THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

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International Council on Clean Transportation (ICCT)

Request for Proposal
Marine Black Carbon Emissions Testing

May 15th, 2015

REPLY DEADLINE: June 15th, 2015
BUDGET: Not to exceed $350,000 USD
RESPOND TO: Alyson Azzara, 1225 Eye Street NW Suite 900, Washington, DC 20005.[1]
TIMEFRAME: Project interim tasks to be completed as detailed in the RFP with all final deliverables received by ICCT no later than October 14th, 2016.

Contact Person:

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The International Council on Clean Transportation (ICCT) is a 501(c) 3 nonprofit organization with a mission to dramatically improve the environmental performance and efficiency of personal, public, and goods transport modes in order to protect and improve public health, the environment, and quality of life. ICCT works to support environmental policymakers worldwide with the best technical information to develop policies to reduce transport emissions (http://www.theicct.org). ICCT staff are active in a variety of policy venues, including IMO, and have contributed papers related to marine black carbon emissions to that forum since 2011.

The ICCT seeks a research team with expertise on marine emissions testing to generate data on baseline emission factors and control technology evaluation for black carbon (BC) emissions from marine vessels and engines. The resulting research will be integrated into a project funded by the Climate and Clean Air Coalition (CCAC) to generate a refined global marine BC inventory and a database to assess the effectiveness of technologies to reduce black carbon emissions.

[1] Digital submissions by deadline will be accepted and can be submitted via email to alyson@theicct.org.

[2] Bond T. C., Doherty S. J., Fahey D. W., Forster, P. M., et al. (2013) Bounding the role of black carbon in the climate

Background

This Request for Proposal (RFP) supports the marine component of a two-year project on marine and ports black carbon emissions funded by the Climate and Clean Air Coalition (CCAC) and implemented by the International Council on Clean Transportation (ICCT). The CCAC is an international cooperative partnership to reduce emissions of short-lived climate pollutants, including black carbon (for further information on the CCAC please see http://www.unep.org/ccac).

Ports and marine vessels are a large source of diesel particulate matter and black carbon. Black carbon is the second largest contributor to human induced climate warming to-date, after carbon dioxide, according to a landmark four year-study on black carbon released in 2013 (Bond et al, 2013). Representing the consensus on BC climate science, this study found that "mitigation of diesel-engine sources offers the most confidence in reducing near-term climate forcing" because diesel particles contain a significantly higher proportion of BC than other sources, and less of the organic carbon that causes atmospheric cooling. International shipping contributes approximately 2% of global black carbon emissions, and 9% of overall diesel BC emissions, with one-third of those emissions occurring north of 40 degrees latitude.

The maritime sector faces unique challenges in controlling black carbon emissions. Although stricter requirements apply in certain regions, marine vessels typically operate on low quality “bunker” fuels that currently average 27,000 ppm sulphur, inhibiting the adoption of advanced pollution control equipment used to control diesel emissions in other sectors. Despite progress in some areas, implementation of controls for PM/BC from marine sources are slow to develop. Key barriers to progress include: poor data on baseline emissions and resulting health and climate impacts at local, regional and global scales; lack of a comprehensive assessment of control technologies and measures, especially for ocean going vessels; and poor capacity for policy implementation, particularly at emerging ports which is compounded by overlapping, fragmented and sometimes conflicting jurisdiction hindering coordinated policy making.

The CCAC work plan will address two areas – ports and marine vessels– where there is significant need and opportunity for improved climate and health benefits through major black carbon reductions from heavy-duty diesel engines. The objective of the marine component is to directly address these obstacles through a series of activities that develop, compile and share information, provide real-world testing of emissions controls on in-use marine vessels, and reach out to stakeholders. The end result will be a major contribution to policy-relevant knowledge supporting emission controls across multiple venues.

