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**PROJECT I: DEVELOPMENT OF BASEYEAR AND
FUTURE YEAR GRIDDING SURROGATES FOR
SPATIAL DISTRIBUTION OF AREA AND OFF-ROAD
SOURCE EMISSION CATEGORIES
IN THE CCOS DOMAIN**

**WORK PLAN
STI-799680-1925-WP**

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INTRODUCTION

An accurate and sufficiently detailed emission inventory is a key input for air quality simulation modeling. Ozone and aerosol formation models require spatially distributed estimates of precursor emissions resolved over the entire geographic grid system that defines the modeling domain. This work plan describes the development of spatial allocation factors for area and off-road mobile sources. The spatial allocation factors will be used to geographically distribute emissions throughout the Central California Ozone Study (CCOS) domain at a spatial resolution of 1×1 km covering all of California from Shasta to Kern County.

Spatial allocation factors for area and off-road mobile sources will be developed for the years 2000, 2005, 2010, and 2020 using various sources of data that are representative of the spatial distribution of emissions activity. These data are referred to as surrogates and commonly include: demographic and socioeconomic data and land cover/land use data. We will review existing area and off-road mobile source surrogate assignments and use new and innovative methodologies similar to those used in the 1997 South Coast Ozone Study (SCOS97) to assign surrogates to emissions sources.

Additionally, we will review and recommend improvements to existing temporal distributions (hourly, daily, seasonal) of emissions activity for all area and off-road sources. In order to complete this project, local data will be acquired from several planning agencies and air districts and combined into a unified database.

The work plan is divided into three sections:

Technical Approach contains an in-depth discussion of the key technical issues involved with the preparation of the CCOS spatial allocation factors and temporal profiles: (a) need for consensus and communication with the local air districts; (b) quality assurance of the gridded spatial allocation factors; and (c) review and improvement of existing temporal activity data.

Project Management Personnel identifies the key personnel who will perform the work.

Estimated Costs and Schedule presents estimates of the labor hours required to perform each task and also delineates the proposed project schedule.

TECHNICAL APPROACH

Task 1 – Development of Spatial Allocation Factors for Area Sources

In consultation with the California Air Resources Board (ARB), STI will develop a list of area source categories for which spatial allocation factors will be developed. This list will be based on the area source categories contained in the ARB's Emission Inventory Code (EIC) system. Early in the project, we will arrange a series of conference calls and meetings with local agencies to discuss the most appropriate selection and use of area source surrogates. Initially, we will consider those surrogates chosen for use in recent air quality management plans (AQMP) or

state implementation plans (SIP). Ultimately, we will develop new and innovative methods of assigning surrogates to emissions source categories that are consistent with the methods used in SCOS97. This approach will result in a more representative spatial allocation of emissions activities while introducing consistent allocation methodologies throughout California. Before any processing begins, we will present a list of activity surrogates cross-referenced with related area source categories for the local air districts' and ARB's review. Upon acceptance, we will grid the surrogates and prepare graphical displays for ARB's review and for internal quality control.

The surrogates used to develop spatial allocation factors will be based on the most recent data available and will be resolved at the highest possible level representing county-specific information (at a minimum) for a 2000 base year. We understand that the ARB will provide STI with available demographic and socioeconomic surrogate data by traffic analysis zone (TAZ) for each county. In addition to the demographic and socioeconomic surrogate data, unique sources of data (identified by STI during the SCOS97 project) will be used to update and improve upon surrogates used in the past, including:

- The Electronic Yellow Pages (EYP): a database of business listings and addresses for the entire country. This information can be used to assign the locations of individual area source facilities such as dry cleaners and gasoline service stations to grid cells.
- StreetInfo: a geographic information system (GIS) database of streets (with address ranges), airports, schools, waterways, harbors, and railroads covering the state of California. StreetInfo can be used to spatially allocate emissions sources associated with public facilities to actual facility locations.
- Computed Surrogates: For transient activities, such as building and road construction, the development of representative spatial allocation factors is more challenging. Because cities tend to expand outward, new construction usually occurs in the suburban and rural regions surrounding the central business district (CBD). We recommend an approach to spatially allocate construction emission sources with a computed surrogate. Specifically, we suggest that surrogates for building construction activities be computed from the difference in each grid cell for retail, non-retail, and housing statistics between a past year and a future year (e.g., 1995 and 2000, respectively). Construction emissions may then be allocated in proportion to the differences between past-year and future-year activities, resulting in the greatest amount of emissions being assigned to the grid cells with the highest levels of growth.

For those areas of the domain not covered by local planning agencies, we will acquire statewide planning model activity data from the Caltrans statewide model. Where data are available, separate estimates of surrogates will be made for weekdays and weekends.

In addition to developing spatial allocation factors for the 2000 base year, STI will obtain or project estimates of surrogate activity levels for the years 2005, 2010, and 2020. For some source categories, the spatial pattern of the selected surrogate will not change between the base and future years. However, other categories such as residential fuel combustion or construction will likely have different spatial patterns between the base and future years.

Spatial allocation factors will be developed for the entire CCOS domain at a resolution of 1 x 1 km. Spatial distributions will be developed using GIS techniques and manually as needed. The gridded spatial allocation factor files will be provided to ARB in an electronic format approved by the ARB.

