



TABLE OF CONTENTS

PART 1 - GENERAL INFORMATION 3

1.1 STATEMENT OF WORK.....3

1.2 DEBRIEFINGS3

1.3 TRADE AGREEMENTS3

PART 2 - BIDDER INSTRUCTIONS 4

2.1 STANDARD INSTRUCTIONS, CLAUSES AND CONDITIONS4

2.2 SUBMISSION OF BIDS.....4

2.3 FORMER PUBLIC SERVANT.....4

2.4 ENQUIRIES - BID SOLICITATION.....5

2.5 APPLICABLE LAWS.....5

PART 3 - BID PREPARATION INSTRUCTIONS..... 6

3.1 BID PREPARATION INSTRUCTIONS6

PART 4 - EVALUATION PROCEDURES AND BASIS OF SELECTION 7

4.1 EVALUATION PROCEDURES.....7

4.2 BASIS OF SELECTION.....10

PART 5 – CERTIFICATIONS AND ADDITIONAL INFORMATION 11

5.1 CERTIFICATIONS REQUIRED WITH THE BID11

5.2 CERTIFICATIONS PRECEDENT TO CONTRACT AWARD AND ADDITIONAL INFORMATION11

PART 6 - RESULTING CONTRACT CLAUSES 12

6.1 SECURITY REQUIREMENTS12

6.2 STATEMENT OF WORK.....12

6.3 STANDARD CLAUSES AND CONDITIONS12

6.4 TERM OF CONTRACT12

6.5 AUTHORITIES12

6.6 PROACTIVE DISCLOSURE OF CONTRACTS WITH FORMER PUBLIC SERVANTS13

6.7 PAYMENT13

6.8 INVOICING INSTRUCTIONS14

6.9 CERTIFICATIONS AND ADDITIONAL INFORMATION.....14

6.10 APPLICABLE LAWS.....15

6.11 PRIORITY OF DOCUMENTS15

ANNEX "A" 16

STATEMENT OF WORK16

ANNEX "B" 25

BASIS OF PAYMENT25



PART 1 - GENERAL INFORMATION

1.1 Statement of Work

The work to be performed is detailed under Article 6.2 Statement of Work of the resulting contract clauses

1.2 Debriefings

Bidders may request a debriefing on the results of the bid solicitation process. Bidders should make the request to the Contracting Authority within 15 working days from receipt of the results of the bid solicitation process. The debriefing may be in writing, by telephone or in person.

1.3 Trade Agreements

The requirement is subject to the provisions of the North American Free Trade Agreement (NAFTA), the Canadian Free Trade Agreement (CFTA), Canada-Chile Free Trade Agreement, Canada-Colombia Free Trade Agreement, Canada-Ukraine Free Trade Agreement, Canada-Honduras Free Trade Agreement, Canada-Korea Free Trade Agreement, Canada–Panama Free trade agreement, and Canada - Peru Free Trade Agreement.



PART 2 - BIDDER INSTRUCTIONS

2.1 Standard Instructions, Clauses and Conditions

All instructions, clauses and conditions identified in the bid solicitation by number, date and title are set out in the [Standard Acquisition Clauses and Conditions Manual](https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-manual) (<https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-manual>) issued by Public Works and Government Services Canada.

Bidders who submit a bid agree to be bound by the instructions, clauses and conditions of the bid solicitation and accept the clauses and conditions of the resulting contract.

The [2003](#) (2019-03-04) Standard Instructions - Goods or Services - Competitive Requirements, are incorporated by reference into and form part of the bid solicitation.

2.2 Submission of Bids

Bids must be submitted only to Public Works and Government Services Canada (PWGSC) Bid Receiving Unit by the date, time and place indicated in the bid solicitation.

Due to the nature of the bid solicitation, bids transmitted by facsimile will not be accepted.

2.3 Former Public Servant

Contracts awarded to former public servants (FPS) in receipt of a pension or of a lump sum payment must bear the closest public scrutiny, and reflect fairness in the spending of public funds. In order to comply with Treasury Board policies and directives on contracts awarded to FPSs, bidders must provide the information required below before contract award. If the answer to the questions and, as applicable the information required have not been received by the time the evaluation of bids is completed, Canada will inform the Bidder of a time frame within which to provide the information. Failure to comply with Canada's request and meet the requirement within the prescribed time frame will render the bid non-responsive.

Definitions

For the purposes of this clause, "*former public servant*" is any former member of a department as defined in the [Financial Administration Act](#), R.S., 1985, c. F-11, a former member of the Canadian Armed Forces or a former member of the Royal Canadian Mounted Police. A former public servant may be:

- a. an individual;
- b. an individual who has incorporated;
- c. a partnership made of former public servants; or
- d. a sole proprietorship or entity where the affected individual has a controlling or major interest in the entity.

"*lump sum payment period*" means the period measured in weeks of salary, for which payment has been made to facilitate the transition to retirement or to other employment as a result of the implementation of various programs to reduce the size of the Public Service. The lump sum payment period does not include the period of severance pay, which is measured in a like manner.

"*pension*" means a pension or annual allowance paid under the [Public Service Superannuation Act](#) (PSSA), R.S., 1985, c.P-36, and any increases paid pursuant to the [Supplementary Retirement Benefits Act](#), R.S., 1985, c. S-24 as it affects the PSSA. It does not include pensions payable pursuant to the [Canadian Forces Superannuation Act](#), R.S., 1985, c. C-17, the [Defence Services Pension Continuation Act](#), 1970, c. D-3, the [Royal Canadian Mounted Police Pension Continuation Act](#), 1970, c. R-10, and the [Royal Canadian Mounted Police Superannuation Act](#), R.S., 1985, c. R-11,



the [Members of Parliament Retiring Allowances Act](#), R.S. 1985, c. M-5, and that portion of pension payable to the [Canada Pension Plan Act](#), R.S., 1985, c. C-8.

Former Public Servant in Receipt of a Pension

As per the above definitions, is the Bidder a FPS in receipt of a pension? **Yes** () **No** ()

If so, the Bidder must provide the following information, for all FPSs in receipt of a pension, as applicable:

- a. name of former public servant;
- b. date of termination of employment or retirement from the Public Service.

By providing this information, Bidders agree that the successful Bidder's status, with respect to being a former public servant in receipt of a pension, will be reported on departmental websites as part of the published proactive disclosure reports in accordance with [Contracting Policy Notice: 2012-2](#) and the [Guidelines on the Proactive Disclosure of Contracts](#).