Scope of Work

Project Purpose and Outline

The ICCT, working with the contractor, will provide updated black carbon emission factor data to the research and policy community to support an updated global black carbon inventory. Additionally, the ICCT seeks to better understand the impacts of mitigation technologies and operational practices on actual reduction of black carbon emissions from marine vessels. More research in particular is needed to characterize the marine BC inventory and mitigation potential in order to enable local, domestic, and international control measures.

A core element of the maritime activity is real world ship testing to characterize baseline emissions and to identify best available control technologies (BACT) for marine BC. Ideally, this testing will be coordinated closely with existing research. The testing will aim to fill identified research gaps to compile the best available information on marine emissions, performance, and costs of emission control technologies to inform policy discussions across multiple venues. The project will provide information and knowledge for CCAC Member Countries to support action at the IMO related to marine Black Carbon.

Data collected under this project will be used by the ICCT to generate two key deliverables: a refined global marine BC inventory and a technology performance database evaluating the cost effectiveness of key control technologies. To date, most inventories have used crude BC emission factors, generally as a function of g black carbon/kg fuel, that are independent of vessel activity, engine load, and engine type.

Bond et. al. 2013[2] includes a highly cited inventory for black and organic carbon from combustion sources. The study estimates global annual emission of 7530 Gg/yr in 2000 of black carbon from fossil fuel and biofuel burning, open biomass burning, and burning of urban waste. The study did not develop an inventory specific to marine transportation but does include a widely referenced black carbon emissions factor of 0.34 g/kg fuel for ships. Several studies have estimated the BC inventory from global shipping resulting in a wide range of estimates. They include: Eyring et al. (2005), Dalsøren et al. (2009), Fuglestvedt et al. (2008) and Dentener et al. (2006). According to the UNECE Expert Group black carbon report, inventory information is lacking from several important sources including shipping, which leads to the large disparity (orders of magnitude) in the current global inventories.[3]

The refined inventory will use improved BC emission factors along with spatially disaggregated vessel operations to create an improved global marine BC inventory and to identify specific routes with high BC emissions particularly near polar areas due to the impact of these emissions the albedo of snow and ice covered areas. Since emissions from in-use vessels may vary significantly from emissions measured within a controlled test bed environment, emission factors derived from laboratory tests of well-maintained

[2] Bond T. C., Doherty S. J., Fahey D. W., Forster, P. M., et al. (2013) Bounding the role of black carbon in the climate system: a scientific assessment. J Geophys Res 118(11): 5380–5552. doi:10. 1002/jgrd.50171

[3] http://www.unece.org/fileadmin/DAM/env/documents/2010/eb/eb/ece.eb.air.2010.7.e.pdf (pg 10)

engines will require validation against emissions measured from in-use vessels under typical operating conditions.

The technology performance database will provide updated information on mitigation technologies and operational practices believed to reduce BC emissions. Slow-steaming, fuel switching, and scrubbers are generally believed to be the most readily applicable approaches to reducing BC from vessel engines, however do not constitute an exhaustive list (e.g. DPFs for certain applications). Thus far, the majority of reduction estimates and emissions factors are derived from PM emissions measures. Direct measurements of BC emissions will resolve questions of PM/BC fractions as well as changes in the relationship based on operations and fuel type. Emission measurements at various engine loads, speeds, and representative fuels will also inform the evaluation of cost effectiveness and applicability of these techniques for global BC reduction from shipping.

The contractor will provide inputs into both of these deliverables by generating state of the art BC emission factors for baseline vessels and engines along with emissions testing for control technologies.

Project Objectives

In pursuit of these goals, ICCT is soliciting project proposals that will provide updated BC emission factors under a range of operational conditions and mitigation practices. Submissions under this RFP will take into consideration collaboration among organizations with expertise in maritime BC measurement. The successful bidder or consortium will have demonstrable expertise among its members and a proven research record supporting the ability to complete each task.

