavior of concrete and steel in the structure can be predicted with reasonable accuracy. A simplified model of this behavior is being completed. The computer-based analysis program gives reliable predictions of forces, stresses, overall deformations, and displacements of thick-walled concrete structures subjected to earthquake forces. From these studies, it is possible to rely upon some shear transfer capacity from the combination of normal vertical and horizontal steel and the inherent roughness of the crack surface in the concrete in reinforced containment vessels and similar structures. This saves reinforcing steel and permits a more rational design.

891. Delaying Shear Strength Decay in Reinforced Concrete Flexural Members Under Large Load Reversals
University of Michigan, Department of Civil Engineering
Scribner CF, Wight JK
May 1978 245p ENV7513900
NSF/RA-780170 PB286570/NKS

Eight half-size and four full-size T-shaped reinforced concrete exterior beam-column subassemblies were tested to determine the effect of intermediate longitudinal shear reinforcement on the hysteretic behavior of flexural members subjected to repeated reversed loading. Specimens were tested by applying a constant axial load to the fixed column portion of the specimen and applying a cyclic shear load to the beam. The beam typical loading history was chosen to simulate the distortion which might take place at a typical connection in a ductile moment-resisting frame during a severe earthquake. Several conclusions were drawn on the basis of test results. The repeatability of member hysteretic behavior was related to maximum beam

shear stress. Intermediate longitudinal shear reinforcement provided significant increases in member energy dissipation and repeatability of hysteretic response for beams with shear stresses between $3/\overline{f}'_c$ and $6/\overline{f}'_c$. Beams with shear stresses below this range performed satisfactorily without intermediate longitudinal shear reinforcement and beams with shear stresses higher than $6/\overline{f}'_c$ did not perform totally satisfactorily, regardless of the type of shear reinforcement used.

892. Structural Walls in Earthquake-Resistant Buildings, Dynamic Analysis of Isolated Structural Walls, Input Motions, Final Report
Portland Cement Association, Construction Technology Laboratories
Derecho AT, Fugelso LE, Fintel M
December 1977 59p ENV7414766
NSF/RA-780200 PB288028/NKS

A characterization of input motions for use in dynamic analysis is given in terms of intensity, duration, and frequency content. Different measures of intensity are examined. On the basis of this examination, spectrum intensity is selected as a good measure of ground motion intensity. A review of the work of other investigators shows that a 20-second duration of strong ground motion is generally adequate for determining maximum cumulative deformation estimates of maximum response quantities other than cumulative deformations. Estimates of maximum response may be obtained using 10 seconds of strong ground motion. Accelerograms are classified with respect to frequency content as "peaking" or "broad band," depending upon the character of the associated 5%-damped relative velocity response spectra.

893. Strength and Dynamic Characteristics of Mechanically Jointed Cast-Iron Water Pipelines (Grant Report No. 3A)
Weidlinger Associates
Kratky RG, Salvadori MG
June 1978 48p ENVP769838
NSF/RA-780224 PB285727/NKS

Elastic and dynamic characteristics of both mechanical joints with rubber gaskets and cast-iron pipes are discussed. The main characteristics for pipe failure are the ultimate tension force and the ultimate bending moment M_u. Practical observations confirm that other modes of failure seldom occur, although some compression failures have occurred. Bolt failure, ultimate gasket friction, the longitudinal elastic constant of gasket, longitudinal periods of pipe due to gasket elasticity, longitudinal periods of pipe due to pipe elasticity, the rotational constant of gasket, periods of rotational motion due to gasket, and periods

of vibration for vertical anti-symmetrical rotational modes of continuous elastic pipes are topics discussed. Some calculations are carried out as examples.

894. Strength and Dynamic Characteristics of Gasket-Jointed Concrete Water Pipelines (Grant Report No. 5)
Weidlinger Associates
Kratky RG, Salvadori MG
June 1978 291p ENVP769838
NSF/RA-780225 PB285728/NKS

This study extends to gasket-jointed concrete water-pipelines the information given in previous reports on cast-iron pipelines. Types of concrete pipe and their usage are included; however, prestressed concrete cylinder pipe and prestressed concrete embedded cylinder pipe are discussed in detail. Since only straight jointed pipelines are considered, the effects of major changes in the direction of the pipeline are ignored. A description of the actual performance of some existing concrete pipelines, including dates of installation and types of failure, is included. Some test data on pipes and joints are considered. The general design methods used by the manufacturing industry are illustrated by means of examples. A brief review of the recommendations on pipe design by the Bureau of Reclamation and the American Water Works Association is given. The authors briefly discuss some of the criteria concerning state-of-the-art design. More tests supported by Federal funds are recommended so that adequate design criteria for pipelines can be established.

895. Role of Corrosion in the Seismic Performance of Buried Steel Pipelines in Three United States Earthquakes (Grant Report No. 6)
Weidlinger Associates
Isenberg J
June 1978 85p ENVP769838
NSF/RA-780226 PB285725/NKS

This study considers the effects of corrosion on the seismic performance of underground water pipelines in three U.S. earthquakes: 1965 Puget Sound, Washington; 1969 Santa Rosa, California; and 1971 San Fernando, California. Seismic performance depends on soil conditions, intensity of ground shaking, surges in internal pressure, the diameter and wall thickness of the pipe, and the strengths of materials used in the pipe and its joints. The report concentrates on steel pipe damage in regions where the maximum ground displacements are of the order of 10 cm. Numerous leaks in the pipes were traced to local weaknesses caused by corrosion. Some evidence suggests that the likelihood of earthquake-induced leakage may be

estimated from leak rate under normal conditions; however, inadequate data in the three earthquakes studied do not permit correlation. The corrosion control programs used by the utilities whose earthquake experience is reported in the study are briefly discussed. They consist of wrapping and cathodic protection, and replacement of corroded pipe with non-corroding asbestos-cement pipe.

896. Seismic Analysis of Pipelines with Interference Response Spectra (Grant Report No. 7)
Weidlinger Associates
Weidlinger P, Nelson I
June 1978 70p ENVP769838
NSF/RA-780227 PB285726/NKS

Lifeline structures (bridges, tunnels, highways, and pipelines) that extend over long horizontal distances are affected by the non-coherent components of ground shaking. The response of interest is the relative displacement of adjacent points on the structure, instead of displacement relative to the ground. For this reason, the seismic analysis of lifelines requires techniques which are different from those used in the analysis of buildings. In this paper, the concept of the Interference Response Spectrum (IR Spectrum) is discussed. The IR Spectrum presents quantitatively and in a unified form the effects of the non-coherent free field on the dynamic response of lifeline structures. Derivations, properties and examples of IR spectra are given. Further investigations for using the IR Spectrum in seismic analysis are suggested.

897. Structural Walls in Earthquake-Resistant Buildings, Dynamic Analysis of Isolated Structural Walls, Representative Loading History, Final Report
Portland Cement Association, Construction Technology Laboratories
Derecho AT, Iqbal M, Ghosh SK, et al
August 1978 139p ENV7715333
NSF/RA-780255 PB287323/NKS

An analytical investigation attempts to estimate the maximum forces and deformations that can reasonably be expected in critical regions of structural walls subjected to strong ground motion. This document deals with the qualitative description of "a representative loading history" which can be used in testing isolated structural wall specimens under slowly reversing loads. One hundred and seventy rotational response histories, representing a broad range of parameter values, are examined. The representative loading history is described in terms of the magnitude of the largest rotational deformation

that can reasonably be expected in the hinging region of isolated walls, the total number of cycles of such large-amplitude deformations, and the sequence in which these large-amplitude deformations occur relative to deformations of lesser amplitude. Also considered are the forces (moments and shears) that can accompany these deformations. For the isolated walls considered in this study, the maximum number of large-amplitude cycles that can reasonably be expected for a 20-second duration of strong ground motion is six. A significant result is the fact that the first large-amplitude cycle of deformation can occur early in the response, with hardly any inelastic cycle preceding it.

898. Rational Approach to Damage Mitigation in Existing Structures Exposed to Earthquakes, Phase 1 Report
Earthquake Engineering Systems, Inc.
May 1978 95p AEN7719463
NSF/RA-780299 PB288365/NKS

This study examined the feasibility of developing a Rational Decision Analysis Methodology to be used by building owners and managers and by the financial and insurance industries in the evaluation of possible modification schemes for existing buildings exposed to a predicted earthquake. Available procedures to determine the expected earthquake hazard at a given site were studied, and a methodology to apply the results of these procedures to the decision-making process is presented. A procedure to calculate the damages to various components of a building due to different levels of ground shaking was developed. To provide flexibility for future development, the indirect damages related to events like fire and substructure failure and their respective probabilities were also included. A computer program, DAMSTAT, was developed to automate the calculation steps for this proposed methodology. A description, listing, and application of this computer program is presented. The usefulness of the methodology greatly depends on the ability to estimate the damages to a building due to a given earthquake intensity. Therefore, a method to generate damage matrices from historical damage data was developed to estimate the expected damage successfully. This method was applied to masonry buildings, and a number of damage statistics curves were generated for four classes of masonry buildings. Results of an extensive literature search, performed to gather information on the performance of the older masonry Type III low-rise building during previous seismic events, are reported.