Work Force Adjustment Directive

Is the Bidder a FPS who received a lump sum payment pursuant to the terms of the Work Force Adjustment Directive? **Yes** () **No** ()

If so, the Bidder must provide the following information:

- a. name of former public servant;
- b. conditions of the lump sum payment incentive;
- c. date of termination of employment;
- d. amount of lump sum payment;
- e. rate of pay on which lump sum payment is based;
- f. period of lump sum payment including start date, end date and number of weeks;
- g. number and amount (professional fees) of other contracts subject to the restrictions of a work force adjustment program.

For all contracts awarded during the lump sum payment period, the total amount of fees that may be paid to a FPS who received a lump sum payment is \$5,000, including Applicable Taxes.

2.4 Enquiries - Bid Solicitation

All enquiries must be submitted in writing to the Contracting Authority no later than six (6) calendar days' calendar days before the bid closing date. Enquiries received after that time may not be answered.

Bidders should reference as accurately as possible the numbered item of the bid solicitation to which the enquiry relates. Care should be taken by Bidders to explain each question in sufficient detail in order to enable Canada to provide an accurate answer. Technical enquiries that are of a proprietary nature must be clearly marked "proprietary" at each relevant item. Items identified as "proprietary" will be treated as such except where Canada determines that the enquiry is not of a proprietary nature. Canada may edit the question(s) or may request that the Bidder do so, so that the proprietary nature of the question(s) is eliminated, and the enquiry can be answered to all Bidders. Enquiries not submitted in a form that can be distributed to all Bidders may not be answered by Canada.

2.5 Applicable Laws

Any resulting contract must be interpreted and governed, and the relations between the parties determined, by the laws in force in Ontario.

Bidders may, at their discretion, substitute the applicable laws of a Canadian province or territory of their choice without affecting the validity of their bid, by deleting the name of the Canadian province or territory specified and inserting the name of the Canadian province or territory of their choice. If no change is made, it acknowledges that the applicable laws specified are acceptable to the Bidders.



PART 3 - BID PREPARATION INSTRUCTIONS

3.1 Bid Preparation Instructions

- If the Bidder chooses to submit its bid electronically, Canada requests that the Bidder submits its bid in accordance with section 08 of the 2003 standard instructions. Bidders must provide their bid in a single transmission.
- The bid must be gathered per section and separated as follows:

Section I: Technical Bid File

Section II: Financial Bid File

Section III: Certifications File

Section I: Technical Bid

In their technical bid, Bidders should explain and demonstrate how they propose to meet the requirements and how they will carry out the Work.

Section II: Financial Bid

Bidders must submit their financial bid in accordance with the Basis of Payment.

Section III: Certifications

Bidders must submit the certifications and additional information required under Part 5.



PART 4 - EVALUATION PROCEDURES AND BASIS OF SELECTION

4.1 Evaluation Procedures

- (a) Bids will be assessed in accordance with the entire requirement of the bid solicitation including the technical and financial evaluation criteria.
- (b) An evaluation team composed of representatives of Canada will evaluate the bids.

4.1.1 Technical Evaluation

4.1.1.1 Mandatory Technical Criteria

Mandatory requirements are evaluated on a simple pass or fail basis. Failure by bidders to meet any of the mandatory requirements will render the bidder's proposal non-responsive. The treatment of mandatory requirements in any procurement process is absolute.

Proposers must meet all the mandatory requirements described below. This will be evaluated as either "Yes" or "No". Proposals not receiving "Yes" for any mandatory requirement will not be considered further.

	Requirements	Met (Y/N)	Comments/Reference in Proposal
M1	The bidder or project leader must have a Ph.D from a recognized university with specialization in Statistics.		
M2	The bidder or project leader must demonstrate that they have undertaken projects with Canadian mortality data since 2014 . Provide a one-page summary.		
M3	The bidder or project leader must demonstrate that they have undertaken projects with Canadian hospitalization data since 2014 . Provide a one-page summary.		
M4	The bidder or project leader must have peer-reviewed publications on Canadian air pollution data in scientific journals since 2014 . Provide titles, journals and years. Provide a one-page summary		
M5	The bidder or project leader must show that they have experience working on missing data of hourly or daily air pollution since 2014 . Provide a one-page summary.		
M6	The bidder or project leader must show that they have experience with Bayesian modeling and inference since 2014 . Provide a one-page summary		
M7	The bidder or project leader must show that they have experience with multi-pollutant data accounting for their seasonally varying covariance structure since 2014 . Provide a one-page summary		
M8	The bidder or project leader must show that they have experience with Canadian climate data since 2014 . Provide a one-page summary		
M9	The bidder or project leader must show that they have experience working with case-crossover or case-control models since 2014 . Provide a one-page summary		
M10	The bidder or project leader must show that they have experience working with Bayesian statistical software such as R-stan and R-INRA, or WinBUGS and OpenBUGS . Provide a one-page summary		



4.1.1.2 Point Rated Technical Criteria

A proposal with a score less than the specified minimum for technical compliance for any one criteria will be considered non responsive, and eliminated from the competition. To be considered responsive, a bid must obtain the required minimum points for each criterion which are subject to point rating. The rating is performed on a scale of 10 points.

	Point-Rated Criteria	Page Number	Points for the Criteria	Minimum Points Required	Score
R1	<p>Indicate the number of peer-reviewed publications for which the bidder's project leader was listed as an author and which dealt with Canadian health data. Provide the name and date of the publication and the title of article.</p> <p><u>Scoring Grid</u></p> <p>Two points for each, up to a maximum of 10 points.</p>		10	6	
R2	<p>Indicate the number of peer-reviewed publications for which the bidder's project leader was listed as author, which dealt with Time series analysis, Generalized additive model, or Poisson model. Provide the name and date of the publication and the title of article.</p> <p><u>Scoring Grid</u></p> <p>Two points for each, up to a maximum of 10 points.</p>		10	6	
R 3	<p>Indicate the number of peer-reviewed publications for which the bidder's project leader was listed as author, which dealt with Bayesian analysis. Provide the name and date of the publication and the title of article.</p> <p><u>Scoring Grid</u></p> <p>Two points for each, up to a maximum of 10 points.</p>		10	6	
R 4	<p>Indicate the number of peer-reviewed publications for which the bidder's project leader was listed as author, which dealt with temporal changes over 10 years or longer time period. Provide the name and date of the publication and the title of article.</p> <p><u>Scoring Grid</u></p> <p>Two points for each, up to a maximum of 10 points.</p>		10	6	



