State of California

AIR RESOURCES BOARD

Resolution 80-15

April 24, 1980

WHEREAS, an unsolicited research Proposal Number 892-75 entitled "Air Quality and Birth Outcome, South Coast Air Basin" has been submitted by the University of California at Los Angeles to the Air Resources Board; and

WHEREAS, the Research staff has reviewed and recommended this proposal for approval; and

WHEREAS, the Research Screening Committee has reviewed and recommends for funding:

> Proposal Number 892-75 entitled "Air Quality and Birth Outcome, South Coast Air Basin" submitted by the University of California at Los Angeles for an amount not to exceed $157,521;

NOW, THEREFORE, BE IT RESOLVED, that the Air Resources Board pursuant to the authority granted by Health and Safety Code Section 39703, hereby accepts the recommendation of the Research Screening Committee and approves the following:

> Proposal Number 892-75 entitled "Air Quality and Birth Outcome, South Coast Air Basin" submitted by the University of California at Los Angeles for an amount not to exceed $157,521,

BE IT FURTHER RESOLVED, that the Executive Officer shall initiate administrative procedures and execute all necessary documents and contracts for the research effort proposed in an amount not to exceed $157,521.

I certify that the above is a true and correct copy of Resolution 80-15 as passed by the Air Resources Board.

Sally Rump

Sally Rump
Board Secretary

State of California
AIR RESOURCES BOARD

ITEM NO: 80-7-3
DATE: April 24, 1980

ITEM: Research Proposal No. 892-75 entitled "Air Quality and Birth Outcome: South Coast Air Basin."

RECOMMENDATION: Adopt Resolution 80-15 approving Research Proposal No. 892-75 for funding in an amount not to exceed $157,521.

SUMMARY: This proposal was considered by the Board at its March 26, 1980 meeting, at which the Board deferred approval of the proposal pending formation of a committee of epidemiologists and statisticians to guide the study. Such a committee has been formed and the members and their affiliations follows the summary of the proposal presented below.

Numerous epidemiological studies have been carried out to determine how medium-to-long term exposure to air pollution affects the general population as well as identifiable sensitive sub-groups within the general population. Asthmatics, children, heart and lung disease patients are among these sub-groups.

Another research area of importance has been the potential effects of ambient air quality on birth outcome. Animal studies tentatively point to the possibility that nitrogen dioxide and certain other air pollutants play a role in birth outcome. The few human studies done in this area seem to suggest an air quality-birth outcome relationship, but have generated more questions than they have answers. What is proposed here is a more thorough study that might help answer the basic question "Does air pollution exposure affect birth weight, fetal development, congenital malformation rate and survival into early infancy?"

The project as proposed would assess whether or not there exists an association between levels and/or types of air pollution and reproductive success. Study areas would include the four counties of the South Coast Air Basin - Orange, Los Angeles, Riverside and San Bernardino. The period for study would include 1972-1978, a time that would include about one million births. Air quality information would

come from the South Coast Air Quality Management District and ARB. The air quality data would be used after application of exposure interpolation methods to give time relation exposure estimates on a small-scale spatial basis. The methods developed by Technology Services Corporation in a recently completed study for ARB would be the most likely approach. Pollutant exposures would be derived on an individual basis for all births. Variations in exposures received by mothers on a monthly basis will also be considered. In this way any relationship between stage of pregnancy and sensitivity to exposure might be shown. Areas with similar air pollution exposures will be grouped in some parts of the study. This would allow study of how factors such as social or economic status, prenatal care and racial make-up influence any birth outcome - air quality trends.

A guidance committee has been selected to assist the principal investigator on this project. Members represent two basic areas of expertise, either epidemiology or biostatistics. The members and their affiliations are listed below:

1. Heinz Berendes - Chief, Epidemiology and Biometry
   National Institute of Child Health and Human Development

2. Warren Winkelstein - Dean, School of Public Health
   University of California, Berkeley

3. Lou Mahoney - Director, San Bernardino County Health Department

4. Alice Whittemore - Department of Family, Community and Preventative Medicine
   Stanford Medical School

5. Jean Bowman - Health Program Advisor
   State Department of Health Services

State of California

AIR RESOURCES BOARD

Resolution 80-28

April 23, 1980

WHEREAS, a solicited research Proposal Number 921-76 entitled "An Inventory of Carcinogenic Substances Released Into the Ambient Air of California--Phase II" has been submitted by Science Applications, Inc., to the Air Resources Board; and

WHEREAS, the Research staff has reviewed and recommended this proposal for approval; and