The project consultant will be expected to attend two international workshops – the first scheduled for September 2015 in Europe, and a second project summary workshop approximately one year later during which the final results will be presented. The September workshop will focus on instrumentation and measurement protocols to support a coordinated emission measurement campaign under the CCAC project and in parallel with discussions at IMO. The successful bidder will contribute to that discussion, with the results incorporated into the measurement approach so that the project results are consistent with other similar work being conducted by other groups.

Submissions should outline proposed methodology including, testing locations, measurement methods, fuel type, engine load, and duty cycle, as well as partners identified and demonstrated commitments for their participation. Proposals should include plans and details for repeated measures on all platforms; multiple instruments should be proposed to allow comparisons across real-time methods such as photo-acoustic or laser induced incandescence, as well as filter-based thermal-optical, and/or other methods, and filter smoke method. The focus of this research is on refining the scientific understanding of BC, PM, and other co-pollutants from oceangoing vessels;

where possible, additional tests on other engine types and vessel classes can be proposed by the applicant.

Key issues to address:

1. Utilize engine bench tests to establish baseline emission factors for representative marine engines over a variety of loads, fuel types and possibly mitigation technologies.

2. On-board vessel testing to evaluate actual vessel emissions under typical operating conditions and after the application of key control technologies (e.g. fuel switching, scrubbers) and operational changes (e.g. slow steaming). Emissions measurements on main engines should be prioritized, although proposals to collect data from on-board diesel auxiliary generators consistent with the budget limit defined below are also welcome.

Tasks

Component	Content
Project scope and definition	Kickoff meeting to clarify scope of work and finalize project timeline
Task 1	Bench-testing to develop baseline emission factors for key engine types used on oceangoing vessels under representative fuels and operating loads
Task 2	On-board testing on oceangoing vessels to: a. Validate the emission factors derived from well-maintained engines under bench-test conditions to emissions from representative engines under typical operating conditions and maintenance. Where necessary, develop a general methodology to account for conditions that increase BC emissions beyond the levels measured under test-bench conditions. b. Investigate the link between slow steaming and BC emissions.
Task 3	On-board testing on oceangoing vessels to evaluate key main engine control technologies (e.g. scrubbers, fuel switching, DPFs where applicable) under real-world operating conditions
Workshops	Participation in two international workshops: September 2015 and Q3 2016.
Technical report	For both the bench tests and on board tests, include methodology and full results of each test individual test as well as outcomes from test inter-comparison, including any issues or limitation of instruments, variability in emission factor results, and test location approach limitations or challenges impacting tests or results.

Deliverables

Proposed dates for deliverables are included, however modifications may be considered based on vessel and test-bench availability.

Deliverable	Date
Revised scope of work based on outcome of kick off meeting	July 30, 2015
2015 Workshop participation	September 16 and 17, 2015
A draft methodology outlining testing locations, instruments proposed, and partners identified	October 1, 2015
Final methodology outlining testing locations, instruments proposed, and partners identified	October 10, 2015
Draft report outlining Task 1 results	December 1, 2015
Draft report outlining Task 2 results	May 1, 2016
Draft report outlining Task 3 results	July 1, 2016
A draft final report summarizing data sources, assumptions, methods and results	July 15, 2016
A final technical report, revised to ICCT comments	August 5, 2016
All data or spreadsheet(s) developed while conducting this work. These should make transparent all calculations for EFs or BC reductions. These should also highlight assumptions and provide notations that explain their rationale.	August 5, 2016
Final workshop presentation	Q3, 2016

Timeline

The overall project should be completed within 15 months from the completion of the kick off meeting, subject to agreement between project consultant and the ICCT.

Budget

Proposals must not exceed $350,000. Overall funding will depend upon on the final agreed-upon scope of work and available resources. This is a competitive bidding process.

Personnel

Any change in key staff persons identified in the contract is subject to the approval of the ICCT. Removal by the consultant of any key staff persons identified in the contract without written consent of the ICCT project manager may be considered a material

breach of contract.

