



environment

National Science Foundation

Washington, D.C. 20550

Recent Awards: October-December 1977

REORGANIZATION OF RANN AND ESTABLISHMENT OF ASRA

On January 5, 1978, Dr. Richard Atkinson, Director of the National Science Foundation (NSF) announced the establishment of a Directorate for Applied Science and Research Applications (ASRA) to strengthen the links between applied and problem-oriented research and the Foundation's basic research activities. The new directorate, which became effective February 6, 1978, replaces the Directorate for Research Applications (RA) which contained the Research Applied to National Needs (RANN) program and the Division of Advanced Environmental Research and Technology (AENV). Most of the functions of RA will be taken over by ASRA, and most of the functions of AENV will be taken over by ASRA's Division of Problem-Focused Research Applications (see below). Besides strengthening links between applied and basic research, ASRA was established to improve the ties between research applications activities and user groups in State and local governments, private industry, and other Federal mission agencies; to focus problem-oriented research applications on fewer national issues to increase the impact of the NSF programs; and to provide a funding source for high quality applied research.

The New Directorate will consist of six units: the Office of the Assistant Director (AD/ASRA), the Office of Problem Analysis (OPA), the Division of Integrated Basic Research (IBR), the Division of Applied Research (AR), the Division of Problem-Focused Research Applications (PFRA), and the Division of Intergovernmental Science and Public Technology (ISPT).

The Office of the Assistant Director will carry out the policy-making, management, review and coordination functions of ASRA.

The Office of Problem Analysis will work with internal NSF and external groups and organizations in assessing problems for strategic and problematic planning by the Assistant Director/ASRA.

The Division of Integrated Basic Research will provide a direct link between ASRA and the basic research directorates of NSF by jointly identifying basic research related to significant national problems.

The Division of Applied Research will be organized into two sections, an Applied Social and Behavioral

Sciences Section and an Applied Physical, Mathematical and Biological Sciences Section. The objectives of this division will be to support applied research proposals which will benefit social, economic, and technical problems and policy issues. It also will identify and stimulate the growth of new technologies and processes based on discoveries in various fields of science.

The Division of Intergovernmental Science and Public Technology will be transferred from the Research Applications Directorate to the New ASRA with its functions and organizations unchanged.

The Division of Problem-Focused Research Applications (PFRA) will consist of four major program elements: Earthquake Hazards Mitigation; Chemical Threats to Man and the Environment; Alternative Biological Sources of Materials (formerly contained in RANN's Division of Advanced Energy and Resources Research and Technology (AERRT)); and Community Water Management. The objective of PFRA is to focus scientific and technological capabilities on selected societal problems where NSF can make a unique contribution to the science and technology base needed for their timely, practical solution. The common objectives of the programs within PFRA are to concentrate research and proof-of-concept experiments on selected problem areas in order to facilitate the incorporation of science as a working tool for problem resolution in the public and private sectors; to provide support for problem-focused research that bridges from basic research discoveries to application; and to enhance the capability and capacity of nontraditional research users to employ research results and methods.

PFRA PROGRAMS

Earthquake Hazards Mitigation

The objectives of the Earthquake Hazards Mitigation program are to develop methods and techniques that can provide effective protection for man, his works and institutions from life loss, personal injury, property damage, social dislocations, and economic

and ecological disruption associated with potential or realized earthquake hazards.

SITING: The Siting category of the Earthquake Hazards Mitigation program provides research support for the elucidation of the physical basis of earthquake energy generation and the transmission and propagation of the generated shock waves through various geologic and soil conditions; with the impact of earthquake ground motion on structures; and with development of criteria and guidelines for the mitigation of potential impacts on the built environment. The specific objectives of the Siting program are to:

- Develop a comprehensive data base on the nature of earthquake motion at typical construction sites and for representative structures;
- Establish the physical basis for characterizing the nature of earthquake motions and the dynamic forces generated by such motions and other natural hazards;
- Develop capabilities for prediction of the magnitude and frequencies of ground motion;
- Develop a methodology for qualitative and quantitative estimates of local or regional risk associated with earthquakes and other types of hazards and combined hazards;
- Develop a comprehensive and unified program to improve geotechnical engineering practices applicable to soil dynamics, foundation design, failure and instability, and other aspects of earthquake ground motion; and
- Identify procedures for integrating information on natural hazards into land use planning, urban and coastal zone planning, offshore engineering and siting procedures.

