



environment

National Science Foundation

Washington, D.C. 20550

Recent Awards: January-March 1977

Introduction

The Research Applied to National Needs (RANN) Program focuses U.S. scientific and technical resources on selected problems of National importance for the purpose of contributing to their timely and practical solution. Programs involved with problem areas include Resources, Environment, Productivity, Intergovernmental Science and Research and Development Incentives, and Exploratory Research and Technological Assessment.

The goal of the Environment Division is to enhance the Nation's capability to mitigate unacceptable environmental hazards and conditions, whether man-caused or natural. This research activity seeks 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 booklet presents an index of the projects recently funded by the Division of Advanced Environmental Research and Technology (AENV). Interested readers wishing further information pertaining to research in areas of science currently investigated by the Division are encouraged to complete and mail the attached post card. Additional information regarding proposal guidelines and proposal submissions is available upon request.

The following report presents brief descriptions of awards for scientific research given by the Division of Advanced Environmental Research and Technology during the period January 1, 1977 through March 31, 1977. This booklet describes the total number of awards granted during the aforementioned time period. The data collected and contained in this report was derived from records of the Division of Advanced Environmental Research and Technology.

Definitions and Explanation of Format

Sample Statistical Summary:

Effects of Sludge on Marshland Ecosystems;^{1*} Charles F. Rogers;² Department of Chemistry and

Physical Sciences, University of Northern Alabama, Huntsville, Alabama 35805;³ Grant #77-10369;⁴ Supplemental Award.⁵

*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 nonprofit basis, as well as State governments and Federal organizations.

4. Grant Number

5. **Type of Grant:** a) "New" refers to an award which has received no prior support from NSF, regardless of whether the principal investigator has received support on previous occasions; b) "Renewal" refers to follow-on support of a project which is currently supported; and c) "Supplement" refers to the addition of funds to an existing NSF supported project without increasing the duration of NSF support.

Managing the Natural Environment

Provide economically and ecologically sound options to manage environmental risks created by human activity.



Chemical Threats to Man and Environment

Identify, understand, and reduce contamination arising from the manufacture, use, and disposal of chemical products.

1. Effect of Chemicals and Physical Properties of Organic Compounds on their Biodegradation; Martin Alexander; Department of Agronomy, Cornell University, Ithaca, New York 14853; Grant #77-03912; Renewal Award.

- Determine the effects of adding particular substituents to organic compounds on their microbial biodegradation. Establish the reasons some biodegradable molecules resist degradation in certain environments. Assess the role of com-etabolism in the biodegradation of organic pollutants. Determine the effect of utilizable nutrients and structural analogues of potential pollutants on the rate of their biodegradation in mixtures.
2. **Chemodynamic Studies on Bench Mark Industrial Chemicals**; Cary C. T. Chiou; Environmental Health Sciences Center, Oregon State University, Corvallis, Oregon 97331; Grant #77-00905; Supplemental Award.

Determine the number of physical and chemical properties for representative compounds of several classes of industrial chemicals in order to generate the data base needed to predict the environmental transportation and deposition of various hazardous organic compounds.
 3. **Global Atmospheric Measurements Experiment on Tropospheric Aerosols and Gases (GAMETAG)**; Douglas D. Davis; Georgia Institute of Technology, Atlanta, Georgia 30332; Grant #76-81487; New Award.

Investigate the importance of hydroxyl radical tropospheric chemistry and begin to assess the global tropospheric budget for many species which interact with this radical, which is regarded as the primary scavenger and reactant in the troposphere.
 4. **Cytogenetic Effects of Mutagens and Mitotic Poisons on Mammalian Cells**; T. C. Hsu; University of Texas—M.D. Anderson Hospital & Tumor Center, Houston, Texas 77030; Grant #76-82241; Renewal Award.

Develop a protocol for the analysis of clastogens (agents which cause chromosome breaks) and mitotic poisons in mammalian cells. Modify the analytical techniques for water-insoluble chemicals. Refine the premature condensed chromosome technique to measure the background abnormality rates in gametogenesis. Examine chemical mutagens for the effects of spindle derangement and investigate the feasibility of using male, mammalian meiosis as a test system for environmental mutagens.
 5. **Chemical Transformations in Photochemical Smog and Their Applications to Air Pollution Control Strategies**; James N. Pitts, Jr.; Statewide Air Pollution Research Center, University of California, Riverside, California 92502; Grant #76-84022; Renewal Award.

Prepare an experimentally validated model for chemical transformations in photochemical smog. Elucidate the formation and role of particulates in photochemical air pollution.
 6. **The Role of Solar Ultraviolet Radiation in the Formation of Hydroxyl Radicals in the Troposphere**; F. Bach Sellers; Panametrics, Inc., 221 Crescent Street, Waltham, Massachusetts 02154; Grant #76-23902; New Award.

