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16. Abstract (Limit: 200 words)

This brochure presents brief descriptions of awards made by Problem-Focused Research Applications (PFRA) during the period April 1, 1978 through June 30, 1978. Four major categories are covered: "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; "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; "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 "Earthquake Hazards Mitigation" focuses on reducing the casualties, damage, and social 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.

17. Document Analysis a. Descriptors

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Earthquakes	Resources	Environmental impacts
Contaminants	Water pollution	Awards

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

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RECENT AWARDS: APRIL-JUNE 1978

NATIONAL SCIENCE FOUNDATION
DIVISION OF PROBLEM-FOCUSED RESEARCH APPLICATIONS
DIRECTORATE FOR APPLIED SCIENCE AND RESEARCH APPLICATIONS
WASHINGTON, D.C. 20550

INTRODUCTION

RECENT AWARDS keeps researchers, research users, and policymakers informed about projects being supported by NSF's Division of Problem-Focused Research Applications (PFRA).

This brochure presents brief descriptions of awards made by PFRA during the period April 1, 1978 through June 30, 1978. The data collected and contained herein has been reconciled with NSF's Management Information System.

Readers wishing information on PFRA, ASRA, NSF, or any of the individual projects listed in this brochure should complete and return the post card on page 6. Information on proposal guidelines and submission is available upon request. PFRA welcomes reader comments and suggestions for improving the utility of this publication.

HOW TO OBTAIN PFRA RESEARCH FINDINGS AND RESULTS

One of the most important objectives of PFRA is the timely and widespread dissemination of the results of PFRA-supported research to potential users. The name and mailing address of the Principal Investigator and Grantee Institution is contained in each project description in this brochure. Persons wishing to obtain information on project findings including project reports, monographs, journal articles, technical reports, and other such relevant materials should write to the Principal Investigator at the Grantee Institution to determine what information is available and at what, if any, cost it may be obtained. The Grantee Institution may charge a nominal amount for the duplication and mailing of such materials to cover costs. The Principal Investigator may furnish information on how interested persons may acquire reports and other materials as appropriate from the National Technical Information Service (NTIS) of the Department of Commerce in lieu of furnishing the report or other material directly. NTIS is the central point in the United States for the public sale of Government-funded research and development reports and other analyses prepared by Federal agencies, their contractors, and grantees. The Principal Investigator may also cite journals or other publications where project information may be looked up instead of furnishing a copy of the article.

DEFINITIONS AND EXPLANATION OF FORMAT

Strip Mining and Its Effect on Environmental Health;[1] Walter G. Lewis;[2] Lewis and Day, Inc. 6822 Westcott Drive, Richmond, VA 22325;[3] **Award #77-00017**[4]

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, laboratory, industry, or other organization, whether operating on a profit or nonprofit basis, as well as State governments and Federal organizations.
4. **Award Number.**

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. Three particular topics have been selected for investigation in Fiscal Year 1978; biological conversion of lignocellulosic materials to useful chemicals; biological nitrogen fixation; and production of rubber from the guayule plant.

1. Semisolid Fermentation of Grass Straw; A.W. Anderson; Oregon State University, Department of Microbiology, Corvallis OR 97331; **Award #75-17494 A01**

   Develop and test a process of chemical or mechanical pretreatment followed by yeast fermentation to yield a nutritious, palatable animal feed from ryegrass straw.

2. Chemicals From Wood by Organic Solvent Treatment; Gary C. April; University of Alabama, Depart-

ment of Chemical and Metallurgical Engineering, Tuscaloosa, AL 35486; **Award #78-02651**

Investigate the extraction efficiency of organic alcohol systems for removing lignin from southern pine to determine the feasibility of conversion of wood into chemicals for the production of synthetic plastics, fibers and rubbers.

3. Conference on Chemicals and Materials from Renewable Resources; Alexander Cruickshank; University of Rhode Island, Gordon Research Conferences, Department of Chemistry, Kingston, RI 02881; **Award #78-18770**

   Provide support for a Gordon Conference, "Chemicals and Materials from Renewable Resources", of mulitdisciplinary discussions on the production of biomass and its conversion to chemicals and materials.

4. Enhancement of Biological Nitrogen Fixation by Genetic Manipulation of *Rhizobium*; Donald R. Helinski; University of California-San Diego, Department of Biology, B-022, La Jolla, CA 92037; **Award #77-24945**

   Enhance the nitrogen fixing ability of the bacterium *Rhizobium meliloti* by recombinant DNA manipulation; clone genes from the *R. meliloti* chromosome on a suitable plasmid in *E. coli* to establish a hybrid *R. meliloti* strain; test for increased symbiotic effectiveness with alfalfa.