DESIGN: The specific objectives of the Design program are to:

- Improve the characterization of earthquake and natural hazard loadings necessary for the economical design of structures subject to dynamic loading;
- Develop new methods of analysis and design of buildings and structures of all types which will take into account nonlinear and inelastic behavior of materials;
- Develop methods to assess the hazard potential and risk assessments applicable to existing structures and facilities, and devise innovative methods for improving performance within economically acceptable bounds;
- Obtain information for engineering analysis and design by observing the damage of facilities following actual earthquakes, and incorporate this information into standard design practice;
- Develop improved computational capability for dynamic analysis of structures and facilities and improve user access to any computer software which is developed;
- Develop model standards and design criteria for design of structures and facilities subjected to earthquake and natural hazard loadings; and
- Conduct detailed studies of the behavior of smaller nonengineered structures and secondary components of buildings to improve recom-

mended minimum analysis and design guidelines.

POLICY: The specific objectives of the Policy program are to:

- Expand the base of knowledge on alternative social adjustments to earthquakes;
- Identify the social, economic, political, legal, and related factors which facilitate or hinder the adoption of both social and technological solutions to earthquake hazards;
- Facilitate the beneficial use of earthquake hazards mitigation measures by devising effective techniques for disseminating information to the public and to decision-makers at the local, State, and national levels; and
- Investigate measures which will reduce possible negative social, economic, and political consequences of earthquake predictions and warnings.

Chemical Threats to Man and the Environment

The Chemical Threats to Man and the Environment program supports research to increase our scientific knowledge of man-made contaminants and naturally occurring toxicants on human health and the quality of the environment, and to make this knowledge available to appropriate users. The objectives of the Chemical Threats to Man and the Environment program are to:

- Define the exposure of ecosystems and human populations to chemicals and their conversion products by determining chemical pathways and transformations in the environment;
- Accelerate the application of recent discoveries in the basic sciences to the identification and measurement of environmental contaminants;
- Develop methods to enable us to predict the toxicological effects of chemicals on humans based on animal tests and other laboratory data; and
- Identify contaminant effects on living forms critical for the functioning of whole ecosystems.

Alternative Biological Sources of Materials

The Alternative Biological Sources of Materials program deals with selected aspects of the problem of meeting the Nation's future needs for raw materials. This program is directed toward alleviating national dependence on selected scarce resources by making alternative biological sources of materials available in the United States. The objectives of the Alternative Biological Sources of Materials program are to:

- Determine which biological sources constitute promising alternatives;
- Develop biologically based procedures needed to convert the sources to useful materials; and

- Determine the socioeconomic, technical, and environmental impacts of various proposed biological alternative systems on the country.

Community Water Management

The Community Water Management program addresses the Nation's capability and capacity to efficiently and effectively manage the use and reuse of water in the built environment, and to reduce risks to public health, safety, and the environment that arise from or are otherwise associated with the use and reuse of water. The objectives of the Community Water Management program are to:

- Identify threats to community water and assess their effects on public health, safety and welfare;
- Evaluate existing and new concepts for management of the community water cycle in terms of costs, impacts, effectiveness, and acceptability of risk;
- Synthesize approaches to management of the integrity of community water supplies with emphasis on conservation, reclamation, and reuse; and
- Improve the process by which knowledge relating to management of threats to community waters is translated into action and public policies.

INTRODUCTION

The goal of AENV has been to enhance the Nation's capability to mitigate unacceptable environmental hazards and conditions, whether man-caused or natural. This research activity sought to provide a scientific and technological base for managing these risks by preventing or reducing loss of life, property damage, and the disruption of vital community and ecological relationships. This brochure presents brief descriptions of awards given by AENV primarily during the period October 1, 1977 through December 31, 1977. Several AENV awards made in Fiscal Year 1977 but inadvertently omitted from earlier editions of this brochure have also been included, as have RANN 1977 awards in Biological Nitrogen Fixation (AERRT). The data collected and contained in this report were derived from records of AENV and AERRT and at the time of printing had not been reconciled with National Science Foundation's Management Information System reports.

Readers wishing information on ASRA, PFRA, or individual projects are encouraged to complete and return the attached post card. Additional information regarding proposal guidelines and proposal submission is available upon request.