Provide accurate airborne ultraviolet flux measurements made simultaneously with the chemical and meteorological measurements of the Global Atmospheric Measurements Experiment on Tropospheric Aerosols and Gases (GAMETAG) program funded by NSF. Provide the GAMETAG project with adequate radiation information to define the chemical role of the hydroxyl radical in the troposphere.
 7. **Environmental Flow of Cadmium and Other Trace Metals**; Kenneth J. Yost; Institute of Environmental Health, Purdue University, West Lafayette, Indiana 47907; Grant #77-01605; Renewal Award.

Provide technical information to regulatory agencies, industries, and trade organizations which will aid the determination of the technical and economic feasibility of emission/effluent standards for specific industrial sources of cadmium, zinc, lead, and other heavy metals. Develop a basic understanding of the movement, points of accumulation, and biological effects of heavy metal emissions from the steel making and metal finishing industries located along the southern shoreline of Lake Michigan.



Regional Environmental Management

Develop management and analytic procedures for identifying, exploring, and comparing alternatives for achieving environmental goals.

1. **Land Use Dilemmas and Public Policy: An Assessment of Research Needs**; Michael F. Brewer; The Academy for Contemporary Problems, 2030 M St., N.W., Washington, D.C. 20036; Grant #76-83200; New Award.

Review the status of land use issues and determine the need for land use research over the next decade.
2. **Water Pollution and the Urban Economy**; Alan S. Cohen and George S. Tolley; Department of Economics, University of Chicago, Chicago, Illinois 60637; Grant #76-81802; New Award.

Assess the impact of urban water pollution on the economy of a metropolitan site and its relationship with land-use and local regulations. Develop economic models which, coupled with tested hydrological and transport models for point and nonpoint sources of contaminants, will be used to predict the effects of water quality regulations, control costs, and benefits on administrative responses and land use controls.

3. Utilization of Soil Invertebrates in Stabilization, Decontamination, and Detoxification of Residual Sludges from Treatment of Wastewater; Roy Hartenstein; College of Environmental Science and Forestry, State University of New York, Syracuse, New York 13210; Grant #77-06994; Renewal Award.

Determine the role of soil invertebrates in the stabilization of municipal wastewater treatment plant sludges and the application of this knowledge to their management by placement on agricultural land. Organisms being evaluated include several species of earthworms and nematodes. Representative sludges from aerobic and anaerobic digesters are being studied to identify the agents that are toxic to the test organisms and thus limit the application rates of sludges on soil.

4. Assessment of Programs for Public Participation in State Land Use Decisionmaking; Nelson M. Rosenbaum; Urban Institute, Land Use Center, 2100 M St., N.W., Washington, D.C. 20037; Grant #77-05169; Supplemental Award.

Develop a useful conceptual framework for the planning and evaluation of programs for public participation in land use decisionmaking. Undertake a comparative empirical evaluation of such programs in a number of large-scale jurisdictions.

Disasters and Natural Hazards

Seek methods and techniques that can provide more cost-effective protection for man and his works.



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.

1. Underground Lifelines in a Seismic Environment; Melvin L. Baron; Weidlinger Associates, 110 East 59th Street, New York, New York 10022; Grant #76-80982; Supplemental Award.

Study the behavior of underground lifeline structures such as pipelines, conduits, and channels in seismic environments. Apply the technical knowledge gained with cost-benefit and optimization studies in order to plan, design, and construct such structures.

2. Stability of Structures Under Static and Dynamic Loading - International Colloquium, May 17-19, 1977; Lynn S. Beedle; Fritz Engineering Laboratory, Lehigh University, Bethlehem, Pennsylvania 18015; Grant #76-20825; New Award.

Bring together the generators of research information on the static and dynamic stability of structures and elements and the users of this information to evaluate the latest research results. Identify further needed research and documentation of static and dynamic stability information in a form suitable to be incorporated into design guides.

3. Safety Evaluation of Buildings Exposed to Earthquakes and Other Catastrophic Environmental Hazards; Boris Bresler; Department of Civil Engineering; University of California, Berkeley, California 94720; Grant #76-82384; New Award.

Develop methods and criteria for assessing the damage potential of existing structures. Develop guidelines based on damage potential indices which would be suitable for use by practicing engineers and building regulation departments.

4. Seismic Resistance of Fossil-Fuel Power Plants; John L. Bogdanoff; School of Aeronautics and Astronautics; Purdue University, Lafayette, Indiana 47907; Grant #77-01392; Renewal Award.

Examine the structural dynamic behavior and response of major components of large fossil-fuel steam power plants subjected to seismic forces.