WHEREAS, the Research Screening Committee has reviewed and recommends for funding:

> Proposal Number 921-76 entitled "An Inventory of Carcinogenic Substances Released Into the Ambient Air of California--Phase II" submitted by Science Applications, Inc., for an amount not to exceed $199,974;

NOW, THEREFORE, BE IT RESOLVED, that the Air Resources Board pursuant to the authority granted by Health and Safety Code Section 39703 hereby accepts the recommendation of the Research Screening Committee and approves the following:

> Proposal Number 921-76 entitled "An Inventory of Carcinogenic Substances Released Into the Ambient Air of California--Phase II" submitted by Science Applications, Inc., for an amount not to exceed $199,974,

BE IT FURTHER RESOLVED, that the Executive Officer shall initiate administrative procedures and execute all necessary documents and contracts for the research effort proposed in an amount not to exceed $199,974.

I certify that the above is a true and correct copy of Resolution 80-28 as passed by the Air Resources Board

Sally Rump

Sally Rump
Board Secretary

State of California
AIR RESOURCES BOARD

Item No.: 80-7-3
Date: April 24, 1980

ITEM: Research Proposal No. 921-76 entitled "An Inventory of Carcinogenic Substances Released Into the Ambient Air of California--Phase II"

RECOMMENDATION: Adopt Resolution 80-28 approving Research Proposal No. 921-76 for funding in an amount not to exceed $199,974.

SUMMARY: In Phase I of the project, eleven candidate carcinogenic materials released into the State's ambient air from mining and manufacturing sources were identified. These are in alphabetical order: arsenic, asbestos, benzene, cadmium, carbon tetrachloride, chloroform, ethylene dibromide, ethylene dichloride, nitrosamines, perchlorothylene and polycyclic organic materials (POM). Seventeen potential emission sources of the carcinogens were located, and sampling and chemical testing procedures for quantification of the carcinogens were recommended.

In Phase II of this project, the contractor will implement the recommended or suitable alternative sampling and testing procedures at the selected sites to develop emission factors and rates for the carcinogens. The contractor will then suggest control measures for emissions reduction and provide supporting data for the development of air quality or emission standards.

The Research Screening Committee approved the RFP for this project, which was then released to approximately 90 potential contractors. Two responses were received, of which the proposal by Science Applications, Inc. was judged to be the more meritorious by the staff and the Committee.

The objectives of this study are to: review the proposed sampling and analytical procedures recommended in the Phase I effort, comparing and contrasting alternative sampling methods; sample the effluents, statistically basing the number of sources tested and samples analyzed to provide the greatest confidence in the test data; implement a Quality Assurance program to enhance the

State of California

AIR RESOURCES BOARD

Resolution 80-29

April 23, 1980

WHEREAS, a solicited research Proposal Number 915-76 entitled "Evaluation of Performance Properties of CARB Complying versus Conventional Industrial Coatings" has been submitted by D L Laboratories, Inc. to the Air Resources Board; and

WHEREAS, the Research staff has reviewed and recommended this proposal for approval; and

WHEREAS, the Research Screening Committee has reviewed and recommends for funding the proposal:

> Proposal Number 915-76 entitled "Evaluation of Performance Properties of CARB Complying versus Conventional Industrial Coatings" submitted by D L Laboratories, Inc. for an amount not to exceed $98,444;

NOW, THEREFORE, BE IT RESOLVED, that the Air Resources Board pursuant to the authority granted by Health and Safety Code Section 39703 hereby accepts the recommendation of the Research Screening Committee and approves the following:

> Proposal Number 915-76 entitled "Evaluation of Performance Properties of CARB Complying versus Conventional Industrial Coatings" submitted by D L Laboratories, Inc. for an amount not to exceed $98,444,

BE IT FURTHER RESOLVED, that the Executive Officer shall initiate administrative procedures and execute all necessary documents and contracts for the research effort proposed in an amount not to exceed $98,444.

I certify that the above is a true and correct copy of Resolution 80-29 as passed by the Air Resources Board

Sally Rump

Sally Rump
Board Secretary

State of California
AIR RESOURCES BOARD

Item No.: 80-7-3
Date: April 24, 1980

ITEM: Research Proposal 915-76 entitled "Evaluation of Performance Properties of CARB-Complying versus Conventional Industrial Coatings"

RECOMMENDATION: Adopt Resolution 80-29, approving Research Proposal 915-76 for funding in an amount not to exceed $98,444.

