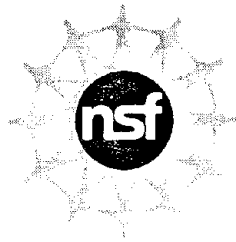


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# environment

## National Science Foundation

Washington, D.C. 20550

### Recent Awards: April-June 1977

#### Introduction

This booklet presents an index of the projects recently funded by the National Science Foundation's Research Applied to National Needs program in Advanced Environmental Research and Technology (AENV). The goal of the Environment Division has been 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.

The following report presents brief descriptions of awards for scientific research given by the Division of Advanced Environmental Research and Technology during the period April 1, 1977 through June 30, 1977. This booklet describes the total number of awards granted during the aforementioned time period. The data collected and contained in this report were derived from records of the Division of Advanced Environmental Research and Technology and at the time of its printing had not been reconciled with National Science Foundation's Management Information System reports.

Interested readers wishing further information pertaining to research in areas of science 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.

#### Definitions and Explanation of Format

##### Sample Statistical Summary:

Strip Mining and It's Effects on Environmental Health;\* Walter G. Lewis;<sup>2</sup> Lewis & Day, Inc., 6822 Westcott Drive, Richmond, Virginia 22325;<sup>3</sup> Grant #77-00017;<sup>4</sup> New Award.<sup>5</sup>

##### \*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) "Supplemental" 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. Field Studies of Biologically Produced Atmospheric Sulfur Compounds; Alan R. Bandy; Department of Chemistry, Drexel University, Philadelphia, Pennsylvania 19010; Grant #76-80322; New Award.

Test the hypothesis that biogenic emissions, believed to be dominant on a global scale, are significant for the production of airborne sulfate particles in regions impacted with sulfur dioxide-like coal- or oil-burning plants.

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

Develop an isolated perfused gill preparation as a model to study the effect of pollutants on fish.

3. Immunological Studies of Cadmium and Zinc Binding Proteins; Justine S. Garvey; Department of Biology, Syracuse University, Syracuse, New York 13210; Grant #77-07896; New Award.

Study the structure and distribution of metal binding proteins when they are exposed to cadmium, mercury, silver and zinc. Investigate the feasibility of developing a radio-immunoassay to determine trace metal exposure.

4. Eleventh Annual Conference on Trace Substances in Environmental Health; Delbert D. Hemphill; Department of Horticulture, University of Missouri, Columbia, Missouri 65201; Grant #77-06004; Renewal Award.

Bring together the numerous and various disciplines concerned with effects of trace substances in the environment. Exchange the latest scientific information in the interdisciplinary areas. Relate the indirect effect of trace substances upon man through changes in the ecosystem. Explore methodologies aimed at evaluating and controlling the effects of these substances.

5. An evaluation of Toxicological Information Relevant to Future Testing Requirements for Hazardous Chemical Substances and Mixtures; John C. Kolojeski; Clement Associates, Inc., 1055 Thomas Jefferson Street, N.W., Washington, D.C. 20007; Grant #77-15417; Renewal Award.

Identify, quantify and assess the impact of the spread of hazardous chemical substances on the environment and their effects on human populations.

6. An Investigation into the Chemistry of the Ultraviolet-Ozone Water Purification Process; Eriks Leitis; Westgate Research Corporation, 1931 Pontius Avenue, Los Angeles, California 90025; Grant #76-24652; New Award.

Define the Chemical and photochemical mechanisms that account for the known synergistic action of ozone and ultraviolet light in destroying organic chemicals in water so as to aid in designing the widest possible applications of this process.

7. Characterization of Aquatic Organics and Complexes; Walter J. Maier; Department of Civil and Mineral Engineering, University of Minnesota, Minneapolis, Minnesota 55455; Grant #77-04496; New Award.

Determine the identity, stability and sources of aquatic organic material from natural and anthropogenic origins in the upper Mississippi River.

8. Measurement of Sulfur Dioxide Oxidation on Particulate Surfaces; Volker A. Mohnen; Atmospheric Sciences Research Center, State University of New York, Albany, New York 12203; Grant #76-81817; New Award.