899. Material and Dimensional Properties of an Eleven-Story Reinforced Concrete Building, Final Report
Washington University, School of Engineering and Applied Science
Gardiner RA, Hatcher DS
August 1978 107p ENV7608244
NSF/RA-780316 PB288891/NKS

Full-scale destructive testing of an eleven-story reinforced concrete structure was conducted. Objectives were to investigate the in-situ structural dimensions and material properties, to determine the dynamic characteristics of the structure by small amplitude shaking tests, and to observe the structural damage and the degradation of the dynamic characteristics due to large amplitude shaking tests. This investigation concerns only the study of the in-situ structural dimensions and material properties. The methods used in the determination of the strength of the materials in the structure and the results obtained thereby are reported. Included are both the yield and ultimate strength of the reinforcing steel and the compressive strength of the concrete. An enumeration is provided of the variations of the structural dimensions from their specified values and the manner in which these variations were determined. The effect of all the above variations on the flexural strength of representative sections of members in the structure is shown. Also included is a comparison of these results with the capacity reduction factors specified by the A.C.I. Code (318-77). Conclusions state that variations of dimensions and properties of the structure investigated are generally similar to those of other buildings, and that the average strength of the members exceeds the design strength.

900. System Identification, Damage Assessment and Reliability Evaluation of Structures (Technical Report No. CE-STR-78-1)
Purdue University, School of Civil Engineering
Ting EC, Hong Chen SJ, Yao JTP
February 1978 69p ENV7705290
NSF/RA-780325 PB288889/NKS

Available literature on the methods of structural identification, damage assessment, and reliability evaluation are reviewed and summarized and the possibility of combining those techniques into a rational procedure for practical implementation is discussed. The available literature has been presented in tabular form. System identification is a process for constructing a mathematical description or model of a physical system when both the input to the system and the corresponding output are known. For most of the current applications, the input is usually a forcing function and the output is the displacement or other motions of the structure subjected to the forces. The

mathematical model obtained from the identification process should produce a response that in some sense matches closely the system's output, when it is subjected to the same input. Several recommended procedures for inspection and safety assessment are reviewed and summarized. It is believed that further development and improvement are possible and desirable. The possible incorporation of system identification techniques into damage assessment is also discussed.

901. Shear Transfer Across Cracks in Reinforced Concrete (No. 78-4)
Cornell University, Department of Structural Engineering
Jimenez-Perez R, Gergely P, White RN
August 1978 375p 7623896
NSF/RA-780328 PB288885/NKS

An experimental and analytical investigation was conducted to assess the transfer of cyclic shear forces in cracked reinforced concrete by means of the interface shear transfer and dowel action mechanisms. Two test series evaluated the transfer of shear forces by the combination of the interface shear transfer and dowel action mechanisms, and the dowel action mechanism alone. The initial crack width and the reinforcement ratios provided at the shear plane, the number of loading cycles, and the cyclic shear stress intensity were the main variables studied using a test specimen modeled after an idealized section of the cracked structure. The average shear displacement, crack width, and reinforcement strains were measured in each specimen for all load increments. Simplified equations were developed to describe the first loading cycle stiffness exhibited by both the interface shear transfer and dowel action mechanism. A bilinear idealization was proposed for the experimental hysteresis curve of each mechanism together with the corresponding stiffness coefficients. Equations were derived from a nonlinear regression analysis for the splitting failure force for axial or dowel forces, and for their interaction. An equation was also proposed for the ultimate shear stress that can be transferred across a precracked shear plane. The research concluded that shear forces can be efficiently transferred across cracked surfaces by the combined action of the interface shear transfer and dowel action mechanisms.

Siting

902. Research Needs and Priorities for Geotechnical Earthquake Engineering Applications, Workshop (June 1977, University of Texas at Austin)
University of Texas at Austin
Lee KL, Marcuson WF III, Stokoe KH II, et al
1978 150p AEN7709861
NSF/RA-780223 PB286142/NKS

The workshop was held to discuss research needs and priorities in geotechnical earthquake engineering. Group discussions involved the following topics: (1) dynamic soil properties and measurement techniques in the laboratory; (2) dynamic soil properties and measurement techniques in the field; (3) analytical procedures and mathematical modeling; (4) design earthquakes, ground motion, and surface faulting; (5) assessment of seismic stability of soil; (6) soil structure interaction; and (7) experimental modeling and simulation. The workshop recommended that applied research be carried out to improve understanding of basic fundamentals, improve design methods; evaluate and verify the design procedures, and transfer technology.

903. In-Situ Soil Investigation System, Final Report (1249-2)
ANCO Engineers, Inc.
September 1978 139p AEN7719653
NSF/RA-780310 PB288348/NKS

An analytical and experimental technique to determine subsurface soil parameters in-situ is evaluated. The experimental and modeling aspects were successfully carried out. The theoretical basis for the parameter estimation technique was presented and implemented in a computer code. The unreconcilable differences between the model and experimental response prevented the combined use of these different aspects. The work to date indicates that the approach is feasible and that further work to resolve the difficulties encountered in this study is warranted. Errors for which the model may be responsible are outlined. Features to be included in future tests and studies are noted.

904. Mycotoxins as a Potential Human Health Hazard, Final Report
SISA, Inc.; Massachusetts Institute of Technology
Ghosh AC, Demain AL, Townsend JM, et al
April 1978 72p AEN7719655
NSF/RA-780052 PB286976/NKS

Research is reported in the development of a methodology for the detection and estimation of toxins elaborated by molds frequently encountered as contaminants in soybeans, rice, wheat, chocolate syrup, cheese, flour, and animal feedstock. Thirty-five fermentation experiments using twelve penicillia and thermophilic fungi and five experiments with P. islandicum Sopp were carried out. Two potent toxins, cyclochlorotine and simatoxin, were isolated from the crude fermentation products. The detection limit of the thin layer chromatographic technique for the detection of pure cyclochlorotine was found to be approximately 1 part per million. Simatoxin and lumi-luteoskyrin, the photoproduct of luteoskyrin, showed considerable mutagenic activity against Salmonella typhimurium. The possibility that the carcinogenic activity previously ascribed to luteoskyrin and cyclochlorotine could in fact be due to the presence of lumi-luteoskyrin and simatoxin, respectively, as impurities, is noted.

905. Management of Wastewater Residuals With Iron (VI) Ferrate, (First Annual Report, March 1, 1977 - February 28, 1978)
Northwestern University, Department of Civil Engineering
Waite TD
February 1978 215p ENV7683897
NSF/RA-780079 PB288565/NKS

Environmental constraints on the use of chlorine for wastewater disinfection has increased the need for alternative treatment chemicals. It has become apparent that chlorine treatment may introduce toxic, soluble chlorinated organics into the waste stream. Recent work with iron (VI) ferrate has been undertaken to evaluate its potential as a substitute for chlorine in wastewater treatment processes. Due to the ability of iron to act as a coagulant and nutrient scavenger, as well as an oxidant, it holds promise of being a multipurpose additive. The capacity of ferrate to treat secondary and primary sewage-treatment effluents and its germicidal effectiveness in secondary effluents and raw sewage are discussed. The effectiveness of ferrate as a disinfectant against enteric pathogens, particularly salmonella typhimurium, shigella flexneri, E. coli, and streptoccus faecalis and the optimal concentrations of ferrate needed to produce rapid die-off of these bacteria are examined.

A discussion of the effects of pH on disinfection kinetics, the effects of temperature, suspended solids, and the role of dissolved organic matter are also included.

906. Virus Survival in Soils Injected with Municipal Wastewater Treatment Residuals, Final Report
University of Texas at San Antonio, Center for Applied Research and Technology
Sagik BP
June 1978 523p AEN7504513
NSF/RA-780139 PB286029/NKS

A study was made to determine possible viral contamination of the environment resulting from domestic sludge injection into soils. Specific goals were: determination of virus levels in certain treatment plant sludges; determination of sludge virus levels at the time of injection into soils; concentration from soil and enumeration of viruses at varying periods after sludge injection; quantification of survival of polioviruses, coliphages, and fecal coliforms in soil; and studying in the laboratory of viral movement through soils. Using sludges from treatment plants in Boulder, Colorado, and Butte, Montana, it was found that the level of enteric viruses (pfu/mg TSS on Hela) was as high as four pfu/mg of primary sludge and 2000 pfu/mg TSS of coliphage. Soil analyses yielded confirmed enteric virus isolates at Butte (where thickened primary sludge had been injected) and at Boulder (where anaerobically digested thickened sludges were injected). Among the identified isolates were Poliovirus II and Coxsackie B-3. These recoveries were made more than six months after injection. Included in this report are four relevant theses: (1) "Land Applications of Sludges: Minimizing the Impact of Viruses on Water Resources"; (2) "The Fate of Solids--Incorporated Poliovirus During Continuous, High-Rate Anaerobic, and Aerobic Digestion"; (3) "Poliovirus Survival and Movement in Soils Following Application of Wastewater Effluent"; and (4) "Chemical Sludge Disinfection."