DEFINITIONS AND EXPLANATION OF FORMAT

Strip Mining and Its Effect on Environmental Health;¹ Walter G. Lewis;² Lewis & Day, Inc., 6822 Westcott Drive, Richmond, Virginia 22325;³ Award #77-00017⁴

1. **Title of the Specific Grant**
2. **Principal Investigator:** the chief scientist or administrator who is responsible for the research plan and fiscal expenditures as an NSF-sponsored awardee.
3. **Institution Conducting the Research:** any college, university, laboratory, industry, or other organization, whether operating on a profit or non-profit basis, as well as State governments and Federal organizations.
4. **Award Number.**

MANAGING THE NATURAL ENVIRONMENT

Identify environmental hazards, evaluate and quantify environmental risks, and devise methods for more effective risk control and management.



Chemical Threats to Man and Environment

Identify, understand, and reduce contamination arising from the manufacture, use, and disposal of man-made and naturally occurring chemical products. (RANN's Chemical Threats Program will be continued in ASRA/PFRA)

1. A Water Pollution Monitoring Laser Optical System; Silverio P. Almeida; Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061; Award #77-10184.
Provides for the acquisition of additional aquatic species of diatoms and preparation of these for inclusion in the collection of optical spatial filters used in laser holography systems.
2. Workshop of the Scientific Aspects of Polybrominated Biphenyls; Steven D. Aust; Michigan State University, East Lansing, Michigan 48824; Award #77-22187.
Discuss the human health and environmental effects of PBB's and the need for further research (No final report).
3. Quantitative Electron Microprobe Analysis of Individual Airborne Particles; Peter Buseck; Arizona State University, Tempe, Arizona 85281; Award #76-17130.

Investigate the chemical composition of individual submicron particles and relate this composition to sources and physical and chemical transformation processes to refine electron microscope correction procedures, characterize inorganic airborne particles, pinpoint emissions sources, and investigate particle coating and agglomeration.

4. N-Nitrosamine Derivatives of Pesticides and Other Chemical Formulations; David H. Fine; Thermo Electron Corporation, 85 First Avenue, Waltham, Massachusetts 02145; **Award #77-00163**
Determine possible sources of human exposure to various N-nitrosamines produced in the environment and in the formulation of chemical products.
5. Mycotoxins as a Potential Human Health Hazard; Anil C. Ghosh; Sisa, Incorporated, 767 B Concord Ave., Cambridge, Massachusetts 02138; **Award #77-19655**
Develop methodology to detect mycotoxin contamination of selected foodstuffs, and test mycotoxins for mutagenicity.
6. Aerosol Characterization in Real Time; Robert Gould; AeroChem Research Laboratories, Inc., P.O. Box 12, Princeton, New Jersey 08540; **Award #77-11252**
Develop atmospheric aerosol analysis techniques to provide information on particle mass and composition through separation and vaporization in a high-temperature cell.
7. An Immunochemical Assay for Asbestos in the Environment; H. R. Lukens; IRT Corporation, P.O. Box 80817, San Diego, California 92138; **Award #77-19495**
Produce an immunoglobulin with specific binding sites for asbestos which can be labeled with a fluorescent tracer and used to measure asbestos in environmental and biological samples quickly, at low cost, with high specificity and sensitivity.
8. Approaches for the Acquisition of Mass Spectral Data for Inclusion in the NIH/EPA Mass Spectral Data Base; David P. Martinsen; Fein-Marquart Associates, Inc., 7215 York Road, Baltimore, MD 21212; **Award #77-19673**
Develop procedures to seek out mass spectral data and incorporate them into the computerized system which the Federal government makes available to the general public.
9. Remote Measurement of Air Pollutants; Edward Murray at SRI; Robert Byer at Stanford; Stanford Research Institute with subcontract to Stanford University, Menlo Park, California 94025; **Award #77-10198**
Develop laser methods for remote measurement of atmospheric levels of gases under different pollutant-gas levels and variable meteorological conditions.
10. Reactive Tapes for Automatic Environmental Analyses; Larry D. Nichols; Moleculon Research Corp., 139 Main Street, Cambridge, Massachusetts 02142; **Award #77-19771**
Optimize trial analytic schemes for use with an improved (high liquid content, good strength, large diffusion content) chemically impregnated tape for use in environmentally related chemical analysis; test sample-concentrating methods based on tape; prepare tape samples, and demonstrate performance.
11. Development of Antiserum to Benzo(a)pyrene and its Metabolites; Kent Painter; Western Research Institute, Inc., Fort Collins, Colorado 80522; **Award #77-19698**
Produce and purify an antiserum to Benzo(a)pyrene and its metabolites to be used to develop a sensitive, specific immunochemical assay for these chemicals.
12. Application of Computer Graphics to Air Quality Data Analysis; Alvin H. Vanderpol; Meteorology Research, Inc., 464 West Woodbury Rd., Altadena, California 91001; **Award #77-12487**
Developing statistical procedures with which to probe large air quality data bases in a cost-effective manner.