Develop and evaluate techniques for studying the mechanisms and importance of sulfur dioxide oxidation on solid atmospheric particulate sources of anthropogenic and natural origin.

9. Study of Chemistry of Airborne Particulates; Tihomir Novakov; Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720; Grant #77-01607; Supplemental Award.

Determine the chemical nature of atmospheric aerosols and the roles they play in producing the end-product particulates of polluted air.

10. Socio-Behavioral Responses to Chemical Hazards; Enrico L. Quarantelli; Disaster Research Center, Ohio State University, Columbus, Ohio 43201; Grant #77-14445; New Award.

Increase knowledge on the social impact of chemical hazards and identify policy options for mitigating the consequences of chemical disasters.

11. Symposium on Terrestrial Microcosms and Environmental Chemistry; James M. Witts; Department of Agricultural Chemistry, Oregon State University, Corvallis, Oregon 97331; Grant #77-15856; New Award.

Review the state-of-the-art of terrestrial microcosm technology. Develop provisional, standard test procedures using terrestrial microcosms for the determination of the environmental hazard potential of industrial chemicals. Determine future research needs to establish the efficiency of a surrogate chemical substance as a candidate test material in terrestrial microcosm systems.

12. Cancer Mortality in an Urban-Industrial Environment: A Planning Study; Kenneth J. Yost; Institute of Environmental Health, Purdue University, West Lafayette, Indiana 47907; Grant #76-83885; New Award.

Determine whether an epidemiological study can provide the basis for a quantitative assessment of the relationship between site-specific cancer and polycyclic aromatic hydrocarbons and other airborne carcinogens at the census tract scale.



### Regional Environmental Management

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

1. Consumer Response to Urban Drought in Central California; William H. Bruvold; School of Public

Health, University of California, Berkeley, California 94720; Grant #77-16171; New Award.

Provide local and regional administrators with more efficient, effective and equitable drought-management strategies through the assessment and analysis of institutional and use responses to a current urban drought.

2. Hydrometeorological Studies Addressing Urban Water Resource Needs; Stanley A. Changnon, Jr.; Illinois State Water Survey, Box 232, Urbana, Illinois 618801; Grant #76-84178; Renewal Award.

Develop strategies for management of storm water systems based on improved analysis of environmental factors. Develop a real-time prediction-monitoring system for storm rainfall. Improve precipitation data collection and analysis processes for optimizing hydrological system design and operation. Establish methods for transferral of research findings to other areas.

3. Mechanism of Virus Inactivation in Soils Injected with Municipal Wastewater and Treatment Plant Sludges; P. C. Cheo; The California Arboretum Foundation, 301 N. Baldwin Avenue, Arcadia, California 91006; Grant #76-82743; New Award.

Investigate anti-viral activity in soil and assess its significance with reference to current emphasis on utilizing land for management of sludges from municipal wastewater treatment plants.

4. The Impacts of Nutrient Loading and Atmospheric Contaminants on the Water Quality of Lake Tahoe, California-Nevada; Charles R. Goldman; Institute of Ecology, University of California, Davis, California 95616; Grant #77-06506; New Award.

Provide improved scientific information on the atmospheric contaminants inputs into a lake located in a rapidly growing area.

5. Control of Heavy Metal Content of Municipal Wastewater Sludges; C. Fred Gurnham; Gurnham and Associates, Inc., 223 West Jackson Blvd; Chicago, Illinois 60606; Grant #77-04355; New Award.

Determine the feasibility of controlling the amounts of heavy metals in municipal wastewater treatment plant sludges by regulating their sources.

6. Effect of Infrared Radiation on Compaction of Municipal Wastewater Sludges; Stephen C. Havilcek; Engineering Experiment Station, Georgia Institute of Technology, Atlanta, Georgia 30332; Grant #77-15086; New Award.

Characterize the conditions under which infrared radiation influences the compaction of wastewater treatment plant sludges for determination of the conditions under which this phenomenon can be utilized in processing sludges to reduce their moisture content.