907. Fundamental Research Needs for Water and Wastewater Treatment Systems (Proceedings of a Conference, Arlington, Virginia, December 15, 1977)
Association of Environmental Engineering Professors
Andrews JF, Keinath TM, Sherrard JH
February 1978 108p
NSF/RA-780234 PB286136/NKS

The conference was organized to direct the attention of those in government, in academia, and in the private sector to the need for increased efforts in long-term fundamental research on water and wastewater treatment systems in order to reverse

the trend toward short-term immediate application research. The conference objectives were to provide a forum and focal point for the exchange of information on fundamental research needs between the academic community, users of research, and granting agencies; to define and establish priorities for these research needs; to disseminate the conference proceedings for the purpose of stimulating research in high priority areas; and to discuss methods designed to improve the quality of the nation's water resources. Topics covered were: (1) research needs as seen by a municipal water department, an industrial user of technology, an industrial user of research, and a consulting engineer; (2) research needs in water treatment (microbial, viral, and organic compound), particles and pollution; (3) research needs in wastewater treatment for biological processes, physicochemical processes, dynamics and control of wastewater treatment plants; (4) research needs for evaluating the interactions of treatment plants with aqueous systems; and (5) research needs for evaluating the interactions of treatment plants with ultimate sludge disposal systems.

908. Regionalization of Wastewater Collection and Treatment Location, Scale and Construction Sequence of System Components, Final Report
University of North Carolina at Chapel Hill, School of Public Health
Lauria DT
1978 76p ENV7601135
NSF/RA-780248 PB287092/NKS

A mixed integer programming model was developed for the analysis of alternatives concerning extensive regional wastewater planning. Application to a typical problem in Pennsylvania involved about 1,000 variables and 1,000 constraints. The model was found to be difficult and expensive to solve, requiring extensive expertise in mathematical programming. Research reported was intended to: (1) make the objective function of the previous model conform more closely to the EPA's planning guidelines; (2) reduce problem set-up time; (3) improve the solution strategy; and (4) demonstrate applicability to real problems. Work was done to take account of such things as treatment process upgrading, useful economic life of existing facilities, salvage values, inflation, O & M, and replacement costs. In order to shorten problem set-up time, a matrix generation program was written that reduces the input data deck for a typical problem from 3,000 to 300 cards. The solution strategy employed relies on linear instead of mixed integer programming. Using engineering judgment or the results of screening runs with the computer, the user must select alternative times and places for construction. Numerous alternatives can be investigated in a few man-days, each solution requiring

between 1 and 2 minutes, CPU time. The model was applied to three ongoing "201" studies with the cooperation of two different firms of consulting engineers to demonstrate its applicability.

909. Mechanism of Plant Virus Inactivation in Soil Injected with Municipal Wastewater and Treatment Plant Sludges (Interim Report, December 1977 - June 1978)
Los Angeles State and County Arboretum, Research Division
Cheo PC
1978 34p ENV7682743
NSF/RA-780251 PB287012/NKS

The fact that microbiological factors can degrade Tobacco Mosaic Virus (TMV) in a soil environment has been established by laboratory experiments. Biological assay of isolates from soil using the autoclaved soil vial system has indicated that the majority of bacteria isolates do not show any activity. Several isolates, however, show a positive response in such a complex and noncriterion system. An alternate medium for the bacteria-TMV interaction assay system is presently being developed. Glass beads in the size range of 0.2 mm and 0.11 mm in diameter, and silica sand, 30 and 60 mesh, are being tested as possible replacement for the autoclaved soil-vial system. Preliminary data indicate that the biological factor in soil responsible for TMV degradation can be determined using the glass beads system. The data from the field plot experiment are still being analyzed; however, the early data indicate that a rapid disappearance of TMV in surface soil occurred. TMV is readily leached and may aggregate in lower layers of the soil when insufficient water is present to leach it on through the soil profile. In deeper soil horizons, TMV tends to be more stable due to poor aeration and possibly less microbiological activity.

910. Controlled Soil Microbial Detoxification of 2, 4-D Herbicide Manufacturing Residue, Phase 1
George D Ward and Associates
1978 99p ENV7719832
NSF/RA-780252 PB287408/NKS

This study investigated the feasibility of achieving bacteriological detoxification of herbicide and pesticide manufacturing residues through the action of naturally occurring soil microorganisms under controlled soil conditions. Municipal sewage sludge was used as a nutrient source and stimulant for growth and basic support of the soil microorganisms capable of using herbicide and pesticide residues as a food source for carbon. The basic toxic waste material investigated was Trichlorophenol, distilled from 2, 4-D manufacturing residue (tars). Both aerobic

and anaerobic soil test samples were incubated in a greenhouse with loadings of TCP at 100 ppm and 1,000 ppm. Soil samples were taken once a week over a two-month period and then analyzed to determine the rate of TCP degradation. For the conditions examined, it was found that naturally occurring soil microorganisms do have the capability of bacteriological degradation of Trichlorophenol in a microbial process that appears to be potentially continuous as well as safe.

911. Virus Survival in Soils Injected with Municipal Wastewater Treatment Residuals, Executive Summary of Final Report (No. 78-7)
University of Texas at San Antonio, Center for Applied Research and Technology
Sagik BP
June 1978 24p AEN7504513
NSF/RA-780266 PB287215/NKS

The primary objective of this program was to determine possible viral contamination of the environment resulting from domestic sludge injection into soils. Specific goals were: (1) determination of virus levels in specific treatment plant sludges; (2) determination of sludge virus levels at the time of injection into soils; (3) concentration from soil and enumeration of viruses at varying periods after sludge injection; (4) quantification of survival of polioviruses, coliphages, and fecal coliforms in soil; and (5) studying viral movement through soils. In laboratory studies, it was shown that viruses incorporated in sludge were recovered from soil column percolates at significantly lower levels than were viruses added in effluents (1 percent compared to 19-47 percent recovery with effluent application). These results suggest that sludge-associated viruses may be retained effectively within the sludge-soil matrix. Whether this matrix serves as a reservoir is not known. Sludge disinfection studies with sodium hypochlorite and lime were initiated using total coliforms, fecal coliforms, fecal streptococci and acid-free microorganisms as monitoring aids. Acid-fast bacteria were the most marked in their resistance to chemical disinfection.

912. Land Management of Subsurface Injected Wastewater Liquid Residuals (Final Report, May 1, 1974 - February 27, 1978)
Colorado State University, Department of Agricultural and Chemical Engineering
Smith JL
August 1978 44p ENV771151
NSF/RA-780269 PB287090/NKS

Concern over environmental pollution has initiated research to improve waste disposal systems. Project objectives and major accomplishments in the development of a subsurface injection

system for the recycling of wastewater residuals are outlined. A utilization program is presented as an integral part of the research during the project. More detailed research reports have been published in a series of technical articles listed in the report. The new system, commercially available, requires proper site design, monitoring, and management. A simple mass balance approach is recommended for predicting the change in concentration of contaminants in the soils and groundwater at an application site. Using selected data, the predicted change in concentration compared favorably with measured values. In a proposed experiment, technologies developed from this program would be combined to provide an economically and environmentally sound treatment system.

Alternative Biological Sources of Materials

913. Enhancing Biological Production of Ammonia from Atmospheric Nitrogen and Soil Nitrate, Annual Report
University of California at Davis
Lyons JM, Valentine RC, Phillips DA, et al
June 1978 69p AER7707301
NSF/RA-780161 PB286515/NKS

This report contains five significant contributions to an understanding of the genetic control of N_2 fixation and photosynthesis: (1) an estimate of the energy cost to Rhizobium for fixing N_2 obtained by using genetically altered free-living cultures of N_2-fixing bacteria; (2) the first report of regulation of an enzyme system (hydrogenase) which takes up H_2 in free-living, N_2-fixing Rhizobium; (3) the first report of catalytic mutants in ribulose bisphosphate carboxylase, the primary enzyme responsible for photosynthetic CO_2 reduction; (4) the first report of a soybean plant which continues to photosynthesize and to fix N_2 during and after seed pod development; and (5) the first report of genetically altering the host specificity of Rhizobium bacteria. New data are reported which emphasize the interaction between photosynthesis and N_2 fixation. Another section outlines the advances made toward development of an agronomically sound management plan which uses ammonia, symbiotically fixed by the water fern Azolla-blue-green algae, to grow rice.

