

State of California  
AIR RESOURCES BOARD

Research Resolutions

Research Division

February 8, 2002

## **INTRODUCTION**

Contained herein for Board review are two resolutions and accompanying summaries from the Extramural Research Program recommended to the Board by the Research Screening Committee.

Item 1 is a research proposal from the University of California, Berkeley, entitled, "Keeping Tahoe Blue through Identifying Nitrogen Transport to Lake Tahoe: Additional Ambient Air Nitrogen Species Measurements". The principal investigator will be Ronald C. Cohen.

Resolution No.

Item 2 is a research proposal from the University of California, Davis, entitled, "Keeping Tahoe Blue through Ambient Air Quality Modeling: Aircraft and Boat Measurements of Air Quality and Meteorology Over Lake Tahoe". The principal investigator will be John J. Carroll and Cort Anastasio.

Resolution No.

## PROPOSED

State of California  
AIR RESOURCES BOARD

Resolution 02-6

February 21, 2002

Agenda Item No.: 02-1-6

WHEREAS, the Air Resources Board has been directed to carry out an effective research program in conjunction with its efforts to combat air pollution, pursuant to Health and Safety Code sections 39700 through 39705;

WHEREAS, a research proposal, number 2506-223, entitled "Keeping Tahoe Blue through Identifying Nitrogen Transport to Lake Tahoe: Additional Ambient Air Nitrogen Species Measurements", has been submitted by the University of California, Berkeley;

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

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

Proposal Number 2506-223 entitled "Keeping Tahoe Blue through Identifying Nitrogen Transport to Lake Tahoe: Additional Ambient Air Nitrogen Species Measurements", submitted by the University of California, Berkeley, for a total amount not to exceed \$175,036.

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 2506-223 entitled "Keeping Tahoe Blue through Identifying Nitrogen Transport to Lake Tahoe: Additional Ambient Air Nitrogen Species Measurements", submitted by the University of California, Berkeley, for a total amount not to exceed \$175,036.

BE IT FURTHER RESOLVED, that the Executive Officer is hereby authorized to initiate administrative procedures and execute all necessary documents and contracts for the research effort proposed herein, and as described in Attachment A, in an amount not to exceed \$175,036.

**ATTACHMENT A****"Keeping Tahoe Blue through Identifying Nitrogen Transport to Lake Tahoe: Additional Ambient Air Nitrogen Species Measurements"****Background**

Nutrient loading is believed responsible for loss of clarity in Lake Tahoe. Enrichment of nitrogen and phosphorus in Lake Tahoe has been observed and some researchers have attributed a significant portion of that enrichment to atmospheric sources. However, the estimates of atmospheric (and some non-atmospheric) contributions are uncertain. Better quantification is required to understand what actions would be effective for reducing nitrogen enrichment of the Lake. Through dry and wet deposition, atmospheric nitrogen oxides including NO<sub>x</sub>, nitric acid and organic nitrates may contribute to increases in the nitrogen available as a nutrient in the Lake. Sources of atmospheric nitrogen oxides may include direct emissions within the Basin from vehicles and home wood burning as well as natural sources and emissions from combustion, bacterial modification of fertilizers and natural bacterial emissions from the Sacramento Valley and the Bay Area that are transported to the Tahoe Basin.

**Objective**

The objective of this project is to provide a detailed baseline of observations of the annual cycle of four different types of reactive nitrogen oxides in the Tahoe Basin and advance the understanding of the sources, chemical transformations, surface deposition rates and the dynamical factors that affect the input of atmospheric nitrogen oxides to Lake Tahoe. The project will determine the deposition rates and the origin of deposited nitrogen by measuring ambient concentrations of nitric acid, nitrogen dioxide, peroxy acetyl nitrate, and total organic nitrates at Lake Tahoe.

**Methods**

State-of-the-art laser induced fluorescence (LIF) instrument, designed and built by Dr. Cohen, will be used to measure the target species.

**Expected Results**

Atmospheric measurements will be made of nitric acid, nitrogen dioxide, peroxyacetyl nitrate, total alkyl nitrates, and total organic nitrates at the upwind boundary of the Lake Tahoe Basin. Fluxes of nitrogen species may also be measured near Lake level to estimate deposition to the Lake. These measurements will be analyzed to determine: 1) the factors that control the mixing ratios of total reactive nitrogen in the Lake Tahoe Basin, 2) the factors that control partitioning among nitrogen species, 3) the contribution alkyl nitrates make to the atmospheric nitrogen oxides deposited to the Lake Tahoe Basin, and 4) the fractions of NOy in the Tahoe Basin contributed by the global background, sources in regions of California to the West, and local sources.

**Significance to the Board**

Ambient data, including fluxes, will provide inputs and validation databases for the Board's Lake Tahoe air quality modeling exercises. It is expected that these modeling

exercises will characterize any enrichment from the atmosphere to the lake and evaluate required control measures to reduce the enrichment.

