

GENERAL SERVICE AGREEMENT



For Administrative Purposes Only

Ministry Contract No.: __2013-126__ Requisition No.: _____ Solicitation No.(if applicable): __RFP HL 173_ Commodity Code: _____ Contractor Information Supplier Name: _Intrinsik Environmental Sciences Inc. Supplier No.: _____ Telephone No.: (403) 237-0275_____ E-mail Address: _bkoppe@intrinsik.com__ Website: _www.intrinsik.com_____	Financial Information Client: 026_____ Responsibility Centre: 66L21_____ Service Line: 47231_ STOB: 6001_____ Project: 6600000_____ Template version: February 8th, 2012
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SCHEDULE A – SERVICES

- Part 1 - Term**
- Part 2 - Services**
- Part 3 - Related Documentation**
- Part 4 - Key Personnel**

Schedule A – Appendix 1

SCHEDULE B – FEES AND EXPENSES

- Part 1 - Maximum Amount Payable**
- Part 2 - Fees**
- Part 3 - Expenses**
- Part 4 - Statements of Account**
- Part 5 - Payments Due**

SCHEDULE C – APPROVED SUBCONTRACTOR(S)

SCHEDULE D – INSURANCE

SCHEDULE E – PRIVACY PROTECTION SCHEDULE

SCHEDULE F – ADDITIONAL TERMS

SCHEDULE G – SECURITY SCHEDULE

THIS AGREEMENT is dated for reference the __31st__day of __October__, 2012.

Intrinsik Environmental Sciences Inc. (the "Contractor") with the following specified address and fax number:

736 8th Avenue SW, Suite 1060
Calgary, AB
T2P 1H4
Fax Number (403) 237-0291

AND:

HER MAJESTY THE QUEEN IN RIGHT OF THE PROVINCE OF BRITISH COLUMBIA, as represented by the **Minister of Health** (the "Province") with the following specified address and fax number:

4-2 1515 Blanshard Street
Victoria, BC
V8W 3C8
Fax Number (250) 952 1713

The Province wishes to retain the Contractor to provide the services specified in Schedule A and, in consideration for the remuneration set out in Schedule B, the Contractor has agreed to provide those services, on the terms and conditions set out in this Agreement.

As a result, the Province and the Contractor agree as follows:

1 DEFINITIONS

General

1.1 In this Agreement, unless the context otherwise requires:

- (a) "Business Day" means a day, other than a Saturday or Sunday, on which Provincial government offices are open for normal business in British Columbia;
- (b) "Incorporated Material" means any material in existence prior to the start of the Term or developed independently of this Agreement, and that is incorporated or embedded in the Produced Material by the Contractor or a Subcontractor;
- (c) "Material" means the Produced Material and the Received Material;
- (d) "Produced Material" means records, software and other material, whether complete or not, that, as a result of this Agreement, are produced by the Contractor or a Subcontractor and includes the Incorporated Material;
- (e) "Received Material" means records, software and other material, whether complete or not, that, as a result of this Agreement, are received by the Contractor or a Subcontractor from the Province or any other person;
- (f) "Services" means the services described in Part 2 of Schedule A;
- (g) "Subcontractor" means a person described in paragraph (a) or (b) of section 13.4; and
- (h) "Term" means the term of the Agreement described in Part 1 of Schedule A subject to that term ending earlier in accordance with this Agreement.
- (i) "Steering Committee" means a group of stakeholders or managers representing stakeholders, chaired by the Sponsor. It is responsible for setting policy; making decisions on business and inter-departmental issues; authorizing and reviewing the budget; reviewing project progress; and serving as final arbiter of any decision affecting the project.
- (j) "Stakeholders" means the people who are the primary recipients of the project's end results.

Meaning of "record"

- 1.2 The definition of “record” in the *Interpretation Act* is incorporated into this Agreement and “records” will bear a corresponding meaning.

2 SERVICES

Provision of services

- 2.1 The Contractor must provide the Services in accordance with this Agreement.

Term

- 2.2 Regardless of the date of execution or delivery of this Agreement, the Contractor must provide the Services during the Term.

Supply of various items

- 2.3 Unless the parties otherwise agree in writing, the Contractor must supply and pay for all labour, materials, equipment, tools, facilities, approvals and licenses necessary or advisable to perform the Contractor’s obligations under this Agreement, including the license under section 6.4.

Standard of care

- 2.4 Unless otherwise specified in this Agreement, the Contractor must perform the Services to a standard of care, skill and diligence maintained by persons providing, on a commercial basis, services similar to the Services.

Standards in relation to persons performing Services

- 2.5 The Contractor must ensure that all persons employed or retained to perform the Services are qualified and competent to perform them and are properly trained, instructed and supervised.

Instructions by Province

- 2.6 The Province may from time to time give the Contractor reasonable instructions (in writing or otherwise) as to the performance of the Services. The Contractor must comply with those instructions but, unless otherwise specified in this Agreement, the Contractor may determine the manner in which the instructions are carried out.

Confirmation of non-written instructions

- 2.7 If the Province provides an instruction under section 2.6 other than in writing, the Contractor may request that the instruction be confirmed by the Province in writing, which request the Province must comply with as soon as it is reasonably practicable to do so.

Effectiveness of non-written instructions

- 2.8 Requesting written confirmation of an instruction under section 2.7 does not relieve the Contractor from complying with the instruction at the time the instruction was given.

Applicable laws

- 2.9 In the performance of the Contractor’s obligations under this Agreement, the Contractor must comply with all applicable laws.

3 PAYMENT

Fees and expenses

- 3.1 If the Contractor complies with this Agreement, then the Province must pay to the Contractor at the times and on the conditions set out in Schedule B:
- (a) the fees described in that Schedule;
 - (b) the expenses, if any, described in that Schedule if they are supported, where applicable, by proper receipts and, in the Province's opinion, are necessarily incurred by the Contractor in providing the Services; and
 - (c) any applicable taxes payable by the Province under law or agreement with the relevant taxation authorities on the fees and expenses described in paragraphs (a) and (b).

The Province is not obliged to pay to the Contractor more than the "Maximum Amount" specified in Schedule B on account of fees and expenses.

Statements of accounts

- 3.2 In order to obtain payment of any fees and expenses under this Agreement, the Contractor must submit to the Province a written statement of account in a form satisfactory to the Province upon completion of the Services or at other times described in Schedule B.

Withholding of amounts

- 3.3 Without limiting section 9.1, the Province may withhold from any payment due to the Contractor an amount sufficient to indemnify, in whole or in part, the Province and its employees and agents against any liens or other third-party claims that have arisen or could arise in connection with the provision of the Services. An amount withheld under this section must be promptly paid by the Province to the Contractor upon the basis for withholding the amount having been fully resolved to the satisfaction of the Province.

Appropriation

- 3.4 The Province's obligation to pay money to the Contractor is subject to the *Financial Administration Act*, which makes that obligation subject to an appropriation being available in the fiscal year of the Province during which payment becomes due.

Currency

- 3.5 Unless otherwise specified in this Agreement, all references to money are to Canadian dollars.

Non-resident income tax

- 3.6 If the Contractor is not a resident in Canada, the Contractor acknowledges that the Province may be required by law to withhold income tax from the fees described in Schedule B and then to remit that tax to the Receiver General of Canada on the Contractor's behalf.

Prohibition against committing money

- 3.7 Without limiting section 13.10(a), the Contractor must not in relation to performing the Contractor's obligations under this Agreement commit or purport to commit the Province to pay any money except as may be expressly provided for in this Agreement.

Refunds of taxes

3.8 The Contractor must:

- (a) apply for, and use reasonable efforts to obtain, any available refund, credit, rebate or remission of federal, provincial or other tax or duty imposed on the Contractor as a result of this Agreement that the Province has paid or reimbursed to the Contractor or agreed to pay or reimburse to the Contractor under this Agreement; and
- (b) immediately on receiving, or being credited with, any amount applied for under paragraph (a), remit that amount to the Province.

4 REPRESENTATIONS AND WARRANTIES

4.1 As at the date this Agreement is executed and delivered by, or on behalf of, the parties, the Contractor represents and warrants to the Province as follows:

- (a) except to the extent the Contractor has previously disclosed otherwise in writing to the Province,
 - (i) all information, statements, documents and reports furnished or submitted by the Contractor to the Province in connection with this Agreement (including as part of any competitive process resulting in this Agreement being entered into) are in all material respects true and correct,
 - (ii) the Contractor has sufficient trained staff, facilities, materials, appropriate equipment and approved subcontractual agreements in place and available to enable the Contractor to fully perform the Services, and
 - (iii) the Contractor holds all permits, licenses, approvals and statutory authorities issued by any government or government agency that are necessary for the performance of the Contractor's obligations under this Agreement; and
- (b) if the Contractor is not an individual,
 - (i) the Contractor has the power and capacity to enter into this Agreement and to observe, perform and comply with the terms of this Agreement and all necessary corporate or other proceedings have been taken and done to authorize the execution and delivery of this Agreement by, or on behalf of, the Contractor, and
 - (ii) this Agreement has been legally and properly executed by, or on behalf of, the Contractor and is legally binding upon and enforceable against the Contractor in accordance with its terms except as enforcement may be limited by bankruptcy, insolvency or other laws affecting the rights of creditors generally and except that equitable remedies may be granted only in the discretion of a court of competent jurisdiction.

5 PRIVACY, SECURITY AND CONFIDENTIALITY

Privacy

5.1 The Contractor must comply with the Privacy Protection Schedule attached as Schedule E.

Security

5.2 The Contractor must:

- (a) make reasonable security arrangements to protect the Material from unauthorized access, collection, use, disclosure, alteration or disposal; and
- (b) comply with the Security Schedule attached as Schedule G.

Confidentiality

- 5.3 The Contractor must treat as confidential all information in the Material and all other information accessed or obtained by the Contractor or a Subcontractor (whether verbally, electronically or otherwise) as a result of this Agreement, and not permit its disclosure or use without the Province's prior written consent except:
- (a) as required to perform the Contractor's obligations under this Agreement or to comply with applicable laws;
 - (b) if it is information that is generally known to the public other than as result of a breach of this Agreement; or
 - (c) if it is information in any Incorporated Material.

Public announcements

- 5.4 Any public announcement relating to this Agreement will be arranged by the Province and, if such consultation is reasonably practicable, after consultation with the Contractor.

Restrictions on promotion

- 5.5 The Contractor must not, without the prior written approval of the Province, refer for promotional purposes to the Province being a customer of the Contractor or the Province having entered into this Agreement.

6 MATERIAL AND INTELLECTUAL PROPERTY

Access to Material

- 6.1 If the Contractor receives a request for access to any of the Material from a person other than the Province, and this Agreement does not require or authorize the Contractor to provide that access, the Contractor must promptly advise the person to make the request to the Province.

Ownership and delivery of Material

- 6.2 The Province exclusively owns all property rights in the Material which are not intellectual property rights. The Contractor must deliver any Material to the Province immediately upon the Province's request.

Matters respecting intellectual property

- 6.3 The Province exclusively owns all intellectual property rights, including copyright, in:

- (a) Received Material that the Contractor receives from the Province; and
- (b) Produced Material, other than any Incorporated Material.

Upon the Province's request, the Contractor must deliver to the Province documents satisfactory to the Province that irrevocably waive in the Province's favour any moral rights which the Contractor (or employees of the Contractor) or a Subcontractor (or employees of a Subcontractor) may have in the Produced Material and that confirm the vesting in the Province of the copyright in the Produced Material, other than any Incorporated Material.

Rights in relation to Incorporated Material

- 6.4 Upon any Incorporated Material being embedded or incorporated in the Produced Material and to the extent that it remains so embedded or incorporated, the Contractor grants to the Province:
- (a) a non-exclusive, perpetual, irrevocable, royalty-free, worldwide license to use, reproduce, modify and distribute that Incorporated Material; and
 - (b) the right to sublicense to third-parties the right to use, reproduce, modify and distribute that Incorporated Material.

7 RECORDS AND REPORTS

Work reporting

- 7.1 Upon the Province's request, the Contractor must fully inform the Province of all work done by the Contractor or a Subcontractor in connection with providing the Services.

Time and expense records

- 7.2 If Schedule B provides for the Contractor to be paid fees at a daily or hourly rate or for the Contractor to be paid or reimbursed for expenses, the Contractor must maintain time records and books of account, invoices, receipts and vouchers of expenses in support of those payments, in form and content satisfactory to the Province. Unless otherwise specified in this Agreement, the Contractor must retain such documents for a period of not less than seven years after this Agreement ends.

8 AUDIT

- 8.1 In addition to any other rights of inspection the Province may have under statute or otherwise, the Province may at any reasonable time and on reasonable notice to the Contractor, enter on the Contractor's premises to inspect and, at the Province's discretion, copy any of the Material and the Contractor must permit, and provide reasonable assistance to, the exercise by the Province of the Province's rights under this section.

9 INDEMNITY AND INSURANCE

Indemnity

- 9.1 The Contractor must indemnify and save harmless the Province and the Province's employees and agents from any losses, claims, damages, actions, causes of action, costs and expenses that the Province or any of the Province's employees or agents may sustain, incur, suffer or be put to at any time, either before or after this Agreement ends, including any claim of infringement of third-party intellectual property rights, where the same or any of them are based upon, arise out of or occur, directly or indirectly, by reason of any act or omission by the Contractor or by any of the Contractor's agents, employees, officers, directors or Subcontractors in connection with this Agreement, excepting always liability arising out of the independent acts or omissions of the Province and the Province's employees and agents.

Insurance

- 9.2 The Contractor must comply with the Insurance Schedule attached as Schedule D.

Workers compensation

- 9.3 Without limiting the generality of section 2.9, the Contractor must comply with, and must ensure that any Subcontractors comply with, all applicable occupational health and safety laws in relation to the performance of the Contractor's obligations under this Agreement, including the *Workers Compensation Act* in British Columbia or similar laws in other jurisdictions.

Personal optional protection

- 9.4 The Contractor must apply for and maintain personal optional protection insurance (consisting of income replacement and medical care coverage) during the Term at the Contractor's expense if:
- (a) the Contractor is an individual or a partnership of individuals and does not have the benefit of mandatory workers compensation coverage under the *Workers Compensation Act* or similar laws in other jurisdictions; and

- (b) such personal optional protection insurance is available for the Contractor from WorkSafeBC or other sources.