7. Application of Sequencing Batch Reactors for Treatment of Municipal and Industrial Wastewaters; Robert L. Irvine; Department of Civil Engineering; University of Notre Dame, Notre Dame, Indiana 46556; Grant #77-12120; Renewal Award.

Evaluate controlled periodic operation of wastewater treatment processes as an alternative to continuous flow as a major step toward improvement of performance and reliability of plant operations.

8. Agricultural Value of Irradiated Municipal Wastewater Treatment Plant Sludge; Mary Beth Kirkham; Department of Agronomy, Oklahoma State University, Stillwater, Oklahoma 74074; Grant #77-04092; New Award.

Assess the feasibility of using irradiated sludges on agricultural land.

9. Assessing of Selected RANN Regional Environmental Systems Modeling Projects: Transfer and Comparability Testing; Brian W. Mar; Department of Civil Engineering, University of Washington, Seattle, Washington 98105; Grant #77-13903; Supplemental Award.

Provide a minimal data base regarding the transfer and utility aspects of selected Regional Environmental Systems projects.

10. Feasibility of Eliminating Discharges of Pollutants from Cooling Towers; Jack V. Matson; Department of Civil Engineering, University of Houston, Houston, Texas 77004; Grant #77-06504; New Award.

Determine the feasibility of using lime-softening for removal of excess dissolved substances from water circulating in a cooling system permitting reuse of the water as a coolant and eliminating the need for discharge of pollutants to surface waters.

11. The Implementation of State Land Use Policy: Testing a Framework of Analysis; Daniel A. Mazmanian; Department of Government, Pomona College, Claremont, California 91711; Grant #77-14589; and Paul A. Sabatier; Division of Environmental Studies, University of California, Davis, California 95616; Grant #77-20077; New Award.

Develop an improved capability to analyze and predict the problems and requirements of implementing land use regulatory policies.

12. Utilization of Cypress Wetlands for Management of Municipal Wastewater Treatment Plant Effluents; Howard T. Odum; Center for Wetlands, University of Florida, Gainesville, Florida 32611; Grant #77-06013; New Project.

Complete studies of the response characteristics of cypress wetlands to their experimental use for conservation of nutrient and water content of municipal wastewater.

13. Water Quality and Health Significance of Bacterial Indicators of Pollution; Wesley O. Pipes; Department of Biological Sciences, Drexel University, Philadelphia, Pennsylvania 19104; Grant #77-12114; New Award.

Conduct a workshop that will critically review current knowledge regarding the water quality and environmental risk significance of bacterial indicators of pollution. Identify needed research to improve the basis for quantitative evaluation of risk to public health indicated by the parameters of the workshop.

14. The Implementation of State Land Use Policy: Testing a Framework of Analysis; Paul A. Sabatier.

See #11.

15. Land Management of Subsurface Injected Wastewater Liquid Residuals; James L. Smith; Department of Agricultural Engineering, Colorado State University, Fort Collins, Colorado 80521; Grant #77-11551; Supplemental Award.

Evaluate the feasibility of direct injection of municipal wastewater treatment plant residual sludges into soil as a long range solution for their management. Design an integrated sludge management system for a particular location to assist in the conceptualization of the planned proof-of-concept sludge management experiment.

16. Use of Wetlands for Management of Pond-Stabilized Domestic Wastewater; Jeffery C. Sutherland; Williams & Works, Inc., 611 Cascade West Parkway, S.E.; Grand Rapids, Michigan 49506; Grant #76-20812; Supplemental Award.

Assess the feasibility of using wetlands for management of effluent from municipal wastewater treatment plants.

### Disasters and Natural Hazards

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



Earthquake Engineering

### 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. Seminars-Earthquake Design; Mihran S. Agbalian; Earthquake Engineering Research Institute;

424 40th Street, Oakland, California 95609; Grant #77-07473; New Award.

Conduct regional seminars for professional engineers on the subject of earthquake design criteria, structural performance and interpretation of strong-motion records.

2. Tall Buildings and Urban Habitat: Impact on the Urban Environment and Planning for Natural Disasters; Lynn S. Beedle; Fritz Engineering Laboratory, Lehigh University, Bethlehem, Pennsylvania 18015; Grant #77-01598; New Award.