<p>R 5</p>	<p>Indicate the number of peer-reviewed publications for which the bidder's project leader was listed as author, which dealt with spatial changes across Canada. Provide the name and date of the publication and the title of article.</p> <p><u>Scoring Grid</u> Two points for each, up to a maximum of 10 points.</p>		10	6	
<p>R6</p>	<p>Indicate the number of formal reports (including book chapters but excluding publications) for which the bidder's project leader was listed as an author and which dealt with the Canadian environment data or Canadian health data. Provide the title and date of the report.</p> <p><u>Scoring Grid</u> Two points for each, up to a maximum of 10 points.</p>		10	6	
<p>R7</p>	<p>Indicate the number of projects for which the bidder's project leader has conducted involving temperature and/or other climate data. Provide the name and date of the publication and the title of article.</p> <p><u>Scoring Grid</u> Two points for each, up to a maximum of 10 points.</p>		10	6	
<p>R8</p>	<p>Indicate the number of projects for which the bidder's project leader has conducted involving multi-pollutant data. Provide the title and date of the report.</p> <p><u>Scoring Grid</u> Two points for each, up to a maximum of 10 points.</p>		10	6	
<p>R9</p>	<p>Indicate the number of projects or peer-reviewed publications for which the bidder's project leader has conducted involving interpolation method for missing data.</p> <p><u>Scoring Grid</u> Two points for each, up to a maximum of 10 points.</p>		10	6	
<p>R10</p>	<p>Indicate the number of projects or peer-reviewed publications for which the bidder's project leader was listed as an author and which dealt with Canadian environment data. Provide the name and date of the publication and the title of article.</p>		10	6	



	<p><u>Scoring Grid</u></p> <p>Two point for each, up to a maximum of 10 points.</p>				
Total Points			100	60	

4.1.2 Financial Evaluation

The maximum funding available for the Contract resulting from the bid solicitation is \$170,000.00 (Applicable Taxes extra). Bids valued in excess of this amount will be considered non-responsive. This disclosure does not commit Canada to pay the maximum funding available.

4.2 Basis of Selection

4.2.1 Basis of Selection - Highest Rated Within Budget

- a) To be declared responsive, a bid must:
 - i. comply with all the requirements of the bid solicitation;
 - ii. meet all mandatory technical evaluation criteria; and
 - iii. obtain the required minimum of 60 points overall for the technical evaluation criteria which are subject to point rating. The rating is performed on a scale of 100 points

- b) Bids not meeting (a) or (b) or (c) will be declared non responsive. The responsive bid with the highest number of points will be recommended for award of a contract, provided that the total evaluated price does not exceed the budget available for this requirement.



PART 5 – CERTIFICATIONS AND ADDITIONAL INFORMATION

Bidders must provide the required certifications and additional information to be awarded a contract.

The certifications provided by Bidders to Canada are subject to verification by Canada at all times. Unless specified otherwise, Canada will declare a bid non-responsive, or will declare a contractor in default if any certification made by the Bidder is found to be untrue whether made knowingly or unknowingly, during the bid evaluation period or during the contract period.

The Contracting Authority will have the right to ask for additional information to verify the Bidder's certifications. Failure to comply and to cooperate with any request or requirement imposed by the Contracting Authority will render the bid non-responsive or constitute a default under the Contract.

5.1 Certifications Required with the Bid

Bidders must submit the following duly completed certifications as part of their bid.

5.1.1 Integrity Provisions - Declaration of Convicted Offences

In accordance with the Integrity Provisions of the Standard Instructions, all bidders must provide with their bid, **if applicable**, the declaration form available on the [Forms for the Integrity Regime](http://www.tpsgc-pwgsc.gc.ca/ci-if/declaration-eng.html) website (<http://www.tpsgc-pwgsc.gc.ca/ci-if/declaration-eng.html>), to be given further consideration in the procurement process.

5.2 Certifications Precedent to Contract Award and Additional Information

The certifications and additional information listed below should be submitted with the bid, but may be submitted afterwards. If any of these required certifications or additional information is not completed and submitted as requested, the Contracting Authority will inform the Bidder of a time frame within which to provide the information. Failure to provide the certifications or the additional information listed below within the time frame provided will render the bid non-responsive.

5.2.1 Integrity Provisions – Required Documentation

In accordance with the section titled Information to be provided when bidding, contracting or entering into a real property agreement of the [Ineligibility and Suspension Policy](http://www.tpsgc-pwgsc.gc.ca/ci-if/politique-policy-eng.html) (<http://www.tpsgc-pwgsc.gc.ca/ci-if/politique-policy-eng.html>), the Bidder must provide the required documentation, as applicable, to be given further consideration in the procurement process.

5.2.2 Federal Contractors Program for Employment Equity - Bid Certification

By submitting a bid, the Bidder certifies that the Bidder, and any of the Bidder's members if the Bidder is a Joint Venture, is not named on the Federal Contractors Program (FCP) for employment equity "FCP Limited Eligibility to Bid" list available at the bottom of the page of the [Employment and Social Development Canada \(ESDC\) - Labour's](https://www.canada.ca/en/employment-social-development/programs/employment-equity/federal-contractor-program.html#) website (<https://www.canada.ca/en/employment-social-development/programs/employment-equity/federal-contractor-program.html#>).

Canada will have the right to declare a bid non-responsive if the Bidder, or any member of the Bidder if the Bidder is a Joint Venture, appears on the "FCP Limited Eligibility to Bid" list at the time of contract award.



PART 6 - RESULTING CONTRACT CLAUSES

The following clauses and conditions apply to and form part of any contract resulting from the bid solicitation.

6.1 Security Requirements

6.1.1 There is no security requirement applicable to the Contract.

6.2 Statement of Work

The Contractor must perform the Work in accordance with the Statement of Work at Annex "A".

6.3 Standard Clauses and Conditions

All clauses and conditions identified in the Contract by number, date and title are set out in the [Standard Acquisition Clauses and Conditions Manual](https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-manual) (<https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-manual>) issued by Public Works and Government Services Canada.

6.3.1 General Conditions

[2010C](#) (2018-06-21), General Conditions - Services (Medium Complexity) apply to and form part of the Contract.

6.3.2 Supplemental General Conditions

[4006](#) (2010-08-16), Contractor to Own Intellectual Property Rights in Foreground Information, apply to and form part of the Contract.

6.4 Term of Contract

6.4.1 Period of the Contract

The Work is to be performed during the period of contract award to March 31, 2020.

6.4.2 Option to Extend the Contract

The Contractor grants to Canada the irrevocable option to extend the term of the Contract by up to two (2) additional one (1) year periods, under the same conditions. The Contractor agrees that, during the extended period of the Contract, it will be paid in accordance with the applicable provisions as set out in the Basis of Payment.