Regional Environmental Management

Develop management and analytical procedures for identifying, exploring, and comparing alternatives for achieving environmental goals. (Regional Environmental Management will be phased out except for Community Water Management research in ASRA/PFRA; Land Use Policy will be phased out)

1. "Collaborative Research on Assessment of Man's Activities in the Lake Powell Region" - Study of Kaiparowitz Plateau Resources, and Coordination of Natural Science Components; Orson L. Anderson; University of California, Los Angeles, Los Angeles, California 90024 **Award #77-23238**
Continue to conclusion an interdisciplinary project concerned with the effects of development on Lake Powell and its surrounding region.
2. Process Integration for Optimum Management of Municipal Wastewater Treatment Sludges; Richard I. Dick; Cornell University, Ithaca, New York 14853 **Award #77-22947**
Determine the influence of both design and operating variables in both aerobic and anaerobic water treatment plant sludges.
3. Utilization of Waste Heat From Power Plants in Aquaculture; Carlos Guerra; Public Service Electric and Gas Company, 80 Park Place, Newark, New Jersey; **Award #77-01074**
Confirm the technical feasibility of utilizing thermal discharges from power station cooling condensers to culture edible aquatic animals commercially.
4. Development and Testing of Risk-Benefit-Cost Analysis for Policy Formulation; Ivars Gutmanis; Sterling Hobe Corp., P.O. Box 19406, Washington, DC 20036; **Award #77-15501**
Develop qualitative and quantitative procedures for analysis and management of high con-

sequence/low probability events; test these procedures on alternative liquid gas policies currently under consideration.

5. An Air Quality Model of Agricultural Field Burning in Oregon's Willamette Valley; E. Wendell Hewson; Oregon State University, Corvallis, Oregon 97331; **Award #76-83202**

Test the Livermore Regional Air Quality (LIRAQ) model, developed for the greater San Francisco Bay area, for applicability to air pollution problems associated with agricultural field burning.

6. Local Land Use Development Management Through Capital Improvements Programming; James Hoben; H U D, Washington, DC 20410; **Award #77-21821**

Conduct eight case studies of local government practices to assess how Federal aid programs affect local government capital investment decisions.

7. An Analysis of Urban Drought: A Case Study of the San Francisco Bay Area; Mark Hoffman; Teknekron Inc., 2118 Milvia St., Berkeley, California 94704; **Award #77-16283**

Provide managers and users of urban water systems with recommendations to minimize the overall societal costs of drought through an analysis of the impacts of a recent drought on the San Francisco Bay area.

8. Analysis of the Adoption and Implementation of Community Land Use Regulations for Flood Plains; Dennis Mileti; Woodward-Clyde Consultants, 3 Embarcadero Center, San Francisco, California 94111; **Award #77-13908**

Develop a conceptual framework and methods for analyzing what factors affect the adoption and implementation of community land use regulations for flood plains.

9. An Assessment of Conflicts Between Federal Resource Lands and Adjacent Non-Federal Lands; William E. Shands; Conservation Foundation, Washington, D.C. 20036; **Award #77-13904**

Provide an overview on the nature, scope and magnitude of conflicts between Federal resource lands and adjacent non-Federal lands.

10. Identifying, Evaluating, and Managing Environmental Risks- Part II; Paul Slovic; Decision Research/Perceptronics, Inc., 1201 Oak Street, Eugene, Oregon 97401; **Award #77-15332**

Develop one structural taxonomy and one social/psychological taxonomy of technological hazards based on people's perceptions; analyse concepts of "acceptable risk"; develop improved methods for communicating facts about hazards and about risk management; map the hazards management process.