Develop utilization/implementation techniques to transfer the large quantity of research information and data collected by the Council on Tall Buildings and Urban Habitat on tall buildings and their interaction with the urban environment to decisionmakers, and others concerned with the conception, planning, design, and operation of tall buildings with particular emphasis on planning for natural hazards.

3. Partial Support of the Committee on Seismology; Joseph W. Berg; National Academy of Sciences, 2101 Constitution Avenue, N.W., Washington, D.C. 20418; Grant #76-24167; Renewal Award.

Provide Earth Sciences research data needs input into RANN program planning for its program in strong-motion instrumentation.

4. Seismic Behavior of Complete Structural Systems; Ray W. Clough; Department of Civil Engineering, University of California, Berkeley, California 94720; Grant #77-00280; Renewal Award.

Develop computer procedures for predicting structural response to earthquakes. Formulate mathematical models to reproduce the observed behavior analytically. Develop and test special structural components for improving the seismic resistance and conducting reconnaissance surveys of earthquake damaged structures.

5. Summer Institute on Architectural Design for Earthquake Disaster Mitigation; John P. Eberhard; AIA Research Corporation, 1735 New York Avenue, N.W., Washington, D.C. 20006; Grant #76-80799; New Award.

Conduct a one-week short course for faculty of architectural schools with respect to an understanding of the earthquake phenomenon and the methods to mitigate the damages as a result of a seismic event.

6. Processing and Analysis of Oroville Earthquake Aftershock Ground Motion Records; Thomas C. Hanks; U.S. Geological Survey, 12201 Sunrise Valley Drive, Reston, Virginia 22092; Grant #76-81816; New Award.

Process the large set of earthquake records obtained after the Oroville earthquake of 1975 with the data arranged into a four volume set. Carry out an analysis of this data to develop

- methods for predicting potential ground motions of specific sites taking into account frequency band and variables which are of engineering interest. The Survey is processing 100 aftershock accelerograms, analyzing data in terms of ground motion parameters, body wave spectra, seismic source parameters, and performing studies on synthesis of ground motion time histories. This project is being pursued in conjunction with the California Institute of Technology (see #8).
7. 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 reversed earthquake loadings. Recommend design regulations for seismically loaded reinforced concrete structures.
  8. Processing and Analysis of Oroville Earthquake Aftershock Ground Motion Records; Donald V. Helmberger; Department of Geology and Planetary Sciences, California Institute of Technology, Pasadena, California 91104; Grant #76-21652; New Award.
 

Process the large set of aftershock records obtained after the Oroville earthquake of 1975 with the data arranged into a four volume set. Carry out an analysis of this data to develop methods for predicting potential ground motions of specific sites taking into account frequency bands and variables which are of engineering interest. More specifically, it is processing long period data in terms of velocity and displacement time histories of 40 seismograms, analyzing data for the elasto-dynamic response of half space to faulting motions and generating synthetic motion histories. This project is in conjunction with the U.S. Geological Survey (see #6).
  9. Research Initiation-Strengthening of Reinforced Concrete Columns for Earthquake Resistance; Lawrence F. Kahn; Department of Civil Engineering, Georgia Institute of Technology, Atlanta, Georgia 30332; Grant #77-06478; New Award.
 

Determine the adequacy of various methods of strengthening and repairing concrete columns for improved earthquake resistance.
  10. Third U.S. National Conference on Wind Engineering Research, February 26-March 1, 1978; Bernard M. Leadon; Department of Engineering Sciences, University of Florida, Gainesville, Florida 32601; Grant #77-10170; New Award.
 

Bring together researchers and practitioners interested in dynamic wind effects to exchange information, to improve communication between researchers and users, to identify areas of research which require further effort and to produce a proceedings of the conference.
  11. Structural Response Under Random Wind Loading; Yu K. Lin; Department of Aeronautical Engineering, University of Illinois, Urbana, Illinois 61801; Grant #76-84171; New Award.
 