Evidence of coverage

- 9.5 Within 10 Business Days of being requested to do so by the Province, the Contractor must provide the Province with evidence of the Contractor's compliance with sections 9.3 and 9.4.

10 FORCE MAJEURE

Definitions relating to force majeure

- 10.1 In this section and sections 10.2 and 10.3:

- (a) "Event of Force Majeure" means one of the following events:
 - (i) a natural disaster, fire, flood, storm, epidemic or power failure,
 - (ii) a war (declared and undeclared), insurrection or act of terrorism or piracy,
 - (iii) a strike (including illegal work stoppage or slowdown) or lockout, or
 - (iv) a freight embargoif the event prevents a party from performing the party's obligations in accordance with this Agreement and is beyond the reasonable control of that party; and
- (b) "Affected Party" means a party prevented from performing the party's obligations in accordance with this Agreement by an Event of Force Majeure.

Consequence of Event of Force Majeure

- 10.2 An Affected Party is not liable to the other party for any failure or delay in the performance of the Affected Party's obligations under this Agreement resulting from an Event of Force Majeure and any time periods for the performance of such obligations are automatically extended for the duration of the Event of Force Majeure provided that the Affected Party complies with the requirements of section 10.3.

Duties of Affected Party

- 10.3 An Affected Party must promptly notify the other party in writing upon the occurrence of the Event of Force Majeure and make all reasonable efforts to prevent, control or limit the effect of the Event of Force Majeure so as to resume compliance with the Affected Party's obligations under this Agreement as soon as possible.

11 DEFAULT AND TERMINATION

Definitions relating to default and termination

- 11.1 In this section and sections 11.2 to 11.4:

- (a) "Event of Default" means any of the following:
 - (i) an Insolvency Event,
 - (ii) the Contractor fails to perform any of the Contractor's obligations under this Agreement, or
 - (iii) any representation or warranty made by the Contractor in this Agreement is untrue or incorrect; and
- (b) "Insolvency Event" means any of the following:
 - (i) an order is made, a resolution is passed or a petition is filed, for the Contractor's liquidation or winding up,

- (ii) the Contractor commits an act of bankruptcy, makes an assignment for the benefit of the Contractor's creditors or otherwise acknowledges the Contractor's insolvency,
- (iii) a bankruptcy petition is filed or presented against the Contractor or a proposal under the *Bankruptcy and Insolvency Act* (Canada) is made by the Contractor,
- (iv) a compromise or arrangement is proposed in respect of the Contractor under the *Companies' Creditors Arrangement Act* (Canada),
- (v) a receiver or receiver-manager is appointed for any of the Contractor's property, or
- (vi) the Contractor ceases, in the Province's reasonable opinion, to carry on business as a going concern.

Province's options on default

- 11.2 On the happening of an Event of Default, or at any time thereafter, the Province may, at its option, elect to do any one or more of the following:
- (a) by written notice to the Contractor, require that the Event of Default be remedied within a time period specified in the notice;
 - (b) pursue any remedy or take any other action available to it at law or in equity; or
 - (c) by written notice to the Contractor, terminate this Agreement with immediate effect or on a future date specified in the notice, subject to the expiration of any time period specified under section 11.2(a).

Delay not a waiver

- 11.3 No failure or delay on the part of the Province to exercise its rights in relation to an Event of Default will constitute a waiver by the Province of such rights.

Province's right to terminate other than for default

- 11.4 In addition to the Province's right to terminate this Agreement under section 11.2(c) on the happening of an Event of Default, the Province may terminate this Agreement for any reason by giving at least 10 days' written notice of termination to the Contractor.

Payment consequences of termination

- 11.5 Unless Schedule B otherwise provides, if the Province terminates this Agreement under section 11.4:
- (a) the Province must, within 30 days of such termination, pay to the Contractor any unpaid portion of the fees and expenses described in Schedule B which corresponds with the portion of the Services that was completed to the Province's satisfaction before termination of this Agreement; and
 - (b) the Contractor must, within 30 days of such termination, repay to the Province any paid portion of the fees and expenses described in Schedule B which corresponds with the portion of the Services that the Province has notified the Contractor in writing was not completed to the Province's satisfaction before termination of this Agreement.

Discharge of liability

- 11.6 The payment by the Province of the amount described in section 11.5(a) discharges the Province from all liability to make payments to the Contractor under this Agreement.

Notice in relation to Events of Default

- 11.7 If the Contractor becomes aware that an Event of Default has occurred or anticipates that an Event of Default is likely to occur, the Contractor must promptly notify the Province of the particulars of the Event

of Default or anticipated Event of Default. A notice under this section as to the occurrence of an Event of Default must also specify the steps the Contractor proposes to take to address, or prevent recurrence of, the Event of Default. A notice under this section as to an anticipated Event of Default must specify the steps the Contractor proposes to take to prevent the occurrence of the anticipated Event of Default.

12 DISPUTE RESOLUTION

Dispute resolution process

- 12.1 In the event of any dispute between the parties arising out of or in connection with this Agreement, the following dispute resolution process will apply unless the parties otherwise agree in writing:
- (a) the parties must initially attempt to resolve the dispute through collaborative negotiation;
 - (b) if the dispute is not resolved through collaborative negotiation within 15 Business Days of the dispute arising, the parties must then attempt to resolve the dispute through mediation under the rules of the British Columbia Mediator Roster Society; and
 - (c) if the dispute is not resolved through mediation within 30 Business Days of the commencement of mediation, the dispute must be referred to and finally resolved by arbitration under the *Commercial Arbitration Act*.

Location of arbitration or mediation

- 12.2 Unless the parties otherwise agree in writing, an arbitration or mediation under section 12.1 will be held in Victoria, British Columbia.

Costs of mediation or arbitration

- 12.3 Unless the parties otherwise agree in writing or, in the case of an arbitration, the arbitrator otherwise orders, the parties must share equally the costs of a mediation or arbitration under section 12.1 other than those costs relating to the production of expert evidence or representation by counsel.

13 MISCELLANEOUS

Delivery of notices

- 13.1 Any notice contemplated by this Agreement, to be effective, must be in writing and delivered as follows:
- (a) by fax to the addressee's fax number specified on the first page of this Agreement, in which case it will be deemed to be received on the day of transmittal unless transmitted after the normal business hours of the addressee or on a day that is not a Business Day, in which cases it will be deemed to be received on the next following Business Day;
 - (b) by hand to the addressee's address specified on the first page of this Agreement, in which case it will be deemed to be received on the day of its delivery; or
 - (c) by prepaid post to the addressee's address specified on the first page of this Agreement, in which case if mailed during any period when normal postal services prevail, it will be deemed to be received on the fifth Business Day after its mailing.

Change of address or fax number

- 13.2 Either party may from time to time give notice to the other party of a substitute address or fax number, which from the date such notice is given will supersede for purposes of section 13.1 any previous address or fax number specified for the party giving the notice.

Assignment

- 13.3 The Contractor must not assign any of the Contractor's rights under this Agreement without the Province's prior written consent.

Subcontracting

- 13.4 The Contractor must not subcontract any of the Contractor's obligations under this Agreement to any person without the Province's prior written consent, excepting persons listed in the attached Schedule C. No subcontract, whether consented to or not, relieves the Contractor from any obligations under this Agreement. The Contractor must ensure that:
- (a) any person retained by the Contractor to perform obligations under this Agreement; and
 - (b) any person retained by a person described in paragraph (a) to perform those obligations fully complies with this Agreement in performing the subcontracted obligations.

Waiver

- 13.5 A waiver of any term or breach of this Agreement is effective only if it is in writing and signed by, or on behalf of, the waiving party and is not a waiver of any other term or breach.

Modifications

- 13.6 No modification of this Agreement is effective unless it is in writing and signed by, or on behalf of, the parties.

Entire agreement

- 13.7 This Agreement (including any modification of it) constitutes the entire agreement between the parties as to performance of the Services.

Survival of certain provisions

- 13.8 Sections 2.9, 3.1 to 3.4, 3.7, 3.8, 5.1 to 5.5, 6.1 to 6.4, 7.1, 7.2, 8.1, 9.1, 9.2, 9.5, 10.1 to 10.3, 11.2, 11.3, 11.5, 11.6, 12.1 to 12.3, 13.1, 13.2, 13.8, and 13.10, any accrued but unpaid payment obligations, and any other sections of this Agreement (including schedules) which, by their terms or nature, are intended to survive the completion of the Services or termination of this Agreement, will continue in force indefinitely, even after this Agreement ends.

Schedules

- 13.9 The schedules to this Agreement (including any appendices or other documents attached to, or incorporated by reference into, those schedules) are part of this Agreement.

Independent contractor

- 13.10 In relation to the performance of the Contractor's obligations under this Agreement, the Contractor is an independent contractor and not:
- (a) an employee or partner of the Province; or

(b) an agent of the Province except as may be expressly provided for in this Agreement.

The Contractor must not act or purport to act contrary to this section.

Personnel not to be employees of Province

13.11 The Contractor must not do anything that would result in personnel hired or used by the Contractor or a Subcontractor in relation to providing the Services being considered employees of the Province.

Key Personnel

13.12 If one or more individuals are specified as “Key Personnel” of the Contractor in Part 4 of Schedule A, the Contractor must cause those individuals to perform the Services on the Contractor’s behalf, unless the Province otherwise approves in writing, which approval must not be unreasonably withheld.

Pertinent information

13.13 The Province must make available to the Contractor all information in the Province’s possession which the Province considers pertinent to the performance of the Services.

Conflict of interest

13.14 The Contractor must not provide any services to any person in circumstances which, in the Province’s reasonable opinion, could give rise to a conflict of interest between the Contractor’s duties to that person and the Contractor’s duties to the Province under this Agreement.

Time

13.15 Time is of the essence in this Agreement and, without limitation, will remain of the essence after any modification or extension of this Agreement, whether or not expressly restated in the document effecting the modification or extension.

Conflicts among provisions

13.16 Conflicts among provisions of this Agreement will be resolved as follows:

- (a) a provision in the body of this Agreement will prevail over any conflicting provision in, attached to or incorporated by reference into a schedule, unless that conflicting provision expressly states otherwise; and
- (b) a provision in a schedule will prevail over any conflicting provision in a document attached to or incorporated by reference into a schedule, unless the schedule expressly states otherwise.

Agreement not permit nor fetter

13.17 This Agreement does not operate as a permit, license, approval or other statutory authority which the Contractor may be required to obtain from the Province or any of its agencies in order to provide the Services. Nothing in this Agreement is to be construed as interfering with, or fettering in any manner, the exercise by the Province or its agencies of any statutory, prerogative, executive or legislative power or duty.

Remainder not affected by invalidity

13.18 If any provision of this Agreement or the application of it to any person or circumstance is invalid or unenforceable to any extent, the remainder of this Agreement and the application of such provision to any other person or circumstance will not be affected or impaired and will be valid and enforceable to the extent permitted by law.

Further assurances

- 13.19 Each party must perform the acts, execute and deliver the writings, and give the assurances as may be reasonably necessary to give full effect to this Agreement.

Additional terms

- 13.20 Any additional terms set out in the attached Schedule F apply to this Agreement.

Governing law

- 13.21 This Agreement is governed by, and is to be interpreted and construed in accordance with, the laws applicable in British Columbia.

14 INTERPRETATION

14.1 In this Agreement:

- (a) “includes” and “including” are not intended to be limiting;
- (b) unless the context otherwise requires, references to sections by number are to sections of this Agreement;
- (c) the Contractor and the Province are referred to as “the parties” and each of them as a “party”;
- (d) “attached” means attached to this Agreement when used in relation to a schedule;
- (e) unless otherwise specified, a reference to a statute by name means the statute of British Columbia by that name, as amended or replaced from time to time;
- (f) the headings have been inserted for convenience of reference only and are not intended to describe, enlarge or restrict the scope or meaning of this Agreement or any provision of it;
- (g) “person” includes an individual, partnership, corporation or legal entity of any nature; and
- (h) unless the context otherwise requires, words expressed in the singular include the plural and *vice versa*.

15 EXECUTION AND DELIVERY OF AGREEMENT

- 15.1 This Agreement may be entered into by a separate copy of this Agreement being executed by, or on behalf of, each party and that executed copy being delivered to the other party by a method provided for in section 13.1 or any other method agreed to by the parties.

The parties have executed this Agreement as follows:

SIGNED on the ____ day of _____, 20__ by the Contractor (or, if not an individual, on its behalf by its authorized signatory or signatories): _____ Signature(s) <u>Bart Koppe</u> Print Name(s) <u>Vice President – Western Region, Intrinsic Environmental Sciences Inc.</u> Print Title(s)	SIGNED on the ____ day of _____, 20__ on behalf of the Province by its duly authorized representative: _____ Signature <u>Arlene Paton</u> Print Name <u>Assistant Deputy Minister, Population and Public Health Division, BC Ministry of Health</u> Print Title
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Schedule A – Services

PART 1. TERM:

1. The term of this Agreement commences on October 31, 2012 and ends on March 31, 2014.

PART 2. SERVICES:

Services Provided by the Contractor are further detailed in Schedule A – Appendix I

Outputs

In phase 2, the focus of the project is to use certain findings from the Phase 1 report to investigate and research the potential for significant human health risks, within the context of environmental health, stemming from oil and gas activity in northeastern British Columbia (BC).

The Contractor is to complete a human health risk assessment with respect to oil and gas activity in northeastern BC, with particular focus to environmental pathways of exposure (air quality, water quality and quantity, land and food quality). The study will consider the hazards posed through environmental issues and events such as incidents, fluid releases and increased traffic with regard to possible impacts on health via the identified pathways. In addition the Province's institutional framework (monitoring and compliance, regulation and enforcement, communication, emergency response planning and tracking and reporting) will be reviewed with respect to oil and gas operational issues (exploration and drilling, processing, wells and pipelines and transportation and traffic).

