TITLE:	Developing a Comprehensive Framework for Estimating the Social Costs of Emissions of Criteria Pollutants and Air Toxics In California, and Identifying Other Direct and Indirect Benefits of California's Climate and Air Quality Programs
PRIME CONTRACTOR:	University of California, Davis.($406,265)
SUBCONTRACTOR(s):	Donald McCubbin, Ph.D.($49,980)
PRINCIPAL INVESTIGATOR(s):	Mark Delucchi, Ph.D.
CONTRACT TYPE:	Interagency Agreement
BUDGET:	$456,245
CONTRACT TERM:	30 Months

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I. SUMMARY

Achieving California's challenging air quality and climate objectives will require accurate information about the health benefits (and avoided damages) of relevant policies. Metrics on the impact of policies on the health and well-being will make it easier for communities and decision-makers to understand and track the effect of aggressive climate and air quality policies and measures. The current Cost of Carbon metric is not sufficient to meet these needs and new metrics are needed to better quantify climate, air quality health, and other co-benefits of California's climate programs. This project will address that need by qualitatively assessing the environmental, energy, economic, and social benefits related to California's climate and air-quality programs. This project will estimate air-quality health benefits by developing a more comprehensive set of concentration-response functions, capture the effects of socio-economic status, and include a detailed analysis of the impacts of the emissions of toxic air contaminants. This work will also include estimates of the agricultural and visibility benefits of improvements in air quality, ecosystem benefits, and incorporate the interaction of the nitrogen cycle with air quality. The project will produce a spreadsheet model that will account for all of the major factors

that determine air-pollution damages. CARB staff will be able to use this model to evaluate the full social costs and benefits of its climate-change and air-quality programs.

II. TECHNICAL SUMMARY

Objective

This project will support CARB's cost-benefit analyses by developing detailed estimates of the human health, agricultural, and visibility benefits of improved air quality, providing simple estimates of materials and ecosystem benefits, and identifying and discussing qualitatively a wide range of other potential environmental, energy, economic, and social benefits related to California's climate and air-quality programs.

Background

As noted in the Scoping Plan, the Social Cost of Carbon (SC-CO_2), while intended to be a comprehensive estimate of the damages caused by carbon globally, does not represent the cumulative cost of climate change and air pollution to society. The SC-CO_2 does not capture other important metrics like increased smog due to higher temperatures, odor impacts, or other health impacts. There are additional costs to society outside of the SC-CO2, including costs associated with changes in co-pollutants.

The Intergovernmental Panel on Climate Change (IPCC) has stated that the Interagency Working Group (IWG) on Social Cost of Carbon (IWG SC-CO2) estimates are likely underestimated due to the omission of significant impacts that cannot be accurately monetized, including important physical, ecological, and economic impacts. Examples of unaccounted metrics include avoided damages and health/safety co-benefits of living in communities designed to reduce exposure to air pollution, or increased damages due to additional stressors that many low-income communities face (e.g. limited access to active transportation and health care) that increase their vulnerability to the health risks associated with exposure to air pollution. Thus, California and other regions may see exacerbation of other environmental, economic, and public safety impacts due to climate change that are not captured in the SC-CO2.

A fuller understanding of the air quality health impacts not captured by the SC-CO_2 can better inform climate change policies and measures. For instance, there may be technologies or policies that do not appear to be cost-effective when compared to the SC-CO2, SC-CH4, and SC-N2O associated with GHG reductions. However, these technologies or policies may result in other benefits that are not reflected in the IWG social costs. For instance, the more comprehensive evaluation of social costs might include air quality health impacts due to changes in local air pollution that result from reductions in GHGs, diversification of the portfolio of transportation fuels (a goal outlined in the Low Carbon Fuel Standard) and reductions in criteria pollutant emissions from power plants (as in the Renewable Portfolio Standard).

Proposal Summary

This project creates a conceptual framework for organizing the direct and indirect benefits of climate and air-quality policies, develops a spreadsheet model for estimating in detail the most significant benefits related to changes in air quality, and identifies and discusses the other benefits (not estimated in the spreadsheet model).

Benefits related to GHG emission impact include those accounted for in the US Interagency Working Group (IWG) social cost of carbon (SCC) (IWG, 2016), and GHG emission impacts not accounted for by the IWG. An example of the latter is changes in GHG emissions affect temperature which affects ozone formation which affects human health. Benefits related to changes in criteria-pollutant and air-toxic (CPAT) emissions include impacts on human health (mortality and morbidity), visibility, agriculture, materials, and ecosystems. The health effects will be quantified in detail based on an original analysis using a four-step damage-function approach. The agriculture and visibility category will be quantified with original analysis. The ecosystem impacts include effects on biodiversity and forests will be quantified based on a review of the literature. Additional benefits, not estimated in the spreadsheet model, include ecological impacts (e.g., on water quality), energy security, indirect effects on activities, and others.

A spreadsheet model will be created to provide detailed estimates of health, visibility, and agriculture benefits. With the spreadsheet model CARB will be able to specify different

future emission scenarios and estimate the air-quality benefits of those scenarios relative to a business-as-usual (BAU) scenario. The model will use the standard four-step damage estimation method, in which changes in emissions result in changes in air-quality (including toxic air contaminants), exposure, impacts, and the monetary value of impacts (Figure 2 in the proposal). (Note that Figure 1 in the proposal shows the elements of the four-step method embedded within the overarching cost-benefit framework.) The model also will be able to calculate benefits in terms of dollars per ton of pollutant.