11. High Energy Electron Irradiation of Municipal Wastewater Liquid Residuals; John Trump; Massachusetts Institute of Technology, Dept. of

Electrical Engineering, Cambridge, Massachusetts 02139; **Award #77-10196**

Continue research on the technical and economic feasibility of disinfecting liquid municipal wastewater residuals with high energy electrons.

12. Controlled Soil Microbial Detoxification of Herbicide Residues; George D. Ward; George D. Ward & Associates; 821 NW Flanders, Portland, Oregon 97209; **Award #77-19832**

Investigate the feasibility of soil encapsulation and biological detoxification of herbicide and pesticide manufacturing residues through the construction of large aerobic sludge soil beds.

DISASTERS AND NATURAL HAZARDS

Develop methods to protect man, his works and institutions from loss of life, injury, property damage, and economic, ecological, and social disruptions before, during and after naturally occurring hazardous events.



Weather Modification

Develop and test technologies which mitigate undesirable effects of weather, and identify problems and opportunities arising from intentional and inadvertent weather modification due to human activity. (Weather Modification will be transferred to NSF's Directorate for Astronomical, Atmospheric, Earth and Ocean Sciences (AAEO))

1. Workshop on Extended Area Effects of Weather Modification; Robert Elliott; North American Weather Consultants, 600 Norman Firestone Road, Goleta, California 93017; **Award #77-15023**

Hold a workshop (July 1977) to determine the importance of advertent and inadvertent weather modification spatially and temporally.

2. National Hail Research Experiment (NHRE); Patrick Squires; National Center for Atmospheric Research, Boulder, Colorado 80303; **Award #77-23757 A 02.**

Complete the analysis of thunderstorm data collected in prior years (NHRE). A data catalogue describing archived data and a bibliography of journal papers and reports resulting from NHRE will be included as appendices to the final report (NOTE: Persons wishing copies of this final report should write directly to the Principal Investigator at NCAR).

3. Hail Suppression Seeding Technology: An Assessment Based on Silver Content in Rain and Hail; Joseph Warburton; Desert Research Institute, University of Nevada, Reno, Nevada 89507; **Award #77-01600.**

Determine the effectiveness of seeding technologies used by the National Hail Research Experiment by chemical analysis of rain and hail, radar data, aircraft seeding data, and radiosonde data.



Earthquake Engineering

Develop economically feasible design and construction methods for building earthquake resistant structures; study procedures for integrating information on seismic risk with ongoing land use procedures; improve understanding of the social and economic consequences of individual and community decisions on earthquake issues. (Earthquake Engineering will be continued in ASRA/PFRA as Earthquake Hazards Mitigation, with subprograms in Design, Siting, and Policy)

1. Safety Evaluation of Structures to Earthquake and Other Natural Hazards; A. H-S Ang; University of Illinois at Urbana-Champaign, Urbana, Illinois 61801; **Award #77-09090**

Coordinate analytical program to develop the basis for structural safety evaluation and reliability design of structures to resist natural hazards.

2. A Strong Motion Seismography Array in Northern Baja California - Northwestern Sonora, Mexico; James N. Brune; University of California, San Diego, La Jolla, California 92037; **Award #75-02939 A01**

Install and maintain a timed strong motion seismograph system array in Northwest Mexico near the Cerro Prieto, Imperial, Agua Blanca and San Miguel Faults.

3. Seismic Hardening of Unreinforced Masonry Walls Through a Surface Treatment; James R. Cagley; Martin & Cagley; 6000 Executive Blvd., Rockville, Maryland 20852; **Award #77-19888**

Develop a simple and economical method of reinforcing masonry to resist seismic forces through use of a coating.

4. Earthquake Response of Dams Including Hydrodynamic and Foundation Interaction; Anil K. Chopra; University of California, Berkeley, California 94720; **Award #76-80073 A01**

Develop reliable techniques, including computer programs, for earthquake analysis of concrete gravity, concrete arch, and earth dams.

5. Seismic Response of Three-Dimensional Dam Reservoir Systems; Allen T. Chwang; California Institute of Technology, Pasadena, California 91125; **Award #77-16085**

Determine the seismic response of a dynamically coupled, three-dimensional dam reservoir system including the hydrodynamic interaction effect, the flexibility effect, the effect of phase variation and spatial attenuation of seismic waves, and the effect of the side confinement of the dam.

6. National Information Service for Earthquake Engineering (NISEE); Ray W. Clough; University of California, Berkeley, California 94720; **Award #76-20744 A02**

Provide for the transfer of earthquake and

other hazards information generated through research to the public users.