Requirements for submission

Interested parties must submit electronically their proposal in PDF format by 5 p.m. Eastern Time on 15 June 2015 to the point of contact listed above. Proposals received after this date and time will not be considered. Proposals shall be considered firm offers to provide the services described for a period of 60 calendar days from the time of submittal.

The proposal should include the following components:

Transmittal Letter

Please submit a transmittal letter, which shall be in the form of a standard business letter on the vendor's letterhead, signed by an individual authorized to legally bind the vendor. The transmittal letter should identify the project team, including lead contractor and any subcontractors. The transmittal letter should also include the name, telephone number, and email address of a primary contact person who can be contacted during normal business hours for questions regarding this submission. The transmittal letter should include a statement that the proposal (or Best and Final Offer, if applicable) is a binding offer to contract with the ICCT according to this RFP for a period of 60 calendar days from the due date for submission of proposals. Any relevant supporting information or attachments should be reduced to letter size and attached to the transmittal letter. Please do not include generic marketing material.

Title Page
Proposals must include a title page that gives the RFP subject, the name of the proposer's firm, local address, telephone number, name of contact person, and the date.

Table of Contents
Proposals must include a table of contents that includes a clear identification of the material by section and page number.

Project Overview and Summary
This section should clearly convey the consultant's understanding of the nature of the work and the general approach to be taken, and to identify any specific considerations. It should include, but not be limited to, the following:
1. A discussion of the project's purpose;
2. A summary of the proposed approach; and
3. The assumptions made in selecting the proposed approach

Detailed Work Plan

- Provide summary and detailed text on how the goals and tasks of this project will be achieved by your team. This technical text will make up the bulk of the proposal and great consideration should be given to communicating approach, data, methodologies, expected outcome, and any other technical aspect of the proposal deemed necessary to be communicated within the submitted proposal. Where appropriate, describe how this project would fit within your future work.

- Propose a preliminary list of project tasks based on information provided in this RFP, identify deliverables, and propose a preliminary schedule. The discussion must be in sufficient detail to demonstrate a clear understanding of the project. For each task, the consultant should expand on the ICCT's task description to provide more detail on how work will actually be performed and identify any important considerations not addressed. The schedule should show the expected sequence of tasks and important milestones.

- Provide a narrative that describes the organizational structure of the project team that describes roles and responsibilities of key personnel and reporting structure, including relationships with subcontractors, if any. Identify the general categories of tasks to be assigned to members of the project team.
    - Include reference to partnerships identified for bench and on-board testing.
    - Include reference to partnerships identified for instrument acquisition
    - Include reference to partnerships identified for fuel, mitigation technology or other aspect required to successfully complete the objectives.

  Where appropriate, letters of commitment from partners demonstrating access to key test platforms, instruments, and mitigation technologies are highly recommended.

- Please give us a sense of the availability of the data needed to inform this project, and highlight any data gaps. Please indicate constraints posed by confidential data, if any.

- Identify and explain other foreseeable problem areas or potential obstacles (such as schedule creep, budget overruns, personnel management, and feasibility, etc.) to successful completion of the proposed scope of work. Discuss alternative approaches that you may use to track and resolve these problems during the course of the project

Firm Overview and Technical Capabilities

Describe your firm and any previous experience working with non-profit groups, if any. Describe your approach and style to managing projects clients. Describe your preferred means of communicating and working with a client. Disclosure of any real or potential

conflict of interest must be provided based on the firm's clients, proposals to pending clients, direct business or significant personal relationship with any ICCT council member, Board member, or staff member.