SUMMARY: At its meeting on September 27, 1978, the Board adopted a model rule to control volatile organic compound (VOC) emissions from a category of industrial painting operations entitled "Manufactured Metal Parts and Products". With the exception of automobiles, cans and coils, marine vessels and aircraft and aerospace vehicles, the rule applies to all metal objects that are painted during a manufacturing process. In general, the rule requires the substitution of low-polluting and generally more energy-efficient low-solvent (waterborne and high-solids) and powder coatings for conventional high-solvent industrial coatings. However, due to the technology-forcing nature of the rule, the length of time required for development of suitable complying coatings for all affected end uses could not be predicted with a great deal of accuracy. For this reason, a provision was included in the rule requiring a review of the emission limitations prior to its implementation on January 1, 1982. Therefore, a study is needed to determine the progress of the coating industry toward the development of complying industrial coatings that satisfy the varied requirements of its customers.

A Request For Proposals was released for this project and two responses were received. The proposal submitted by D L Laboratories, Inc. was determined by staff and the Research Screening Committee to be most responsive to the RFP.

The objective of this study is to determine the availability of industrial coatings that will comply with the ARB model rule and to evaluate the properties of these coatings. The purpose of this evaluation is to identify specific coating end uses for which suitable complying low-solvent

coatings may not be commercially available before the date of compliance.

A brief but comprehensive questionnaire will be sent to 50 raw material suppliers, 200 paint manufacturers and 200 paint users requesting information on and samples of both low-solvent and conventional coatings. Roughly equal numbers of both types of coatings, up to a maximum of 160 total samples, will be tested for relevant coating properties. The extensive testing program will allow the investigator to make a fairly independent evaluation of the latest coating technologies relevant to the ARB's model rule.

State of California

AIR RESOURCES BOARD

Resolution 80-30

April 23, 1980

WHEREAS, a solicited research Proposal Number 917-76 entitled "Investigation Into the Nature of Emulsified Asphalts Compatible With Local California Aggregate and Substitution of Sulfur for Asphalt in Aqueous Emulsified Systems" has been submitted by Engineers Testing Laboratories, Inc., to the Air Resources Board; and

WHEREAS, the Research staff has reviewed and recommended this proposal for approval; and

WHEREAS, the Research Screening Committee has reviewed and recommends for funding:

> Proposal Number 917-76 entitled "Investigation Into the Nature of Emulsified Asphalts Compatible with Local California Aggregates and Substitution of Sulfur for Asphalt in Aqueous Emulsified Systems" submitted by Engineers Testing Laboratories, Inc. for an amount not to exceed $123,873;

NOW, THEREFORE, BE IT RESOLVED, that the Air Resources Board pursuant to the authority granted by Health and Safety Code Section 39703 hereby accepts the recommendation of the Research Screening Committee and approves the following:

> Proposal Number 917-76 entitled "Investigation Into the Nature of Emulsified Asphalts Compatible With Local California Aggregates and Substitution of Sulfur for Asphalt in Aqueous Emulsified Systems" submitted by Engineers Testing Laboratories, Inc., for an amount not to exceed $123,873,

BE IT FURTHER RESOLVED, that the Executive Officer shall initiate administrative procedures and execute all necessary documents and contracts for the research effort proposed in an amount not to exceed $123,873.

I certify that the above is a true and correct copy of Resolution 80-30 as passed by the Air Resources Board

Sally Rump

Sally Rump
Board Secretary

State of California
AIR RESOURCES BOARD

Item No.: 80-7-3
Date: April 24, 1980

ITEM: Research Proposal No. 917-76 entitled "Investigation Into the Nature of Emulsified Asphalts Compatible With California Local Aggregate and Substitution of Sulfur for Asphalt in Aqueous Emulsified Systems"

RECOMMENDATION: Adopt Resolution 80-30 approving Research Proposal No. 917-76 for funding in an amount not to exceed $123,873.

SUMMARY: Emissions of hydrocarbon solvent from cutback asphaltic cold paving mixes contribute to the buildup of atmospheric ozone. This problem is particularly acute in non-urban and agricultural areas where logistics demand a greater use of these solvent-borne cold liquid systems for paving applications. The Air Resources Board has recommended that emulsified asphalt systems with a maximum solvent content of three volume percent be substituted for a majority of the paving and surface treatment applications currently involving solvent cutbacks, thus achieving a statewide hydrocarbon emission reduction of 85 percent (60 tons per day). However, difficulty encountered in the successful application of emulsified asphalts for road building in California has centered around the claim that the aqueous systems currently available do not make successful mixed-in-place cold mixes with local aggregates.