914. Chemical Synthesis and Biological Applications of Nucleic Acids to Nitrogen Fixation (Semi-Annual Progress Report No. 2, January 6, 1978 - July 15, 1978)
Collaborative Research, Inc.
July 1978 18p AER7710195
NSF/RA-780165 PB286968/NKS

The purpose of this research is the development of new and improved methods for the chemical synthesis of oligodeoxyribonucleotides and their application to gene transfer studies involving biological nitrogen fixation. The use of the pivaloyl group for the protection of the amino group of guanine is described and compared to the previously used isobutyryl group. The use of the t-butyldimethylsilyl group in the preparation of N-acylated monomers and as a protecting group for the 3' and 5' hydroxyl function is also examined. These techniques were applied to the scaled up synthesis of protected monomers. A description of the use of the methyl group for the protection of the 3'-5' phosphodiester link is presented, as is a discussion of further investigations of a new chain elongation procedure involving the use of phosphites. The initial studies covering solid phase support and plans to increase overall efficiency by use of chain elongation reactions on a solid phase support are included.

915. Assessment of Free-Living Nitrogen Fixing Microorganisms for Commercial Nitrogen Fixation
California Institute of Technology, Jet Propulsion Laboratory
Stokes BO, Wallace CJ
August 1978 155p AER7609093
NSF/RA-780166 PB286049/NKS

Ammonia production by Klebsiella pneumoniae is not economical with present strains, and improving nitrogen fixation to its theoretical limits in this organism is not sufficient to achieve economic viability. Contamination and reversion of the mutant are major technical problems leading to sterilization requirements which are economically prohibitive. Since both the value of the hydrogen produced by this organism and the methane value of the carbon source required greatly exceed the value of the ammonia formed, ammonia (fixed nitrogen) should be considered the by-product, and attention should be focused on other products. The value of hydrogen produced by Klebsiella greatly exceeds the value of the nitrogen fixed and the activity of nitrogenase offers a significant improvement in hydrogen production. The production of fixed nitrogen in the form of cell mass by Azotobacter is also uneconomical and the methane value of the carbon substrate exceeds the value of the nitrogen fixed. Parametric studies indicate that as efficiencies approach the theoretical limits, the economics may become competitive under

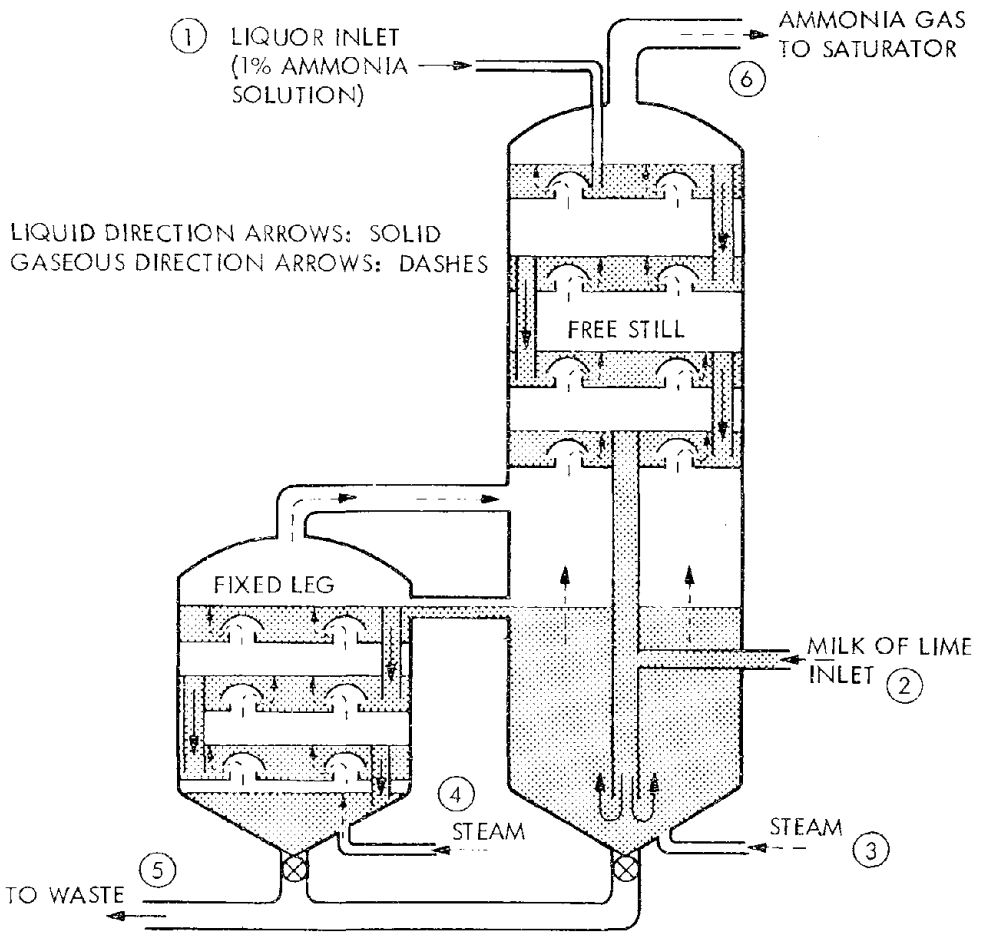


Figure 9. Diagram of Ammonia Still

See Entry 915.

the assumptions of the economic model employed. The use of nif-derepressed microorganisms, particularly blue-green algae, may have significant potential for in-situ fertilization in the environment.

916. Assessment of a Semi-Closed, Renewable Resource-Based Aquaculture System, Six-Month Progress Report
New Alchemy Institute
Todd J
May 1978 94p ERS7716790
NSF/RA-780189 PB287286/NKS

This report combines theoretical studies on the nature of solar-driven, semi-closed aquatic ecosystems and their practical application for the culture of fishes. Solar and bio-technologies developed for raising fish cheaply, productively, and on predominantly indigenous and low-quality feeds are being evaluated. Underlying the above is a research program to elucidate and model the biological enrichment process within the test facilities and their susceptibility to variations in solar and thermal conditions. The responses of the aquaculture facilities to high population densities, heavy feeding, the build-up of indigenous toxic metabolites and natural oscillations in light and thermal conditions are being monitored and modeled to determine the factors which limit solar-based aquaculture.

917. Power Plant Waste Heat Utilization in Aquaculture (Second Semi-Annual Report, November 1, 1977 - June 1, 1978)
Public Service Electric and Gas Company, Research and Development Department
Guerra CT, Godfriaux BL, Eble AF, et al
June 1978 181p ENV7619854
NSF/RA-780270 PB287373/NKS

The principal objective is to evaluate, at proof-of-concept scale, the potential of intensive aquaculture operations using power plant thermal discharges to enhance productivity. The field experiments involve the rearing of rainbow trout (Salmo gairdneri), channel catfish (Ictalurus punctatus), and American eel (Anguilla rostrata) for successive periods (semi-annual) in accordance with the temperature of the thermal effluents. Striped bass (Morone saxatilis) and freshwater shrimp (Macrobrachium rosenbergii) are also being tested in smaller, laboratory size culture systems. It is expected that the aquaculture experimentation will furnish data with the reliability necessary for engineering and economic assessments to help decide whether this technology can be commercially applied in the near term. The above-mentioned species were selected because of their economic importance. They will be evaluated

for food quality and marketability with the cooperation of potential commercial users. Aquaculture facilities were constructed at a steam electric generating plant for studies determining use for waste heat released into condenser cooling water. Growth rates, food conversion ratios, disease problems, and mortality rates are being studied in the project.

918. Photoproduction of Hydrogen by Marine Blue-Green Algae (Annual Progress Report, December 15, 1977 - June 15, 1978)
University of Miami, School of Marine and Atmospheric Science
Mitsui A
1978 71p AER7711545
NSF/RA-780272 PB287508/NKS

Addressed is the biological and biochemical photoproduction of hydrogen for use as an alternate fuel. Earlier investigations found an organism which exhibits exceptionally high hydrogen producing capabilities in the form of a blue-green algal strain, Miami BG7. Further studies were performed to reveal the mechanisms of hydrogen production in this strain and to determine whether the efficiency of hydrogen production can attain levels required for applied projects. Emphasis in research shifted from the study of metabolic inhibitors of hydrogen production to a study of the enzyme systems which catalyze hydrogen production. In Phase I it was discovered that hydrogen evolution by Miami BG7 involves the participation of both hydrogenase and nitrogenase, with the latter appearing as the major contributor of the hydrogen production. However, Miami BG7 does not appear to exhibit hydrogenase activity. Phase II was based on the environmental regulation and enhancement of hydrogen photoproduction by Miami BG7. The effects of light intensity, temperature, and pH were tested, and optimum conditions for hydrogen photoproduction were determined. It was found that the regulation of specific environmental parameters could lead to marked changes in the quantum efficiency of hydrogen production. For purposes of reference, a brief background review and discussion of hydrogen photoproduction is given with the author's approach to hydrogen production research.