Qualifications and References

- Describe the proposed team's qualifications (education and experience) specific to the requirements set forth in *Minimum Qualifications and Requirements* above. Identify the personnel, including subcontractor's personnel, whose expertise or experience addresses each of the specified needs.
- To the extent possible, describe project team capability and expertise related to the following:
    - measurement and analysis of marine air emissions
    - familiarity with BC instrumentation approaches and sampling
    - experience with bench testing of air emissions from marine engines
    - experience with on-board vessel emissions testing
    - familiarity with marine inventory development, including emission factor analysis, vessel population, and activity patterns
    - relationships and contacts within the industry, including the ability to access key research platforms (i.e. engines/vessels for testing);
    - if necessary, identify and provide examples of other qualifications that may be critical to successful completion of this work
- Provide brief background information for key personnel (including subcontractors) and briefly discuss individual qualifications to perform assigned tasks.
- Provide a succinct description of any previous projects similar to the services requested, indicating the duration, budget, sponsor, and roles played by individuals proposed for this project. Include the name of the group for which the work was performed, year performed, name of a contact person as a reference, and their telephone number.
- Provide at least one sample of a written technical report or memo prepared by key members of the consultant team, identifying the authors. Only one copy is required, and this may be transmitted electronically. Hard copies will be returned after proposal evaluation, upon request.
- Provide three references from previous clients for whom work related to vessel emissions technology and testing was completed.

Cost proposal

Provide a description and breakdown of expenditures. The budget should include the following:

- A breakdown of hours, expenses, cost categories, and billing rates for the project. It should identify or refer to key personnel or job descriptions in relation to each task to provide a full explanation of the resources committed to the project.
- Provide a breakdown of all fee areas, individuals involved, and individual's fee rates by individual process step and deliverable. [Fees should be all-inclusive.]

- A line item for sub-consultants should be included.
- Describe your preferences for the frequency, timing, and method of payment.

Note that the ICCT will not reimburse any consultants for the costs related to preparing and submitting a proposal.

Conflict of Interest

Disclosure of any real or potential conflict of interest must be provided based on the applicant's clients, proposals to pending clients, direct business or significant personal relationship with any ICCT council member, Board member or staff member.

Proposal Evaluation

The ICCT reserves the right to accept or reject any or all proposals submitted, waive minor irregularities in proposals, request additional information or revisions to offers, and to negotiate with any or all consultants. After initial screening, the strongest applicant will be invited to develop a detailed scope of work prior to finalizing a contract. Any contract award will be to the firm that presents the proposal that, in the opinion of the ICCT, is the most advantageous to the ICCT.

References

Azzara, A., Minjares, R., and Rutherford, D. (2015) Needs and opportunities to reduce blackcarbon emissions from maritime shipping. The ICCT, Working Paper 2015-2 Accessed from http://www.theicct.org/needs-and-opportunities-reduce-black-carbon-emissions-maritime-shipping

Bond T. C., Doherty S. J., Fahey D. W., Forster, P. M., et al. (2013) Bounding the role of black carbon in the climate system: a scientific assessment. J Geophys Res 118(11): 5380–5552. doi:10. 1002/jgrd.50171

Dalsøren, S.B., Eide, M., S., Endresen, O., Mjelde, A., Gravir, I. I., and Isaksen, S. A. (2009) Update on emissions and environmental impacts from the international fleet of ships. The contribution from major ship types and ports. Atmospheric Chemistry and Physics Discussions, 8(5): p. 18323-18384

Dentener, E., Kinne, s., Bond, T. et al., (2006). Emissions of primary aerosol and precursor gases in the years 2000 and 1750 prescribed data-sets for AeroCom. Atmos. Chem. Phys., 6, 4321-4344.

Eyring, V., H. W. Köhler, J. van Aardenne, and A. Lauer (2005). Emissions from International Shipping: 1. The Last 50 Years. *J. Geophys. Res.*, **110**, DOI:10.1029/2004JD005619.

Fuglestvedt, J., Berntsen, T., Myhre, G., Rypdal, K., and Skeie, R.B. (2008) Climate forcing from the transport sectors. PNAS, 105(2): p. 454-458

Workshop report from Marine Black Carbon Emissions: Identifying research gaps, Ottawa Canada, September 9-10, 2014. Summary available at: http://www.theicct.org/events/marine-black-carbon-emissions-identifying-research-gaps