With the guidance of the Research Screening Committee, the staff released a Request for Proposals for a study to evaluate the application of emulsified asphalts and emulsified systems composed of flexibilized sulfur of blends of asphalt and sulfur, to determine whether any of these systems can be successfully used in paving mixes with local aggregate.

One response was received from the Engineers Testing Laboratories, Inc. The proposal is fully responsive to the requirements listed in the RFP. Additionally, because of this firm's experience in similar research projects, the

qualifications of the principal investigator and staff, and their current involvement in a two-year study to evaluate aqueous emulsified binders of sulfur-extended asphalt and flexibilized sulfur for the federal Department of Highways, the Committee recommended the ETL proposal be funded.

The objectives of this study are to evaluate binder performance of emulsified asphalt and sulfur-extended and flexibilized sulfur systems with local aggregate, formulating cold paving mixes to the specification requirements by the California Department of Transportation. Aggregate from three statewide sites will be selected for evaluation. On completion of all tests, the Contractor will perform an analysis of variance of the many variables and from the analysis recommend optimum design criteria. The costs of building comparable roads with emulsified mixes and hot road oil mixes will also be compared.

State of California

Resolution 80-31

April 23, 1980

WHEREAS, a solicited research Proposal Number 919-76 entitled "A Study of the Origin and Fate of Oxidant in the North Central Coast Air Basin" has been submitted by SRI International to the Air Resources Board; and

WHEREAS, the Research staff has reviewed and recommended this proposal for approval; and

WHEREAS, the Research Screening Committee has reviewed and recommends for funding:

> Proposal Number 919-76 entitled "A Study of the Origin and Fate of Oxidant in the North Central Coast Air Basin" submitted by SRI International for an amount not to exceed $199,969;

NOW, THEREFORE, BE IT RESOLVED, that the Air Resources Board, pursuant to the authority granted by Health and Safety Code Section 39703, hereby accepts the recommendation of the Research Screening Committee and approves the following:

> Proposal Number 919-76 entitled "A Study of the Origin and Fate of Oxidant in the North Central Coast Air Basin" submitted by SRI International for an amount not to exceed $199,969,

BE IT FURTHER RESOLVED, that the Executive Officer shall initiate administrative procedures and execute all necessary documents and contracts for the research effort proposed in an amount not to exceed $199,969.

I certify that the above is a true
and correct copy of Resolution 80-31
as passed by the Air Resources Board

Sally Rump

Sally Rump
Board Secretary

State of California
AIR RESOURCES BOARD

ITEM NO: 80-7-3
DATE: April 24, 1980

ITEM: Research Proposal No. 919-76 entitled "A Study of the Origin and Fate of Oxidant in the North Central Coast Air Basin".

RECOMMENDATION: Adopt Resolution 80-31 approving Research Proposal No. 919-76 for funding in an amount not to exceed $199,969.

SUMMARY: Wind patterns in the Bay Area suggest that emissions from this region are transported through the Santa Clara Valley and into the North Central Coast Air Basin, thus contributing to the oxidant levels in the North Central Coast Air Basin. As a result there is concern about the extent of this transport of pollutants into Santa Clara, Monterey and Santa Cruz Counties. The frequency of occurrence of such transport is poorly characterized and the impacts have never been quantified.

This project will consist of a meteorological study to identify the conditions under which pollutant transport from the Bay Area into the Santa Clara Valley and into the North Central Coast Air Basin may occur, and the frequency of such conditions; and tracer studies to define the extent and degree of pollutant transport. The tracer studies will consist of 10 tests in which small amounts of two chemically inert tracer gases will be released from sites within or adjacent to the San Francisco Bay Area. Each of these tracer releases will be acccompanied by release of a constant altitude balloon (tetroon) equipped with a radar transponder. The tetroon will be tracked by airborne radar in an instrumented aircraft. Air samples will be collected for tracer analysis by the aircraft and by fixed and mobile ground stations. Air quality analyses will also be made by the aircraft and by two fixed laboratory vans as well as by stations of the State air quality monitoring network.

The results of this project are needed to assist in the development of control strategies that will permit achievement of the ambient air quality standard for ozone in the areas where the sources are located and in the downwind receptor areas.