7. Seismic Behavior of Complete Structural Systems; Ray W. Clough; University of California, Berkeley, California 94720; **Award #76-04262 A02**

Develop computer procedures for predicting earthquake response through the use of mathematical models and actual buildings.

8. Masonry Buildings - Response of Existing Systems to Earthquake Motions; Robert D. Ewing; Agbajian Associates, 250 N. Nash St., El Segundo, California 90245; **Award #77-19829**

Identify improved methods for analyzing the earthquake response of existing unreinforced masonry structures and develop methods for strength retrofitting.

9. The Use of Structural Foams to Improve Earthquake Resistance of Buildings; B. C. Gabrielsen; Scientific Service, Inc., Redwood City, California 94063; **Award #77-21426**

Investigate the feasibility of using polyurethane foams to increase the shear capacity of timber stud walls and timber joist floors and ceilings.

10. Earthquake Resistant Design of Braced Steel Frame Structures; Subhash C. Goel; University of Michigan, Ann Arbor, Michigan 48109; **Award #76-82209 A01**

Study configurations of braced multistory steel frame systems subjected to seismic forces to determine their advantages and disadvantages.

11. Engineering Design for Natural Hazards; W. J. Hall; University of Illinois, Urbana, Illinois 01801; **Award #77-07190**

Develop simplified and improved methods of structure design to provide protection against natural hazards.

12. A Portable Vibrating Structure for Soils Investigations; Paul Ibanez; Applied Nucleonics Company, Inc., Los Angeles, California 90024; **Award #77-19653**

Develop a method for high strain *in situ* measurement of soil properties.

13. International Workshop on Strong Motion Earthquake Instrument Arrays; Wilfred D. Iwan; California Institute of Technology, Pasadena, California 91101; **Award #77-24726**

Organize and convene an International Workshop on Strong Motion Earthquake Instrumentation Arrays (three dimensional) in the spring of 1978. The workshop will provide a basis for development of a plan for the future deployment of dense, three-dimensional strong motion earthquake resistant arrays.

14. A Rational Approach to Damage Mitigation in Existing Structures Exposed to Earthquakes; Ben Kacyra; Earthquake Engineering System, Inc., 141 Battery Street, Suite 400, San Francisco, California 94111; **Award #77-19463**

