LADCO | LAKE MICHIGAN AIR DIRECTORS CONSORTIUM

REQUEST FOR PROPOSAL

Southeast Michigan Air Quality Modeling Study

The Lake Michigan Air Directors Consortium (LADCO) is seeking contractor assistance to conduct regional-scale air quality modeling to assess emissions control strategies for mitigating surface ozone concentrations in Southeast Michigan (SEMI). This project will produce high spatial resolution simulations of current and future year air quality in the SEMI region to quantify the impacts of ozone precursor emissions reductions on ozone concentrations. The objective of this project is to evaluate strategies to demonstrate attainment of the 2015 ozone National Ambient Air Quality Standard (NAAQS) for the SEMI nonattainment area.

Proposals must be received no later than 5 p.m. Central on August 13, 2021. An electronic PDF copy of the proposal is required and should be sent to:

Zac Adelman
Executive Director
Lake Michigan Air Directors Consortium
adelman@ladco.org

No late proposals will be accepted, and the offer shall remain effective for a period of 60 days from the date of the mailing.

Your response to this Request for Proposal (RFP) should include a complete technical proposal that describes your approach for accomplishing the activities outlined below in the Scope of Work. The technical proposal should include a draft work plan that clearly describes your technical activities, schedule, and deliverables. The technical proposal should include a summary of your capabilities and your experience in the field of work. Include a complete cost proposal with a detailed breakdown of projected expenditures by task, including person hours and other direct charges. LADCO does not anticipate there being any travel expenses for this project.

Please limit the proposal to 20 pages (single-spaced, 12-point font).

In addition, your response should include an appendix with supplemental information, such as references, resumes, and descriptions of recent relevant work. The supplemental information has no page limit.

All contracts will be issued by LADCO and managed by LADCO's Executive Director. It is anticipated that LADCO will award a fixed price contract as a result of this solicitation. LADCO may consider awarding another type of contract, provided that its use is consistent with the objectives and interests of the Consortium.

Funds available for this contract are federal funds from the U.S. Environmental Protection Agency (EPA) and contractors must meet requirements associated with the use of federal funds (2CFR 200).

All information and data produced and delivered under this contract will be in the public domain. While LADCO does not anticipate restricting the publication or presentation of results obtained from this study, LADCO reserves the right to review all presentations and manuscripts derived from this study.

LADCO will make positive efforts to utilize small, minority business enterprises (MBE), women's business enterprises (WBE), and disadvantaged business enterprises (DBE), whenever possible.

Details of the LADCO procurement process, including draft contract terms, are available in the LADCO Procurement Policy Manual.

All inquiries regarding this RFP should be directed to Zac Adelman (adelman@ladco.org) no later than 5 p.m. Central on July 26, 2021. LADCO will post responses to all received inquiries to the LADCO website RFPs page by July 28, 2021.

We expect to award the project and enter a contract with the winning bidder by September 1, 2021.

If your organization would like to be included on the interested bidders list for this and subsequent work, then please send an email to the LADCO Executive Director with your email address and contact information.

Scope of Work

Introduction

The Southeast Michigan (SEMI) ozone nonattainment area (Figure 1) will likely be reclassified from marginal nonattainment status to moderate nonattainment of the 2015 ozone National Ambient Air Quality Standards (O_3 NAAQS). The area's nonattainment status will be "bumped up" due to ozone concentrations measured at four regulatory monitors: Port Huron, New Haven, Oak Park, and East 7 Mile Road. The three-year ozone design value (DV3) for 2020 at each of these monitors, defined as the three-year average of the annual mean 4th highest daily maximum 8-hour average ozone corresponding to the years 2018 through 2020, is above the 2015 O_3 NAAQS of 70 ppb. A bump-up will require Michigan Environment, Great Lakes, and Energy (MI EGLE) to submit to U.S. EPA a nonattainment area State Implementation Plan (SIP) in early 2023 that demonstrates that the area will reach attainment of the O_3 NAAQS by August 3, 2024.