Develop stochastic models for wind forces in the along-wind and across-wind directions and to establish the stability criteria for structural response in the non-linear range.
  12. United States-Republic of China Cooperative Research in Earthquake Engineering-Part II; Le-Wu Lu; Department of Civil Engineering, Lehigh University, Bethlehem, Pennsylvania 18015; Grant #77-07470; New Award.
 

Conduct joint research on ground motion studies and seismic response of embedded structures (siting problems) and on strengthening concrete buildings with differential foundation settlements (design problems) which will be beneficial to both countries. This portion of the research will deal with earthquake resistance and strengthening of concrete buildings with foundation settlement and partial structural damage. (see #17).
  13. Soil-Structure Interaction with Arbitrary Seismic Environment; John Lysmer; Department of Civil Engineering, University of California, Berkeley, California 94720; Grant #76-23277; New Award.
 

Investigate earthquake soil structure interaction problems by finite element methods and approximate analytical approaches. Develop the theory and an associated finite element computer code for public utilization.
  14. Reliability of Existing Buildings in Earthquake Zones-Part II; Hugh D. McNiven; Earthquake Engineering Research Center, University of California, Berkeley, California 94720; Grant #77-06489; New Award.
 

Investigate the earthquake reliability of existing buildings by establishing a non-linear mathematical model representing the building and subjecting the model to a large family of earthquake excitations. This institution will develop the model. (see #26).
  15. Seismic Behavior of Multistory Masonry Structures; Hugh D. McNiven; Earthquake Engineering Research Center, University of California, Berkeley, California 94720; Grant #77-00281; Renewal Award.
 

Conduct experimental and analytical studies of the behavior of masonry wall panels subjected to earthquake excitation. Perform correlation studies with forced vibration test results and determine equivalent elastic constants of masonry structures.
  16. Seismic Behavior of Structures: Analysis and Design; Joseph Penzien; Department of Civil Engineering, University of California, Berkeley,

California 94720; Grant #77-00186; Renewal Award.

Apply improved seismic analysis capabilities to complete structural systems and develop methods of design with increased reliability of controlling seismic damage with a proper balance between cost and safety.

17. United States-Republic of China Cooperative Research in Earthquake Engineering-Part I; Joseph Penzien, Department of Civil Engineering, University of California, Berkeley, California 94720; Grant #76-06006; New Award.

Conduct cooperative research on ground motion studies and seismic response of embedded structures (siting problems) and on strengthening concrete buildings with differential foundation settlements (design problems) which will be beneficial to both countries. This portion of the research will study attenuation laws, maximum acceleration and other ground motion characteristics in order to find common features, correlations and discrepancies. (see #12).

18. Symposium on Structural Engineering and Mechanics; Karl S. Pister; Department of Civil Engineering, University of California, Berkeley, California 94720; Grant #77-06518; New Award.

Conduct a symposium to bring researchers, faculty and professionals together to present and discuss current knowledge needed in several areas of dynamic behavior, and developments in education, with respect to structural engineering and mechanics.

19. Seismic Behavior of Structural Components; Egor P. Popov; Department of Civil Engineering, University of California, Berkeley, California 94720; Grant #77-00275; Renewal Award.

Conduct experimental and analytical studies of the behavior of structural components subjected to earthquake excitation. Perform the experimental work on large-scale components which extrapolate the experimental results to practical situations.

20. Research Initiation-Behavior of Buried Conduit Structures Subjected to Seismic Loading; Jack Rosenfarb; Department of Civil Engineering, Drexel University, Philadelphia, Pennsylvania 19140; Grant #77-06421; New Award.

Investigate the behavior of buried conduit-type structures such as pipelines and tunnels. Assess the effects of structure flexibilities as influenced by conduit geometry, material and connection restraint conditions.

21. Workshop on Research Priorities for Geotechnical Earthquake Engineering Applications; Kenneth H. Stokoe, III; Department of Civil Engineering, University of Texas, Austin, Texas 78122; Grant #77-09861; New Award; and Felix Y. Yokel; Center for Building Technology, National Bureau

of Standards, Washington, D.C. 20234; Grant #77-14157; New Award.

This joint project is to organize, administer, and conduct a workshop on Geotechnical Earthquake Engineering Applications. It is also to review needs and priorities for future research and establish liaison among the various research groups.