919. Nitrogen Fixation with Photosynthetic Marine Microorganisms (Eighteen Months Progress Report, February 15, 1978 - July 3, 1978)
University of Miami, School of Marine and Atmospheric Science
Mitsui A
1978 51p AER7617159
NSF/RA-780273 PB287590/NKS

When primary production is coupled with biological nitrogen fixation in the marine environment, the need for nitrogenous

fertilizers and fresh water is virtually eliminated. This research is an attempt to develop a system for the mass culturing of nitrogen-fixing marine photosynthetic microorganisms that could be applicable to food and fertilizer production. The system should be capable of providing food without the use of combined nitrogen, but with solar radiation as the principle source of energy and salt water as the base for these organisms. A 3-year work plan, divided into 5 steps, was implemented to achieve these goals. A variety of organisms were collected and cultured under varying conditions, and some isolations of N-fixing organisms have taken place. Studies of algal strains indicate that there are blue-green algae available for culturing under nitrogen-free conditions in a wide range of salt water environments, and some of these strains show definite potential applications as food or food additives. Aquaculture studies, using invertebrates as test animals, were initiated and toxicity tests were performed using bioassays and blood hemolysis techniques.

920. Enhancement of Municipal Ferrous Waste Recycling Through Direct Foundry Application, 1978 Technical Report
George Washington University, School of Engineering and Applied Science
Gilmore CM, Purcell AH, Imam MA, et al
December 1978 24p AER7682249
NSF/RA-790001 PB294003/NKS

Charges of magnetically separated municipal ferrous waste (MFW) have been fed directly into a crucible foundry furnace mixed with varying fractions of stock and scrap cast iron. Mechanical testing of cast specimens with up to 50 weight percent MFW has revealed sound structures with strengths equal to those of standard cast specimens composed wholly of normal material. The recycled material from this experimental process appears to be useful for many cast iron applications. This research was performed at a working foundry using separated ferrous scrap from the National Center for Resource Recovery facility in Anacostia. The simplicity of the technology involved and its direct compatibility with established materials handling facilities indicate that such technology could be applied on small or large scales in a variety of waste recycling environments.

921. Remote Employment of the Physically Handicapped
Multisystems, Inc.
May 1978 110p
NSF/RA-780199 PB285614/NKS

This report investigates the overall feasibility of employing physically handicapped people in their homes. The concept of home employment of the handicapped is an attempt to solve an often-cited and long-recognized societal problem in significant new ways using telecommunications. The handicapped employee would have a computer terminal at home which would be used to perform work on a computer located at the employer's place of business or elsewhere. Ordinary telephone lines can be used for data telecommunications. Through telecommunications, large numbers of permanently and temporarily disabled people could be employed. Existing computer technology is adequate to support this type of employment and is available at reasonable cost. An analysis of costs and benefits of the technology is given, and problems with remote employment are discussed.

DIVISION OF INTERGOVERNMENTAL SCIENCE AND PUBLIC TECHNOLOGY

Intergovernmental Program

Local Government

922. Personnel Management and Productivity in City Government
Georgetown University, Public Services Laboratory
Mushkin SJ, Sandifer FH
March 1978 244p APR7608199
NSF/RA-780051 PB288309/NKS

A joint study on personnel management was undertaken by the Public Services Laboratory, the National League of Cities, and the U.S. Conference of Mayors. The eight cities selected for participation and study were: Dayton, Ohio; Lakewood, Colorado; Nashville-Davidson, Tennessee; St. Paul, Minnesota; Savannah, Georgia; Scottsdale, Arizona; Tacoma, Washington; and Worcester, Massachusetts. Selection criteria included size, geographic location, and experience in productivity measurement or improvement. The study focused on convergence of productivity in government through improved personnel management, and personnel management as a component of government management. The study was designed to emphasize the interrelationship of processes of personnel management as a part of city management and personnel aspects of program effectiveness. The study aimed to formulate objectives of personnel management, develop assessment criteria, and survey the relationship of personnel management to productivity.

State Government

923. Innovations
Council of State Governments
1978 74p ISP7716111
NSF/RA-780214SET PB286637/NKS

Eight issues relating to innovation in state government are addressed: (1) health cost containment efforts as experienced in Connecticut, New Jersey, Maryland, Rhode Island, and Washington; (2) Minnesota's management plan; (3) New York

Public Service Commission's use of management audit studies in connection with regulation of utilities; (4) Georgia's indirect cost allocation experiment in connection with recovering from the Federal Government expenditures in the delivery of social welfare programs; (5) the New Jersey qualified bond program of state assistance to local government bonding efforts; (6) Florida's systematic development of a structured volunteer force, averaging 7,000 volunteers per month, through its Department of Health and Rehabilitative Services; (7) the management assessment center as a method of selecting the best qualified individuals for senior state government management positions as experienced in Michigan and Illinois; and (8) Kentucky's approach to centralizing state information services.

924. Planning the Texas Innovation Group (Planning Phase Report, March 1, 1977 - April 30, 1978)
Texas A and M University, Center for Urban Programs
Moore CD, Thomas RE
June 1978 100p ISP7680722
NSF/RA-780291 PB288001/NKS

Texas A&M University and local government officials developed a statewide Texas Innovation Group (TIG) for the purpose of making the scientific and technological resources of universities and other private and public agencies available to cities throughout the state. This final report concentrates on process development of the TIG's approach to serving these cities. Steps were taken to establish three regional committees, form a Statewide Policy Advisory Committee, develop plans for the TIG, and test the developed and planned mechanisms in three regions. A Q-sort instrument, Assistance Solitaire, capable of returning a tremendous amount of information for a small cost in time and money, was developed to identify priority needs. Plans were also developed to secure funding for the development phase of TIG. Thirty-six Texas municipalities worked to test innovation transfer processes and methods for inclusion in TIG plans. Part I of the report summarizes results of TIG work to date. Agencies and city governments are listed with a brief description of their participation in TIG planning as well as methods tested for inclusion in the plans. Part 2 discusses background and contemporary situations influencing TIG planning and development. Planning tasks, results, and the actual TIG plans are included in Parts 3 and 4.

Science and Technology Resources

925. Assessment of Science and Technology in State Legislatures
National Conference of State Legislatures, Office of Science and Technology
Mack J
July 1978 46p
NSF/RA-780256 PB285785/NKS

A workshop was convened to study state legislative capacity for handling the scientific and technical aspects of policy issues. Types of legislative science and technology staff and the functions of such staff within existing legislative structures are defined. Outside assistance sources are explored, and recommendations for Federal action to encourage state science and technology capacity building are made. All Federal agencies supporting policy development on the state executive level should be required to fund an equal level of support for such activities by the corresponding state legislative branches. State legislatures should promote the development of internal capabilities to define their S&T problems and to form stable links with outside resources. Outside providers of S&T information should be encouraged to develop internal liaison capabilities and to follow legislative information. The effectiveness of scientific staff should not be measured by products, but by institutionalization of their function. If state legislatures are to deal with the problems of the present and future, they must develop the capacity to analyze and act upon scientific and technical issues.

926. Increasing the Capacity of State Governments to Access and Use Scientific, Engineering, and Technical Resources, a Continuing Assessment of the Study Phase of the National Science Foundation's State Science, Engineering, and Technology Program
SRI International
Gollub JO, King JR, Malek R, et al
January 1979 136p
NSF/RA-790014 PB290697/NKS

This program was authorized by Congress to assist state governments in conducting studies in order to establish or improve state policy management capacities for assessing and using scientific and technical resources. Major findings conclude that: (1) response to the State Science, Engineering, and Technology (SSET) Program announcement by both executive and legislative branches of state governments exceeded expectations; (2) the strong interest by both branches of government in most states in incorporating scientific and technical information and expertise into the state policy management process was demonstrated

by the heavy involvement of key policymakers in the study phase; (3) the commitment of state government officials was shown by their attempt to use the study phase to identify appropriate approaches for incorporating scientific and technical expertise in their policymaking process; (4) the organization of a group of elected and appointed officials who understand the need for improving use and access of scientific and technical resources has come into being nationwide; (5) the draft final report submitted by projects demonstrates a credible analysis of complex issues within a policy relevant focus; and (6) SSET planning has played a significant role in initiating and accelerating dialogue about roles and relationships between science and technology performers and users in state government.