In an ozone attainment demonstration, a 5-year weighted design value (DV5) centered around a base year is multiplied by a model-derived relative response factor (RRF) to determine whether emissions control strategies will bring an area into attainment of the NAAQS by the designated future attainment year. For example, the value of DV5 for the base year 2016 and the five-year period from 2014 through 2018 is equal to the arithmetic mean of DV3 at a monitoring site for the years 2016, 2017, and 2018. The RRF for a given monitoring site is defined as the ratio of the modeled concentration in the attainment year (in the current case, 2023) at the monitoring site to the corresponding modeled concentration in the base year (e.g., 2016). Modeled emissions control strategies must result in values of RRF sufficiently below 1.0 to simulate attainment of the ozone NAAQS by the future attainment year.

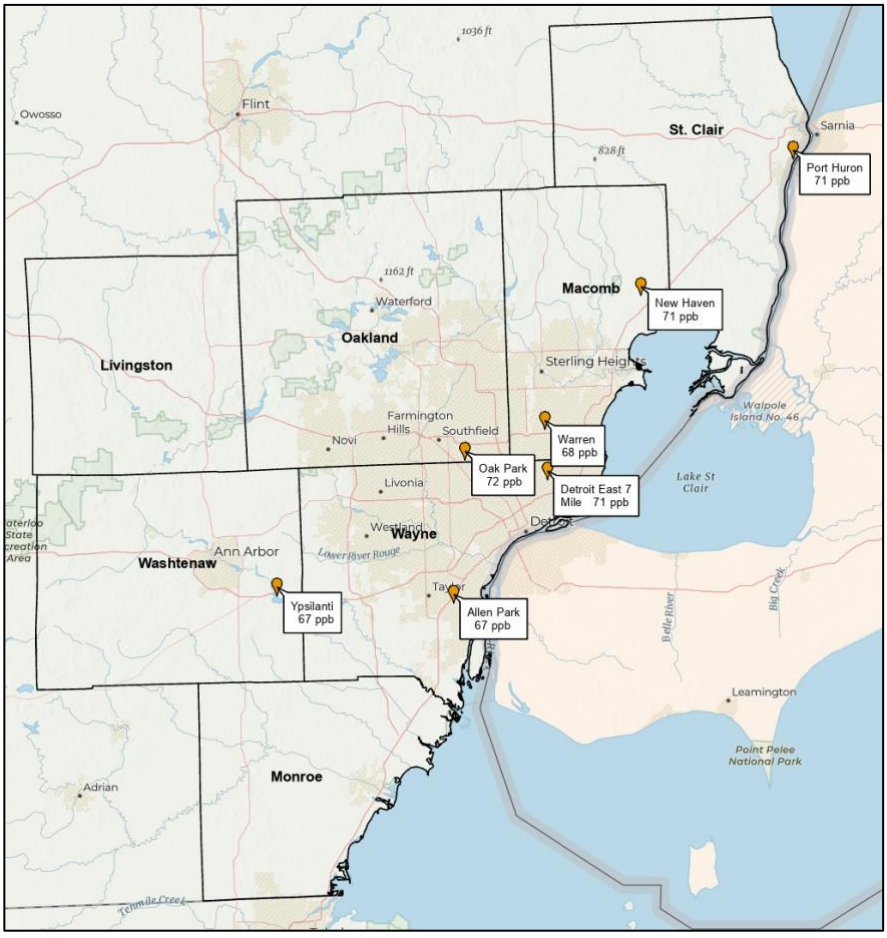

Figure 1. Monitoring sites and 2018-2020 ozone design values in SEMI nonattainment counties

A fundamental influence that must be accounted for by models of ozone in the SEMI region is how the complex lake breeze affects pollutant transport. The previous 2017 Lake Michigan Ozone Study (LMOS) examined this issue in the context of the western Great Lakes region (Stanier et al., 2021). A major conclusion of the LMOS was that high spatial resolution is required in a meteorological model (i.e., below 4-km horizontal grid cells) to be able to properly simulate lake breeze fronts and their effects on the transport of ozone and its precursor species across Lake Michigan (LADCO, 2019). Likewise, the older 2007 Canadian Border Air Quality-Meteorology Study (BAQS-MET) demonstrated the importance of correctly simulating lake breezes in modeling ozone over the eastern Great Lakes (Brook et al., 2013), so that the most current version of the Global Environmental Multi-scale/Modeling Air Quality and Chemistry

(GEM-MACH) model used by Environment and Climate Change Canada (ECCC) is run at 2.5-km resolution.