5. Biological Solar Energy Conversion: Approaches to Overcome Yield, Stability and Product Limitations; Bessel Kok; Martin Marietta Laboratories, 1450 South Rolling Road, Baltimore, MD 21227; **Award #78-06094**

   Assess the feasibility of using photosynthesis for producing energy-intensive substances from renewable resources; specifically, assess the cause of loss of photosynthetic activity after isolation of chloroplasts from leaf cells and differences in electron transport activities among chloroplasts isolated from different leaf tissues.

6. Multifaceted Approach to Enhancing Biological Nitrogen Fixation; Marvin R. Lamborg; Charles F. Kettering Laboratory, 150 East South College Street, Yellow Springs, OH 45387; **Award #77-27269**

   Increase the capacity for nitrogen fixation of several living organisms and the enzymes involved through physiological and chemical research. Specifically: compare the physiological responses to environment of four species of the water fern *Azolla;* develop a new assay for the symbiotic nitrogen fixing bacterium *Rhizobium* in soils based on the selective binding compounds known as lectins; determine the optimum conditions for nitrogen fixation by *Rhizobium* in the free living state; and improve the catalytic properties of nitrogenase, with emphasis on the molybdenum cofactor.

7. Enhancing Biological Production of Ammonia from Atmospheric Nitrogen and Soil Nitrate; James M. Lyons; University of California-Davis, College of Agricultural and Environmental Sciences, Davis, CA 95616; **Award #77-07301 A01**

   Enhance nitrogen fixation in bacteria *(Klebsiella, Rhizobium)* by genetic manipulation; increase the efficiency of symbiotic nitrogen fixation in legumes (soybeans, alfalfa) with *Rhizobium;* evaluate the potential for supplying nitrogen to rice crops through a symbiotic system using *Azolla/Anabaena;* and increase the efficiency of conversion of nitrate to ammonia in soil bacteria and crop plants.

8. Incorporation of a Nitrogen-Fixing Organelle into Plant Cells; Leo P. Vernon; Brigham Young University, A-333, ASB, Provo UT 84602; **Award #77-10040 A01**

   Incorporate nitrogen fixing blue-green algae into crop plants by isolation from the host, modification to eliminate oxygen-evolving capability, and incorporation into higher plant protoplasts by fusion.

9. Development of Superior Cultivars of Jojoba; Demetrios M. Yermanos; University of California-Riverside, Department of Plant Sciences, Riverside, CA 92521; **Award #78-12709**

   Conduct a systematic selection and breeding program to develop superior cultivars of jojoba (jojoba seed oil is potentially useful in various pharmaceutical, cosmetic and industrial applications) for development as an agricultural crop in the Southwest.

CHEMICAL THREATS TO MAN AND THE ENVIRONMENT

The Chemical Threats to Man and the Environment program seeks to identify, understand, and reduce contamination and environmental hazard arising from the manufacture, use, and disposal of chemical products by increasing our scientific knowledge of man-made contaminents and naturally occurring toxicants and making this knowledge available to appropriate users.

1. Soils as a Source or Sink of Atmospheric Nitrous Oxide; John M. Duxbury; Cornell University, Department of Agronomy, Ithaca, NY 14853; **Award #78-11639**

Test the hypothesis that modern agricultural methods may result in a sharp increase in nitrous oxide production, thereby upsetting the natural balance and the stratospheric ozone cycle. This will be done by measuring nitrous oxide and nitrate fluxes across the soil-atmosphere interface and in drainage water and by determing if soils acts as a source or a sink of atmospheric nitrous oxide.

2. Effects of Pollutants on Gills of Fresh Water Fishes; Paul O. Fromm; Michigan State University, Department of Physiology, East Lansing, MI 48824; **Award #77-12300 A01**

   Study the action of pollutants on fish gills to provide information on the impact of man's activities on the aquatic environment. The project will include permeability properties and the effect of pollutants on same; salt transport capabilities in gills exposed to pollutants; and biotransformation of pollutants by gills during transit of materials to the blood.