927. Developing Access to Science, Engineering, and Technology Resources for the General Assembly of North Carolina, Final Report
North Carolina Legislative Services Commission
January 1979 62p SP7802509
NSF/RA-790024 PB294006/NKS

Three areas of activity concluded for this project include an examination and identification of science/engineering/technology issues encountered by past sessions of the General Assembly, projections of future science/engineering/technology issues, and an inventory of science/engineering/technology resources available to the State of North Carolina. In order to enhance the selection of a model for use by the North Carolina General Assembly, the project staff examined operating programs in other states which utilized various approaches to providing science/engineering/technology information for legislators. It was decided that North Carolina might be best served by a model which would constitute a hybrid of the professional staff model and the intern staff model. This approach would allow the threshold institutionalization of the science/engineering/technology concept into the North Carolina General Assembly's research system capacity and at the same time would only require a modest economic investment and organizational structure change. Because the Legislative Services Office in North Carolina has no partisan commitments, the professional staff would likewise be nonpartisan in perspective. Activities of this staff are described.

RESEARCH REPORTS FROM PREVIOUSLY SUPPORTED

RESEARCH APPLICATIONS PROGRAMS

Energy Systems

928. Applied Research on Energy Storage and Conversion for Photovoltaic and Wind Energy Systems, Study Summary and Concept Screening, Final Report, Volume 1
General Electric Company, Valley Forge Space Center
Johnson AW, Buerger EJ, Fogaroli R, et al
January 1978 220p
NSF/RA-780136 HCPT22221011

Volume 1 summarizes the investigations performed and presents the results, conclusions, and recommendations pertaining to the use of energy storage with photovoltaic and/or wind energy conversion systems in both dedicated and utility system/multiple-source charging modes. Part A describes utility, residential, and intermediate applications and utility system analyses for both photovoltaic energy storage and wind energy storage assessments. Part B is mainly a review of eleven candidate energy storage concepts, and of these it was concluded that battery storage is the most universally attractive method for near term (1985) use at all application levels. A table presents, in summary form, the key characteristics of the storage units examined in terms of their relative technical desirability for use with photovoltaic and wind conversion systems. Because future use of energy storage is heavily dependent on achievement of projected cost goals, it was suggested that continued development effort of longer term candidate concepts should not be ruled out. Approximate cost goals, based on 1976 dollars, are given for utility, residential, and intermediate systems. Areas for further research and development investigations are identified and discussed in regard to applications and storage technology. A system cost methodology is included.

929. Applied Research on Energy Storage and Conversion for Photovoltaic and Wind Energy Systems, Photovoltaic Systems with Energy Storage, Final Report, Volume 2
General Electric Company, Valley Forge Space Center
Johnson AW, Buerger EJ, Fogaroli R, et al
January 1978 322p
NSF/RA-780137 HCPT22221012

Volumes 2 and 3 provide a description of study methodology, procedures, analyses, and results associated with the use of energy storage in conjunction with photoelectric systems. Those energy storage technologies best suited for use with a photovoltaic (PV) energy conversion system are evaluated with respect to utility, residential, and intermediate applications. Break even costs goals, developed for several storage technologies in each application, are compared with cost projections

presented in Volume 1 of this report to show technologies and time frames of potential economic viability. Three basic PV system sizes are included in the study. Results are based on climatic data from three widely separated locations representing conditions in coastal, mountain, and plains areas of the U.S. The overall findings and general conclusions are summarized briefly. More detailed findings related to the specific study baseline conditions and assumptions are presented throughout the report. Because of the interaction of basic parameters involved in actually applying PV systems and energy storage, the overall study results provide general guidance which should be supplemented by detailed investigations for any specific system design proposed.

930. Applied Research on Energy Storage and Conversion for Photovoltaic and Wind Energy Storage, Wind Energy Systems With Energy Storage, Final Report, Volume 3
General Electric Company, Valley Forge Space Center
Johnson AW, Buerger ET, Fogaroli R, et al
January 1978 324p
NSF/RA-780138 HCPT22221013

See entry 929 for abstract.

Exploratory Research and Technology Assessment

931. Use of Structural Modeling for Technology Assessment, Volume 1
Portland State University
Linstone HA
February 1978 175p ERS7621040
NSF/RA-780236 PB285997/NKS

This two-volume report attempts to bridge the gap between modeler and technology assessor in the area of structural modeling (SM) by clarifying the role of structural modeling in technology assessment. The tasks necessary for a technology assessment are: technology description and projections, impact analysis, and policy analysis. A structural model is defined as a model which represents a system as a set of elements with pairwise relations linking some or all of the elements, and is graphically represented. A survey of structural modeling literature identifies methods which might be classified as structural modeling techniques and seem potentially useful in technology assessment. Seven computer-oriented tools are tested in considerable detail. Three other important approaches which may or may not be included formally in structural modeling are also studied: tools to aid in generating elements, a misfit variable

concept (SOPA), and cross-impact analysis. Most of these tools and approaches are applied in Volume Two. Finally, the report clarifies the human role in structural modeling, stressing that much effective analysis can be executed without computer assistance by applying the tool techniques.

932. Use of Structural Modeling for Technology Assessment, Volume 2
Portland State University
Linstone HA
February 1978 448p ERS7621040
NSF/RA-780237 PB285998/NKS

See entry 931 for abstract.

933. Large Cargo Aircraft, A Technology Assessment, Final Report, Volume 1
Gellman Research Associates, Inc.
January 1978 349p ERS7680328
NSF/RA-780240 PB286896/NKS

This study provides a preliminary comprehensive technology assessment of a future transportation technology, a large cargo aircraft (LCA), described as having the same capacity as two dedicated Boeing 747 freighters. The study begins with the assumption that the large cargo aircraft has been introduced into service during the 1990 to 2000 time frame. Volume 1 describes the technology and attendant economics. The methodology and the basic assumptions employed in the conduct of the study and theoretical basis for the causal model are presented. The differences between the effects which emanate from the operation of the large cargo aircraft and from its function, are indicated. The future state of the world economy is examined. The causal model and the generic effects are presented. Tables, figures, and matrices are included to illustrate areas of impact. Since the impact of the LCA is expected to be greater in the lesser developed countries, at least one nation was selected as a case study from each major region of developing nations. In Volume 2, case studies on Brazil, Zaire, South Africa, Thailand, and Malaysia are presented.

934. Large Cargo Aircraft, A Technology Assessment, Final Report, Volume 2
Gellman Research Associates, Inc.
January 1978 298p ERS7680328
NSF/RA-780241 PB286897/NKS

See entry 933 for abstract.

935. Appropriate Technology, Workshop, Final Report and Proceedings (January 23-25, 1978)
Design Alternatives, Inc
1979 349p ERS7721824
NSF/RA-790002 PB294030/NKS

The workshop on appropriate technology examined and documented locally focused issues in the field, and made recommendations for a research agenda and program guidelines to be considered in planning a research program. Appropriate technology, defined as a socio-technical process which encompasses technology design, assessment, and use, seeks to optimize solutions wherever possible, through reliance on local problem-solving capabilities as well as by creating a sensitivity to environmental and cultural impacts. Information about the background and purposes of the project, including the rationale for a research program in appropriate technology, the research agenda and program development guidelines is presented. Background information about the issues examined during the project, including copies of the project overview and overview of workshop events, is given. The document also contains 25 papers written by workshop facilitators and participants, as well as other documentation of the ideas and recommendations made by those who attended the workshop. The agenda recommends three main research modes: socio-technical systems research, policy research, and technology transfer research.

Non-Renewable Resources--Fossil Energy

936. Regenerable Sorbents for Fluidized Bed Combustion, Final Report
Exxon Research and Engineering Company, Government Research Laboratory
Ruth LA, Varga GM Jr
June 1978 194p AER7516194
NSF/RA-780121 PB287093/NKS

In order to minimize sorbent requirements and reduce the quantity of waste solids to be disposed, a practical fluidized

bed combustion system will require a sorbent that is capable of being regenerated many times, is resistant to attrition, and is economically attractive. The objective of this program was to identify and develop this kind of sorbent, one which would need to be superior to natural sorbents, viz. limestone and dolomite. About thirty potential sorbents, mostly mixed-metal oxides, had been identified by prior studies to have favorable thermodynamic properties for sulfur absorption and regeneration. The approach was to experimentally measure, using thermogravimetry, the sulfation and regeneration rates of these thermodynamically favored compounds. Preliminary experiments were conducted with sorbents in powdered form in order to minimize diffusion effects and determine which sorbents were intrinsically most reactive. The powdered sorbents were then formed into pellets of a size, about 2-3 mm, which could be used in a fluidized bed combustor.

937. Water in Synthetic Fuel Production, the Technology and Alternatives
Water Purification Associates; Masachusetts Institute of Technology
Probstein RF, Gold H
1978 308p AER7419080
NSF/RA-780133

Practically achievable technology is presented that can be incorporated in synthetic fuel plants to minimize water consumption and pollution. This book is intended as a guide to understanding the role water plays in synthetic fuel production and includes the basic concepts underlying water usage and water treatment in this context. The synthetic fuel technologies examined include the conversion of coal to clean gaseous, liquid, and solid fuels, and the conversion of oil shale to clean liquid fuels. A number of processes are described for each conversion including both above ground and in situ (underground) procedures. For purposes of comparing water requirements, water treatment plants, and residuals generated, detailed conceptual designs for integrated mine-plant complexes are presented for representative conversion processes. Only above ground processing is considered in detail. The coal mining regions chosen were those where the largest and most easily and economically mined deposits are located. In the West these include the Powder River and Fort Union regions in Montana, Wyoming, the Dakotas, and the Four Corners region where New Mexico, Arizona, Utah and Colorado meet. In the central and eastern areas of the country, the Illinois and Appalachian basins were selected.