State of California

AIR RESOURCES BOARD

Resolution 80-32

April 23, 1980

WHEREAS, a solicited research Proposal Number 914-76 entitled "Survey of Heavy-Duty Diesel Maintenance Practices" has been submitted by Science Applications, Inc. to the Air Resources Board; and

WHEREAS, the Research staff has reviewed and recommended this proposal for approval; and

WHEREAS, the Research Screening Committee has reviewed and recommends for funding:

> Proposal Number 914-76 entitled "Survey of Heavy-Duty Diesel Maintenance Practices" submitted by Science Applications, Inc. for an amount not to exceed $74,754;

NOW, THEREFORE, BE IT RESOLVED, that the Air Resources Board pursuant to the authority granted by Health and Safety Code Section 39703, hereby accepts the recommendation of the Research Screening Committee and approves the following:

> Proposal Number 914-76 entitled "Survey of Heavy-Duty Diesel Maintenance Practices" submitted by Science Applications, Inc. for an amount not to exceed $74,754.

BE IT FURTHER RESOLVED, that the Executive Officer shall initiate administrative procedures and execute all necessary documents and contracts for the research effort proposed in an amount not to exceed $74,754.

I certify that the above is a true
and correct copy of Resolution 80-32
as passed by the Air Resources Board

Sally Rump

Sally Rump
Board Secretary

State of California
AIR RESOURCES BOARD

ITEM NO: 80-7-3
DATE: April 24, 1980

ITEM: Research Proposal No. 914-76 entitled "Survey of Heavy-Duty Diesel Maintenance Practices"

RECOMMENDATION: Adopt Resolution 80-32 approving Research Proposal No. 914-76 for funding in an amount not to exceed $74,754.

SUMMARY:

Heavy-duty diesel-powered vehicles (6001 pounds GVW and over) are currently exempt from both the Certificate of Compliance and the Mandatory Vehicle Inspection Programs in California. There are insufficient information or supporting data available to effectively assess the need for a heavy-duty diesel-powered vehicle inspection/maintenance program in California. The information provided by this study, in conjunction with data from studies sponsored by the EPA, other ARB data, and a staff determination of the potential emission reduction benefits, will be used by the staff to assess the need for such a program.

Using surveys, questionnaires, analyses, and preferably personal contacts with heavy-duty vehicle users in the field, the contractor will determine fleet sizes and ownership, vehicle usage, maintenance practices and costs, and other information relevant to inspection/maintenance program needs.

With the guidance of the Research Screening Committee, the staff released a request for proposals for this project.

Two responses were recieved, of which this proposal by Science Applications, Inc., was concluded to be most meritorious by the staff and the Committee.

State of California

AIR RESOURCES BOARD

Resolution 80-33

April 23, 1980

WHEREAS, an unsolicited research Proposal Number 924-76 entitled "Health Effects from the Inhalation of Oxidant Air Pollutants as Related to the Immune System" has been submitted by the University of California at Davis to the Air Resources Board; and

WHEREAS, the Research staff has reviewed and recommended this proposal for approval; and

WHEREAS, the Research Screening Committee has reviewed and recommends for funding:

> Proposal Number 924-76 entitled "Health Effects from the Inhalation of Oxidant Air Pollutants as Related to the Immune System" submitted by the University of California at Davis for an amount not to exceed $82,589;

NOW, THEREFORE, BE IT RESOLVED, that the Air Resources Board pursuant to the authority granted by Health and Safety Code Section 39703, hereby accepts the recommendation of the Research Screening Committee and approves the following:

> Proposal Number 924-76 entitled "Health Effects from the Inhalation of Oxidant Air Pollutants as Related to the Immune System" submitted by the University of California at Davis for an amount not to exceed $82,589.

BE IT FURTHER RESOLVED, that the Executive Officer shall initiate administrative procedures and execute all necessary documents and contracts for the research effort proposed in an amount not to exceed $82,589.

I certify that the above is a true
and correct copy of Resolution 80-33
as passed by the Air Resources Board

Sally Rump

Sally Rump
Board Secretary

State of California
AIR RESOURCES BOARD

ITEM NO: 80-7-3
DATE: April 24, 1980

ITEM: Research Proposal No. 924-76 entitled "Health Effects from the Inhalation of Oxidant Air Pollutants as related to the Immune System"

RECOMMENDATION: Adopt Resolution 80-33 approving Research Proposal No. 924-76 for funding in an amount not to exceed $82,589.

SUMMARY: Asthma has emerged as the disease state considered most sensitive to and most commonly affected by ozone and certain other air pollutants. Both clinical and epidemiological studies have shown that ambient pollutant concentrations are often likely to produce adverse respiratory effects in asthmatics. Asthma is basically a defect in the immune system that produces a hyper-reactive response to inhaled antigens (foreign proteins), cold air and other stimuli. The most apparent clinical manifestation is a restriction of the conducting air-ways leading to extreme breathing difficulty.