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Develop computer codes for the analysis of the major components; develop analysis and design guidelines and criteria; and develop design recommendations for code groups to consider for adaptation.

5. National Information Service for Earthquake Engineering-University of California, Berkeley; Ray W. Clough; Earthquake Engineering Research Center, University of California, Richmond, California 94804; Grant #77-01934; Supplemental Award.

Develop an effective information service for earthquake engineering by developing a library of technical information; by preparing and publishing programs and an abstract journal; by disseminating information; and by providing educational opportunities for professional practitioners.

6. Inflationary Changes in Construction Costs Created by Earthquake Damage: Implications for Government Policy; Harold C. Cochrane; Department of Economics, Colorado State University; Ft. Collins, Colorado 80523; Grant #76-24169; New Award.

Assess the extent of disaster-related inflation following the occurrences of hazardous events. Prepare recommendations for legislative and administrative actions to counteract it.

7. Structural Loads Analysis and Specification; C. Allin Cornell; Department of Civil Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139; Grant #77-01389; Supplemental Award.

Develop a practical, unified approach to the analysis and specification of structural loadings, including extremum value loads and continuous loads by developing a relatively simple, unified set of representatives from the random characteristics of loads and by developing alternative codifiable treatments of loading and load combination specification.

8. Structural Connections in Industrial Installations Subject to Earthquakes; George C. Driscoll; Fritz Engineering Laboratory, Lehigh University, Bethlehem, Pennsylvania 18015; Grant #76-01551; New Award.

Study current practices of connections in industrial installations with respect to their earthquake performance. Develop recommendations for improved design for connections within equipment and between equipment and supporting or containing structures.

9. Formulation and Expression of Seismic Design Provisions; Steven J. Fenves; Carnegie-Mellon University, Pittsburgh, Pennsylvania 15213; Richard N. Wright; National Bureau of Standards, Gaithersburg, Maryland 20834; Grant #77-01497; Supplemental Award.

Facilitate the development, usefulness, and implementation of the seismic design provisions that are currently being developed by the National Bureau of Standards and the Applied Technology Council.

10. Conference on the Repair and Rehabilitation of Buildings; Robert D. Hanson; Department of Civil Engineering, University of Michigan, Ann Arbor, Michigan 48109; Grant #76-83884; New Award.

Conduct a conference and workshop consisting of professionals, faculty, and researchers to assess the current practices and needs of the professionals concerned with the repair and rehabilitation of structures, including other hazardous buildings. Undertake a projection of future research.

11. Earthquake Induced Bond Deterioration of Reinforced Concrete; Neil M. Hawkins; Department of Civil Engineering, University of Washington, Seattle, Washington 98105; Grant #76-15366; New Award.

Study the bond deterioration between reinforcing bars and the surrounding concrete when reinforced concrete elements are subjected to reverse earthquake loadings. Recommend design regulations for seismically loaded reinforced concrete structures.

12. Earthquake Ground Motion Modeling for the Central United States; Robert H. Hermann; Department of Earth and Atmospheric Sciences; St. Louis University, St. Louis, Missouri 63103; Grant #76-20875; New Award.

Conduct theoretical and observational studies to re-examine the available data base and improve the empirical model for predicting ground motion. Predict strong motion parameters and time histories in the distance range of up to 500 kilometers for earthquakes with a magnitude equal to or stronger than five, based on the study.

13. Effects of Damage from Strong Earthquakes; George W. Housner; Department of Civil Engineering and Applied Mechanics, California Institute of Technology, Pasadena, California 91125; Grant #76-17137; Renewal Award.

Develop practical techniques for the analysis of non-linear structural response to seismic forces and apply the methods to control the damage of structures beyond the elastic range.

14. National Information Service for Earthquake Engineering - California Institute of Technology; George W. Housner; Department of Civil Engineering and Applied Mechanics, California Institute of Technology, Pasadena, California 91125; Grant #77-07472; Supplemental Award.

Serve as a source of earthquake engineering information with particular emphasis on strong earthquake recordings data such as digitized

acceleration, velocity and displacement. Provide a unique earthquake engineering reference source collection and make available to researchers and practitioners copies of reports, recorded accelerograms, digitized card decks and tapes.

15. Seismic Safety Design for Police and Fire Stations; Earle W. Kennett; American Institute of Architects, Research Corporation, 1735 New York Avenue, N.W., Washington, D. C. 20006; Grant #76-80695; New Award.

Explore, define, and record seismic design considerations to be used by the architectural and public safety professions in the design, construction, and operation of police and fire stations, including recommendations for specific, prototypical architectural design alternatives.