3. Characterization of Aquatic Organics and Complexes; Walter J. Maier; University of Minnesota, Department of Civil and Mineral Engineering, Minneapolis, MN 55455; **Award #77-04496 A02**

   Organic and inorganic chemicals shown to be detrimental to the public health and the aquatic ecosystem are accumulating in natural waters. Regulations have required control or elimination of this contamination, but accurate information on the origin, distribution, concentration, interactions, residence time and ultimate fate of natural and anthropogenic organic materials is not available. This project will characterize aquatic organics in the Upper Mississippi River as related to identity, stability, chemical-physical properties, source-related behavior, transport, and metal-interactions.

4. Nitrous Oxide Environmental Measurement Program; Michael B. McElroy; Harvard University, Division of Engineering and Applied Physics, Cambridge, MA 02138; **Award #76-24239 A02**

   Develop accurate, reliable gas chromatographic methods for field measurement of nitrous oxide; and,through field measurements, determine production of nitrous oxide by biological activity in near-shore areas to determine importance of nitrous oxide production from fertilizers relative to natural processes.

5. Development of Screening Methods for Developmental Abnormalities; Robert Seecof; City of Hope National Medical Center, 1500 East Duarte Road, Duarte, CA 91010; **Award #78-09625**

   Determine which responses of cell differentiation and tissue formation in *Drosophila* are the best indicators of teratogenicity; detect developmental abnormalities in developing *Drosophila* embryos; assess the usefulness of such observations for screening chemicals relative to their ability to produce birth defects in humans and mammals.

6. The Detection of Pyrrolizidine Alkaloids and Their Metabolites; Henry J. Segall; University of California-Davis, Department of Physiological Sciences, School of Veterinary Medicine, Davis, CA 95616; **Award #78-06924**

   Isolate, identify and purify known and unknown pyrrolizidine alkaloids and their metabolites from rangeland plants, and develop methodologies to determine if these chemicals are transferred to milk of dairy cows. Analytical tools include high pressure liquid chromatography and gas chromatography/mass spectroscopy.

7. Chemical Structure, Reactivity and Carcinogenicity of Halohydrocarbons; Benjamin L. Van Duuren; New York University, Institute of Environmental Medicine, 550 Fifth Avenue, New York, NY 10016; **Award #76-10656 A01**

   Determine the relationship between the chemical structures of various industrially produced halogenated hydrocarbons, both saturated and unsaturated, and their reactivity with a variety of reagents, stereochemistry, *in vivo* and *in vitro* metabolism and carcinogenic activities.

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.

1. Mechanisms of Virus Inactivation in Soils Injected with Municipal Wastewater and Treatment Plant Sludges; P.C. Cheo; The California Arboretum Foundation, The Los Angeles Arboretum, 301 N. Baldwin Avenue, Arcadia, CA 91006; **Award #76-82743 A01**

   Bacteria normally found in soil may be responsible for inactivation of viruses. This research will characterize the anti-viral factors in soils of different compositions, correlate the viruscidal effect with other physical and chemical properties of the soil, and investigate and relate the mechanisms of anti-viral activity in the soil to land application of municipal wastewater treatment plant sludges.

2. Stabilization of Community Wastewater Sludges by Soil Invertebrates; Roy Hartenstein; State University

of New York-Syracuse, College of Environmental Science and Forestry, Syracuse, NY 13210; **Award #78-09331**

Determine the feasibility of utilizing earthworms for stabilization of community wastewater treatment plant sludges. Studies include nutritional requirements and metabolism of earthworm species, the efficiency of transforming sludges into castings, and quality of the castings.

3. Disinfection of Enteric Viruses in Sludge by Energized Electrons; Theodore G. Metcalf; University of New Hampshire, Department of Microbiology, Durham, NH 03824; **Award #77-14454 A01**

   Continue research to determine the effectiveness of high-energy electron radiation as a method for inactivation of enteric virus pathogens in municipal wastewater treatment plant sludges; characterize the relationship between dose rate and virus inactivation.

4. Potential Health Risks Associated with Injection of Residual Domestic Wastewater Sludges into Soils; Bernard P. Sagik; University of Texas-San Antonio, College of Science and Mathematics, San Antonio, TX 78285; **Award #77-10187 A01**

   Assess the potential risk to human health from the application of community wastewater treatment plant sludges to land. Identify virological criteria for the selection of land application sites, assess soil properties and their effect on virus survival and transport, conduct a workshop to recommend criteria for selection and monitoring of sludge injections sites to minimize health risks.