The **goal** is to assess the public health risks and where appropriate provide recommendations to address potential public health risks. Project objectives include the following:

- i) Review the significant concerns identified by stakeholders in Phase 1, and determine if they may be assessed using human health risk assessment methods;
- ii) Through the development and application of a human risk health assessment and other research and analysis, including evaluation of existing institutional mitigation requirements, identify and validate areas of concern; and
- iii) Improve public health outcomes through the development of key reports and deliverables and where appropriate recommendations to manage significant human health risks related to oil and gas activities.

The deliverables and schedule to be completed by the Contractor are described in Table 1.

Table 1. Phase Two Deliverables* and Schedule

No	Deliverable and Description	Due Date(s)
1	Phase 2 Direction Document • Review of Phase 1 report to extract specific health and environmental exposure pathways issues to guide the jurisdictional scan, the screening level risk assessment and to address as many as possible technically and economically feasible issues in the quantitative human health risk assessment. • Identification of the nature and extent of oil and gas activities and their related categorization to aid in the screening level risk assessment. • Geographic Information System used to provide representative mapping for scenario simulations to be used later in the risk assessment.	Draft – December 1, 2012 Final – December 15, 2012

	- Retrieval of publicly available information related to emission sources of Chemicals of Concern (COCs), environmental media data and baseline health data for local residents. Sourcing of environmental data from local industry. - Development of an information request to source existing data that may not be readily available through public channels. - Contractor is to start on this document by November 1, 2012.	
2	Communication Plan - The Contractor is to develop and maintain throughout the duration of the project a detailed communication plan. - The Contractor is to develop project communication materials based on the direction of the Province. - The Contractor is to start on the communication plan by October 31, 2012.	Draft – November 15 , 2012 Final – November 30th, 2012
3	Project Kick-Off Meeting and Workplan <u>Day 1-2</u> - Introduction of team members and leads – discuss overall goals and objectives with the Project steering committee and key government representatives, and go through in detail the proposal to meet the specific needs of the project team. Changes to timelines and tasks can be discussed at the meeting. - Discuss project details – go through the proposed workplan and identify information needs/requests. <u>Day 3</u> - At a later date meet with select stakeholders and separately representatives of the Province in Fort St John/Dawson Creek to discuss the scope and direction of the human health risk assessment project. - At a later date the Contractor and a representative of the Province shall meet with the Canadian Association of Petroleum Producers. - The Contractor is to complete the first draft of the workplan by November 30, 2012 and a project kick off document based on the project kick-off meeting by December 31st, 2012.	Final - December 31, 2012
4	Jurisdictional Scan - Design and use of a systematic search approach according to the Cochrane Guidelines (www.cochrane.org) for conducting systematic reviews for retrieval of the peer-reviewed and grey literature that is relevant (in-scope) to this project. - Relevant literature is reviewed by team members (toxicologists, risk assessors, physician and epidemiologist) to develop a report summarizing the search findings, with the intent that the findings will help to identify relevant chemicals of concern (COCs) from oil and gas activity and potential health outcomes that need to be taken into consideration in the screening level risk assessment (SLRA) and the human health risk assessment (HHRA).	Draft – February 15, 2013 Final – March 15, 2013

	The Contractor is to start on the jurisdictional scan by December 1st, 2012.	
5	Screening Level Risk Assessment - Development of a conceptual model based on the information from the phase 2 direction document and the jurisdictional scan activities. The conceptual model is to focus on issues surrounding oil and gas activity in northeastern BC. - Information to be included in the conceptual model are the historical, current and reasonably predicted to occur in the future oil and gas activities. The chemical releases to air, water, and land are to be identified and human receptors and surrounding land use patterns are to be categorized. - A screening level matrix for the combination of these events (previous bullet) is to be developed. Qualitative definitions of likelihood and magnitude of risk outcome are to be established prior to the screening of the oil and gas activities. The SLRA shall provide a potential magnitude of potential health risk to receptor categories on the basis of activity. - The SLRA matrix is to evaluate routine and or upset accidental conditions (e.g. gas leak). - In the SLRA each scenario is to undergo a significance ranking and be assigned a significance score. - An assessment of data availability for the subsequent quantitative risk assessment for each scenario is to be completed. Where data is deemed insufficient for a quantitative risk assessment, a qualitative risk assessment is to take place. Recommendations for future acquisition of appropriate environmental data to support a quantitative risk assessment are to be provided, when a qualitative risk assessment is completed. - The Contractors advisory panel is to review and advise on the SLRA as required. - The Contractor is to start on the screening level risk assessment by January 1, 2013.	Draft – April 1, 2013 Final – April 30, 2013
6	Human Health Risk Assessment - The HHRA is to consider a range of oil and gas events/activities that are in-scope (project scope) for the assessment. The selection of the events/activities should take into consideration the findings of the SLRA, and the consultations with the Province's representatives and the project team members. Four different oil and gas events/activities are being provisionally considered for quantitative risk assessment in the HHRA. - Chemical specific toxicology data from recognized regulatory agencies is to be used for the quantification of human health risk. - Dispersion and exposure modeling is to be part of the HHRA. - The Contractor is to start on the human health risk assessment by May 1st, 2013.	Draft – September 30 th , 2013 Final – October 30 th , 2013
7	Review of BC Statutory, Regulatory and Policy Frameworks Within the scope of this project and using the results from the SLRA and HHRA the Contractor is to complete a focused review of the provincial statutes, regulations and policy frameworks that are within the project	Draft – September 1, 2013 Final – November 30, 2013

	scope. • In the review, the Contractor is to: • identify where current statutes, regulations and policies are sufficient or exceed the necessary level for managing human health risk; • identify gaps where statutes, regulations and policies do not currently exist for managing human health risk; and • identify where current statutes, regulations and policies may benefit from a change to enable improved management of human health risks with respect to oil and gas activities. • The Contractor is to start on the review by July 1, 2013.	
8	Project Recommendations • The Contractor is to provide a final project report for Phase 2, that includes: • recommendations on spatial monitoring programs that could improve efforts to monitor and manage human health risk. • recommendations related to air quality, water quality and human health monitoring to ensure ongoing protection of public health. • recommendations or protocols to be employed to assess the potential for future human health risks resulting from historical, continued or future oil and gas activities. • The Contractor is to start on the recommendations report by December 1, 2013.	Draft – January 15, 2014 Final – March 1, 2014
9	Project Management • The Contractor is to provide coordination services for the contractor team. • The Contractor has primary responsibility for the completion of all services and deliverables. • The Contractor is to provide one primary contact for the Province. • The Contractor is responsible for the Preparation and completion of reports, as listed under 'Reporting Requirement' in the Schedule A of this Contract.	On-Going

* The Province is to be provided with three hardcopies and updates as required (electronic format) in Microsoft Word format or other formats as specified for each draft and final deliverable. Further detail regarding all deliverables located in Schedule A – Appendix I.

Inputs

The Contractor must:

- 1) provide all qualified resources with appropriate experience;
- 2) provide resources with appropriate experience (see 1 under Inputs);
- 3) provide a primary point of contact (project manager);
- 4) provide all necessary equipment to perform the services;
- 5) cover all travel, accommodation and meeting costs, as required; and
- 6) be responsible for the successful delivery of the services.

The Province must:

- 1) provide clarification of relevant issues;
- 2) review, comment and approve product development; and
- 3) review, comment and sign-off on all deliverables.

Outcomes

Through the delivery of the services the Province wishes to realize the following outcomes and, without limiting the obligation of the Contractor to comply with other provisions of this Part, the Contractor must use commercially reasonable efforts to achieve them:

- Share science based information with the public regarding the actual health risks associated with oil and gas development in northeast BC
- Provide potential recommendations to create an acceptable balance between oil and gas development and human health risks posed by the industry.
- Improve public health awareness and practice amongst the public and the oil and gas industry leading to improved public health outcomes.

The parties acknowledge that the Contractor does not warrant that these outcomes will be achieved.

Reporting requirements

- The Contractor must attend bi-weekly project status meetings in person or via teleconference with the Province's representative. The Contractor's project manager or alternate is to attend all the meetings.
- The Contractor must prepare bi-weekly status reports. The reports are to include progress to date (% complete), bi-weekly progress, dashboard issues (important), cost and expense tracking, risk assessment, summary of accomplishments during the reporting period and planned activities for the next reporting period. The bi-weekly status reports are to be provided to the Province's representative in electronic format, two days prior to the scheduled bi-weekly meeting(s) in the status report template provided by the Province
- The Contractor must prepare bi-monthly reports for the Steering Committee. The Contractor must also attend the bi-monthly Steering Committee meetings in person or via teleconference with the Province's representative, as required. The Contractor must use the status report template/format approved by the Province. The bi-monthly status reports are to be provided to the Province's representative in electronic format, two business days prior to the scheduled bi-monthly meeting(s).
- The Contractor must maintain/update the project workplan and communication plan, as required. The workplan should provide detailed task descriptions for three (3) months ahead, listed tasks for six (6) months ahead and all milestone names and dates for the Contract term. The communication plan must be updated/reviewed on a monthly basis.

PART 3. RELATED DOCUMENTATION:

Not applicable

PART 4. KEY PERSONNEL:

1. The Key Personnel of the Contractor are as follows:

- (a) Bart Koppe
- (b) Elliot Sigal
- (c) Don Davies
- (d) Karl Bresee
- (e) Karen Phillipps
- (f) Kimberley McCarthy

- (g) James Freeman
- (h) David J Van Vliet
- (i) Steve Shikaze
- (j) Ian Dowsett -
- (k) Katie Butler
- (l) Mary McDaniel
- (m) Deborah Overholt
- (n) Brad Woods
- (o) Ross Wilson
- (p) Geoff Granville
- (q) Judi Krzyzanowski
- (r) David Chadder
- (s) Jeff Lundgren
- (t) Andres Soux
- (u) Nancy Chan
- (v) Julia Veerman

Schedule A – Appendix I – Intrinsik Solution and Approach

Proposed Solution and Approach – Tasks for Successful Completion

The project has been subdivided into discrete goal-oriented tasks that will ensure the timely and successful completion of the project. These tasks were developed to align with Section 2.2.1 Project Description of the RFP. Although details on how the Intrinsik Team envisions completing these tasks are provided, we believe that it is important that we do not presuppose in too much detail the findings of the early tasks that will guide the conduct of the subsequent tasks.

Table 2 provides the overall task list proposed by the Intrinsik Team, with details of how each task will be carried out provided below.

Table 1. Proposed Task List

Task Number	Task Description
Management	Project Management, Meetings and Limited Stakeholder Engagement
Task 1	Kick-off Meeting and Scope Review
Task 2	Review of Phase 1 Document, Gap Analysis, Information Request
Task 3	Jurisdictional Scan
Task 4	Screening Level Risk Assessment
Task 5	Human Health Risk Assessment
Task 6	Review of BC Statutory, Regulatory and Policy Frameworks
Task 7	Recommendations on Monitoring and Managing Health Concerns

Project Management, Meetings and Limited Stakeholder Engagement

It is important to understand from the outset that although the RFP envisioned a March 31, 2014 completion, the Intrinsik Team believes the project can be expedited and that the project can be completed by December 2013. This goal can be achieved through active project management of the process, Intrinsik Team member's assignments and excellent coordination between the project team and the MOH project director. Further details on project management, meetings and timelines are contained in subsequent sections of this proposal.

Task 1 - Project Kick-off Meeting and Scope Review

Upon contract award, the Intrinsik Project Manager (Bart Koppe) and appropriate Discipline Leads (Mr. David Chadder – air, Dr. Mary McDaniel – community health, Mr. David Van Vliet – water, and Mr. Ian Dowsett – emergency response and engineering) will meet with the MOH to review project timelines, tasks and budget items to ensure they meet the goals and objectives of the project. The following is a high level proposed outline for the two day agenda:

- Day 1 Intrinsik Team and MOH (and other ministries required by the MOH) to discuss the overall goals and objectives of the Phase 2 and ensure that the details of the Intrinsik proposal meet the specific needs of the government team. In the event that changes to timelines or tasks are required they can be discussed at the meeting.
- Day 2 Intrinsik Team, MOH, representatives from stakeholder ministries (*e.g.*, MOE, MEM, OGC, *etc.*), Regional Medical Health Officer, and other government agencies to discuss information requests and to ensure that all government staff are clear on the objectives of the project.

No later than two weeks following the meeting Intrinsik will provide MOH with any additions or deletions to the task list, scope and budget of the project. Intrinsik recognizes that there is a fixed budget for this undertaking. To that end, any changes in scope or tasks will have to be adjusted while ensuring the overall proposed budget does not change.

Task 2 – Review of Phase 1 Findings, Gap Analysis and Information Request

The Phase I report documented a set of concerns about the current and potential health impacts related to environmental exposure pathways – air quality, water quality and quantity, land and food quality – that may have been impacted as a result of oil and gas resource development in the area. It also included a number of health concerns that residents and First Nations expressed as being attributable to living in proximity to oil and gas activities. The Intrinsik Team has spent considerable time reviewing the issues raised in the Phase 1 report in preparation of our proposed approach for this project. These concerns are similar to those expressed in other communities living in close proximity to oil and gas projects. The Intrinsik Team will extract the specific health and environmental exposure pathway issues from the Phase 1 report to guide the jurisdictional scan, the screening level risk assessment and ultimately attempt to address as many technically and economically feasible issues in the quantitative human health risk assessment.

At this stage it will also be important to identify the nature and extent of oil and gas activities in northeast BC. The RFP has identified oil and gas activity as including: exploration and drilling, processing, wells, pipelines and transportation. Specific oil and gas activities will be grouped and identified for the purposes of the screening level risk assessment. The Intrinsik Team includes a number of experts that are well versed in the oil and gas activities in the area, both historical and projected, and we will capture their knowledge and that of the relevant government organizations, such as MEM (Ministry of Energy and Mines) and the OGC (Oil and Gas Commission). Geographic Information System (GIS) will also be employed during this task; however, a comprehensive GIS of all oil and gas activity, residences, and watersheds will not be created for this project. Rather the intention is to provide representative mapping for scenarios to be used later in the risk assessment. Simultaneously, the Intrinsik Team will attempt to retrieve as much publically-available information on emission sources of COCs, available environmental media data, and baseline health data for residents of Local Health Areas 81, 60 and 59. We believe that the Intrinsik Advisory Panel will also prove useful in attempting to source relevant environmental data. For example, Mr. Granville may be able to aid us in securing relevant environmental data from local industry, Mr. Wilson may be aware of BC-specific data relevant to the undertaking, while Dr. Krzyzanowski has gained extensive local knowledge of environmental data that may be available specifically for northeast BC.