Task 2 – Development of Spatial Allocation Factors for Off-Road Mobile Sources

The development of the base-year and future-year gridded spatial allocation factors for off-road mobile sources will be carried out using an approach similar to the one described for area sources. The off-road mobile source categories for which spatial allocation factors will be developed will be based on the ARB's OFFROAD emissions model. Special emphasis will be placed on the spatial distribution of portable equipment (i.e., compressors, generators, drilling rigs) and off-road equipment used at military bases. The approach we plan to take for portable and military off-road equipment will involve identifying the most important portable equipment categories from an ozone precursor emissions standpoint. Priority will be given to those categories that are significant sources of ROG or NO_x emissions.

Off-road mobile surrogate assignments for portable equipment will be made by classifying the equipment in terms of how it is used and assigning the appropriate surrogate. For example, portable equipment associated with farming operations will be assigned a surrogate representative of agricultural land use, while military equipment will be assigned to the grid cells with military bases.

Task 3 – Development of Improved Temporal Profiles

STI will review currently existing temporal profiles for area and off-road mobile sources in use by the ARB and local air pollution control districts. Priority will be given to categories that are significant sources of ozone precursor emissions. The seasonal, weekly, daily, and hourly activity profiles for each source category will be reviewed with special attention focused on seasonal variations in temporal activities as well as variations between weekday and weekend emissions activity. Many source categories demonstrate seasonal variations in emissions activities. For example, emissions activities associated with agricultural processes are highly dependent on seasonal farming practices. Emissions sources associated with recreational off-road mobile sources also have very strong seasonal activity patterns.

In order to improve existing temporal profiles, research will be carried out to gather new information about emissions activity patterns associated with area and off-road mobile sources. Sources of temporal data will be obtained including published reports and papers, data collected by government agencies (i.e., ARB's recently compiled statewide "Crop Calendar"), and information from local agencies such as county agricultural commissioners, local planning agencies, and departments of natural resources. Because the domain covers such a broad geographical range, climate and seasonal characteristics may vary among counties. As a result we believe that county-specific temporal profiles should be developed. The temporal profiles will be provided in an electronic format compatible with the ARB's CEIDARS and CEFS databases.

Task 4 – Review and Quality Assure (QA) the Spatial Allocation Factors and Temporal Profiles

STI will perform a QA review of the gridded spatial allocation factors and temporal profiles in order to check for inconsistencies, missing data, or errors. Graphical displays of the gridded spatial allocation factors will be prepared using the ARC/INFO GIS software package. Time-series plots will be prepared showing the temporal activity profiles for major emissions categories by county and subregion. All tabular and graphical summaries will be provided to ARB in both hardcopy and electronic formats.

The proposed study domain, at a grid size of 1×1 km, encompasses a large region of California. We will conduct checks to identify possible mis-allocations of surrogates, drawing from our experience and engineering judgment. A careful evaluation of the final gridded spatial allocation factors will be conducted to examine the appropriateness of the emission surrogates for the area sources. Also, the profiles used for temporal allocation of emissions will be carefully evaluated. From these evaluations, STI will recommend areas of future research and data collection that could improve the accuracy of the spatial allocation factors and temporal profiles.

PROJECT MANAGEMENT PERSONNEL

The key personnel for this project will be Mr. Lyle Chinkin, Ms. Dana Coe, and Ms. Tami Funk. Lyle Chinkin will serve as the Project Manager whose responsibilities will include the overall management of the project, as well as the project schedule and budget. Dana Coe and Tami Funk will be responsible for conducting and tracking day-to-day work efforts as well as the overall technical quality of work products. Technical staff members include data processing technicians who will maintain communication with the Project Manager regarding the use of resources, progress, and especially any problems that may be encountered.

ESTIMATED COSTS AND SCHEDULE

Following is a table that shows the proposed budget for this project and a figure that shows the proposed project schedule.

Proposed Budget for Development of Baseyear and Future Year Gridding Surrogates for Spatial Distribution of Area and Off-Road Source Emission Categories in the CCOS Domain

Cost Estimate:
11/15/99 17:15

		TOTAL All Tasks		Tasks 1&2 Gridded Area and Off-Road Mobile		Task 3 Temporal Profiles		Task 4 Final QA/QC Review	
STI LABOR	1999 Rates	Hours	Dollars	Hours	Dollars	Hours	Dollars	Hours	Dollars
L. Chinkin	\$159.00	160	25,440	80	12,720	40	6,360	40	6,360
D. Coe	\$84.60	160	13,536	80	6,768	40	3,384	40	3,384
T. Funk	\$57.40	1,040	59,696	840	48,216	100	5,740	100	5,740
Data Technician	\$42.00	870	36,540	720	30,240	0	0	150	6,300
Technical Editor	\$67.10	24	1,610	0	0	0	0	24	1,610
Clerical	\$52.20	24	1,253	0	0	0	0	24	1,253
SUBTOTAL - STI LABOR		2,278	138,075	1,720	97,944	180	15,484	378	24,647
STI MATERIAL AND OTHER DIRECT COSTS									
Miscellaneous (Data Purchase)			500		500		0		0
SUBTOTAL - STI MATERIAL AND OTHER DIRECT COSTS			500		500		0		0
BELOW LINE COSTS (GIS & Computer)			4,000		3,000		500		500
INFLATION (Labor, M&ODCs, Below line)			7,129	5%	5,072	5%	799	5%	1,257
SUBTOTAL - COSTS			149,704		106,516		16,783		26,405
Fee on M&ODCs	10%		53		53		0		0
SUBTOTAL - FEE			53		53		0		0
GRAND TOTAL		2,278	\$149,757	1,720	\$106,569	180	\$16,783	378	\$26,405

Percent of Project, by Task (Hours & Dollars)	100%	100%	76%	71%	8%	11%	17%	18%
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