Note: Available from MIT Press, Cambridge, Massachusetts 02139. Price $9.95.

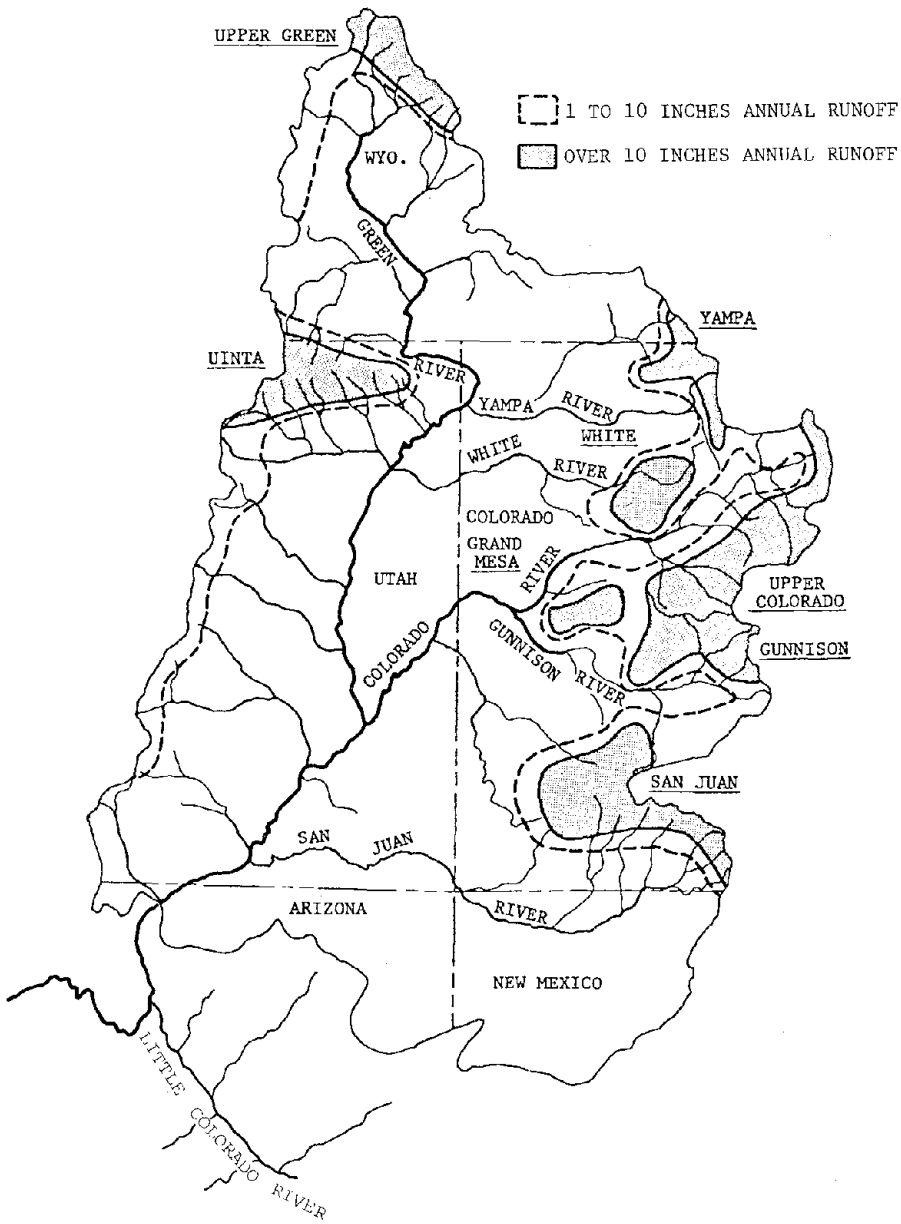


Figure 9-2
Major rivers and runoff producing areas in the Upper Colorado River Basin and the Little Colorado River in the Lower Colorado River Basin.

See Entry 937.

Regional Environmental Management

938. Chicago Hydrometeorological Area Project, A Comprehensive New Study of Urban Hydrometeorology (Final Report, February 1976 - July 1978)
Illinois State Water Survey, Atmospheric Sciences Section
Huff FA, Changon SA, Towery NG, et al
July 1978 58p ENV7601447
NSF/RA-780247 PB287011/NKS

The investigative program procured and studied all the historical rainfall data available for the area. The resulting analyses were aimed primarily at providing rainfall information of various types that would be useful to urban hydrologists in the design of storm-sanitary sewer systems. Further research was aimed at the extensive needs for a more sophisticated comprehensive urban hydrometeorological investigation. The extensive rainfall measurement program, Phase 2, has included the development of the world's largest dense raingage network of over 320 recording raingages and a new advanced 10-cm weather radar with state-of-the-art signal processing and an attached computer that allows for rapid digitization of rainfall data. The raingage network has furnished rainfall data for calibrating the radar-indicated rainfall, for testing water quality models, for developing new rainstorm intensity models, and for studying localized effects on rainfall.

939. National Environmental Models of Agricultural Policy, Land Use and Water Quality, Final Report
Iowa State University, Center for Agricultural and Rural Development
June 1978 174p ENV7203389
NSF/RA-780274 PB287637/NKS

In order to provide the best analyses of potentials and policies in agriculture, this project is directed toward the development of models which are capable of picking up interrelations among producing regions and among problems of income, land use, soil erosion, nonpoint pollution, energy supplies and prices, water supplies and use, agricultural and export policies, rural employment, and physical and social environments. A family of models was developed which provides detail in outcomes at national and regional levels, and traces the impact of policies implemented in one region on resource use and values, income, and environmental conditions in far removed regions. Included are sets of linear and quadratic programming models and variations of an econometrically based simulation model. The project was divided into three phases: the first involved specification, development, and quantification of the basic 233 producing region model; the

second involved a large-scale and several smaller user activities and the completion and initiation of several subject matter studies; and the third involved updating and modifying the models so they covered a greater range of user needs. Ten subject matter studies, covering a wide range of agriculturally related problems were initiated during this phase and six of these were completed. A summary of models development and descriptions of subject matter studies and user activities make up the bulk of this report.

Renewable Resources--Crops

940. Improvement and Evaluation of Techniques for the Mechanical Removal and Utilization of Excess Aquatic Vegetation, Final Report
University of Wisconsin at Madison, Departments of Agricultural Engineering and Mechanical Engineering
Koegel RG, Livermore DF, Bruhn HD
1978 75p GI39193
NSF/RA-780249 PB286759/NKS

Two harvesting approaches have resulted as alternatives or complements to the state-of-the-art harvester: the gathering arm system for mobile harvesters and the stationary vegetation removal system. The former offers the possibility of tripling the swath width while doubling the forward speed, thus increasing the area coverage/unit time by a factor of six. Since the pick-up mechanism does not extend more than about one foot into the water, damage and down-time due to striking submerged objects should be minimized. The stationary vegetation removal system can be scaled from relatively small sizes to larger ones capable of handling vegetation from five or more acres/hr. It has a modest acquisition cost relative to mobile harvesters but is more site-dependent and may be more labor intensive. Where seasonal labor is available, a more labor intensive approach can still be cost-effective. Processing equipment, compacting, and dewatering units have been developed during this research but additional evaluation is required. The uses for aquatic plants are outlined and explored. The technical feasibility of food/feed applications, energy production, and/or fertilizer/soil conditioner uses have been established.

Renewable Resources--Geothermal Energy

941. Heat Flow Studies in the Steamboat Mountain-Lemei Rock Area, Skamania County, Washington
State of Washington, Department of Natural Resources, Division of Geology and Earth Resources
Schuster JE, Blackwell DD, Hammond PE, et al
1978 61p AER7502747
NSF/RA-780179 PB287513/NKS

In order to investigate the possible occurrence of geothermal energy in areas of Quaternary basaltic volcanism, the Washington State Department of Natural Resources drilled several 152 m deep heat-flow holes in the Steamboat Mountain-Lemei Rock area of Skamania County, Washington. The study area is located in the southern part of Washington's Cascade Mountains between 45°54' and 46°07' N. and 121°40' and 121°53' W. This area was selected for study because geologic mapping had identified a north-trending chain of late Quaternary basaltic volcanoes that had extruded a sequence of lava flows up to 600 m thick, and because the chain of volcanoes is already coincident with a well-defined gravity low with a minimum value of about -110 mgals. The Quaternary lava flows all exhibit normal remanent magnetic polarity, so they are probably less than 690,000 years old. Most of the flows and volcanoes appear to be younger than the Salmon Springs Glaciation (40,000 to 80,000 years ago), and some are younger than Fraser Glaciation (less than about 12,500 years old). One large lava flow (the Big Lava Bed) and its source cinder cone can be shown to be between 450 and 4,000 years old by their relationship to dated ash and cinder deposits erupted from nearby Mount St. Helens. The young basalts rest on deformed Tertiary sedimentary and volcanic rocks.