Once the team has identified all relevant environmental data that we are aware of, an Information Request (IR) will be provided to the MOH Project Manager to attempt to source data that were not readily available. The Questions & Answers #3 for the RFP provided some detail on environmental data that may also be available to the Intrinsik Team. For example *“Oil and gas (O&G) related source emissions (quantity and quality) to air: Permittee discharge data from major point sources under the Environmental Management Act would be available to the successful contractor.”* However, the Intrinsik Team believes that there will unlikely be sufficient environmental data to model all potentially relevant exposure pathways in a detailed quantitative risk assessment.

Task 3 – Jurisdictional Scan

In 2010, Intrinsik completed a *“Systematic Literature Review of Health Outcomes Associated with Living in Proximity to Petrochemical Industries”* for the Lambton Community Health Study Board, chaired by the local Medical Officer of Health. This was a very comprehensive review of the issue, which was undertaken with a significant budget. Given the timeline and budget considerations, the fundamentals of the approach used for the aforementioned review will be applied to this task of the Phase 2 project (Figure 1). The same information specialist/medical

librarian will design a systematic search approach according to the Cochrane Guidelines for conducting systematic reviews for retrieval of the peer-reviewed literature. The rapid review will be modelled after the Cochrane Handbook for Systematic Reviews of Interventions (Cochrane Collaboration, 2008). Cochrane reviews adhere to the principle that “science is cumulative” and by considering the available evidence, decisions can be made that reflect the best science available.

Rapid screening of the bibliographic database results will be undertaken to identify pertinent health outcome literature. The Intrinsic Team will concurrently retrieve relevant jurisdiction reports on health concerns in living in proximity to oil and gas activities.

There has been a considerable amount of effort and funds spent in Alberta on this topic. In addition, there are a number of case reports and regulatory documents completed by the USEPA on topics such as hydraulic fracturing for extraction of unconventional shale gas. This review will also include documents prepared by the local Northern BC Medical Health Officers (MHOs), such as *“Population Health and Oil and Gas Activities: A Preliminary Assessment of the Situation in North Eastern BC, A Report from the Medical Health Officer to the Board of Northern Health”* and Power Point presentations such as *“Northern Health Board: Health Concerns – Oil & Gas Industry in Northern BC”*.

Together the results of this review will focus the risk assessment on those issues that have been identified of greatest potential concern for public health from exposure to relevant oil and gas activities. The reports and peer-reviewed scientific literature will be reviewed by the Intrinsic toxicologists and risk assessors and the McDaniel Lambert physician and epidemiologist. A brief report summarizing the findings of the review will be prepared for review by the Intrinsic Advisory Panel and the MOH staff. Ultimately, the findings of this review will help to identify relevant COCs from upstream oil and gas activity and potential health outcomes that need to be taken into consideration in the SLRA and the HHRA.

Task 4 – Screening Level Risk Assessment

This is a critical task to the Phase 2 project undertaking. It is at this point

that all of the information gathered in Tasks 2 and combined to provide a conceptual model of issues

surrounding oil and gas activity in northeastern BC. Risk assessment follows the fundamental paradigm of:

Source —————> Exposure Pathway —————> Receptor

At this point the oil and gas activities – historical, current and reasonably predicted to occur in the future – will have been characterized. The chemical emissions to air, water and land will have been identified and human receptors and surrounding land use patterns in the area will have to be categorized (*e.g.*, subsistence First Nations, rural, urban, and those who hunt and fish). In addition, exposure pathways and chemicals that may lead to potential adverse health outcomes will have been identified in Task 3. The Intrinsic Team proposes to develop a screening level risk matrix for the combination of these events. Although this risk matrix will be developed on the basis of previously published frameworks, a framework specific to this undertaking will be established.

Prior to screening the various oil and gas activities for relative ranking, qualitative definitions of likelihood and magnitude of risk outcome will be established. It is then envisioned that a matrix scoring will be employed,

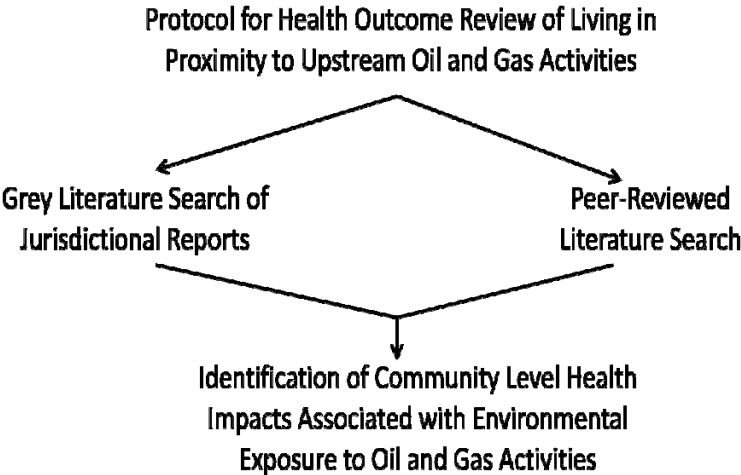


Figure 1. Jurisdictional Scan Approach

3 will be

whereby each of the oil and gas activities and their related emissions to the environment will be assessed for exposure to each of the identified receptor categories.

It is also important to recognize that this evaluation is dependent on routine exploration, operations and decommissioning activities and could be dramatically different under accident, malfunction or upset conditions. Therefore, the SLRA matrix will evaluate both routine and accidental conditions. The following two examples are provided for illustrative purposes only for the proposal, and may not reflect actual scenarios, or the findings of the project:

Example 1:

If a natural gas pipeline is properly constructed and maintained, it is possible that there will be fugitive emissions of COCs from seals, flanges and compressor stations that could be emitted into the environment. However, if an accident were to occur that resulted in a rupture of the pipeline and subsequent fire/explosion then the magnitude and frequency of exposure of people living in proximity to the pipeline would be markedly different than under routine operations. Therefore, each of these scenarios should be evaluated differently.

Example 2:

If an unconventional natural gas well (shale gas) is properly drilled, constructed and operated it is possible that there may be little, if any, potential contamination of shallow potable groundwater aquifers from the use of hydraulic fracturing fluids. However, if improper installation of the well were to occur or an accidental release of hydraulic fracturing fluids were to occur it may significantly impact the potable groundwater system being used by local residents. Therefore, each of these scenarios should be evaluated differently.

The screening level risk matrices will ultimately provide a potential magnitude of potential health risk to receptor categories on the basis of activity. However, there are two other considerations that need to be accounted for at this stage – significance of the risk and availability of environmental data to complete a quantitative risk assessment.

Hence, each scenario will undergo a significance ranking. The Intrinsic Team envisions employing significance scoring criteria often used in Environmental Assessments undertaken for applications for the BC Environmental Assessment Office (EAO) and the Canadian Environmental Assessment Agency (CEAA). Events and risks are often categorized as significant or insignificant on the basis of: magnitude, frequency, duration, reversibility, and geographic area potentially impacted. Therefore, each activity scored in the screening level risk matrix will also be assigned a significance score.

Finally, an assessment of the availability of environmental data to conduct a quantitative human health risk assessment for each oil and gas activity will be made. It is possible that an activity that receives a “high” risk and “significant” score may not have sufficient environmental data to be assessed quantitatively under Phase 2. In this case, we will have arrived at a qualitative assessment of potential risk to those people living in proximity to a particular oil and gas activity in northeast BC. Further recommendations for need to collect environmental data and recommendations for monitoring of human health will be provided in Task 7 for these activities.

The results of this comprehensive SLRA will form the basis on which scenarios will be evaluated quantitatively under Task 5. The SLRA report will be provided to the Intrinsic Advisory Panel for review and discussion, as well as the MOH and other government stakeholder ministries. At this stage it is envisioned that a second Key Stakeholder Engagement be conducted with the Intrinsic Project Manager and MOH representative to ensure buy-in, or understanding of concerns, of the stakeholders prior to undertaking the quantitative HHRA. This meeting will be held in the study area, with participation by conference call or WEBEX for those who cannot attend in person.

Task 5 – Human Health Risk Assessment

A detailed HHRA report will be prepared based on the findings and inputs from aforementioned tasks. It will follow the standard risk assessment paradigm of problem formulation, exposure assessment, hazard assessment and risk characterization. At this stage in the proposal preparation, it is very difficult and likely premature to detail the exact approach to be undertaken to understand what potential health risks exist for residents and First Nations in northeast BC living in proximity to oil and gas activities. Instead a framework and proposed approach is provided which will be honed in consultation with the Intrinsik Advisory Panel, MOH and other government representatives, and key stakeholders upon completion of Task 4.

It would be impossible to conduct an absolutely comprehensive quantitative risk assessment of all oil and gas activities, their chemical emissions and resulting risks to people living in such a large geographic area given the budgetary and time constraints. That is not to say that the Intrinsik Team believes that such an undertaking is without merit. In fact, we believe there are a number of generic oil and gas activity scenarios that exist that could be modelled to provide an estimation of potential risk surrounding their operation. This is an approach that has been adopted previously across Canada for a number of industries (e.g., waste-to-energy facilities and natural gas-fired plants) in an attempt to identify those areas that require individual facility assessment or development of comprehensive monitoring or mitigation programs to ensure the ongoing protection of individuals' health. In addition, it is critical to remember that very valuable qualitative information on activities that could pose an adverse health threat will be identified in Task 4.

Based on the budget and our understanding of the scope and objectives, the Intrinsik Team envisions quantitative evaluation of one large/complex emission source, one medium and two small/simple oil and gas activities. For the purpose of the budget these have largely been envisioned to involve air releases of contaminants in the environment, ground-level air concentrations being predicted, potential deposition in soil, and uptake into edible vegetation and wild game/livestock, where appropriate. Human receptor scenarios likely involving urban, rural and First Nations land use activity patterns would be assessed. Quantification of potential health risk using readily-available chemical-specific toxicology data from recognized regulatory agencies will be completed. It is also possible that if there is enough existing regional airshed data that a quantitative baseline inhalation assessment may be undertaken.

In the event that air quality scenarios are selected for quantitative risk assessment then the RWDI team will develop generic stack and emission and fugitive emissions parameters for each scenario and conduct dispersion modelling for a representative set of COCs defined during the problem formulation. General facility design will be based either on information provided by the OGC or CAPP or on the Intrinsik Team's previous experience. Emission estimates will be based on generally-accepted methodologies, such as the US Environmental Protection Agency's AP-42 compilation of emission factors. Dispersion modelling will be conducted in accordance with the BC Ministry of Environment's *Guideline for Air Quality Dispersion Modelling in BC* and using the CALPUFF dispersion model in ISC mode. Meteorological data representative of the region will be used for dispersion modelling. For example, in Area 81 data from Fort Nelson would likely be used whereas in Areas 59 and 60 meteorological data from the Fort St. John area would likely be used. Either flat or rolling terrain will be assumed depending on the selected area for the quantitative assessment. Maximum ground-level concentrations of the COCs will be predicted for both short- and long-term averaging periods.

In the event that Task 4 identifies a water resource pathway that is potentially "high risk and significant" and sufficient environmental data for modelling exists, the water resources team at Matrix Solutions will provide input data to the HHRA team. For example, hydraulic fracturing (fracking) associated with the development of shale gas deposits is a concern relating to water quality and human health in northeast BC. When hydraulic fracturing operations are carried out properly, it is unlikely that contaminants will reach overlying freshwater

aquifers. However, there are potential scenarios where fracking could result in chemical release to the environment; including:

- Leakage from the hydraulic fracturing well casing due to defective installation or cementing;
- Leakage through the geology overlying the hydrocarbon reservoir;
- Leakage from improper handling of chemicals used in the process and from hydraulic fracturing wastewaters (*i.e.*, flow back or produced water from the formation) brought back to the surface at the well site; or
- A well blowout resulting in underground leakage into aquifers or surface recharge *via* spillage.

In the event that such a scenario is identified for quantitative assessment, the hydrogeologists at Matrix will provide quantitative modelled groundwater concentrations of COCs from fracking activities in a generic hydrogeological setting in northeast BC. This information will then be incorporated into the HHRA to determine the potential risk to surrounding residents.

The results of Task 4 and Task 5 will serve to inform the basis for critical evaluation of the BC statutory, regulatory and policy frameworks (Task 6) and to provide recommendations of any additional appropriate monitoring networks that may need to be established to manage health concerns and outcomes in northeastern BC.

Task 6 – Review of BC Statutory, Regulatory and Policy Frameworks

Upon completion of the HHRA, Phase 2 of the MOH project requires a review of existing BC statutory, regulatory and policy frameworks that ensure the protection of the health of the population living in proximity to oil and gas activities. Although the Intrinsic Team's scientific experts are well versed in the individual frameworks that govern their environmental practices in BC, we have engaged the expertise and support of the environmental legal team from Borden Ladner Gervais (BLG), LLP of Vancouver. The BLG lawyers will be responsible to the Intrinsic Project Manager for retrieving and providing applicable statutes, legislation and policy frameworks to the oil and gas activities in northeastern BC. BLG will only be providing the applicable legislation and it is very important to note that they will not be providing interpretation, clarification or suitability of the existing BC legislation to protect human health. All interpretation or identification of potential science-policy improvements will be made by the Intrinsic Team's scientific leads.

This task requires seasoned environmental professionals that are experts in their fields and have previously contributed to developing science policy for provincial and federal government departments. Intrinsic has specialized in conducting science policy reviews and providing recommendations to protect people from environmental chemical exposure. It is this experience that will be brought to bear in completing Task 6. These recommendations will be in the form of science policy and would not be a line-by-line edit or rewrite of current legislation or policy. Development of such legislative language would need to be undertaken by ministry legal staff or other such legal counsel and departmental representatives.