This proposal seeks support for the third year of a planned three-year study underway to investigate the effects of ozone and ozone-sulfuric acid (H_2SO_4) mixtures in an animal model for asthma. The work done to date and that proposed here delves into the immunological basis for the reactive response that lies at the root of asthma induction. Asthma would be difficult to test for in mice, so another approach has been used to detect the sensitization. Anaphalaxis induced by an injected protein is used as the indicator. The immune mechanism involved in anaphalaxis is identical to that seen in the asthma induction pathway of humans except that it is a systemic response, while asthma is a local reaction to a locally applied antigen. The same agents and biological pathways are involved.

It is also the intent of the proponent to continue to study pollutant-induced defects in the immune system's ability to resist viral infection. Increased incidences of respiratory infections have been associated with community exposures to polluted ambient air. Immunological experiments would validate these observations and perhaps elucidate the mechanism.

A portion of this study will involve determination of whether the cellular level damage caused by O_3 - H_2SO_4 and combination exposures results in the eventual sensitization of the body to its own cells (auto-immune response). This appears to be one explanation of the root for certain serious pulmonary diseases.

New efforts would be initiated this year to elucidate the mechanisms involved in the observed enhanced response to ozone and O_3 -H_2SO_4 exposures. The findings would indicate whether immune system response or cell membrane integrity changes are involved. This would be done by using two strains of mice, one with a known defect in immune regulation and the other normal. The findings of this part of the project would help explain results of work on human subjects who have commonly exhibited enhanced responsiveness to allergens or histamines after ozone exposure.

State of California

AIR RESOURCES BOARD

Resolution 80-34

April 23, 1980

WHEREAS, an unsolicited research Proposal Number 907-76 entitled "The Effects of Present and Potential Air Pollution on Important San Joaquin Valley Crops" has been submitted by the University of California at Riverside to the Air Resources Board; and

WHEREAS, the Research staff has reviewed and recommended this proposal for approval; and

WHEREAS, the Research Screening Committee has reviewed and recommends for funding:

> Proposal Number 907-76 entitled "The Effects of Present and Potential Air Pollution on Important San Joaquin Valley Crops" submitted by the University of California at Riverside for an amount not to exceed $105,472;

NOW, THEREFORE, BE IT RESOLVED, that the Air Resources Board, pursuant to the authority granted by Health and Safety Code Section 39703, hereby accepts the recommendation of the Research Screening Committee and approves the following:

> Proposal Number 907-75 entitled "The Effects of Present and Potential Air Pollution on Important San Joaquin Valley Crops" submitted by the University of California at Riverside for an amount not to exceed $105,472,

BE IT FURTHER RESOLVED, that the Executive Officer shall initiate administrative procedures and execute all necessary documents and contracts for the research effort proposed in an amount not to exceed $105,472.

I certify that the above is a true
and correct copy of Resolution 80-34
as passed by the Air Resources Board

Sally Rump

Sally Rump
Board Secretary

State of California
AIR RESOURCES BOARD

ITEM NO.: 80-7-3
DATE: April 24, 1980

ITEM: Research Proposal No. 907-76 entitled "The Effects of Present and Potential Air Pollution on Important San Joaquin Valley Crops".

RECOMMENDATION: Adopt Resolution 80-34 approving Research Proposal No. 907-76 for funding in an amount not to exceed $105,472.

SUMMARY: Although considerable research has been conducted to determine the effects of air pollutants on various plant species, the majority of this research has focused on either acute exposures or the study of annuals as opposed to perennial crops. This study was undertaken in the Spring of 1979 to evaluate the potential oxidant damage to two of the most important perennial San Joaquin Valley crops grown under field conditions, alfalfa and Thompson Seedless grapes. This proposed study is for the second year effort of what was originally planned as a two to three year effort.

The major objectives of this study are to:

- o determine whether Thompson Seedless grapes are being damaged by existing levels of oxidant-type air pollution (reduction in yields and/or fruit quality).

- o determine the effects of SO_2 and ambient, subambient, and artificially elevated oxidant concentrations on alfalfa growth and quality.