- Undertake a feasibility study of developing a rational decision analysis methodology for evaluating possible modifications for existing buildings exposed to a predicted earthquake.
15. Mitigation of Seismic Hazards in Existing Unreinforced Masonry Wall Buildings; John Kariotis; Kariotis, Kesler and Allies; 1414 Fair Oaks Avenue, South Pasadena, California 91030; **Award #77-19651**
Analyze performance of buildings with unreinforced masonry walls built prior to adoption of seismic building codes; evaluate methods of revising performance of unreinforced elements; investigate changes in response caused by modifications.
 16. Distant and Local Tsunamis in Coastal Regions; Jiin Jen Lee; University of Southern California, Los Angeles, California 90007; **Award #77-01599**
Conduct research into the behavior of tsunamis in coastal regions with complicated topography for use by coastal zone engineers and planners for efficient design of coastal structures and communities.
 17. Soil-Structure Interaction with Arbitrary Seismic Environment; John Lysmer; University of California, Berkeley, California 94720; **Award #76-23277 A01.**
Develop a theory and associated finite element code CREAM(Complex Response Earthquake Analysis Method) and make this available through the NTIS and other appropriate channels.
 18. Post-Earthquake Land Use Planning; George G. Mader; William Spangle and Associates; 3240 Alpine Road, Portola Valley, California; **Award #76-82756.**
An interdisciplinary team will investigate post-earthquake land use planning and reconstruction in San Fernando, Santa Rosa, and Alaska and will develop recommendations for post-earthquake planning procedures, programs and regulations.
 19. Reliability of Existing Buildings in Earthquake Zones - Part II; Hugh D. McNiven; University of California, Berkeley, California 94720; **Award #77-06489 A01.**
Develop a realistic method of evaluating seismic reliability of existing structures through development of mathematical models, development of "failure criteria", and tests of model structures. (See also J. T. Yao)
 20. Seismic Behavior of Multistory Masonry Structures; Hugh D. McNiven; University of California, Berkeley, California 94720; **Award #76-04265 A02.**
Test the seismic shear resistance of single and double window piers in multistory masonry buildings; correlate results with various mathematical models.
 21. Structure-Fluid Interaction Due to Earthquakes; C. C. Mei; Massachusetts Institute of Technology, Cambridge, Massachusetts 02139; **Award #77-10236**
Conduct theoretical and numerical investigations of the phenomenon of structure-fluid interaction in dam-reservoir systems, offshore structures, and other structures of this type.
 22. The Dynamic of Structure with Localized Nonlinearity; Richard K. Miller; University of California, Santa Barbara, California 93106; **Award #77-01096.**
Develop a better understanding of earthquake behavior of localized nonlinear systems and develop more efficient analysis techniques for the transient and earthquake responses of such systems.
 23. Seismic Behavior of Structures; Analysis and Design; Joseph Penzien; University of California, Berkeley, California 94720; **Award #76-04264.**
Develop improved seismic analysis capabilities and apply them in structural designs for increased reliability of controlling seismic damage and costs.
 24. The United States-Japan Cooperative Research Program on Large-Scale Structural Systems; Joseph Penzien; University of California, Berkeley, California 94720; **Award #76-80835 A01.**
Undertake a planning study for development of an effective research program of maximum benefit to both the US and Japan on large-scale tests of structural systems.
 25. Methodology for Mitigation of Seismic Hazards in Existing Unreinforced Masonry Buildings; C. W. Pinkham; S. B. Barnes & Associates; 2236 Beverly Boulevard, Los Angeles, California 90027; **Award #77-19523.**
Review past work on methods of retrofitting unreinforced masonry buildings, determine the need for hazard mitigation, and determine methods to retrofit economically.
 26. Seismic Behavior of Structural Components; Egor P. Popov; University of California, Berkeley, California 94720; **Award #76-04263 A03.**
Conduct advanced experiments and studies of braced steel frames, reinforced concrete walls and filled frames, reinforced concrete ductile frames, and reinforced beam-column components; use results to construct mathematical models for analyzing inelastic behavior.
 27. Seismic Behavior and Design of Buildings; Jose M. Roesset; Massachusetts Institute of Technology; Cambridge, Massachusetts 02139; **Award #77-14174.**
Improve present knowledge on the non-linear dynamic behavior of buildings subject to earthquake excitation and on the effectiveness of various design procedures.
 28. Reliability of Existing Buildings in Earthquake Zones - Part I; James T. P. Yao; Purdue University

ty, Lafayette, Indiana 47907; **Award #77-05290 A01.**

Develop a realistic method of evaluating seismic reliability of existing structures through development of mathematical models, development of "failure criteria", and tests of model structures. (See also H. D. McNiven)



Societal Response to Natural Hazards

Develop an understanding of the probable economic and social costs of natural hazards and design, develop, and test alternative approaches to enable society to prepare for, respond to, and recover from disastrous events (Societal Response will be incorporated into Earthquake Hazards Mitigation in ASRA/PFRA)

1. Seismic Safety Preparedness by Local Governments in California; Dean E. Mann; University of California, Santa Barbara, Santa Barbara, California 93106; **Award #77-03688.**

Four communities in California will be examined to ascertain sources of resistance to adequate seismic safety planning. The study will provide officials at all levels of government and in the private sector with improved strategies for overcoming resistance to effective seismic safety planning.

RENEWABLE RESOURCES (From RANN's Division of Advanced Energy and Resources Research and Technology)



Innovative Biosynthesis Techniques

Develop innovative biological systems for synthesizing energy-intensive substances from renewable resources in three areas; biological nitrogen fixation, photosynthesis, and biophotolysis (Biological Nitrogen Fixation will be transferred to ASRA/PFRA and continued as part of the Alternative Biological Sources of Materials program with emphasis in three areas: biological conversion of lignocellulosic materials to useful chemicals; biological nitrogen fixation; and production of rubber from the guayule plant).

1. Enhancing Plant Productivity with Nitrogen-Fixing Bacteria; Winston J. Brill; University of Wisconsin, Madison, Wisconsin 53706; **Award #77-00879.**

Enhance biological nitrogen fixation in free-bacteria and symbiotic bacteria plant systems.