16. Operation of the National Program in Strong Motion Instrumentation; Robert B. Matthiesen; U.S. Geological Survey, 345 Middlefield Road, Menlo Park, California 94025; Grant #76-82207; Renewal Award.

Develop and operate a national program in strong-motion instrumentation and data management with respect to network design, network operations, and data management. The data development forms the basis for analysis, design, and construction of structures of all types to be earthquake resistant in order to mitigate the losses of life and property.

17. Induced Seismicity at the Nurek Reservoir, Tadzhikistan, U.S.S.R.; David W. Simpson; Lamont-Doherty Geological Observatory, Columbia University, Palisades, New York 10027; Grant #01092; New Award.

Study the induced seismicity near a reservoir. Investigate spatial and temporal variations in the seismicity and their relationship to water level. Perform studies on the frequency characteristics of earthquakes and various geological and geophysical effects to the induced seismic nation.

18. Effects of Earthquake Motions on Reinforced Concrete Buildings; Mete A. Sozen; Department of Civil Engineering, University of Illinois, Urbana, Illinois 61805; Grant #77-01391; Supplemental Award.

Identify and understand the mechanisms of energy dissipation in slender reinforced concrete structures subjected to strong ground motion in an effort to develop simple but realistic design methods for earthquake resistance.

19. Earthquake and Wind Response of Segmentally Constructed Hyperbolic Natural Draft Cooling Towers; Chi C. Tung; Department of Civil Engineering; North Carolina State University, Raleigh, North Carolina 27607; Grant #76-19663; New Award.

Study the dynamic response of segmentally constructed prestressed hyperbolic cooling towers using model studies and develop linear and non-linear analytical models for predicting the dynamic response of such structures.

20. Evaluation of the Seismic Safety of Buildings; Erik H. Vanmarcke; Department of Civil Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139; Grant #76-19021; Renewal Award.

Determine the actual degree of safety against earthquake damage provided by a specific structural system and various materials as a result of the different methods of analysis and consideration of the earthquake motion. Investigate several alternatives, such as time-history analysis, response spectrum model analysis, and random vibration analysis.

21. Seismic Vulnerability, Behavior and Design of Underground Piping Systems; Leon R. L. Wang; Department of Civil Engineering, Rensselaer Polytechnical Institute, Troy, New York 12181; Grant #77-01390; New Award.

Develop a systematic way of assessing the adequacy of existing water/sewer distribution systems. Determine the earthquake vulnerability of the systems and study the cost-effectiveness of new designs to various magnitudes of earthquakes.



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.

1. State Government Policy Options for the Utilization of Earthquake Prediction Technology; Hirst Sutton; Council of State Governments, 1225 Connecticut Ave., N.W., Washington, D.C. 20036; Grant #77-81112; New Award.

Examine public policy, legal, legislative, program, and administrative issues related to the evolving technology of earthquake prediction, with the objective of developing options in state policies and programs.



Weather Modification

Develop and test weather modification technologies which mitigate undesirable effects of weather, and identify problems and opportunities arising from inadvertent modification of weather by human activity.

1. The Legal Implications of Inadvertent Weather Modification: METROMEX and the Law; Ray J. Davis; School of Law, University of Arizona, Tucson, Arizona 85721; Grant #80996; New Award.

Ascertain the legal constraints upon public policy options in dealing with inadvertent weather modification with particular emphasis on urban related weather changes.

2. METROMEX: Social Impacts of Inadvertent Weather Modification: A Comparative Study; Barbara Farhar; Human Ecology Research Services, Inc., 855 Broadway, Boulder, Colorado 80302; Grant #76-22041; New Award.

Determine the societal awareness of and response to weather effects produced by inadvertent weather modification in the METROMEX study area.

3. A Comparative Analysis of Reaction to Weather Modification; Barbara Farhar; Human Ecology Research Services, Inc., 855 Broadway, Boulder, Colorado 80302; Grant #76-83400; Renewal Award.

Analyze the societal response to weather modification for the development of an implementation model which enables technicians to apply it

in a manner which is most beneficial and least disruptive to society.

4. Management of Nucleating Agents Used in Weather Modification: Development of Microbial Threshold Toxicity Criteria; Donald A. Klein; Department of Microbiology, Colorado State University, Fort Collins, Colorado 80521; Grant #76-84005; Supplemental Award; Grant #76-82202; Renewal Award.

Assess the ecological and environmental impact as well as the long-term impact of nucleating agents, such as silver iodide, in weather modification.

5. Ferrate Ion Disinfection of Municipal Wastewater; Thomas D. Waite; Department of Civil Engineering, Northwestern University, Evanston, Illinois 60201; Grant #76-83897; New Award.

Determine the feasibility of using the ferrate ion as a disinfectant for municipal wastewater.

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