Alfalfa and Thompson Seedless grapes are being grown in open-top growth chambers under actual field conditions supplied with air containing pre-determined levels of pollutants. In the proposed second year of the alfalfa study, the air pollutant treatments are as they were last year: (1) ambient, non-filtered air, (2) carbon-filtered air, (3) carbon-filtered air to which ambient levels of ozone are added, (4) ambient air to which SO_2 is added, (5) carbon filtered air to which ozone is added to increase ozone dose by 50 percent, and (6) a non-enclosed ambient plot to test chamber effects. With the second year of the Thompson Seedless grapes, treatments will be: (1) filtered air and (2) ambient (non-filtered) air. All plant responses are correlated with calculated pollution dose, as well as oxidant and/or SO_2 concentration.

State of California
AIR RESOURCES BOARD
Resolution 80-35

April 23, 1980

WHEREAS, an unsolicited research Proposal Number 929-76 entitled "Responses to Oxidants" has been submitted by the University of California at Santa Barbara to the Air Resources Board; and

WHEREAS, the Research staff has reviewed and recommended this proposal for approval; and

WHEREAS, the Research Screening Committee has reviewed and recommends for funding:

> Proposal Number 929-76 entitled "Responses to Oxidants" submitted by the University of California at Santa Barbara for an amount not to exceed $168,834;

NOW, THEREFORE, BE IT RESOLVED, that the Air Resources Board, pursuant to the authority granted by Health and Safety Code Section 39703, hereby accepts the recommendation of the Research Screening Committee and approves the following:

> Proposal Number 929-76 entitled "Responses to Oxidants" submitted by the University of California at Santa Barbara for an amount not to exceed $168,834;

BE IT FURTHER RESOLVED, THAT THE Executive Officer shall initiate administrative procedures and execute all necessary documents and contracts for the research effort proposed in an amount not to exceed $168,834.

I certify that the above is a true
and correct copy of Resolution 80-35
as passed by the Air Resources Board

Sally Rump
Board Secretary

State of California
AIR RESOURCES BOARD

ITEM NO: 80-7-3
DATE: April 24, 1980

ITEM: Research Proposal No. 929-76 entitled "Responses to Oxidants."

RECOMMENDATION: Adopt Resolution 80-35 approving Research Proposal No. 929-76 for funding in an amount not to exceed $168,834.

SUMMARY: California smog is a mixture of many compounds. Prominent are photochemical oxidants, NO_2, aerosols and hydrocarbons. The photochemical oxidant portion is a complex mix of ozone, peroxides and other organic oxidizers, particularly peroxyacyl nitrates (PANs). Considerable research effort has been brought to bear on elucidating the effects of ozone on plants and animals to the extent that a fair picture now exists of the hazards associated with this pollutant. PANs, (specifically peroxyacetyl nitrate) are another case. Early vegetation research was done to identify PAN damage followed by limited exposure work to confirm the field finding that concentrations in the 100-1000 ppb range affect certain plants. Very limited work has been done employing PAN in human or animal exposure work. Among such limited research is the early work by Drs. Gliner and Horvath at U.C. Santa Barbara showing pulmonary function effects at 0.24 ppm PAN.

Recent regulatory actions by EPA have brought up the question of how adverse effects of the oxidant complex might differ from those of ozone. EPA has now established an ozone standard numerically less stringent than the earlier oxidant standard. Such a standard may well protect most of the U.S. where ozone rather than other oxidants is present. One of the central issues regarding their change in the standard from oxidant to ozone was whether removing other oxidants from consideration might allow potentially harmful effects to occur.

One element of this study is to determine whether acute interaction effects can be seen between O_3 and PAN (peroxyacetyl nitrate) on metabolic, pulmonary and neurological responses in man. Subjects numbering between 10 and 15 will undergo moderate exercise (at approximately 50 percent of their maximal capacity) in 30-minute shifts followed by a 30-minute intermission of exercise, and then repeated exercise for another hour. During the rest periods the subjects will perform mental accuracy, motor-skill and pulmonary function testing. Previous studies by the proponent have demonstrated factors to be affected by ozone exposure.

Heart rate, oxygen consumption and carbon dioxide production will also be measured to indicate the metabolic state of the individuals at various times during the exposure. E.E.G. tracings will also be taken at the end of each exercise period to obtain information on nervous system status.

The second part of this study would extend previous efforts to examine the response of subjects to different regimes of repeated ozone exposure. Specifically, work would be done to: 1) provide a more definitive statement concerning effects of prior exposure to low levels of O_3; 2) determine the variables that will predict whether an individual will be sensitized by low levels of ozone, and; 3) determine if there are differences between sexes in sensitivity to ozone as has been seen under current efforts and whether these differences are related to differences in pulmonary capacities between the sexes or to differences in work capacity.