Canada may exercise this option at any time by sending a written notice to the Contractor before the expiry date of the Contract. The option may only be exercised by the Contracting Authority, and will be evidenced for administrative purposes only, through a contract amendment.

Delivery of the requirement will be made to delivery point(s) specified at Annex "X" of the Contract.

6.5 Authorities

6.5.1 Contracting Authority

The Contracting Authority for the Contract is:

Name: Sami Nouh
Title: Senior Procurement and Contracting Officer
Health Canada - Public Health Agency of Canada
Chief Financial Officer Branch
Telephone: 613-941-2074



E-mail address: sami.nouh@canada.ca

The Contracting Authority is responsible for the management of the Contract and any changes to the Contract must be authorized in writing by the Contracting Authority. The Contractor must not perform work in excess of or outside the scope of the Contract based on verbal or written requests or instructions from anybody other than the Contracting Authority.

Contact for enquiries during solicitation period; specifically between December 20, 2019 to January 3, 2020. (remove after contract award)

Name: Caroline Lecours-Savoury

Telephone: 613-941-2092

E-mail address: caroline.lecours-savoury@canada.ca

6.5.2 Project Authority

The Project Authority for the Contract is: *(insert at contract award)*

Name: _____

Title: _____

Organization: _____

Address: _____

Telephone: _____

Facsimile: _____

E-mail address: _____

The Project Authority is the representative of the department or agency for whom the Work is being carried out under the Contract and is responsible for all matters concerning the technical content of the Work under the Contract. Technical matters may be discussed with the Project Authority, however the Project Authority has no authority to authorize changes to the scope of the Work. Changes to the scope of the Work can only be made through a contract amendment issued by the Contracting Authority.

6.5.3 Contractor's Representative

(insert at contract award)

Name: _____

Title: _____

Organization: _____

Address: _____

Telephone: _____

Facsimile: _____

E-mail address: _____

6.6 Proactive Disclosure of Contracts with Former Public Servants

By providing information on its status, with respect to being a former public servant in receipt of a Public Service Superannuation Act (PSSA) pension, the Contractor has agreed that this information will be reported on departmental websites as part of the published proactive disclosure reports, in accordance with Contracting Policy Notice: 2012-2 of the Treasury Board Secretariat of Canada.

6.7 Payment

6.7.1 Basis of Payment - Firm Price - Services

Professional Fees



In consideration of the Contractor satisfactorily completing all of its obligations under the Contract, the Contractor will be paid a firm price of \$ _____ (insert amount at contract award). Customs duties are included and Applicable Taxes are extra.

6.7.2 Limitation of Price

SACC Manual clause C6000C (2017-08-17) Limitation of Price

6.7.3 Milestone Payments - Not subject to holdback

Canada will make milestone payments in accordance with the Schedule of Milestones detailed in the Contract and the payment provisions of the Contract if:

- a. all work associated with the milestone and as applicable any deliverable required has been completed and accepted by Canada.

The schedule of milestones for which payments will be made in accordance with the Contract is as follows:

Milestone Payment	Key Deliverables	Completion Date	Payment (%)
1	Progress Report #1 Statement of work 3.1 (a)	January 15, 2020	50%
2	Final Report #2 Statement of work 3.1 (b) and (c)	March 10, 2020	50%

6.7.4 Electronic Payment of Invoices – Contract

The Contractor accepts to be paid using any of the following Electronic Payment Instrument(s):

- a. Direct Deposit (Domestic and International);

6.8 Invoicing Instructions

The Contractor must submit invoices in accordance with the following. Invoices cannot be submitted until all work identified in the invoice is completed.

Invoices must be distributed as follows:

- a. One (1) copy must be forwarded to the following email address for certification and payment.
hc.p2p.east.invoices-factures.est.sc@canada.ca

6.9 Certifications and Additional Information

6.9.1 Compliance

Unless specified otherwise, the continuous compliance with the certifications provided by the Contractor in its bid or precedent to contract award, and the ongoing cooperation in providing additional information



are conditions of the Contract and failure to comply will constitute the Contractor in default. Certifications are subject to verification by Canada during the entire period of the Contract.

6.10 Applicable Laws

The Contract must be interpreted and governed, and the relations between the parties determined, by the laws in force in Ontario.

6.11 Priority of Documents

If there is a discrepancy between the wording of any documents that appear on the list, the wording of the document that first appears on the list has priority over the wording of any document that subsequently appears on the list.

- (a) the Articles of Agreement;
- (b) the supplemental general conditions 4006 (2010-08-16), Contractor to Own Intellectual Property Rights in Foreground Information;
- (c) the general conditions 2010C (2018-06-21), General Conditions - Services (Medium Complexity);
- (d) Annex A, Statement of Work;
- (e) the Contractor's bid dated _____



ANNEX "A"

STATEMENT OF WORK

1. TITLE
AQHI updates by expanding temporal and spatial coverage

2. SCOPE

2.1. Introduction

The Air Quality Health Index (AQHI) is a communication tool, which sums the individual risks associated with ozone (O₃), nitrogen dioxide (NO₂) and fine particulate matter (PM_{2.5}), to provide guidance to the public on protecting their health from the adverse health effect of outdoor air pollution. The current AQHI is reported in individual communities based on local air pollution concentrations applied to model parameters derived from national analyses. Here the parameters are the relative risk of the three air pollutants, ground-level ozone, NO₂, and PM_{2.5}, nationwide and thus to be estimated by all cities included. The assumption of this approach is: the impact of air pollutant on public health is the same across Canada regardless of the differences between geographical locations. The model parameter indicates this impact **per unit** of each pollutant, and thus should be the same for all Canadian cities. However, each city has different concentrations and environmental background (e.g., temperature), and thus using local concentrations with the national parameter estimates would show the local impact in total (not per unit). This approach depends on the number of cities included and the number of years examined as indicated by the three objectives.

Updates to the AQHI are required in three areas. First, the current AQHI does not fully represent the effect of the combined exposures on health due to interactions among the three air pollutants. Second, the current AQHI is based on major urban centres only, due to air pollution data availability. The AQHI is designed for national usage and thus expanding to rural areas and smaller urban areas is desirable. Third, the current AQHI is based on data for 1991-2000. The Canadian demographic profile, air quality profile, and medical care have changed since 2000, which may change the exposure-health outcome relationship over time and thus expansion to recent years is also necessary.