22. Research Initiation-Nonproportional Damping of Interaction Systems Subjected to Earthquake Motions; David T. Tang; Department of Civil Engineering, State University of New York, Buffalo, New York 14214; Grant #77-06425; New Award.

Explore the concept of employing measured damping data in the computation of seismic response of interaction systems.

23. Shear Transfer in Thick-Walled Reinforced Concrete Structures Subjected to Seismic Loading; Richard N. White; Department of Structural Engineering, Cornell University, Ithaca, New York, 14850; Grant #76-23896; New Award.

Develop engineering and analytical models of the shear transfer mechanism in cracked concrete reinforced with large reinforcing bars. Test these models against structures damaged in actual earthquakes.

24. Summer Institute on Multiprotection Design; Bernard Wobbeking; American Society for Engineering Education, 1 Dupont Circle, Washington, D.C. 20036; Grant #77-01090; New Award.

Educate and train the participants in the methods of structural design to mitigate the losses as a result of natural hazards, such as earthquakes, tsunamis, fire, landslides, extreme winds, and others.

25. Earthquake Strong-Motion Instrument Development and Array Design; Francis T. Wu; Department of Geophysical Sciences, State University of New York, Binghamton, N.Y. 13901; Grant #76-23897; New Award.

Provide strong-motion instrument coverage in Eastern United States. Collect data for resolving the nature of strong-motion waves and for future predictive use in engineering design. Study the dynamic seismic source mechanisms by using near field data.

26. Reliability of Existing Buildings in Earthquake Zones-Part I; James T. Yao; Department of Civil Engineering, Purdue University, Lafayette, Indiana 47907; Grant #77-05290; New Award.

Investigate the earthquake reliability of existing buildings by establishing a non-linear mathematical model representing the building and subjecting the model to a large family of earthquake excitations. This institution will formulate reliability criteria and analyze the test results in terms of



damage probability and other probabilistic response measures. (see #14).

27. Workshop on Research Priorities for Geotechnical Earthquake Engineering Applications; Felix Y. Yokel; Center for Building Technology, National Bureau of Standards, Washington, D.C. 20234; Grant #77-14157; New Award.

See #21.



#### **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. Disaster Knowledge and Beliefs and Emergency Planning; Dennis E. Wenger; Department of Sociology, University of Delaware, Newark, Delaware 19711; Grant #77-10202; New Award.

Analyze public and official knowledge regarding the consequences of natural disasters. Assess community disaster preparedness.



#### **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. Assessing Midwest Cloud Characteristics for Weather Modification; Bernice Ackerman; Illinois State Water Survey, University of Illinois, Box 32, Urbana, Illinois 61801; Grant #77-11527; New Award.

Analyze midwest convective cloud data, synthesize the results, and assess the potential for effective modification to augment precipitation.

2. The Effects of Urban-Industrial Emissions on Downwind Weather Patterns; Roscoe R. Braham, Jr.; Department of Geophysical Sciences, University of Chicago, Chicago, Illinois 60637; Grant #77-06500; New Award.

Determine the effects of urban-industrial emissions on wintertime clouds in the region downwind.

3. Third Workshop on Inadvertent Weather Modification; George D. Robinson; Center for the Environment and Man, Inc.; 275 Windsor Street, Hartford, Connecticut 06101; Grant #77-10186; New Award.

Organize, conduct, and report on a workshop on the local and regional aspects of inadvertent weather and modification.

4. Statistics and Origin of Haze in the Central United States; George D. Robinson; Center for the Environment and Man, Inc.; 275 Windsor Street, Hartford, Connecticut 06101; Grant #77-12125; New Award.

Investigate the frequency, intensity, nature and origin of atmospheric haze in the Central United States and its effects in reducing solar radiation at the earth's surface.

5. Operational Cloud Seeding Evaluation Techniques; Paul T. Schickedanz; Illinois State Water Survey, University of Illinois, Urbana, Illinois 61801; Grant #77-01103; New Award.

Develop and test statistical-meteorological techniques for evaluation of operational seeding programs.

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