Task 7 - Recommendations on Monitoring and Managing Health Concerns

The final report to be prepared by the Intrinsic Team under Phase 2 of this project will provide recommendations on spatial monitoring programs that could improve efforts to monitor and manage health risks to the people of northeastern BC. Again without presupposing the outcomes of the various tasks to be completed in Phase 2, it is envisioned that there may be recommendations surrounding air quality, water resource and even human health

As per the RFP, this task will use the results of the aforementioned tasks to:

- *identify where current statutes, regulations and policies are sufficient or exceed the necessary level for managing human health risk;*
- *identify gaps where statutes, regulations and policies do not currently exist for managing human health risk; and.*
- *identify where current statutes, regulations and policies may benefit from a change to enable improved management of human health risks with respect to oil and gas activities.*

monitoring that could be adopted to ensure the ongoing protection of the health of residents in Local Health Areas 59, 60 and 81. The following are preliminary thoughts or examples that may be applicable:

Air Quality

Ambient air quality in northeastern BC and a perceived lack of comprehensive monitoring programs was a concern expressed during Phase 1 of the Project. Furthermore, the Phase 1 survey respondents had a number of suggestions on the topic of air monitoring, including having a sentinel air monitoring system for the entire region; installing air quality monitoring stations in communities and near residents; and making public the results from the monitoring stations. With these concerns and suggestions in mind, a high-level review will be conducted of current ambient air quality monitoring in BC Local Health Areas 59, 60 and 81 conducted by government and industry. Gaps in terms of the contaminants being monitored, the monitoring locations, and the availability of the data to the public will be identified. Based on this gap analysis, specific recommendations will be provided for improving the ambient monitoring in the region as well as the dissemination of the data collected. The context for these recommendations will be the evolving national strategy for managing air quality that is tending towards an airshed-based system.

Water Resources

The Intrinsik Team will provide recommendations to the province relating to the implementation of monitoring programs that could be employed to better safeguard human health surrounding oil and gas activities. These recommendations may relate to water quantity and quality data collected by the provincial or federal government and to recommendations that would be forwarded to the oil and gas industry as part of its environmental management and compliance obligations.

The monitoring recommendations may relate to either drinking water monitoring or environmental monitoring (source water) and will consider all existing monitoring frameworks that are in place or recognized by government or industry.

Source water monitoring programs offer the benefit of detecting environmental contaminants before they become a human health risk. With respect to environmental, or source water monitoring, there is no comprehensive data collection or monitoring program in the province for environmental water quality. The province operates the BC Environmental Monitoring System (EMS). This system is the province's primary environmental data repository, but because the system data come from either the BC Ministry of Environment or permittee samples related to licensed discharges, monitoring parameters and frequency vary from site to site. The system is designed to capture data covering physical, chemical, and biological analyses performed on water, air, solid waste discharges, and ambient monitoring sites throughout the province. The data in the EMS collection is not publicly accessible except by request, and a fee is charged. It is envisioned that practical recommendations to improving the system could be provided.

Health Outcome Measures

There are a number of health measure surveys that are in place around the world that seek to monitor local residents' health in relation to exposure to industrial activities. These programs can go as far as including biomonitoring regimes wherein biological tissues are collected and analyzed for chemical constituents, markers of enzymatic induction and DNA damage (referred to as biomarkers). Such programs are costly to set-up and may be of little practical use in the identification of a causal link between industry and community health. That being said, through the jurisdictional review and findings of the risk assessment, the health team could propose specific health monitoring programs in northeastern BC to elucidate whether oil and gas activities are impacting individual or community health.

This final task may provide additional recommendations or protocols to be employed to assess the potential for future human health impacts in northeastern BC as a result of historical, continued or future oil and gas activities.

Schedule B – Fees and Expenses

1. MAXIMUM AMOUNT PAYABLE:

Maximum Amount: Despite sections 2 and 3 of this Schedule, \$898,630.00 is the maximum amount which the Province is obliged to pay to the Contractor for fees and expenses under this Agreement.

2. FEES:

Rate per Unit/Deliverable

Fees: at the provided for rate in Table 2 for each deliverable provided by the Contractor as Services during the Term.

Table 2. Payment Schedule for Contract with Intrinsik Environmental Sciences Inc.

Payment No	Deliverable Description	Billing Period Date	Payment Amount (\$)	Holdback Amount (\$)	Total (\$)
FISCAL YEAR 2012/13					
1	Communication Plan	November 30, 2012			
2	Phase 2 Direction Document	December 15, 2012			
3	Project Kick Off Meeting – Final Summary Report	December 31, 2012			
4	Project Management Services	December 31, 2012			
5	Jurisdictional Scan – Final Summary Report	March 15, 2013			
6	Project Management Services	March 31, 2013		\$21	\$21
FISCAL YEAR 2013/14					
7	Screening Level Risk Assessment	April 30, 2013			
8	Project Management Services	June 30, 2013			
9	Human Health Risk Assessment	October 30, 2013			
10	Review of Statutory Regulations Report	November 30, 2013			
11	Project Management Services	September 30, 2013			
13	Project Management Services	December 31, 2013			

12	Project Recommendations Report	March 1, 2014			
14	Project Management Services	March 31, 2014		S21	
	Totals		808767	89863	898630

3. EXPENSES:

None – No expenses will be re-imbursed

4. STATEMENTS OF ACCOUNT:

Statements of Account: In order to obtain payment of any fees and expenses under this Agreement for each completed unit the Contractor must deliver to the Province on a date after the Billing Period (each a "Billing Date"), a written statement of account in a form satisfactory to the Province containing:

- (a) the Contractor's legal name and address;
- (b) the date of the statement, and the Billing Period to which the statement pertains;
- (c) the Contractor's calculation of all fees claimed for that Billing Period, including a declaration by the Contractor of all (units deliverables) provided during the Billing Period for which the Contractor claims fees and a description of the applicable fee rates.
- (d) a chronological listing, in reasonable detail, of any expenses claimed by the Contractor for the Billing Period with receipts attached, if applicable, and, if the Contractor is claiming reimbursement of any HST or other applicable taxes paid or payable by the Contractor in relation to those expenses, a description of any credits, rebates, refunds or remissions the Contractor is entitled to from the relevant taxation authorities in relation to those taxes;
- (e) the Contractor's calculation of any applicable taxes payable by the Province in relation to the Services for the Billing Period;
- (f) a description of this Agreement;
- (g) a statement number for identification; and
- (h) any other billing information reasonably requested by the Province.

5. PAYMENTS DUE:

Payments Due: Within 30 days of the Province's receipt of the Contractor's written statement of account delivered in accordance with this Schedule, the Province must pay the Contractor the fees and expenses (plus all applicable taxes) claimed in the statement if they are in accordance with this Schedule. Statements of account or contract invoices offering an early payment discount may be paid by the Province as required to obtain the discount.

Schedule C – Approved Subcontractor(s)

Approved Subcontractors include the following:

a) **Matrix Solutions Inc.** Address: Suite 200, 150-13 SW Calgary, Alberta T2R 0V2. Tel: (403) 237-0606

- i) James Freeman
- ii) David J Van Vliet
- iii) Steve Shikaze

b) **Skystone Engineering** Address: 330-4311 12 St. NE Calgary Alberta T2E 4P9. Tel: (403) 216-3485

- i) Ian Dowsett -

c) **McDaniel Lambert Inc.** Address: 1608 Pacific Ave. Suite 201, Venice, CA USA 90291. Tel: (310) 392-6462

- i) Katie Butler
- ii) Mary McDaniel

d) **Borden Ladner Gervais LLP** Address: 1200 Waterfront Centre 200 Burrard Street, P.O. Box 48600 Vancouver BC V7X 1T2 Tel: (604) 687 5744

- i) Deborah Overholt
- ii) Brad Woods

e) **Wilson Scientific Consulting Inc.**, 91 West 28th Avenue, Vancouver, BC V5Y 2K7.
Tel: (604) 221-6565

- i) Ross Wilson

e) **G C Granville Consulting Corp.** Address: 2303 Ertom Place, SW Calgary, Alberta T2S2Z3.
Tel: (403) 978-2220

- i) Geoff Granville

f) **Krzyzanowski Consulting** Address: 1344 Minto Road, Stirling-Rawdon Ontario, K0K 3E0.
Tel: (613) 395-9338

- i) Judi Krzyzanowski

g) **Rowan Williams Davies and Irwin Inc.** Address: Suite 1000 736-8th Avenue SW, Calgary, AB T2P 1H4. Tel: (403) 232-6771

- i) David Chadder
- ii) Jeff Lundgren
- iii) Andres Soux
- iv) Nancy Chan
- v) Julia Veerman

Schedule D – Insurance

1. The Contractor must, without limiting the Contractor's obligations or liabilities and at the Contractor's own expense, purchase and maintain throughout the Term the following insurances with insurers licensed in Canada in forms and amounts acceptable to the Province:
 - (a) Commercial General Liability in an amount not less than \$2,000,000.00 inclusive per occurrence against bodily injury, personal injury and property damage and including liability assumed under this Agreement and this insurance must
 - (i) include the Province as an additional insured,
 - (ii) be endorsed to provide the Province with 30 days advance written notice of cancellation or material change, and
 - (iii) include a cross liability clause.
2. All insurance described in section 1 of this Schedule must:
 - (a) be primary; and
 - (b) not require the sharing of any loss by any insurer of the Province.
3. The Contractor must provide the Province with evidence of all required insurance as follows:
 - (a) within 10 Business Days of commencement of the Services, the Contractor must provide to the Province evidence of all required insurance in the form of a completed Province of British Columbia Certificate of Insurance;
 - (b) if any required insurance policy expires before the end of the Term, the Contractor must provide to the Province within 10 Business Days of the policy's expiration, evidence of a new or renewal policy meeting the requirements of the expired insurance in the form of a completed Province of British Columbia Certificate of Insurance; and
 - (c) despite paragraph (a) or (b) above, if requested by the Province at any time, the Contractor must provide to the Province certified copies of the required insurance policies.
4. The Contractor must obtain, maintain and pay for any additional insurance which the Contractor is required by law to carry, or which the Contractor considers necessary to cover risks not otherwise covered by insurance specified in this Schedule in the Contractor's sole discretion.

Schedule E – Privacy Protection Schedule

Definitions

1. In this Schedule,
 - (a) “**access**” means disclosure by the provision of access;
 - (b) “**Act**” means the *Freedom of Information and Protection of Privacy Act* (British Columbia);
 - (c) “**contact information**” means information to enable an individual at a place of business to be contacted and includes the name, position name or title, business telephone number, business address, business email or business fax number of the individual;
 - (d) “**personal information**” means recorded information about an identifiable individual, other than contact information, collected or created by the Contractor as a result of the Agreement or any previous agreement between the Province and the Contractor dealing with the same subject matter as the Agreement but excluding any such information that, if this Schedule did not apply to it, would not be under the “control of a public body” within the meaning of the Act.

Purpose

2. The purpose of this Schedule is to:
 - (a) enable the Province to comply with the Province’s statutory obligations under the Act with respect to personal information; and
 - (b) ensure that, as a service provider, the Contractor is aware of and complies with the Contractor’s statutory obligations under the Act with respect to personal information.

Collection of personal information

3. Unless the Agreement otherwise specifies or the Province otherwise directs in writing, the Contractor may only collect or create personal information that is necessary for the performance of the Contractor’s obligations, or the exercise of the Contractor’s rights, under the Agreement.
4. Unless the Agreement otherwise specifies or the Province otherwise directs in writing, the Contractor must collect personal information directly from the individual the information is about.
5. Unless the Agreement otherwise specifies or the Province otherwise directs in writing, the Contractor must tell an individual from whom the Contractor collects personal information:
 - (a) the purpose for collecting it;
 - (b) the legal authority for collecting it; and
 - (c) the title, business address and business telephone number of the person designated by the Province to answer questions about the Contractor’s collection of personal information.

Accuracy of personal information

6. The Contractor must make every reasonable effort to ensure the accuracy and completeness of any personal information to be used by the Contractor or the Province to make a decision that directly affects the individual the information is about.

Requests for access to personal information

7. If the Contractor receives a request for access to personal information from a person other than the Province, the Contractor must promptly advise the person to make the request to the Province unless the Agreement

expressly requires the Contractor to provide such access and, if the Province has advised the Contractor of the name or title and contact information of an official of the Province to whom such requests are to be made, the Contractor must also promptly provide that official's name or title and contact information to the person making the request.

Correction of personal information

8. Within 5 Business Days of receiving a written direction from the Province to correct or annotate any personal information, the Contractor must correct or annotate the information in accordance with the direction.
9. When issuing a written direction under section 8, the Province must advise the Contractor of the date the correction request to which the direction relates was received by the Province in order that the Contractor may comply with section 10.
10. Within 5 Business Days of correcting or annotating any personal information under section 8, the Contractor must provide the corrected or annotated information to any party to whom, within one year prior to the date the correction request was made to the Province, the Contractor disclosed the information being corrected or annotated.
11. If the Contractor receives a request for correction of personal information from a person other than the Province, the Contractor must promptly advise the person to make the request to the Province and, if the Province has advised the Contractor of the name or title and contact information of an official of the Province to whom such requests are to be made, the Contractor must also promptly provide that official's name or title and contact information to the person making the request.

Protection of personal information

12. The Contractor must protect personal information by making reasonable security arrangements against such risks as unauthorized access, collection, use, disclosure or disposal, including any expressly set out in the Agreement.

Storage and access to personal information

13. Unless the Province otherwise directs in writing, the Contractor must not store personal information outside Canada or permit access to personal information from outside Canada.

Retention of personal information

14. Unless the Agreement otherwise specifies, the Contractor must retain personal information until directed by the Province in writing to dispose of it or deliver it as specified in the direction.

Use of personal information

15. Unless the Province otherwise directs in writing, the Contractor may only use personal information if that use is for the performance of the Contractor's obligations, or the exercise of the Contractor's rights, under the Agreement.

Disclosure of personal information

16. Unless the Province otherwise directs in writing, the Contractor may only disclose personal information inside Canada to any person other than the Province if the disclosure is for the performance of the Contractor's obligations, or the exercise of the Contractor's rights, under the Agreement.
17. Unless the Agreement otherwise specifies or the Province otherwise directs in writing, the Contractor must not disclose personal information outside Canada.