Previous projects developed new models for the combined risk from the three pollutants, which are expected to resolve the first need. Recently Environment and Climate Change Canada (ECCC) has provided hourly or daily modelled data from Objective Analysis across Canada, including rural areas, which will be enhanced further and available in 2020 and a new national forest fire smoke model will be developed under another project entitled "Development of a national forest fire smoke PM_{2.5} exposure model" (Stieb), and thus resolve the second need. Currently (as of Jan 2018) health data are available up to 2012 for mortality and 2015 for hospitalization except for province Quebec. By adding 12-15 recent years, the AQHI can be updated, resolving the third need.

2.2. Objectives of the Requirement

The project objective is to address three concerns related to the AQHI updates:

- (1) improving statistical model to account for correlations among the three specified air pollutants;**
- (2) extending spatial coverage to include rural areas; and**
- (3) extending temporal coverage to include more recent years.**



2.3. Background and Specific Scope of the Requirement

Considerable research over the last 30 years has established a clear and significant link between exposure to ambient air pollution such as ozone, NO₂ and PM_{2.5}, and adverse health effects. Linkages between long-term (chronic) exposure and asthma, hospitalizations and premature deaths, and between short-term (acute) exposure and hospital admissions, coronary ischemic events and strokes have been reported.

In this study, we focus on Canadian mortality and morbidity (hospitalizations) risks attributable to short-term exposure to three ambient air pollutants (O₃, PM_{2.5} and NO₂). Short-term exposure risk estimates typically use a time-series analysis, whereas daily health endpoint counts are regressed against short-term exposure metrics (e.g., daily mean), temperature and a smooth function of time (to control for long-term associations such as seasonal variation and demographic changes). The AQHI has developed models for estimation of risk due to acute exposure to air pollutants, primarily ozone, NO₂ and PM_{2.5} in Canadian urban centers. Research in the field of simultaneous multiple-pollutant estimation has attempted to simply include multiple pollutants in a Poisson regression framework. Primarily, these models have consisted of pollutant-specific risks estimated individually and aggregation through classical or Bayesian hierarchical approach.

a) Three individual health risk estimates vs one combined health risk estimate: It is desirable to estimate a combined health risk due to the 3 air pollutants rather than 3 individual health risks for two main reasons. First, we are exposed to a mixture of air pollutants and thus the health outcomes are responses to them all, not to individual air pollutants. Second, the 3 air pollutants are correlated by sharing sources or environmental nature such as temperature, humidity, etc. The traditional statistical model is a multiple regression model, which produces effect estimates for individual pollutants. Previous projects developed three pollutant models, which can more accurately characterize the joint risk from NO₂, O₃ and PM_{2.5} by producing effect estimates for combinations of pollutants typical encountered during high pollution events. This model is believed to provide a combined health risk from the 3 pollutants and expected to be available from 2019.

b) Urban vs. rural populations and air pollution health effects: Until recently, studies of effects of short-term air pollution exposure were essentially confined to large urban areas mainly due to limited data from ground monitoring stations. Recently however, daily and even hourly modelled data have become available, which made it possible to examine short-term effects in rural areas without monitors. While the rural population of Canada accounts for a small proportion of the total population (approximately 20% and declining), the absolute population of approximately 6 million is nonetheless sizeable and steady over time. Residents of rural areas may be more susceptible to adverse effects of air pollution in relation to older age, poorer health, strenuous outdoor work, and lower socioeconomic status. Some rural areas may be characterized by both more highly susceptible populations and higher ambient pollutant concentrations. Sources include long range atmospheric transport as well as local sources including forest fires, winter wood burning and spring road dust. While there is limited evidence supporting the utility of the AQHI outside of large urban centres, recent public comments have suggested a perceived lack of responsiveness of the AQHI under certain conditions such as forest fire smoke and winter wood smoke. An analysis examining mortality, physician visits and salbutamol dispensations in British Columbia suggested that while the AQHI was significantly associated with all outcomes, both within and outside Metro Vancouver and during all years as well as periods of intense forest fire activity, a version supplemented by a PM_{2.5} index exhibited a better fit to respiratory outcome. A similar analysis is planned of effects of winter wood smoke. Taken together, these findings suggest that a reassessment of the AQHI coefficients is required, taking into account



rural areas generally, as well effects of forest fire smoke and winter wood smoke more specifically.

c) Health effects of air pollution from forest fires: Forest fire smoke is an important source of human exposure to fine particulate matter and other pollutants, which is expected to increase in importance with climate change. Recent reviews have evaluated the current weight of evidence linking forest fire smoke with a variety of health outcomes and concluded that forest fire smoke is most consistently associated with respiratory morbidity, with growing evidence of an association with all-cause mortality. While several studies have been conducted in Canada, they have primarily examined effects in British Columbia, and to our knowledge no national studies have been conducted even though fires affect several provinces. It has been estimated that worldwide 260,000 to 600,000 deaths annually are attributable to landscape fire smoke and that in the U.S. alone the economic value of health impacts of wildland fires is approximately \$90-\$150 billion annually.

d) Health effects of winter wood smoke: Winter wood burning for heating represents a substantial source of ambient particulate matter, particularly in rural areas, accounting for up to 70 percent in some provinces with a higher proportion of rural residents. Recent reviews have highlighted the variety of adverse health effects associated with woodsmoke, but also that there is insufficient evidence to distinguish the adverse health effects of winter woodsmoke exposure from those of exposure to PM from other sources. Only a small number of studies have been conducted In Canada, to our knowledge only in British Columbia.

e) Identification of areas affected by forest fire smoke and winter wood smoke: Areas affected by forest fire smoke and extreme fire days will be identified as described by Elliott, Henderson and Wan, using fire radiative potential (FRP) data obtained from the Fire Information Resource Management System (FIRMS) ("Fire Information for Resource Management System (FIRMS) | Earthdata," n.d.). FRP is known to be reflective of aerosol emissions and consequently smoke. To classify the impact of forest fire smoke on each census division (CD, group of neighbouring municipalities joined together for the purposes of regional planning and managing common services such as police or ambulance services) and census subdivision (CSD), the sum of daily FRP values for all fires within a 100 km buffer of the CD/CSD representative point (approximate geographical centre will be calculated for each day of the study period. CDs/CSDs in which this daily sum exceeds the 95th percentile of daily values among all CDs/CSDs in at least one third of summers will be classified as fire-affected. A sensitivity analysis will be conducted defining extreme fire days as those where the sum of FRP values exceeded the 80th, 90th and 95th percentile among all CDs/CSDs. A validated algorithm based on night-time to daytime PM_{2.5} concentrations, hourly variability of PM_{2.5} and daily temperature will be used to classify days as smoky, and the percent of smoky days will be calculated for each CD/CSD for each winter. Winter wood smoke affected communities will be defined as those where the winter season percent of smoky days exceeds the 95th percentile of winter season percent of smoky days among all CDs/CSDs over the entire study period, in at least one third of winters.