The CAMx model version currently run by the Lake Michigan Directors Consortium (LADCO) for the purpose of facilitating ozone attainment demonstrations in EPA Region 5 nonattainment areas has a 4-km horizontal resolution over the entire Great Lakes region, and a 1.33-km resolution over Lake Michigan. Recent LADCO model experiments at 12-km resolution indicate that NOx emissions controls would be most effective at reducing ozone concentrations for almost all nonattainment areas in the region, and that a combination of nitrogen oxides (NOx) and volatile organic compound (VOC) emissions controls would be effective for the lakeshore areas of the Great Lakes. Recent ECCC GEM-MACH sensitivity studies at 2.5-km resolution indicate that in SEMI, there is a significant region which is VOC-limited (i.e., VOC reductions are more beneficial than NOx reductions), principally near lake breeze frontal boundaries where the highest ozone concentrations tend to occur. This region of VOC sensitivity is where most ozone monitors in SEMI are located, and where there may be large uncounted emissions of formaldehyde (HCHO), as well as VOC emissions from volatile chemical products (VCPs) associated with commercial and industrial sources. Missing sources of these VOCs may hinder ozone model performance (i.e., limit the ability of the model to reproduce observed ozone exceedances) and attenuate the modeled response to emissions control scenarios.

Objectives

In this project, 1.3-km horizontal resolution meteorological model simulations based on the Weather Research Forecasting (WRF) model generated by LADCO will be used to drive 1.3-km horizontal resolution CAMx or CMAQ runs for the SEMI ozone nonattainment area. These runs will investigate the effect of improvements to the emissions inventory on model performance for a base year of 2016 and the potential impact of emissions control strategies on RRF values for a future attainment year of 2023.

The project objectives are as follows:

- To provide a 1.3-km resolution ozone simulation of the SEMI region for the base year 2016 that is acceptable to the US EPA based on model performance statistics.
- To improve emission inventories by the addition of undercounted HCHO and VCP sources.

- To examine the role of added HCHO and VCP emissions in improving ozone model performance and response to control strategies.
- To assess the impacts of selected emissions control strategies on simulated ozone in 2023 and corresponding RRF values.

Technical Tasks

Under this contract, the contractor shall perform the following technical tasks, with the results of these tasks to be thoroughly discussed and interpreted in a project final report (Task 7). LADCO will evaluate the technical and cost proposals for each individual task. We may contract for some or all of the tasks, based on the merits of the proposal and available funding.

For the purposes of the proposal, the contractor shall provide separate statements of work and cost estimates for each task.

Task 1. Modeling Protocol

The contractor shall develop a CAMx or CMAQ modeling protocol that takes advantage of existing LADCO modeling resources for the base year of 2016. These resources include: a) 12-km, 4-km, and 1.3-km resolution WRF runs encompassing SEMI; and b) 12-km and 4-km resolution outer domain runs of CAMx. An important consideration in the modeling protocol is the geographical extent of the inner 1.3-km resolution domain. The modeling domain must encompass the entire SEMI ozone nonattainment area. The protocol shall describe the meteorology and emissions data processing, air quality modeling configuration and procedures, and the model performance evaluation process.