Notice of foreign demands for disclosure

18. In addition to any obligation the Contractor may have to provide the notification contemplated by section 30.2 of the Act, if in relation to personal information in the custody or under the control of the Contractor, the Contractor:
- (a) receives a foreign demand for disclosure;
 - (b) receives a request to disclose, produce or provide access that the Contractor knows or has reason to suspect is for the purpose of responding to a foreign demand for disclosure; or
 - (c) has reason to suspect that an unauthorized disclosure of personal information has occurred in response to a foreign demand for disclosure

the Contractor must immediately notify the Province and, in so doing, provide the information described in section 30.2(3) of the Act. In this section, the phrases “foreign demand for disclosure” and “unauthorized disclosure of personal information” will bear the same meanings as in section 30.2 of the Act.

Notice of unauthorized disclosure

19. In addition to any obligation the Contractor may have to provide the notification contemplated by section 30.5 of the Act, if the Contractor knows that there has been an unauthorized disclosure of personal information in the custody or under the control of the Contractor, the Contractor must immediately notify the Province. In this section, the phrase “unauthorized disclosure of personal information” will bear the same meaning as in section 30.5 of the Act.

Inspection of personal information

20. In addition to any other rights of inspection the Province may have under the Agreement or under statute, the Province may, at any reasonable time and on reasonable notice to the Contractor, enter on the Contractor’s premises to inspect any personal information in the possession of the Contractor or any of the Contractor’s information management policies or practices relevant to the Contractor’s management of personal information or the Contractor’s compliance with this Schedule, and the Contractor must permit and provide reasonable assistance to any such inspection.

Compliance with the Act and directions

21. The Contractor must in relation to personal information comply with:
- (a) the requirements of the Act applicable to the Contractor as a service provider, including any applicable order of the commissioner under the Act; and
 - (b) any direction given by the Province under this Schedule.
22. The Contractor acknowledges that it is familiar with the requirements of the Act governing personal information that are applicable to it as a service provider.

Notice of non-compliance

23. If for any reason the Contractor does not comply, or anticipates that it will be unable to comply, with a provision in this Schedule in any respect, the Contractor must promptly notify the Province of the particulars of the non-compliance or anticipated non-compliance and what steps it proposes to take to address, or prevent recurrence of, the non-compliance or anticipated non-compliance.

Termination of Agreement

24. In addition to any other rights of termination which the Province may have under the Agreement or otherwise at law, the Province may, subject to any provisions in the Agreement establishing mandatory cure periods for defaults by the Contractor, terminate the Agreement by giving written notice of such termination to the Contractor, upon any failure of the Contractor to comply with this Schedule in a material respect.

Interpretation

25. In this Schedule, references to sections by number are to sections of this Schedule unless otherwise specified in this Schedule.
26. Any reference to the “Contractor” in this Schedule includes any subcontractor or agent retained by the Contractor to perform obligations under the Agreement and the Contractor must ensure that any such subcontractors and agents comply with this Schedule.
27. The obligations of the Contractor in this Schedule will survive the termination of the Agreement.
28. If a provision of the Agreement (including any direction given by the Province under this Schedule) conflicts with a requirement of the Act or an applicable order of the commissioner under the Act, the conflicting provision of the Agreement (or direction) will be inoperative to the extent of the conflict.
29. The Contractor must comply with the provisions of this Schedule despite any conflicting provision of this Agreement or, subject to section 30, the law of any jurisdiction outside Canada.
30. Nothing in this Schedule requires the Contractor to contravene the law of any jurisdiction outside Canada unless such contravention is required to comply with the Act.

Schedule F – Additional Terms

1. Contractor Identification – During the term of this Agreement and at the request of the Province, contractors shall identify themselves as contractors to the ministry. This may be in the form of email signature blocks, business cards, correspondence, verbal business dealings and any other identification required by the Province.
2. In addition to section 13.1, the General Services Agreement may be entered into by each party signing and delivering.
3. Notwithstanding the provisions of section 13.14 of the Agreement, the Province acknowledges that the Contractor may be engaged in work that could create the appearance of a conflict of interest but the Contractor will take all reasonable steps, and will ensure its team members take all reasonable steps, to prevent an actual conflict from arising, including performing the obligations and taking the precautions set out in section 5.2 of its proposal dated August 10, 2012 and entitled “Intrinsic, Technical Proposal Phase 2 – Human Health Risk Assessment of the Northeastern British Columbia Oil and Gas Activity”.
4. Should a conflict exist between the terms and conditions of the Agreement and those contained in this Schedule F, the terms of this Schedule F shall govern.

Schedule G – Security Schedule

Not applicable



COST PROPOSAL

PHASE 2 – HUMAN HEALTH RISK ASSESSMENT OF NORTHEASTERN BRITISH COLUMBIA OIL AND GAS ACTIVITY

August 10, 2012

**Prepared for: Ministry of Health
Purchasing Services Branch
c/o 2nd Floor 563 Superior Street
Victoria, BC V8V 1T7
Attention: Norman Helewa**

Cost Proposal for Phase 2 – Human Health Risk Assessment of Northeastern British Columbia Oil and Gas Activity

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1.0 INTRINSIK TEAM COST PROPOSAL

Intrinsik Environmental Sciences Inc. (Intrinsik) is pleased to provide this cost proposal to the British Columbia (BC) Ministry of Health (MOH) to complete *Phase 2 – Human Health Risk Assessment of Northeastern British Columbia Oil and Gas Activity*. It is understood from the RFP that the maximum upset cost for this undertaking is a fixed fee of \$900,000 (excluding any applicable taxes).

To that end Intrinsik has proposed a fixed proposal opinion of cost of \$898,630 (excluding any applicable taxes). This opinion of cost is broken down to \$826,280 in consulting fees and expenses totaling \$72,350.

A detailed breakdown of consulting fees by task and individual hourly rates are provided in Table 1. It should be noted that an hourly rate of \$0 per hour has been assigned to Mr. Elliot Sigal the Project Principal. Mr. Elliot Sigal is the President of Intrinsik and he will contribute 124 hours of his time at no cost to MOH during the course of the project to support the Project Manager, Mr. Bart Koppe and the Intrinsik Team.

The consulting opinion of cost is a result of almost 5,000 personnel hours. It is possible that during the course of the Phase 2 project that the Intrinsik proposed scope and tasks may be altered as a result of consultation with the MOH representative and input from key stakeholders. Therefore, there may be a requirement to adjust budget allocation by task to individuals or team members. At no time will the Intrinsik Project Manager reallocate budget between tasks without the written consent of the MOH representative. It is understood that the total fixed cost of Phase 2 is not to exceed \$900,000 and this will be taken into consideration during any reallocation of effort. However, in the unforeseen event that additional tasks, level of effort or the scope is significantly altered or changed by the MOH representative a formal written change order request will be prepared and submitted for authorization. Under no circumstances will Intrinsik undertake work that would exceed the allocated fixed price of the contract without written authorization. We formally submit that Intrinsik has prepared this budget in good faith and we do not anticipate requiring additional funding to meet the proposed scope of work.

The expenses are detailed in Table 2. These include a fixed cost for the services of the Medical Librarian to complete the systematic literature search and retrieval of up to 200 peer-reviewed scientific articles at a cost of \$20 per hour. GIS and mapping requirements have been estimated at a cost of \$40,000, which may include the services of staff from Matrix Solutions and/or Skystone Engineering and purchase of base maps and databases. Travel expenses to northeastern BC were estimated for travel to Fort St. John and are broken down on an individual basis for a 5 business day trip as:

Flight cost	\$1000	average per round trip from Calgary, Vancouver and Los Angeles
Hotel	\$1000	5 nights @ \$200 per night stay in Fort St. John
Meal Per Diem	\$235	5 days per diem as per BC government guidelines @ \$47 per day
Taxi	\$100	
Total individual trip		\$2335

Expenses will be billed to the MOH at actual costs with no mark-up and will not exceed a total of \$72,350. This will ensure that the overall fixed price of the undertaking will not exceed \$898,690 (excluding any applicable taxes).

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Table 2. Opinion of Cost of Project Expenses

Expenses	Cost
Professional Medical Librarian to conduct systematic peer review literature search	\$5,000
Retrieval of 200 scientific journal articles @ \$20/article	\$4,000
GIS support, mapping and purchase of mapping or databases	\$40,000
Travel expenses for 5 Intrinsic Team members to northeastern BC kick-off meeting	\$11,675
Travel expenses for 5 trips for the Intrinsic Pm to northeastern BC	\$11,675
Total Expenses	\$72,350

2.0 CLOSURE

The Intrinsic Team would like to take this opportunity to thank the Ministry of Health for allowing us to submit this cost proposal. Please do not hesitate to contact either of the undersigned if you have any questions about the cost proposal. If required, the Intrinsic Team would be pleased to discuss the contents of our cost proposal in an interview process at your convenience. We are also prepared to start the project immediately upon contract award.

Sincerely,

INTRINSIK ENVIRONMENTAL SCIENCES



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Vice President Western Region
Intrinsic Environmental Sciences
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TECHNICAL PROPOSAL

PHASE 2 – HUMAN HEALTH RISK ASSESSMENT OF NORTHEASTERN BRITISH COLUMBIA OIL AND GAS ACTIVITY

August 10, 2012

Prepared for: BC Ministry of Health
Purchasing Services Branch
c/o 2nd Floor 563 Superior Street
Victoria, BC V8V 1T7
Attention: Norman Helewa

Proposal for Phase 2 – Human Health Risk Assessment of Northeastern British Columbia Oil and Gas Activity

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1.0

INTRODUCTION AND SUMMARY OF KEY FEATURES OF THE PROPOSAL

Intrinsik Environmental Sciences Inc. (Intrinsik) is pleased to provide this proposal to the British Columbia (BC) Ministry of Health (MOH) to complete *Phase 2 – Human Health Risk Assessment of Northeastern British Columbia Oil and Gas Activity*. This is a complex undertaking that requires the expertise of a diverse range of professionals. To that end, Intrinsik has assembled a world class team of experts and a unique advisory panel that have worked in the oil and gas sector, both for private industry and government organizations (Table 1).

Table 1. The Intrinsik Team and Advisory Panel

Intrinsik has worked in the oil and gas industry for over 20 years. We have brought together experts in human health risk assessment, community medicine and epidemiology, air quality, water resources, emergency response and engineering, and legal support (the “Intrinsik Team”). This team of experts is supported by speciality staff in each of the disciplines. Many of the members of the Intrinsik Team have worked together on other projects to ensure the successful delivery of complex undertakings. Therefore, we will build on the previous success to ensure that the MOH project is delivered “on time and on budget”.

<u>Intrinsik Team</u>	
Intrinsik Environmental Sciences	Toxicology & Risk Assessment
McDaniel Lambert	Community Medicine & Epidemiology
RWDI Air Inc.	Air Quality
Matrix Solutions Inc.	Hydrology / Hydrogeology / Geology / Geomatics
Skystone Engineering	Emergency Response / Engineering
Borden Ladner Gervais	Legal Support
<u>Intrinsik Advisory Panel</u>	
Industry Perspective	Geoffrey Granville, B.Sc.
BC Risk Consulting Perspective	Ross Wilson, M.Sc., DABT
NGO Perspective	Judi Krzyzanowski, Ph.D.

There are a significant number of stakeholders that have expressed interest in this project. This can often lead to one or more stakeholders concerned over the experience or composition of the consulting team. To that end, Intrinsik has also brought together an expert advisory panel to the project. This panel is comprised of a balance of industry, consulting and non-government organization (NGO) experience and perspectives. The role of this panel will be to review milestone achievements of the Intrinsik Team and to provide the Project Manager and the Discipline Leads with independent advice on tackling subsequent tasks of the undertaking. It is also believed that they will be able to contribute to the knowledge and understanding of environmental data that may be available to the Intrinsik Team.

We recognize that potential or perceived conflict of interest is important to the MOH. As such, we attest that collectively the Intrinsik Team has worked for industrial clients, government clients and First Nations clients and, regardless of clientele, their work is subject to open third party and government review. The

Intrinsik Team prides ourselves in letting the science lead us to the answer and not being influenced by external factors.

Over the past decade, concern has been expressed about the health status of people living in Local Health Areas 81, 60 and 59 and a potential link to the oil and gas activity in northeastern BC. These issues have been raised by local residents, First Nations communities and the Medical Health Officer (MHO) of the Northeast Delivery of the Northern Health Authority. Recently, Phase 1 of this undertaking was completed that documented these concerns. The goal of Phase 2 is “...to assess the public health risks and where appropriate provide recommendations to address potential public health risks.” The RFP lists the following three specific project objectives:

- i) *Review the significant concerns identified by Stakeholders in Phase 1, and determine if they may be assessed using human health risk assessment methods;*
- ii) *Through the development and application of a human health risk assessment and other research and analysis, including evaluation of existing institutional mitigation requirements, identify and validate areas of concern; and*
- iii) *Improve public health outcomes through the development of key reports and deliverables and where appropriate recommendations to manage significant human health risks related to oil and gas activities.*

These are ambitious objectives, given the potential relative lack of empirical environmental data, the timeline and the sheer magnitude of the geographic area and historical oil and gas activity that has taken place over the decades. The Intrinsik Team's proposed approach will ensure the success of this project. It begins with a review of the Phase 1 report, data gap analysis and information request from the government ministries. This information will be supplemented by a systematic review of the primary literature involving living in proximity to oil and gas activity and potential health impacts and a government jurisdictional scan. All of this information will be processed in a screening level risk assessment (SLRA). The SLRA will lay out all of the issues in a conceptual model and through a risk matrix will establish which scenarios can be assessed quantitatively at this point, and those that either require additional information or alternative approaches to quantifying potential risk. The quantitative risk assessment will then explore a number of scenarios to assess if it is plausible that exposure to oil and gas activities could result in a negative influence on people's health. The final stage of the project will involve review of the existing statutes, legislation and policy frameworks in BC to determine if they are sufficient to protect health. Recommendations on monitoring, mitigation and science policy will be made to address gaps or potential health effects identified in the risk assessment.

Intrinsik believes that there are a number of factors critical to the success of this complex project, all of which the Intrinsik Team satisfies:

1. Project Manager with experience in managing multidisciplinary teams with tight timeline and budget projects.

Mr. Bart Koppe of our Calgary office has over 15 years of project management experience and has led some of Western Canada's largest risk assessment projects in the oil and gas industry. He will be supported by the project Principal, Mr. Elliot Sigal – President of Intrinsik. Mr. Sigal has managed numerous multimillion dollar projects over his 25 year career.