This contract should update the AQHI through a) to e) above.

3. REQUIREMENTS

3.1. Tasks, Activities, Deliverables and/or Milestones

The flow chart below outlines the process of this study over 3 years. It shows the structure of databases from different data sources and modelling process rather than chronological order. Modelling will be done as new or updated databases become available and thus will be repeated through Years 1-3. This project builds on previous projects, which are expected to more accurately characterize the joint risk from NO₂,



O3 and PM2.5 than the current AQHI, which assumes simple additivity of risk using three single pollutant models. If the correlations or coherences among the three pollutants are not considerable, the current and new models for the AQHI would return comparable estimates.

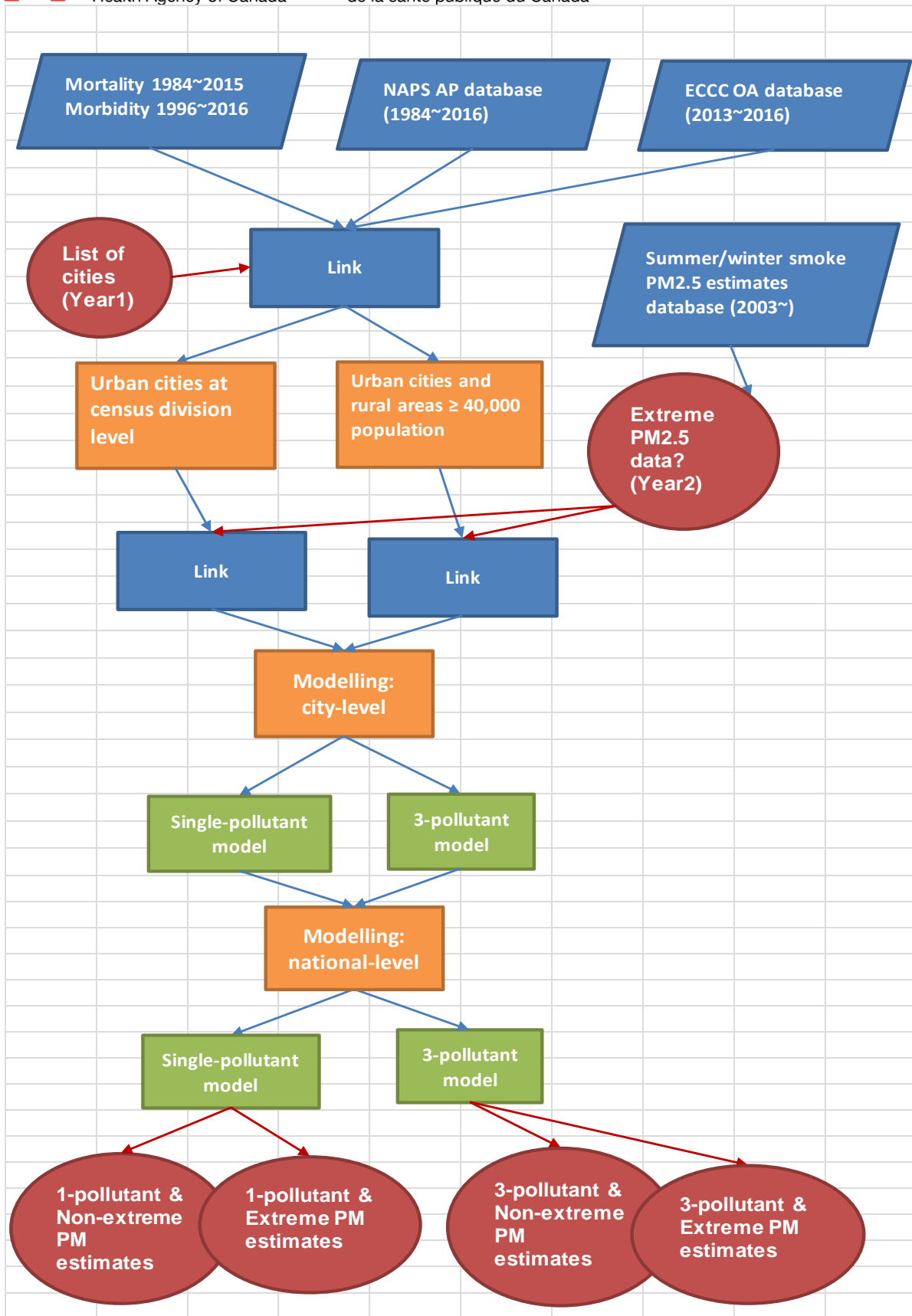
Figure 1 shows 147 census divisions (CDs) each with more than 40,000 population size based on 2011 census year. These CDs will be used to update the AQHI at national level. Figure 2 is a map of winter smoky day distribution for the 147 CDs, which indicates unusually high PM2.5 concentrations. This study will also examine effects of the extreme PM2.5 concentrations during summer (due to forest fire) and winter (due to wood burning) based on annual plans as follows.

It should be noted that 1) PM2.5 data availability is less than that for other pollutants as it was available every six days until 2000 for most cities and 2) morbidity data availability is less than that for mortality data. In general data availability is different as follows and Table 1 summarizes model-specific time periods.

- Ozone & NO2: 1984-2017 (hourly data, NAPS)
- PM2.5: 2001-2017 (hourly data, NAPS)
- OA data: 2013-2016 (national surface daily data on ozone, no2 & PM2.5; to be extended by approximately April 2020)
- Wildfire smoke PM2.5: 2003-2016 (national surface hourly PM2.5 data available by approximately April 2020)
- Mortality: 1984-2015 (daily data)
- Morbidity: 1996-2016 (daily data).