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. Three major aspects of the probelm are considered: Siting, Design and Policy. SITING focuses on the relationship between soil and geologic conditions at a given site, the potential earthquake hazard of the region, and the architectural, land use and engineering practices and policies necessary to make buildings at that site earthquake-resistant. DESIGN investigates the elastic and inelastic behavior of building materials used on the behavior of structures during seismic and wind excitation, ways to minimize the risk of older buildings not built to meet earthquake code standards, and the behavior of non-engineered structures and secondary components of buildings. POLICY deals with social, economic, legal, institutional and other factors which facilitate or hinder the adoption of social and technological solutions, including prediction and warning, to earthquake hazards, and also seeks effective dissemination of earthquake information to the public and to government decisionmakers.

1. Simulation of Strong Earthquake Motion with Contained Explosive Line Source Arrays; G.R. Abrahamson, SRI International, 333 Ravenswood Avenue, Menlo Park, CA 94025; **Award #78-00993**

   Develop an explosive method to develop ground motion through an expandable rubber bladder to test *in situ* full-scale structures at strong earthquake levels to observe vibration modes and explore potential damage mechanisms. The technique will also have application to soil-structure interactions in general, including those in pipelines, power lines, dams, bridges, and tunnels.

2. A New Approach to the Prediction of Earthquake Strong Motion; Keiiti Aki; Massachusetts Institute of Technology, Department of Earth & Planetary Science, Cambridge, MA 02139; **Award #77-2336**

   Using information on the physical properties of an earthquake fault, predict earthquake strong motions on the basis of the laws of physics. Test the validity of a "Barrier Model" which is characterized by five site parameters: fault length, width, maximum slip, rupture velocity, and Barrier Interval, a term developed by Dr. Aki which is based on the states of the stress field across a fault prior to and during the earthquake occurance.

3. Underground Lifelines in a Seismic Environment; Melvin L. Baron; Weidlinger Associates, 110 East 59th Street, New York, NY 10022; **Award #78-15049**

   Develop practical design procedures which can be used by utilities, governmental agencies and manufacturers in their design of water distribution and transmission systems. Research will concentrate on underground water distribution lifelines.

4. A Longitudinal and Cross Cultural Study of the Post Impact Phases of a Major National Disaster; Frederick L. Bates; University of Georgia, Department of Sociology, Athens, GA 30602; **Award #77-12721 A01**

   Develop knowledge on how to prepare for and respond to a major national earthquake disaster through study of the aftermath of the Guatemalan earthquake of 1976; specifically, the impact of an earthquake on a nation and its society, effects of U.S. Government and private sector disaster relief on

recovery processes, the manner in which U .S. relief was coordinated with that of other countries, and the effects of the earthquakes and relief efforts on U.S.-sponsored post earthquake development programs in Guatemala.

5. Seismological Analysis of Strong Motion Records; Bruce A. Bolt; University of California, Seismographic Station, Berkeley, CA 94720; **Award #78-02650**

   Increase the understanding of strong motion records from the viewpoint of seismological wave theory, wave propagation, and source mechanics: examine the consequences of using effective peak acceleration as a scaling parameter for response spectra rather than the dislocation pulse; conduct wave analysis of strong motion records to search for common physical features in terms of source mechanisms, fault rupture and so forth.

6. Optimum Design of Three-Dimensional Building Systems for Multicomponent Earthquake Motions; Franklin Y. Cheng; University of Missouri at Rolla, Department of Civil Engineering, Columbia, MO 65201; **Award #78-05694**

   Study the optimum design of three-dimensional building systems subjected to static loads, wind forces, and earthquake motions; formulate optimization and structural models; develop computer programs for optimum design; conduct computer analysis of design options; and assess critical structure parameters and systems.

7. Collaborative International Research on Earthquake Response of Structures, U.S.-Yugoslavia; Ray W. Clough; University of California, M-11 Wheeler Hall, Berkeley, CA 94720; **Award #77-22527**

   Coordinate ongoing research at Berkeley and in Yugoslavia on the dynamic behavior and earthquake resistance of high rise residential buildings, including foundations and surrounding soil deformations.

8. Progressive Collapse of Transmission Line Structures Due to Dynamic Loads; John J. Fleming; University of Pittsburgh, Department of Civil Engineering, Pittsburgh, PA 15213; **Award #77-23519**

   Determine displacements and forces in electric transmission line structures resulting from loss of support of the wires in a span due to foundation failure, slippage or other earth movements during wind or seismic disturbances; develop design criteria which would prevent progressive collapse.