**Contractor:**

University of California, Berkeley

**Contract Period:**

30 months

**Principal Investigator:**

Ronald C. Cohen

**Contract Amount:**

\$175,036

**Cofunding:**

This research at Lake Tahoe is funded by the California Air Resources Board. However, it is part of a larger cooperative research effort that includes funding of various aspects by the California State Water Quality Control Board, U. S. EPA, Tahoe Regional Planning Agency (TRPA), and the U. S. Forest Service.

**Basis for Indirect Cost Rate:**

The State and UC System have agreed to a ten percent indirect cost rate.

**Past Experience with this Principal Investigator:**

This Principal Investigator has performed very successfully on past contracts, including making similar measurements at Blodgett Forest Research Station using the proposed instrument.

**Prior Research Division Funding to the University of California, Berkeley:**

Year	2001	2000	1999
Funding	\$	\$0	\$3,992,027

## BUDGET SUMMARY

University of California, Berkeley

"Keeping Tahoe Blue through Identifying Nitrogen Transport to Lake Tahoe: Additional Ambient Air Nitrogen Species Measurements"

### **DIRECT COSTS AND BENEFITS**

1.	Labor and Employee Fringe Benefits	\$104,032
2.	Subcontractors	\$
3.	Equipment	\$
4.	Travel and Subsistence	\$ 17,010 <sup>1</sup>
5.	Electronic Data Processing	\$
6.	Reproduction/Publication	\$ 1,000
7.	Mail and Phone	\$ 1,000
8.	Supplies	\$ 26,975 <sup>2</sup>
9.	Analyses	\$
10.	Miscellaneous	<u>\$ 9,917</u>
Total Direct Costs		\$159,934

### **INDIRECT COSTS**

1.	Overhead	\$ 15,102
2.	General and Administrative Expenses	\$
3.	Other Indirect Costs	\$
4.	Fee or Profit	\$
Total Indirect Costs		<u>\$ 15,102</u>

### **TOTAL PROJECT COSTS**

**\$175,036**

<sup>1</sup>The travel cost consists of 70 roundtrips from Berkeley to Lake Tahoe to maintain measurement instruments.

<sup>2</sup> The costs for supplies are based on costs incurred during the Blodgett Forest project which is comparable in scope and duration. The supplies required for the proposed laboratory operations include laboratory chemicals, gases, optics, and laser repairs.



## PROPOSED

State of California  
AIR RESOURCES BOARD

Resolution 02-5

February 21, 2002

Agenda Item No.: 02-1-6

WHEREAS, the Air Resources Board has been directed to carry out an effective research program in conjunction with its efforts to combat air pollution, pursuant to Health and Safety Code sections 39700 through 39705;

WHEREAS, a research proposal, number 2504-223, entitled "Keeping Tahoe Blue through Ambient Air Quality Modeling: Aircraft and Boat Measurements of Air Quality and Meteorology Over Lake Tahoe", has been submitted by the University of California, Davis;

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

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

Proposal Number 2504-223 entitled "Keeping Tahoe Blue through Ambient Air Quality Modeling: Aircraft and Boat Measurements of Air Quality and Meteorology Over Lake Tahoe", submitted by the University of California, Davis, for a total amount not to exceed \$133,382.

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 2504-223 entitled "Keeping Tahoe Blue through Ambient Air Quality Modeling: Aircraft and Boat Measurements of Air Quality and Meteorology Over Lake Tahoe", submitted by the University of California, Davis, for a total amount not to exceed \$133,382.

BE IT FURTHER RESOLVED, that the Executive Officer is hereby authorized to initiate administrative procedures and execute all necessary documents and contracts for the research effort proposed herein, and as described in Attachment A, in an amount not to exceed \$133,382.

## ATTACHMENT A

### "Keeping Tahoe Blue through Ambient Air Quality Modeling: Aircraft and Research Vessel Measurements of Air Quality and Meteorology Over Lake Tahoe"

#### **Background**

Nutrient loading is believed responsible for loss of clarity in Lake Tahoe. Enrichment of nitrogen and phosphorus in Lake Tahoe has been observed and some researchers have attributed a significant portion of that enrichment to atmospheric sources. However, the estimates of atmospheric (and some non-atmospheric) contributions are uncertain. Better quantification is required to understand what actions would be effective for reducing nitrogen enrichment of the Lake. Through dry and wet deposition, atmospheric nitrogen oxides including NO<sub>x</sub>, nitric acid and organic nitrates may contribute to increases in the nitrogen available as a nutrient in the Lake. Sources of atmospheric nitrogen oxides may include direct emissions within the Basin from vehicles and home wood burning as well as natural sources and emissions from combustion, bacterial modification of fertilizers and natural bacterial emissions from the Sacramento Valley and the Bay Area that are transported to the Tahoe Basin. To understand this type of enrichment, the Board's staff will conduct modeling of Lake Tahoe air quality. This proposal will provide input and validation databases for these modeling exercises by developing and delivering vertical profiles of meteorological parameters and ambient concentrations.