2. Health experts with direct experience in oil and gas industry.

Intrinsik is an internationally recognized specialty risk assessment firm in the area of oil and gas. We created and implemented some of the earliest risk assessment frameworks in Canada for dealing with environmental health issues. To strengthen our team, we have engaged Dr. Mary McDaniel from California. Dr. McDaniel is an occupational and environmental board certified physician who started her career as an in-house physician for an oil and gas company. For the past 15 years Dr. McDaniel has been working internationally in community medicine related to environmental exposures, including for government agencies. McDaniel Lambert also will provide the epidemiological support to the project. Intrinsik has worked closely with Dr. McDaniel in the past.

3. Multi-disciplinary experts in environmental exposure pathway modelling.

Intrinsik specializes in environmental fate and transport modeling in relation to HHRA. However, the success of all risk assessments is dependent on the input data and variables. Therefore, we have secured the services of Mr. David Chadder, QEP of RWDI Air Inc. for air quality modeling and Mr. James Freeman, M.Sc. of Matrix Solutions as Discipline Lead for Water Resources. Together these teams have the capability of modeling all relevant exposure pathways. Intrinsik has worked closely with both firms in the past.

4. Team members that have worked in British Columbia and are familiar with its environmental and policy guidelines.

Several of the Intrinsik Team members are currently living and practicing in BC, while the remainder of key members have conducted (or are conducting) projects in BC. Many of the team members are also familiar with northeastern BC and northwestern Alberta and the oil and gas industry. This will be critical to developing the conceptual model for the project.

5. Working with government authorities to establish appropriate health-based policy objectives.

All senior Intrinsik Team members have provided science policy advice and written environmental guidance documents for all three levels of government. However, we have also retained the services of an Environmental Law Partner and Associate at the pre-eminent law firm Borden Ladner Gervais (BLG) to assist in ensuring that the Intrinsik Team has all statutes, regulations and policy frameworks. The scientific experts have considerable experience in other jurisdictions and can draw upon this experience when providing practical recommendations for BC MOH to consider.

6. Experts that have firsthand experience in understanding the public's concerns and an ability to disseminate scientific information on a complex issue in plain language.

The Intrinsik Team specializes in knowledge translation/transfer and will be able to provide reports that are scientifically and technically correct, while ensuring a plain language summary that is readable by the public. Having worked in environmental health for over 20 years we understand the fear and concern that the public and First Nations have surrounding the oil and gas industry. However, it is critical that the science guides the outcomes and that the consulting team has the ability to relay this to the various stakeholders.

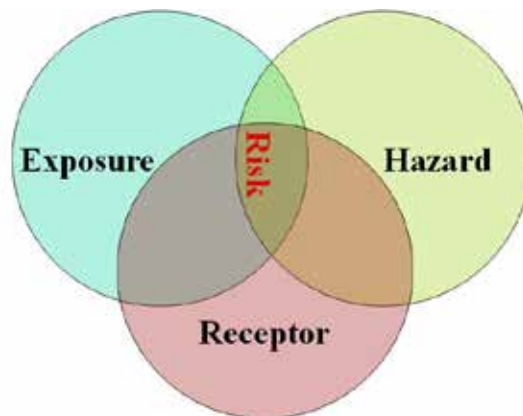
We believe the Intrinsic Team and Advisory Panel have the expertise and demonstrated track-record to provide the MOH with scientific and defensible support for evaluating potential health risks from oil and gas activities in northeastern BC.

2.0 SOLUTIONS AND APPROACH (35 POINTS)

There is no question that the protection of health and the environment are key considerations in developing a sustainable oil and gas strategy that will be acceptable to the public, municipalities, First Nations and regulatory authorities in northeastern BC. The primary concerns with oil and gas activity can be divided into those involved in routine operations and those that can occur during accidents, upset conditions or malfunctions.

In general, a risk assessment is a scientific study that evaluates the potential for the occurrence of adverse health effects from exposures of people to chemicals of concern (COCs) present in environmental media (*e.g.*, air, soil, sediment, surface water, groundwater, food, *etc.*), under existing or predicted exposure conditions. Risk assessment procedures are based on the fundamental dose-response principle of toxicology. The response of an individual to a chemical exposure increases in proportion to the chemical concentration in critical target tissues where adverse effects may occur. The concentrations of chemicals in the target tissues (the dose) are determined by the degree of exposure, which is proportional to the chemical concentrations in the environment where the person resides, works or visits.

All chemicals (both natural and man-made) have the potential to cause effects in people and the ecosystem. It is the chemical concentration, the route of exposure, and the inherent toxicity of the chemical that determines the level of effect and potential for unacceptable risk to the exposed people for health risks arising from acute and chronic exposures.



As illustrated in the diagram to the right, if all three components are present (*i.e.*, where the three circles intersect), there is the potential for risk of adverse effects. If exposure is low enough, the risks may be considered “acceptable”. Where technically and economically feasible, methods can be used to mitigate any predicted “unacceptable” risks.

It is acknowledged that the various uncertainties associated with the HHRA process have the potential to influence estimates of exposure and risk. The methods and assumptions used in predicting risk are designed to be highly cautious (*i.e.*, health protective), and have a built-in tendency to overestimate, rather than underestimate, potential health risks.

In the case of the MOH Phase 2 project, the Intrinsic Team proposes to follow the internationally recognized risk assessment frameworks used by the United States Environmental Protection Agency (USEPA), Health Canada (HC) and the BC MOE.

Although there are nuances between the regulatory approaches, they all follow similar steps:

- I. Problem formulation;
- II. Exposure assessment;
- III. Hazard assessment;
- IV. Risk characterization; and,
- V. Risk mitigation / monitoring recommendations.

However, it is important to recognize that this undertaking does not pertain to a single facility or contaminated site. Rather it envisions understanding the potential health risks from living in proximity to a diverse industrial sector over an expansive geography. To complicate matters, there are also a host of different communities (e.g., First Nation, rural and urban) that may be exposed in varying manners and degrees. Therefore, a tiered approach to risk assessment is being proposed. The first phase will be a screening level risk assessment (SLRA), to be followed by a quantitative risk assessment of a number of generic scenarios.

We believe that this combined screening level and quantitative risk assessment is the best and most appropriate approach to achieving the Phase 2 goal “...to assess the public health risks and where appropriate provide recommendations to address potential public health risks.” and its individual objectives. All facets of the RFP, including those in Section 4 e-q), Section 3.2.1 and Section 3.3.1 have been included in our proposal and proposed approach.

The Intrinsik Team has proposed a more aggressive timeline than envisioned in the RFP and a number of solutions that add value in the approach to ensure the best possible deliverable to meet the needs of the MOH. This section of our proposal outlines the planned approach, the Intrinsik Team members, the qualifications of the Project Manager, project risk management strategies and time and resource requirements of BC ministerial staff.

2.1 Proposed Solution and Approach – Tasks for Successful Completion

The project has been subdivided into discrete goal-oriented tasks that will ensure the timely and successful completion of the project. These tasks were developed to align with Section 2.2.1 Project Description of the RFP. Although details on how the Intrinsik Team envisions completing these tasks are provided, we believe that it is important that we do not presuppose in too much detail the findings of the early tasks that will guide the conduct of the subsequent tasks.

Table 2 provides the overall task list proposed by the Intrinsik Team, with details of how each task will be carried out provided below.

Table 2. Proposed Task List

Task Number	Task Description
Management	Project Management, Meetings and Limited Stakeholder Engagement
Task 1	Kick-off Meeting and Scope Review
Task 2	Review of Phase 1 Document, Gap Analysis, Information Request
Task 3	Jurisdictional Scan
Task 4	Screening Level Risk Assessment
Task 5	Human Health Risk Assessment
Task 6	Review of BC Statutory, Regulatory and Policy Frameworks
Task 7	Recommendations on Monitoring and Managing Health Concerns

2.1.1 Project Management, Meetings and Limited Stakeholder Engagement

It is important to understand from the outset that although the RFP envisioned a March 31, 2014 completion, the Intrinsik Team believes the project can be expedited and that the project can be completed by December 2013. This goal can be achieved through active project management of the process, Intrinsik Team member's assignments and excellent coordination between the project team and the MOH project director. Further details on project management, meetings and timelines are contained in subsequent sections of this proposal.

2.1.2 Task 1 - Project Kick-off Meeting and Scope Review

Upon contract award, the Intrinsik Project Manager (Bart Koppe) and appropriate Discipline Leads (Mr. David Chadder – air, Dr. Mary McDaniel – community health, Mr. David Van Vliet – water, and Mr. Ian Dowsett – emergency response and engineering) will meet with the MOH to review project timelines, tasks and budget items to ensure they meet the goals and objectives of the project. Intrinsik proposes that this meeting be held in the project area, likely in Fort St. John over a three day period (with a travel day on either side). The following is a high level proposed outline for the three day agenda:

- Day 1 Intrinsik Team and MOH (and other ministries required by the MOH) to discuss the overall goals and objectives of the Phase 2 and ensure that the details of the Intrinsik proposal meet the specific needs of the government team. In the event that changes to timelines or tasks are required they can be discussed at the meeting.
- Day 2 Intrinsik Team, MOH, representatives from stakeholder ministries (e.g., MOE, MEM, OGC, etc.), Regional Medical Health Officer, and other government agencies to discuss information requests and to ensure that all government staff are clear on the objectives of the project.
- Day 3 Intrinsik Team, MOH, ministry representatives and a broader group of key stakeholders including First Nations, NGO, local municipal representatives, industry representatives and other stakeholders meet; this is meant to serve as part of the "limited stakeholder engagement" required in the RFP and will allow individual stakeholders to understand how the Intrinsik Team

plans on executing the project. It will also serve to ensure that the Intrinsic Team has a firsthand account of local issues surrounding the oil and gas industry.

The Intrinsic Team will ensure that if not all stakeholders can attend in person that there will be access through conference call or WEBEX to ensure broad participation. Meeting action items and discussions will be captured by the Intrinsic Project Manager. No later than two weeks following the meeting Intrinsic will provide MOH with any additions or deletions to the task list, scope and budget of the project. Intrinsic recognizes that there is a fixed budget for this undertaking. To that end, any changes in scope or tasks will have to be adjusted while ensuring the overall proposed budget does not change.

2.1.3 Task 2 – Review of Phase 1 Findings, Gap Analysis and Information Request

The Phase I report documented a set of concerns about the current and potential health impacts related to environmental exposure pathways – air quality, water quality and quantity, land and food quality – that may have been impacted as a result of oil and gas resource development in the area. It also included a number of health concerns that residents and First Nations expressed as being attributable to living in proximity to oil and gas activities. The Intrinsic Team has spent considerable time reviewing the issues raised in the Phase 1 report in preparation of our proposed approach for this project. These concerns are similar to those expressed in other communities living in close proximity to oil and gas projects. The Intrinsic Team will extract the specific health and environmental exposure pathway issues from the Phase 1 report to guide the jurisdictional scan, the screening level risk assessment and ultimately attempt to address as many technically and economically feasible issues in the quantitative human health risk assessment.

At this stage it will also be important to identify the nature and extent of oil and gas activities in northeast BC. The RFP has identified oil and gas activity as including: exploration and drilling, processing, wells, pipelines and transportation. Specific oil and gas activities will be grouped and identified for the purposes of the screening level risk assessment. The Intrinsic Team includes a number of experts that are well versed in the oil and gas activities in the area, both historical and projected, and we will capture their knowledge and that of the relevant government organizations, such as MEM (Ministry of Energy and Mines) and the OGC (Oil and Gas Commission). Geographic Information System (GIS) will also be employed during this task; however, a comprehensive GIS of all oil and gas activity, residences, and watersheds will not be created for this project. Rather the intention is to provide representative mapping for scenarios to be used later in the risk assessment.

Simultaneously, the Intrinsic Team will attempt to retrieve as much publically-available information on emission sources of COCs, available environmental media data, and baseline health data for residents of Local Health Areas 81, 60 and 59. We believe that the Intrinsic Advisory Panel will also prove useful in attempting to source relevant environmental data. For example, Mr. Granville may be able to aid us in securing relevant environmental data from local industry, Mr. Wilson may be aware of BC-specific data relevant to the undertaking, while Dr. Krzyzanowski has gained extensive local knowledge of environmental data that may be available specifically for northeast BC.

Once the team has identified all relevant environmental data that we are aware of, an Information Request (IR) will be provided to the MOH Project Manager to attempt to source data that were not readily available. The Questions & Answers #3 for the RFP provided some detail on environmental data that may also be available to the Intrinsic Team. For example *“Oil and gas (O&G) related source emissions*

(quantity and quality) to air: Permittee discharge data from major point sources under the Environmental Management Act would be available to the successful contractor.” However, the Intrinsik Team believes that there will unlikely be sufficient environmental data to model all potentially relevant exposure pathways in a detailed quantitative risk assessment.

2.1.4 Task 3 – Jurisdictional Scan

In 2010, Intrinsik completed a “Systematic Literature Review of Health Outcomes Associated with Living in Proximity to Petrochemical Industries” for the Lambton Community Health Study Board, chaired by the local Medical Officer of Health. This was a very comprehensive review of the issue, which was undertaken with a significant budget.

Given the timeline and budget considerations, the fundamentals of the approach used for the aforementioned review will be applied to this task of the Phase 2 project (Figure 1). The same information specialist/medical librarian will design a systematic search approach according to the Cochrane Guidelines for conducting systematic reviews for retrieval of the peer-reviewed literature. The rapid review will be modelled after the Cochrane Handbook for Systematic Reviews of Interventions (Cochrane Collaboration, 2008). Cochrane reviews adhere to the principle that “science is cumulative” and by considering the available evidence, decisions can be made that reflect the best science available.

Rapid screening of the bibliographic database results will be undertaken to identify pertinent health outcome literature. The Intrinsik Team will concurrently retrieve relevant jurisdiction reports on health concerns in living in proximity to oil and gas activities.