9. Summer Institute on Multiprotection Design; George Goforth; Defense Civil Preparedness Agency, Protective Structures Survey and Engineering Division, Washington, D.C. 20301; **Award #78-09865**

   Conduct a Summer Institute for faculty of engineering and architectural schools on seismic engineering, fire engineering, wind engineering, and energy conservation in building design.

10. Earthquake Ground Motion Modeling for Central United States; Robert B. Herrmann; Saint Louis University, 221 North Grant Boulevard, St. Louis, MO 63103; **Award #76-20875 A01**

    Conduct theoretical and observational studies to improve the empirical model for predicting ground motion and for the planning and design of buildings and earthquake reconstruction in the Central United States.

11. Analysis of Strong-Motion Data Network Programs; Wilfred D. Iwan; California Institute of Technology, Department of Engineering and Applied Science, Pasadena, CA 91109; **Award #78-12704**

    Assess NSF-supported programs related to strong ground motions and the response of structures during earthquakes, make recommendations on the operation of the major data network programs, provide coordination for data network programs, and assist in the transfer of data to the user community.

12. Dynamic Wind Loads on Buildings; Bernard M. Leadon; University of Florida, Department of Aero Engineering and Engineering Mechanics, Gainesville, FL 32611; **Award #77-26391**

    Examine the relation between small-scale wind tunnel studies and full-scale structures to estimate the dynamic response of structures under lateral loadings of low frequency and to estimate the convective film heat transfer coefficient for smooth surfaces in curtain walls.

13. Structural Response Under Random Wind Loading; Y.K. Lin; University of Illinois, Department of Aeronautical and Astronautical Engineering, Urbana, IL 61801; **Award #76-84171A01**

    Establish a mathematical theory for structural response to random gusty wind, apply stochastic stability concepts to solve the wind induced structural instability problem, investigate the vortex pattern of wind and its effects, and demonstrate the application of research results in the analysis and design of actual buildings and bridges.

14. Seismic Safety Preparedness by Local Governments in California; Dean E. Mann; University of California, Santa Barbara, Department of Political Science, Santa Barbara, CA 93106; **Award #77-03688 A01**

Focus on four communities in California to understand how local governments differ in planning for and implementing seismic safety; identify more effective strategies for planning and implementing programs for reducing hazards.

15. North American Masonry Conference; J.L. Noland; Atkinson-Noland & Associates, Inc., P.O. Box 3611, Boulder, CO 80303; **Award #77-27812**

    Conduct the North American Masonry Conference for the exchange of concepts, information and experience in all areas related to masonry usage including materials, design, construction, quality control, codes and standards, education and training, manufacturing, energy considerations and other topics; provide this information in a conference proceedings (persons wishing to obtain conference proceedings should contact the Principal Investigator directly).

16. Seismic Behavior of Precast Curtain Walls in High Rise Buildings; Dale C. Perry; Washington State University, Department of Civil and Environmental Engineering, Pullman, WA 91164; **Award #77-20805**

    Explore curtain wall participation in total structural response characteristics of high-rise buildings subjected to seismic excitation; develop models for predicting the contribution of nonstructural fascia to total building stiffness and energy dissipation.

17. Seismic Behavior of Precast Curtain Walls in High Rise Buildings; Ronald L. Sack; University of Idaho, Department of Civil Engineering, Moscow, ID 83943; **Award #77-20884**

    Explore curtain wall participation in total structural response characteristics of high-rise buildings; quantify the constitutive relationships for precast concrete cladding systems; and develop analytical models suitable for predicting the contribution of fascia panels to total building response.

18. Prediction of Earthquake Resistance of Structures; P.C. Wang; Polytechnic Institute of New York, 333 Jay Street, Brooklyn, NY 11201; **Award #76-14893 A01**

    Develop a minimum method to generate linear and nonlinear design earthquakes for reliable structural design, including development of critical response spectra and procedures for choice of design variables, and develop computational aids and computer programs in forms that can be directly used by practicing engineers.

19. An Evaluation of the Effects of Earthquake Input Motion Phasing on Structural Response Characteristics; Stuart D. Werner; Agbabian Associates, 250 North Nash Street, El Segundo, CA 90245; **Award #77-23335**

    Investigate the response of various structures supported on an elastic half-space to traveling P, SV, and Rayleigh waves; determine the importance of input motion phasing on structural response and soil structure interaction.

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