Task 1 Deliverables:

1. Draft modeling protocol
2. Final modeling protocol that incorporates comments on the draft version

Task 2. Formaldehyde and VCP Inventory Improvements

The purpose of this task is to identify and prepare VOC inventory improvements for air quality modeling experiments. The contractor shall work with LADCO and Michigan EGLE staff to assemble updated formaldehyde (HCHO) and volatile chemical product (VCP) 2016 base year inventories for SEMI that are derived from: a) measured ratios of HCHO to CO in stack tests and

prior documented or current field campaigns, including the MOOSE field study in May-June 2021; and b) the most current EPA emission factors for VCPs that are being used to prepare the 2020 National Emissions Inventory. Note that EGLE staff have already done much work towards assembling the HCHO and VCP emissions inventories with a GIS data platform. These data will be provided to the contractor for use in developing the updated inventories. The contractor may also take into account work performed by Ramboll in a separate LADCO project that scaled 2016 emissions to account for missing VCP sources in the inventories[1].

Task 2 Deliverables:

1. Updated HCHO and VCP emissions inventories for counties in the SEMI region in SMOKE FF10 formats, and any ancillary data (e.g., speciation profiles) required for processing these data with SMOKE
2. Power Point slide presentation on the development and evaluation of the HCHO and VCP inventories and emissions estimates
3. Final report chapter describing the methods used to estimate HCHO and VCP emissions, and a comparison of the updated emissions to the base inventory

Task 3. Base Year Ozone Model Optimization

The purpose of this task is to select a model and data configuration that best reproduces observed 2016 high ozone conditions in the SEMI region. The contractor shall, with LADCO and Michigan EGLE guidance, select high-ozone episodes in 2016 in the SEMI region that will serve as the basis for a model improvement and performance evaluation experiment. The contractor shall prepare the LADCO WRF meteorology input to the selected air quality model and process the 2016v1 national emissions inventory[2] with SMOKE to the 1.33 km SEMI modeling domain for the selected time periods. LADCO will provide boundary conditions files from recent 4km 2016 modeling for the 1.33 km SEMI domain. The contractor shall also prepare any other necessary air quality model inputs for the simulation.

[1] Control of ozone precursor emissions in the LADCO region: Task 3 Draft Final Report: https://www.ladco.org/wp-content/uploads/Projects/Emissions-Controls/Ramboll-NOx-VOC-2020/LADCO_Ozone_Emissions_Control_Task3_Chapter_DraftFinal_11Nov2020.pdf

[2] https://www.epa.gov/air-emissions-modeling/2016v1-platform

The contractor shall run the regional air quality model at 1.33 km grid resolution to produce base and model performance optimization strategy air quality model runs for the selected episodes, including sensitivity runs to determine the impacts of additional emissions of HCHO and VCPs from Task 2. For the purpose of estimating this task, assume one 2016 baseline configuration simulation, and four sensitivity simulations to experiment with different VOC inventory or air quality model configurations. Each simulation will be run for a combination of high ozone episodes in 2016 that total no more than four weeks of simulation days (i.e. 5 scenarios x 6 weeks of simulation).

The contractor shall interpret and document the results of the baseline 2016 simulation and model improvement experiments in a Power Point presentation and final report chapter. The model results shall be compared to observations to evaluate the best performing ozone model configuration for the SEMI region. The documentation shall include a comparison of the results between the sensitivity simulations, and justification for selecting one of the simulations as the base year configuration for a 2016 SEMI ozone model.

Task 3 Deliverables:

1. List of selected ozone episodes in 2016 for the SEMI region
2. Air quality model-ready meteorology, emissions, and ancillary data for the selected episodes
3. Air quality model output data files, source code, scripts, and appropriate metadata
4. Power Point presentation on the model experiment results
5. Final report chapter describing the model optimization experiments and results

Task 4. Base Year Air Quality Modeling and Model Performance Evaluation

The purpose of this task is to execute and evaluate a 2016 base year air quality modeling simulation. The contractor shall work with LADCO and Michigan EGLE to select the optimal ozone model configuration for SEMI from Task 3. The contractor shall extend the simulation using the selected configuration to the entire 2016 ozone season (April-October). This task includes the processing of all required model inputs, and operating the air quality model to produce ozone, NOx, and VOC model performance statistics as described in LADCO (2018) to evaluate the base year performance of the air quality model.

The contractor shall interpret the model performance evaluation and present the results in a Power Point presentation and in a final report chapter.