Table1: Model-specific time period

Model	Mortality	Morbidity	Comments
1-pollutant model	Y.mort*-2015	Y.morb**-2016	Y.mort*=1984 for ozone & no2, =2001 for PM2.5 Y.morb**=1996 for ozone & no2, =2001 for PM2.5
3-pollutant	2001-2015	2001-2016	



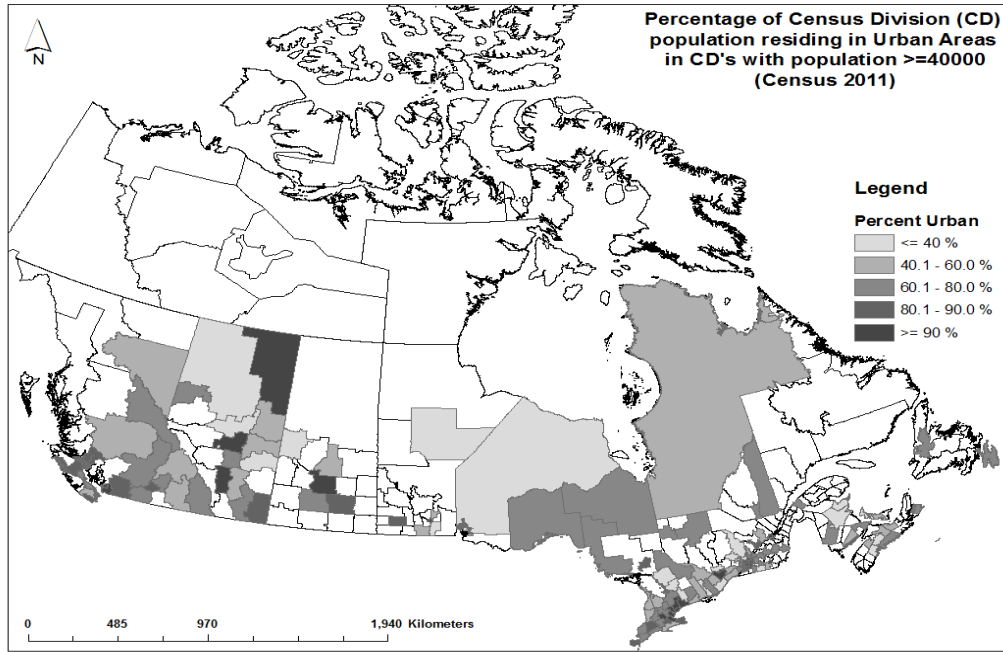


Figure 1: 147 census divisions with $\geq 40,000$ population across Canada

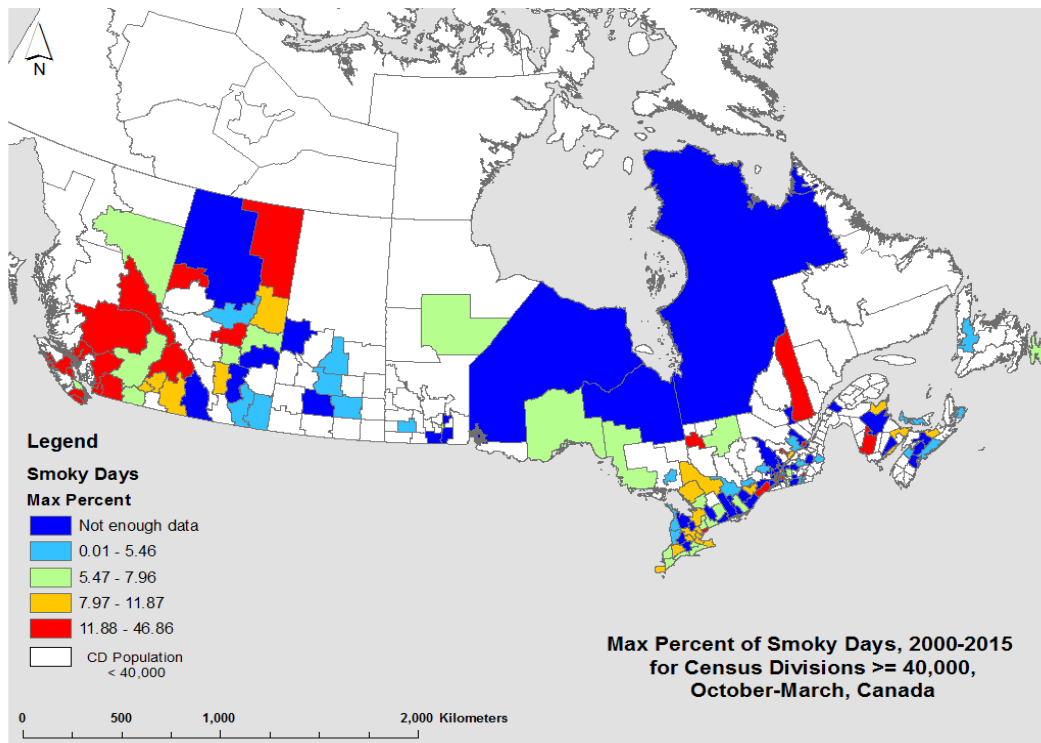


Figure 2: Winter smoky days over the 147 CDs $\geq 40,000$ populations [54].



Initial Contract Period (Contract award to March 31, 2020) will focus on previous versus new models for extended communities through three steps.

- a) Mortality, morbidity and air pollution data should be linked using **NAPS data only** for urban cities (24 CDs). This will be called "**Urban database**" for mortality up to 2015 (or latest year) and morbidity up to 2016 (or latest year) except for province Quebec.
- b) Mortality, morbidity and air pollution data should be linked to include rural areas (147 CDs). This will be called "**UR database**". Note that current OA data of ECCC are available from 2002 to 2012 for summer only and from 2013-16 for the entire year.
- c) Apply single pollutant (current AQHI) and newly developed 3-pollutant model to Urban & UR databases for city-specific associations between the three air pollutants and non-accidental all-cause mortality and morbidity, respectively. This will focus on comparison of previous vs new model, and another comparison of urban vs rural cities. Note that the comparison is only for mortality, as the morbidity is a new addition to the AQHI. Since the previous study found mortality and morbidity little correlated, all models will be applied to mortality and morbidity separately in the current and new AQHI models.

Option Periods

Option Period #1 (April 1, 2020 to March 31, 2021) will focus on extreme events related to summer wildfire and winter wood smoke through three steps. Note that outputs from another project, **Development of a national forest fire smoke PM2.5 exposure model**, which is expected to be available in April 2020, will be used to investigate the impact of high air pollution concentrations due to extreme event.

- d) Mortality data and extreme air pollution data should be linked for urban cities (24 CDs). This will be called "**Urban.E database**".
- e) Mortality, morbidity and air pollution data should be linked using **OA data** to include rural areas (147 CDs). This will be applied to the UR database.
- f) Mortality data and extreme air pollution data should be linked to include rural areas (147 CDs). This will be applied to the UR.E database.
Note that about 65 CDs among the 147 CDs have NAPS data for the three air pollutants all for 2001-2016.
- g) Apply single pollutant and newly developed 3-pollutant model to both Urban.E & UR.E databases for city-specific associations between the three air pollutants and all-cause mortality. The results should be reviewed thoroughly and reported, focusing on comparison of previous vs new model outputs and another comparison of urban vs rural cities.