State of California

AIR RESOURCES BOARD

Resolution 80-36

April 23, 1980

WHEREAS, an unsolicited research Proposal Number 927-76 entitled "Effects of SO_2 and Ozone on Growth Productivity, Physiology and Biochemistry of Crops" has been submitted by the University of California at Davis to the Air Resources Board; and

WHEREAS, the Research staff has reviewed and recommended this proposal for approval; and

WHEREAS, the Research Screening Committee has reviewed and recommends for funding:

> Proposal Number 927-76 entitled "Effects of SO_2 and Ozone on Growth Productivity, Physiology and Biochemistry of Crops" submitted by the University of California at Davis for an amount not to exceed $126,746;

NOW, THEREFORE, BE IT RESOLVED, that the Air Resources Board pursuant to the authority granted by Health and Safety Code Section 39703 hereby accepts the recommendation of the Research Screening Committee and approves the following:

> Proposal Number 927-16 entitled "Effects of SO_2 and Ozone on Growth Productivity, Physiology and Biochemistry of Crops" submitted by the University of California at Davis for an amount not to exceed $126,746,

BE IT FURTHER RESOLVED, that the Executive Officer shall initiate administrative procedures and execute all necessary documents and contracts for the research effort proposed in an amount not to exceed $126,746.

I certify that the above is a true
and correct copy of Resolution 80-36
as passed by the Air Resources Board

Sally Rump

Sally Rump
Board Secretary

State of California
AIR RESOURCES BOARD

ITEM NO.: 80-7-3
DATE: April 24, 1980

ITEM: Research Proposal No. 927-76 entitled "Effects of SO_2 and Ozone on Growth Productivity, Physiology and Biochemistry of Crops".

RECOMMENDATION: Adopt Resolution 80-36 approving Research Proposal No. 927-76 for funding in an amount not to exceed $126,746.

SUMMARY: Much of the work that makes up our current understanding of how air pollution affects plants is derived from the study of rather simple end points such as visible foliar injury or the reduction in the overall weight of plant material at the end of a growing season. Such work has commonly been done under uncontrolled field conditions or in greenhouses. More recently, we and others have tried to consider more subtle factors like protein or carbohydrate content. What is proposed here is a major departure from the more traditional field or greenhouse studies. The proponent would apply potentially more sensitive plant physiological and biochemical methods in conjunction with careful control of environmental parameters to assure a straightforward assessment of effects. In effect, this study would investigate the cellular level implications of air pollution in terms of whole plant exposure. Sulfur dioxide and ozone are the pollutants of interest. They would be employed at several concentrations, both singly and in combination. As with cellular-level assessments of pollutant effects on animal systems, the information obtained would help explain related whole-plant effects. This would allow detection of changes before visible injury occurs and may provide data that can be readily extrapolated to other species.

This study is divided into three related efforts which address different facets of O_3 and SO_2 effects as a multi-disciplinary effort. In all cases the investigators intend to employ several different plant species and varieties within each specie to allow addressing of possible mechanisms for expected variation in sensitivity to the pollutants to be employed.

The first part of this study will concentrate on the effects of SO_2 and ozone on the germination and early development of seedlings. This would allow careful study of the effects of pollutants on the seedling stage of growth and contribute to an assessment of overall sensitivity of each variety tested. The amounts and types of proteins present would also be measured in seedlings that show abnormal growth.

The second part of the study would center on how exposure to SO_2 and ozone would affect leaf and root function in terms of water and solute movement. Air pollutants are known to affect the stomata of many plants. These act as the "first line of defense" for plants to prevent the entry of pollutants to less protected internal air space cell surfaces. Once inside, it is thought that the pollutants will have an effect on the metabolic activity of cells through effects on membrane function of such cells.

Finally, the third part of this study will concentrate on the biochemical effects of SO_2 on plants. It is the investigator's observation that SO_2 exposures initiate the release of "stress" ethylene and ethane in response to lipid peroxidation. Ethylene is also known to be produced in response to other stresses like physical injury.

Specifically the investigators would expose plants to varying amounts of SO_2 and measure the levels of "stress" ethylene and ethane. An attempt will be made to study whether the level of ethylene produced is related to the relative sensitivity of the plants employed. Efforts will also be made to determine if ethylene enhances or reduces the plant's tolerance to SO_2 through the use of agents known to block its production. The investigator would also study the fate of atmospheric SO_2 in soils, its uptake, metabolism and movement in the plant, by employing radio-chemical methods.

The results of these studies should provide valuable insight into the cellular level effects of pollutants on vegetation and improve our total understanding of the effects of pollutants on California crops.