2. Synthesis and Applications of Nucleic Acids to Biological Nitrogen Fixation; John P. Hachmann; Collaborative Research Inc., 1365 Main Street,

Waltham, Massachusetts 02154; **Award #77-10195.**

Improve the chemical synthesis of nucleic acid segments (oligodeoxynucleotides) for their eventual use as tools for the transfer of genetic information in biological nitrogen fixation; develop further the modified triester method of chemically synthesizing defined sequence nucleic acid fragments.

3. Enzymatic Transformations of Lignin; Phillip Hall; Virginia Polytechnic Institute, Blacksburg, Virginia 24061; **Award #76-11050.**

Develop enzymatic or semi-enzymatic processes for the conversion of lignin on a large scale into commercially valuable materials.

4. Conferences on Genetic Engineering for Nitrogen Fixation; Alexander Hollaender; Associated Universities Inc.; 1717 Massachusetts Ave, N.W., Washington, D.C. 20036; **Award #77-05338.**

Hold a conference on March 13-17, 1977 to review the current state of genetic engineering with regard to nitrogen fixation to define and assess the opportunities and limitations of this technique for enhancing net nitrogen fixation; discuss the health, legal, economic, social, and environmental aspects of this issue.

5. Biological Solar Energy Conversion: Approaches to Overcome Yield, Stability and Product Limitations; Bessel Kok; Martin Marietta Laboratories; 1450 South Rolling Road, Baltimore, Maryland 21227; **Award #76-81808.**

Produce the chemical hydrogen from water using the energy conversion system of green plants; more specifically, to improve the stability of the photochemical apparatus *in vitro*, improve the efficiency of the energy conversion system, and assess the influence of oxygen and carbon dioxide on H₂ photoevolution and hydrogenase activity.

6. Bioconversion of Saline Water; Gilbert Levin; Biospherics Inc., 4928 Wyaconda Rd., Rockville, Maryland 20852; **Award #77-19732.**

Develop a system for the conversion of saline water to fresh based on the ion exchange properties of algae; resolve whether or not algae can be induced to take up and release sodium chloride in a controlled fashion.

7. Enhancing Biological Production of Ammonia From Atmospheric Nitrogen and Soil Nitrate; James Lyons; University of California, Davis, California 95616; **Award #77-07301.**

Utilize solar energy to enhance the production of ammonia by biological systems such as natural bacteria, legumes, cereals, and genetically modified soil microorganisms.

8. Nitrogen Fixation With Photosynthetic Marine Microorganisms; Akira Mitsui; University of Miami, 4600 Rickenbacker Causeway, Miami, Florida 33149; **Award #76-17159.**

- Survey photosynthetic marine microorganisms for enhanced nitrogen fixation to assess the production potential of nitrogen-fixing isolates.
9. Isolation of Lignocellulose-Transforming Microorganisms; Dale Norris; University of Wisconsin, Madison, Wisconsin 53706; **Award #77-08279.**
Isolate and characterize lignocellulose-transforming microorganisms from wood-degrading symbiotic insects and examine the products of microbial lignin degradation as animal feed stimulants.
 10. Regeneration, Selection, and Evaluation of Plants From Protoplasts of Potato; James Shepard; Kansas State University, Manhattan, Kansas 66506; **Award #77-12161.**
Develop the technology to regenerate whole plants from potato leaf protoplasts to reduce the time and effort needed to breed new plant varieties.
 11. An Assessment of Nitrogen-Fixing Microorganisms for Ammonia Synthesis; Barry O. Stokes; Jet Propulsion Laboratory, Pasadena, California 91109; **Award #76-90903.**
 12. Enhancement of Animal Protein Production by Novel Genetic Technology; Alison Taunton-Rigby; Collaborative Research, Inc., 1365 Main Street, Waltham, Massachusetts 02154; **Award #77-19654.**
Develop a new method for inserting new genetic information into the DNA of mammalian cells.
 13. Microbial Production of Ammonia from Molecular Nitrogen; Raymond C. Valentine; University of California Davis, Davis, California 95616; **Award #77-01608.**
Assess the feasibility of producing ammonia fertilizer from molecular nitrogen using nitrogen-fixing microorganisms.
 14. Incorporation of a Nitrogen-Fixing Organelle into Plant Cells; Leo P. Vernon; Brigham Young University, Provo, Utah 84602; **Award #77-10040.**
Modify certain nitrogen-fixing algal cells and attempt to incorporate them into higher plant cells.

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