Option Period #2 (April 1, 2021 to March 31, 2022) will focus on the AQHI updates based on estimates for the three air pollutant related mortality risk at national level through four steps.

- h) Apply Bayesian hierarchical model to (3) and compare results from the OA vs original data from ground-monitoring stations.
- i) Apply Bayesian hierarchical model to (6) and compare results from the OA vs original data from ground-monitoring stations.
- j) Write a report in detail on (3), (6)-(8), analyzing characteristics in urban and rural areas, by season and in typical vs. extreme conditions. The final report will also include specific recommendations on how to apply the findings to improve the current AQHI
- k) Prepare a draft paper on AQHI updated results.



3.2. Specifications and Standards

All data collection, screening and interpolation conducted under this contact, along with any recommendations for further research and use of the data, will be summarized in a written report of 20-30 pages for progress reports and extended to 50-70 pages for the final report each year. Appendix can include relevant and supporting materials such as tables, figures and maps. In addition to the final report, delivery of a robust database of screened and interpolated air pollution data is required. The report will describe the sources of all data used in the development, the statistical methods applied, and the results obtained, including a summary of available data for further use. The final report will include an executive summary of 2-3 pages, and all data developed will be delivered on one encrypted portable storage device (eg: USB), which will be specified by the Project Authority (Departmental Representative) following Health Canada regulation.

3.3. Technical, Operational and Organizational Environment

This work can be done in collaboration with ECCC. The proposed work extends some technical aspects originally developed by a contractor in a previous research project. The operation of the study will be facilitated by regular teleconferences and in-person meetings.

3.4. Method and Source of Acceptance

All analyses will be summarized in a written report which will describe the sources of all data used in these analyses, the statistical methods applied, and the results obtained. The Departmental Technical Representative will assess the work in terms of quality, provide feedback to the Contractor, request any necessary modifications, and be responsible for determining final acceptance of the report.

3.5. Reporting Requirements

Refer to Section 3.1 on Tasks, Activities, Deliverables and/or Milestones.

The Departmental Representative will arrange meetings with the contractor on a regular basis (biweekly, via email, phone, or in person) to discuss current progress and updates.

Health Canada needs to provide comments/suggestions on progress reports and final report submitted by the contractor within 10 working days.

3.6. Security

Unscreened contractors must be escorted:

a) Unscreened contractors must be escorted by an employee or Commissionaire at all times when visiting GoC facilities.

b) Information which is to be used in the development of the contracted product, as reference material or otherwise made available to the contractor must be unclassified material and considered to be releasable to the public by HC/PHAC and/or The Government of Canada.

c) No Protected or Classified information is to be made available to the contractor, used in the production of the contracted product, or produced as a result of this contract.

4. ADDITIONAL INFORMATION

4.1. Canada's Obligations

- provide air pollution data (ozone, PM2.5 and no2) upon request,
- provide climate data upon request,
- provide statistical models previously developed for 3 pollutants,
- provide comments on draft and final reports within ten (10) working days, and
- provide other assistance or supports upon request.



4.2. Contractor's Obligations

- Unless otherwise specified, the Contractor must use its own equipment and software for the performance of this Work.
- Meet all tasks, deliverables and milestones as identified in Section 3.1.
- Ensure availability of staff with whom the Provider of Service may need to consult.
- Submit all written reports to Health Canada in electronic Microsoft Office Word and/or portable document format (PDF).
- Participate in teleconferences, if required.
- Attend meetings at government sites, if required.

4.3. Location of Work, Work site and Delivery Point

All the work will be completed at the contractor's workplace. All personnel assigned to this contract are ready to work in close and frequent contact with the Departmental Technical Representative.

4.4. Language of Work

The work can be conducted in either official languages. The reports will be written in English.

4.5. Travel and Living

There is no Travel and Living expenses associated with this project.



ANNEX "B"

BASIS OF PAYMENT

A- Contract Period (From contract award to March 31, 2020)

During the period of the Contract, for Work performed in accordance with the Contract, the Contractor will be paid as specified below.

B- 1 Initial Contract Period

Milestone Payment	Key Deliverables	Completion Date	Payment (%)	Payment (\$)
1	Progress Report #1 Statement of work 3.1 (a)	January 15, 2020	50%	\$
2	Final Report #2 Statement of work 3.1 (a, b and c)	March 10, 2020	50%	\$
Initial Contract Period Total =				\$

Note: Firm Price maximum budget can not go over \$50,000.00 (taxes extra) for the initial period

B- 2 Option to Extend the Term of the Contract

This section is only applicable if the option to extend the Contract is exercised by Canada. During the extended period of the Contract specified below, the Contractor will be paid as specified below to perform all the Work in relation to the Contract extension.

Extended Contract Period (From April 1, 2020 to March 31, 2021)

Milestone Payment	Key Deliverables	Completion Date	Payment (%)	Payment (\$)
4	Progress Report #3 Statement of work 3.1 (d)	July 20, 2020	30%	\$
5	Final Report #4 Statement of work 3.1 (e and f)	November 30, 2020	30%	\$
6	Final Report #5 Statement of work 3.1 (d, e, f and g)	March 10, 2021	40%	\$
Option Period #1 Total =				\$

Note: Firm Price maximum budget cannot go over \$60,000.00 (taxes extra) for Option Period #1



B- 3 Option to Extend the Term of the Contract

This section is only applicable if the option to extend the Contract is exercised by Canada. During the extended period of the Contract specified below, the Contractor will be paid as specified below to perform all the Work in relation to the Contract extension.

Extended Contract Period (From April 1, 2021 to March 31, 2022)

Milestone Payment	Key Deliverables	Completion Date	Payment (%)	Payment (\$)
7	Progress Report #6 Statement of work 3.1 (h)	July 20, 2021	30%	\$
8	Final Report #7 Statement of work 3.1 (i and j)	November 30, 2021	30%	\$
9	Final Report #8 Statement of work 3.1 (a,b,c,d,e,f,g,h,i,j,and k)	March 10, 2022	40%	\$
Option Period #2 Total =				\$

Note: Firm Price maximum budget cannot go over \$60,000.00 (taxes extra) for Option Period #2

Financial Score

Contract Period	Firm Price (\$)
B-1 Initial Contract Period	\$
B-2 Option Period #1	\$
B-3 Option Period #2	\$
Overall Firm Price =	\$

Note: Overall Firm Price cannot be over \$170,000.00 (Applicable Taxes extra)

The maximum funding available for the Contract resulting from the bid solicitation is **\$170,000.00** (Applicable Taxes extra). Bids valued in excess of this amount will be considered non-responsive. This disclosure does not commit Canada to pay the maximum funding available.