#### **Objective**

This project's objectives are to obtain, during spring, summer and fall,::

- 1) Vertical profiles of wind, relative humidity, and temperature over Lake Tahoe to determine proper wind characteristics for deposition estimation,
- 2) Vertical profiles of nitric acid and ammonia,
- 3) Vertical profiles of concentrations of aerosols bigger than 0.3µm and bigger than 3µm in equivalent optical diameter,
- 4) Vertical profiles of ozone, NO, and NO<sub>Y</sub>

This project's objective during winter is to collect an equivalent suite of measurements onboard a research vessel.

UC Davis may also perform transactions across the Lake when the on-board measurements would indicate high concentrations or on their way to the proper altitude for spirals.

#### **Methods**

UC Davis will use a dedicated aircraft during three seasons and a research vessel during the winter. The investigators will measure wind and relative humidity, aerosol concentrations (channel 1 measures particles bigger than 0.3 µm and channel 2 bigger than 3µm in equivalent optical diameter), and concentrations of ozone, NO, NO<sub>Y</sub>, (~1 ppbv detection limits). Gas phase ammonia, nitric acid, particulate phosphorous nitrate and ammonium will be collected through an annular denuder-filter system. In spring,

summer and fall, these instruments will be flown on board a Cessna airplane flown over and across Lake Tahoe. In winter, these instruments will be installed in a research vessel, which will make dedicated cruises on the Lake.

### **Expected Results**

The contractor will supply vertical profiles of meteorological and air quality parameters. These will be analyzed to show the degree of mixing of concentrations aloft and near Lake level. This information on thermal stratification and vertical mixing will be important to assessing when and to what degree upwind concentrations and local emissions will impact concentrations at Lake level. These observations and information will be used in the air quality analysis and modeling efforts to assess the relative importance of local and upwind sources to the deposition of nitrogen and phosphorus to the Lake Tahoe Basin.

### **Significance to the Board**

Analyses and modeling of the air quality and deposition in the Lake Tahoe area will rely on the meteorological and air quality data supplied by this contractor. The analyses and modeling of air quality and deposition at Lake Tahoe is expected to characterize any enrichment from the atmosphere to the Lake and evaluate required control measures to reduce that enrichment.

#### **Contractor:**

University of California, Davis

#### **Contract Period:**

27 months

#### **Principal Investigators:**

John J. Carroll and Cort Anastasio

#### **Contract Amount:**

\$133,382

#### **Cofunding:**

This research at Lake Tahoe is to be funded by the California Air Resources Board. However, it is part of a larger cooperative research effort that includes funding of various aspects by the California State Water Quality Control Board, U. S. EPA, Tahoe Regional Planning Agency (TRPA), and the U. S. Forest Service.

#### **Basis for Indirect Cost Rate:**

The State and UC System have agreed to a ten percent indirect cost rate.

#### **Past Experience with this Principal Investigators:**

The Principal Investigators and the UCD aircraft group successfully contributed to a number of air quality studies including SCOS 97-NARSTO and CCOS 2000 with the

ARB sponsorship. More recent work, using the denuder systems, has been sponsored by the U. S. EPA through the UC Davis Center for Ecologic Health Research.

**Prior Research Division Funding to University of California, Davis:**

Year	2001	2000	1999
Funding	\$314,998	\$315,037	\$567,529

## BUDGET SUMMARY

University of California, Davis

### Keeping Tahoe Blue through Ambient Air Quality Modeling: Aircraft and Boat Measurements of Air Quality and Meteorology Over Lake Tahoe

#### **DIRECT COSTS AND BENEFITS**

1.	Labor and Employee Fringe Benefits	\$ 66,327
2.	Subcontractors	\$
3.	Equipment	\$
4.	Travel and Subsistence	\$ 9,580
5.	Electronic Data Processing	\$ 450
6.	Reproduction/Publication	\$ 400
7.	Mail and Phone	\$ 1,190
8.	Supplies	\$ 900
9.	Analyses	\$
10.	Miscellaneous	<u>\$ 33,500<sup>1</sup></u>

Total Direct Costs \$ 112,347

#### **INDIRECT COSTS**

1.	Overhead	\$ 11,235
2.	General and Administrative Expenses	\$
3.	Other Indirect Costs	\$ 9,800
4.	Fee or Profit	\$ _____

Total Indirect Costs \$ 21,035

**TOTAL PROJECT COSTS** **\$ 133,382**

<sup>1</sup> The miscellaneous cost (of \$33,500) consists entirely of charges for use of a research aircraft (150 hours at \$200 per hour) and research vessel John LeConte (35 hours at \$100 per hour). These rates are based on operating costs including fuel, maintenance and insurance. Both are integral to the proposal.