Renewable Resources--Solar Energy

942. Assessment of the Potential of Solar Energy in Hawaii, Final Report
University of Hawaii, Hawaii Natural Energy Institute
Yoshihara T, Evern PC
January 1978 85p AER7605596
NSF/RA-780201 PB287475/NKS

The historical radiation network on Oahu was augmented with 14 new sites in 1976. An Eppley precision radiometer was the primary standard against which the outer network Eppley 8-48 pyranometers were compared. Global radiation on a 21° south face and diffuse radiation were also measured at the reference site on Holmes Hall at the University of Hawaii Manoa Campus.

Integrated data, stored as hourly values, were printed on paper tape, assessed for quality, then transferred to cards for computer analysis. Minimum clear day diffuse radiation was 8.4% of the global with an average annual diffuse radiation 37% of the global receipt. Global radiation on the south face averaged 10% greater than that on the horizontal but was 31% greater in December and 9% less in June. The annual sunlight for Makiki in the decade 1955-1965 was 525 cal/cm^2/day, consistently in the upper quartile above the 44-year average of 500 cal/cm^2/day. The annual value declined during the next decade and for the 5 years 1972-1975 was only 469 cal/cm^2/day, in the lowest quartile. Annual averages on the windward slopes of the central mountains were 300 cal/cm^2/day, and values for the leeward coasts were greater than 500 cal/cm^2/day. Sunlight values for over 50 sites, normalized to fit the long-term Makiki record, were used to construct contours of sunlight for the island of Oahu.

943. Silicon Schottky Photovoltaic Diodes for Solar Energy Conversion (Annual Progress Report, January 1, 1977 - December 31, 1977)
Rutgers University, Department of Electrical Engineering
Anderson WA
January 1978 46p AER7303197
NSF/RA-780267 PB287417/NKS

Work accomplished on a research study involving a five fold plan to achieve 12.5 percent efficiency and apply the Schottky process to more economical silicon substrates is reported. A study of the interfacial insulating layer was made to correlate layer thickness and composition with solar cell performance. Scanning electron microscope and Auger spectrographic analyses were used with electronic tests to investigate this effect. The results obtained from these procedures should enable the adjustment of the fill factor by altering processing variables. Processing variables were studied using substrate heating, substrate blasting, and sputtered-top metal layers. The Schottky process was applied to ribbon silicon and polysilicon to investigate the efficiency as applied to continuous fabrication techniques. Experimental results will be compared to computer-generated data using the model of a solar cell with variable parameters, and environmental tests will continue on existing and new solar cells. Several accomplishments achieved to date include: the fabrication of a 12.2 percent Cr-MIS cell on single-crystal Si wafers, a 9.8 percent efficiency obtained using a Ti-MIS cell, and a 7.2 percent efficiency recorded using a CR-MIS structure on Wacker polycrystalline Si.

Societal Response to Natural Hazards

944. Building Losses from Natural Hazards, Yesterday, Today and Tomorrow
J. H. Wiggins Company; Engineering Geology Consultants, Inc.
Chrostowki JD, Eguchi RT, Hart GC, et al
1978 22p ENV7708435
NSF/RA-780278 PB286626/NKS

The report addresses development of a forecast of building losses resulting from natural hazards, to be used as a basis for establishing research priorities and public policy directions. The hazards selected for study were earthquake, landslide, expansive soil, hurricane wind/storm surge, tornado, riverine flood, local wind, local flood, and tsunami. Each of the hazards was first modeled and programmed on computers to provide estimates of annual and, in some cases, sudden catastrophic losses which might impart upon the nation's building wealth between 1970 and 2000. Computer modeling was also applied to various mitigations which could be developed and implemented to reduce loss. Potential loss reductions were then projected and evaluations made on both state and national bases. Estimates of building losses from past events were used as a basis for forecasting future losses; however, it is likely that the estimates are low because of inaccurate or incomplete information. Using the completed models, the natural hazards were ranked to show both average annual loss expectancy and the potential for sudden catastrophic loss in a state or region. Scenarios of extreme events, such as the potential cost if the 1906 San Francisco Earthquake reoccurred in 2000, were also modeled. The purpose of this study is to reveal the percentage by which damage might be reduced if some of the more promising mitigations were to be applied.

945. Consumer Response to Urban Drought in Central California, Final Report
University of California at Berkeley, School of Public Health
Bruvold WH
June 1978 82p ENV7716171
NSF/RA-780279 PB286625/NKS

The report assesses consumer attitudes toward residential water conservation programs adopted by nine selected San Francisco Bay Area water districts; and evaluates the effectiveness of the water conservation programs mounted by the selected Bay Area water districts considering differences between residential water restrictions among districts. Methodology included scientific sampling to select respondents, and personal interviews. The

major finding from the research was that rationing or conservation plans should be based upon people, not the previous year's use, average yearly use, size of lot, or ability to pay. Such a conservation program means that water purveyors would have to obtain and update continually information on the number of people served by each service connection. This would require a complicated and costly billing process, but if it were to be the basis of a long term conservation effort, the benefits would outweigh the initial costs. The study also recommends that any rationing or conservation program be strictly enforced. Tabular and graphic material is included.

OTHER NSF/EAS REPORTS

946. Environment, Recent Awards, Problem-Focused Research Applications (PFRA), January-March 1978
National Science Foundation
1978 10p
NSF/RA-780188 PB287477/NKS

This brochure presents brief descriptions of awards given by the Problem-Focused Research Applications (PFRA) Directorate during the period January 1, 1978, through March 31, 1978. The data collected are derived from PFRA program records. Four major categories are covered: (1) Alternative Biological Sources of Materials - focuses on alleviating national dependence on selected scarce resources by making alternative biological sources of materials available in the United States; (2) Chemical Threats to Man and Environment - focuses on identifying, understanding, and reducing contamination and environmental hazard arising from the manufacture, use and disposal of man-made and naturally occurring chemical products; (3) Community Water Management - focuses on reducing risks to public health, safety, and the environment that arise from or are otherwise associated with the use and reuse of water; and (4) Earthquake Hazards Mitigation - focuses on reducing the casualties, damage, and social and economic disruption from earthquakes by developing our technological capabilities through research and developing an increased understanding of the adjustments that units of society can make to earthquake hazards.

947. Role of the National Science Foundation in Arid and Semi-Arid Land Research, 1978 Workshop Report (Washington, D.C., December 1978)
Case Western Reserve University
Haimes YY
February 1979 107p 79SP0399
NSF/RA-790021 PB294930/NKS

This workshop articulated cogent issues stressing priorities relevant to both current and emergent problems in arid and semi-arid regions. Priorities ranked in descending order include: 1) creation within NSF of an Office of Arid and Semi-Arid Lands Research; 2) research responsive to scientific and technological criteria, social-behavioral patterns, institutional and legal agenda, policy decision-making, and translation and transfer of research results and assistance; 3) risk and impacts analysis; 4) ground water; 5) water supply and demand; 6) multiobjective-multiattribute analysis; 7) agriculture and land use; 8) climate and weather modification; 9) Indian concerns; 10) energy issues; and 11) methodologies for planning and management.

948. Recent Awards, Problem-Focused Research Applications (PFRA), July-September 1978
National Science Foundation
1979 16p
NSF/RA-790028 PB292752/NKS

This brochure presents brief descriptions of awards made by the Division of Problem-Focused Research Applications (PFRA) from July 1, 1978, through September 30, 1978, and Fiscal Year (FY) 1978 awards made between October 1, 1977, and June 30, 1978. It describes how to obtain PFRA research findings and results and definitions and explanation of the format. The awards are divided according to subject area: 10 awards are listed for alternative biological sources of materials, 16 for chemical threats to man and his environment, 14 for community water management, and 61 for earthquake hazards mitigation. Biological conversion of lignocellulosic materials to useful chemicals, biological nitrogen fixation, and production of speciality chemicals from arid land plants were some topics selected for investigation in FY 1979. Other topics for consideration include characterization and fate of carbon contaminants and techniques for environmental analysis. Also addressed are the nation's capacity to effectively manage the use of water and the reduction of risks to public health, safety, and the environment. Siting, design, and policy also are emphasized.

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176-341	May 1977	PB268446/NKS	5.25
342-482	September 1977	PB274121/NKS	5.25

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747-843	June 1979	PB298887/NKS	6.00