Task 4 Deliverables:

1. Air quality model-ready meteorology, emissions, and ancillary data for the 2016 ozone season
2. Air quality model output data files, source code, scripts, and appropriate metadata
3. Power Point slide presentation summarizing model performance evaluation results
4. Final report chapter of base year model performance narrative and statistics

Task 5. Future Year Air Quality Modeling Experiments

The purpose of this task is to quantify the impacts of emissions control strategies on RRFs and future year design values. The contractor shall work with LADCO and Michigan EGLE staff to develop 2023 emission inventories that reflect the impact of new ozone SIP rules being contemplated or implemented by Michigan EGLE. The base 2023 inventory will be projected from the optimized 2016 inventory from Task 3. While the majority of the 2023 modeling platform is available from US EPA[2], the inventory sectors from Task 3 with augmented formaldehyde and VCP sources shall be included in the 2023 inventory developed for this task.

The contractor shall prepare the base 2023 emissions for input to the selected air quality model, and conduct an "on-the-books" (OTB) simulation for the modeling episode(s) selected in Task 3. The contractor shall compare the results of the episodic 2023 OTB simulation to the optimized 2016 simulation results from Task 4 and evaluate the changes in future year ozone concentrations relative to the base year.

The contractor shall conduct three episodic future year emissions control strategy simulations. The three separate emissions control scenarios shall include: a) controls on combustion sources such as flares and stationary engines that minimize both NOx and HCHO emissions; b) Ozone Transport Commission (OTC)-derived rules for Architectural and Industrial Maintenance (AIM) coatings and Consumer and Commercial Products to reduce VOC emissions from VCPs; and c) VOC and NOx Reasonably Available Control Technologies (RACT), especially those that reduce VCP emissions. The contractor shall work with Michigan EGLE to define the control efficiencies

and the inventory sources to which these scenarios apply. The contractor shall process the emissions for input to the air quality model, and perform air quality modeling of each emissions control strategy simulation for the selected SEMI modeling periods. The contractor shall compare the results from each of the episodic 2023 control strategy simulations to the optimized 2016 simulation results from Task 4 and evaluate the changes in future year ozone concentrations relative to the base year.

The contractor shall use the results of the OTB and control strategy modeling to estimate ozone relative reduction factors (RRFs) for the monitors in the SEMI 1.33 km modeling domain, and to apply these RRFs to estimate future year design values[3].

The contractor shall document the results of this task in a Power Point presentation and final report chapter. The presentation shall briefly describe the methods and results of this task, with a focus on the RRFs and impacts of the emissions experiments on future year ozone concentrations in SEMI. The chapter shall describe the inventory scenarios developed under this task, the emissions processing and air quality modeling procedures, and the results of the modeling scenarios. The chapter shall convey the impacts of the emissions scenarios on RRFs, ozone precursor concentrations, and future year ozone conditions in SEMI.

Task 5 Deliverables:

1. Air quality model-ready emissions data for the selected episodes
2. Air quality model output data files, source code, scripts, and appropriate metadata
3. Power Point presentation summarizing and comparing the 2023 OTB and emission scenarios, and presenting the results of the air quality modeling that used these emissions
4. SMOKE control packets for applying the emissions control strategies to the base 2023 inventory
5. Final report chapter describing the methods to develop the 2023 OTB and emissions scenario inventories, and presenting the results of the air quality modeling

[3] We acknowledge that the RRFs and future year DVs from this task will be estimates as they are only going to be based on episodic modeling, rather than complete ozone season simulations

Task 6. Future Year Modeling and Attainment Testing

The purpose of this task is to conduct a model attainment test to potentially support an attainment demonstration for the SEMI nonattainment area. The contractor shall work with LADCO and Michigan EGLE to select a future year emissions strategy from the results of Task 5 for use in a future year attainment testing simulation. The contractor shall prepare 2023 emissions for an ozone season (April – October + 1 week spin-up period) simulation on the SEMI 1.33 km modeling domain using the selected emissions strategy. The contractor shall use these emissions to conduct a 2023 ozone season air quality model simulation for comparison to the results from the optimized base year simulation from Task 4. The results of the 2016 and 2023 simulations shall be used to conduct an ozone attainment test for SEMI using the Speciated Model Attainment Test – Community Addition (SMAT-CE) software.

The contractor shall document the results of this task in a Power Point presentation and final report chapter. The Power Point presentation shall briefly describe the modeling methods, RRFs, and results of the attainment test. The final report chapter shall include details of the modeling methods, data processing, and attainment testing results.

Task 5 Deliverables:

1. Air quality model-ready emissions data for the 2016 ozone season
2. Future year air quality model output data files, source code, scripts, and appropriate metadata
3. Power Point presentation summarizing and 2023 ozone season simulation, RRFs and future year design values for ozone monitors in SEMI
4. Final report chapter describing the methods to develop the 2023 emissions and air quality modeling scenarios, and presenting the results of the air quality modeling and attainment testing, including RRFs and future year design values

Task 7. Project Management and Final Report

At the beginning of the project, the contractor shall develop a draft workplan describing the approach they plan to take to address Tasks 1 through 6, including a project timeline and schedule of deliverables. The contractor shall share this workplan with LADCO and Michigan

EGLE for comment. The contractor shall produce a final workplan that addresses these comments.

During the project, the contractor shall have regularly (at least monthly) scheduled calls with LADCO and Michigan EGLE to discuss the progress of the work. The contractor shall take and circulate notes and action items from these calls.

At the end of the project, the contractor shall develop a draft final report to LADCO that documents the methods and results from each technical task (Task 1-6). The chapters of the report shall describe the data sources and methods used in the analyses, the air quality model configurations, the 2016 and 2023 emissions inventories, results of the modeling experiments, and the final ozone attainment test results. The contractor shall provide a final report outline based on the comments received from LADCO and Michigan EGLE.

The contractor shall share the draft final report with LADCO and Michigan EGLE for comment. The contractor shall produce a final report that addresses the comments received on the draft.

Deliverables:

1. Draft workplan
2. Final workplan
3. Monthly conference calls, notes, and action items
4. Draft outline of report
5. Final outline of report
6. Draft report
7. Final report

Proposal Requirements

Proposals should include the following elements:

1. Project statement - summarize the project from the perspective of the bidder
2. Technical proposal - detail the approach by task used to accomplish the objectives and requirements of the project
3. Project Timeline - detail the schedule of deliverables by task
4. Cost proposal - description of the projected expenditures by task, including person hours and other direct charges
5. Bidder qualifications - description of the qualifications should include years of experience, number of staff, and a narrative highlighting the bidders capabilities
6. MBE/WBE statement - statement of whether the bidder is a registered minority or woman-owned business
7. Appendix - references, resumes, and descriptions of recent relevant work

Please limit proposal elements 1-6 to 20 pages; there is no page limit for element 7.

Level of Effort and Project Timeline

The project should be completed by March 1, 2022. Additional funding and time considered necessary to conduct a more complete analysis should be included as options to the primary work effort.

Evaluation Criteria

The following criteria will be used in evaluating the responses to this RFP. A review panel will score each of the five factors below from 1 (worst) to 5 (best). The proposal with the highest weighted score will be selected for funding.

1. Project statement: 10%
2. Technical proposal: 45%
3. Cost proposal: 20%
4. Bidder qualifications: 20%
5. MBE/WBE statement: 5%

Supporting Information

Brook, J.R. et al., Exploring the nature of air quality over southwestern Ontario: main findings from the Border Air Quality and Meteorology Study, Atmos. Chem. Phys., 13, 10461–10482, 2013.

Lake Michigan Air Directors Consortium (LADCO), 2017 Lake Michigan Ozone Study (LMOS): Preliminary finding report, Rosemont, IL, 2019.

Stanier, C.O., et al., Overview of the Lake Michigan Ozone Study 2017, Bull. Am. Met. Soc., online 2021. https://journals.ametsoc.org/view/journals/bams/aop/BAMS-D-20-0061.1/BAMS-D-20-0061.1.xml. 2021