There has been a considerable amount of effort and funds spent in Alberta on this topic. In addition, there are a number of case reports and regulatory documents completed by the USEPA on topics such as hydraulic fracturing for extraction of unconventional shale gas. This review will also include

documents prepared by the local Northern BC Medical Health Officers (MHOs), such as “Population Health and Oil and Gas Activities: A Preliminary Assessment of the Situation in North Eastern BC, A Report from the Medical Health Officer to the Board of Northern Health” and Power Point presentations such as “Northern Health Board: Health Concerns – Oil & Gas Industry in Northern BC”.

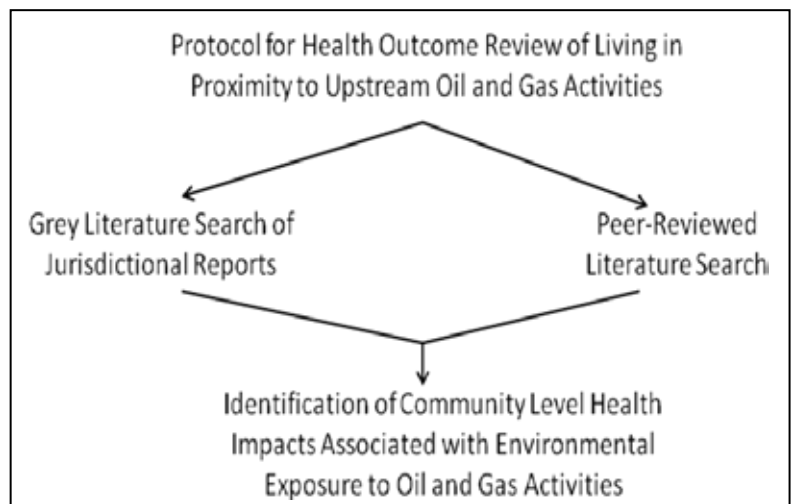


Figure 1. Jurisdictional Scan Approach

Together the results of this review will focus the risk assessment on those issues that have been identified of greatest potential concern for public health from exposure to relevant oil and gas activities. The reports and peer-reviewed scientific literature will be reviewed by the Intrinsik toxicologists and risk assessors and the McDaniel Lambert physician and epidemiologist. A brief report summarizing the

findings of the review will be prepared for review by the Intrinsic Advisory Panel and the MOH staff. Ultimately, the findings of this review will help to identify relevant COCs from upstream oil and gas activity and potential health outcomes that need to be taken into consideration in the SLRA and the HHRA.

2.1.5 Task 4 – Screening Level Risk Assessment

This is a critical task to the Phase 2 project undertaking. It is at this point that all of the information gathered in Tasks 2 and 3 will be combined to provide a conceptual model of issues surrounding oil and gas activity in northeastern BC. Risk assessment follows the fundamental paradigm of:



At this point the oil and gas activities – historical, current and reasonably predicted to occur in the future – will have been characterized. The chemical emissions to air, water and land will have been identified and human receptors and surrounding land use patterns in the area will have to be categorized (e.g., subsistence First Nations, rural, urban, and those who hunt and fish). In addition, exposure pathways and chemicals that may lead to potential adverse health outcomes will have been identified in Task 3. The Intrinsic Team proposes to develop a screening level risk matrix for the combination of these events. Although this risk matrix will be developed on the basis of previously published frameworks, a framework specific to this undertaking will be established.

Prior to screening the various oil and gas activities for relative ranking, qualitative definitions of likelihood and magnitude of risk outcome will be established. It is then envisioned that a matrix scoring will be employed, whereby each of the oil and gas activities and their related emissions to the environment will be assessed for exposure to each of the identified receptor categories.

It is also important to recognize that this evaluation is dependent on routine exploration, operations and decommissioning activities and could be dramatically different under accident, malfunction or upset conditions. Therefore, the SLRA matrix will evaluate both routine and accidental conditions. The following two examples are provided for illustrative purposes only for the proposal, and may not reflect actual scenarios, or the findings of the project:

Example 1:

If a natural gas pipeline is properly constructed and maintained, it is possible that there will be fugitive emissions of COCs from seals, flanges and compressor stations that could be emitted into the environment. However, if an accident were to occur that resulted in a rupture of the pipeline and subsequent fire/explosion then the magnitude and frequency of exposure of people living in proximity to the pipeline would be markedly different than under routine operations. Therefore, each of these scenarios should be evaluated differently.

Example 2:

If an unconventional natural gas well (shale gas) is properly drilled, constructed and operated it is possible that there may be little, if any, potential contamination of shallow potable groundwater aquifers from the use of hydraulic fracturing fluids. However, if improper installation of the well were to occur or an accidental release of hydraulic fracturing fluids were to occur it may

significantly impact the potable groundwater system being used by local residents. Therefore, each of these scenarios should be evaluated differently.

The screening level risk matrices will ultimately provide a potential magnitude of potential health risk to receptor categories on the basis of activity. However, there are two other considerations that need to be accounted for at this stage – significance of the risk and availability of environmental data to complete a quantitative risk assessment.

Hence, each scenario will undergo a significance ranking. The Intrinsic Team envisions employing significance scoring criteria often used in Environmental Assessments undertaken for applications for the BC Environmental Assessment Office (EAO) and the Canadian Environmental Assessment Agency (CEAA). Events and risks are often categorized as significant or insignificant on the basis of: magnitude, frequency, duration, reversibility, and geographic area potentially impacted. Therefore, each activity scored in the screening level risk matrix will also be assigned a significance score.

Finally, an assessment of the availability of environmental data to conduct a quantitative human health risk assessment for each oil and gas activity will be made. It is possible that an activity that receives a “high” risk and “significant” score may not have sufficient environmental data to be assessed quantitatively under Phase 2. In this case, we will have arrived at a qualitative assessment of potential risk to those people living in proximity to a particular oil and gas activity in northeast BC. Further recommendations for need to collect environmental data and recommendations for monitoring of human health will be provided in Task 7 for these activities.

The results of this comprehensive SLRA will form the basis on which scenarios will be evaluated quantitatively under Task 5. The SLRA report will be provided to the Intrinsic Advisory Panel for review and discussion, as well as the MOH and other government stakeholder ministries. At this stage it is envisioned that a second Key Stakeholder Engagement be conducted with the Intrinsic Project Manager and MOH representative to ensure buy-in, or understanding of concerns, of the stakeholders prior to undertaking the quantitative HHRA. This meeting will be held in the study area, with participation by conference call or WEBEX for those who cannot attend in person.

2.1.6 Task 5 – Human Health Risk Assessment

A detailed HHRA report will be prepared based on the findings and inputs from aforementioned tasks. It will follow the standard risk assessment paradigm of problem formulation, exposure assessment, hazard assessment and risk characterization. At this stage in the proposal preparation, it is very difficult and likely premature to detail the exact approach to be undertaken to understand what potential health risks exist for residents and First Nations in northeast BC living in proximity to oil and gas activities. Instead a framework and proposed approach is provided which will be honed in consultation with the Intrinsic Advisory Panel, MOH and other government representatives, and key stakeholders upon completion of Task 4.

It would be impossible to conduct an absolutely comprehensive quantitative risk assessment of all oil and gas activities, their chemical emissions and resulting risks to people living in such a large geographic area given the budgetary and time constraints. That is not to say that the Intrinsic Team believes that such an undertaking is without merit. In fact, we believe there are a number of generic oil and gas activity scenarios that exist that could be modelled to provide an estimation of potential risk surrounding their

operation. This is an approach that has been adopted previously across Canada for a number of industries (e.g., waste-to-energy facilities and natural gas-fired plants) in an attempt to identify those areas that require individual facility assessment or development of comprehensive monitoring or mitigation programs to ensure the ongoing protection of individuals' health. In addition, it is critical to remember that very valuable qualitative information on activities that could pose an adverse health threat will be identified in Task 4.

Based on the budget and our understanding of the scope and objectives, the Intrinisk Team envisions quantitative evaluation of one large/complex emission source, one medium and two small/simple oil and gas activities. For the purpose of the budget these have largely been envisioned to involve air releases of contaminants in the environment, ground-level air concentrations being predicted, potential deposition in soil, and uptake into edible vegetation and wild game/livestock, where appropriate. Human receptor scenarios likely involving urban, rural and First Nations land use activity patterns would be assessed. Quantification of potential health risk using readily-available chemical-specific toxicology data from recognized regulatory agencies will be completed. It is also possible that if there is enough existing regional airshed data that a quantitative baseline inhalation assessment may be undertaken.

In the event that air quality scenarios are selected for quantitative risk assessment then the RWDI team will develop generic stack and emission and fugitive emissions parameters for each scenario and conduct dispersion modelling for a representative set of COCs defined during the problem formulation. General facility design will be based either on information provided by the OGC or CAPP or on the Intrinisk Team's previous experience. Emission estimates will be based on generally-accepted methodologies, such as the US Environmental Protection Agency's AP-42 compilation of emission factors. Dispersion modelling will be conducted in accordance with the BC Ministry of Environment's *Guideline for Air Quality Dispersion Modelling in BC* and using the CALPUFF dispersion model in ISC mode. Meteorological data representative of the region will be used for dispersion modelling. For example, in Area 81 data from Fort Nelson would likely be used whereas in Areas 59 and 60 meteorological data from the Fort St. John area would likely be used. Either flat or rolling terrain will be assumed depending on the selected area for the quantitative assessment. Maximum ground-level concentrations of the COCs will be predicted for both short- and long-term averaging periods.

In the event that Task 4 identifies a water resource pathway that is potentially "high risk and significant" and sufficient environmental data for modelling exists, the water resources team at Matrix Solutions will provide input data to the HHRA team. For example, hydraulic fracturing (fracking) associated with the development of shale gas deposits is a concern relating to water quality and human health in northeast BC. When hydraulic fracturing operations are carried out properly, it is unlikely that contaminants will reach overlying freshwater aquifers. However, there are potential scenarios where fracking could result in chemical release to the environment; including:

- Leakage from the hydraulic fracturing well casing due to defective installation or cementing;
- Leakage through the geology overlying the hydrocarbon reservoir;
- Leakage from improper handling of chemicals used in the process and from hydraulic fracturing wastewaters (i.e., flow back or produced water from the formation) brought back to the surface at the well site; or
- A well blowout resulting in underground leakage into aquifers or surface recharge via spillage.

In the event that such a scenario is identified for quantitative assessment, the hydrogeologists at Matrix will provide quantitative modelled groundwater concentrations of COCs from fracking activities in a generic hydrogeological setting in northeast BC. This information will then be incorporated into the HHRA to determine the potential risk to surrounding residents.

The results of Task 4 and Task 5 will serve to inform the basis for critical evaluation of the BC statutory, regulatory and policy frameworks (Task 6) and to provide recommendations of any additional appropriate monitoring networks that may need to be established to manage health concerns and outcomes in northeastern BC.

2.1.7 Task 6 – Review of BC Statutory, Regulatory and Policy Frameworks

Upon completion of the HHRA, Phase 2 of the MOH project requires a review of existing BC statutory, regulatory and policy frameworks that ensure the protection of the health of the population living in proximity to oil and gas activities. Although the Intrinsic Team's scientific experts are well versed in the individual frameworks that govern their environmental practices in BC, we have engaged the expertise and support of the environmental legal team from Borden Ladner Gervais (BLG), LLP of Vancouver. The BLG lawyers will be responsible to the Intrinsic Project Manager for retrieving and providing applicable statutes, legislation and policy frameworks to the oil and gas activities in northeastern BC. BLG will only be providing the applicable legislation and it is very important to note that they will not be providing interpretation, clarification or suitability of the existing BC legislation to protect human health. All interpretation or identification of potential science-policy improvements will be made by the Intrinsic Team's scientific leads.

As per the RFP, this task will use the results of the aforementioned tasks to:

- *identify where current statutes, regulations and policies are sufficient or exceed the necessary level for managing human health risk;*
- *identify gaps where statutes, regulations and policies do not currently exist for managing human health risk; and.*
- *identify where current statutes, regulations and policies may benefit from a change to enable improved management of human health risks with respect to oil and gas activities.*

This task requires seasoned environmental professionals that are experts in their fields and have previously contributed to developing science policy for provincial and federal government departments. Intrinsic has specialized in conducting science policy reviews and providing recommendations to protect people from environmental chemical exposure. It is this experience that will be brought to bear in completing Task 6. These recommendations will be in the form of science policy and would not be a line-by-line edit or rewrite of current legislation or policy. Development of such legislative language would need to be undertaken by ministry legal staff or other such legal counsel and departmental representatives.

2.1.8 Task 7 - Recommendations on Monitoring and Managing Health Concerns

The final report to be prepared by the Intrinsic Team under Phase 2 of this project will provide recommendations on spatial monitoring programs that could improve efforts to monitor and manage health risks to the people of northeastern BC. Again without presupposing the outcomes of the various tasks to be completed in Phase 2, it is envisioned that there may be recommendations surrounding air

quality, water resource and even human health monitoring that could be adopted to ensure the ongoing protection of the health of residents in Local Health Areas 59, 60 and 81. The following are preliminary thoughts or examples that may be applicable:

Air Quality

Ambient air quality in northeastern BC and a perceived lack of comprehensive monitoring programs was a concern expressed during Phase 1 of the Project. Furthermore, the Phase 1 survey respondents had a number of suggestions on the topic of air monitoring, including having a sentinel air monitoring system for the entire region; installing air quality monitoring stations in communities and near residents; and making public the results from the monitoring stations. With these concerns and suggestions in mind, a high-level review will be conducted of current ambient air quality monitoring in BC Local Health Areas 59, 60 and 81 conducted by government and industry. Gaps in terms of the contaminants being monitored, the monitoring locations, and the availability of the data to the public will be identified. Based on this gap analysis, specific recommendations will be provided for improving the ambient monitoring in the region as well as the dissemination of the data collected. The context for these recommendations will be the evolving national strategy for managing air quality that is tending towards an airshed-based system.

Water Resources

The Intrinsic Team will provide recommendations to the province relating to the implementation of monitoring programs that could be employed to better safeguard human health surrounding oil and gas activities. These recommendations may relate to water quantity and quality data collected by the provincial or federal government and to recommendations that would be forwarded to the oil and gas industry as part of its environmental management and compliance obligations.

The monitoring recommendations may relate to either drinking water monitoring or environmental monitoring (source water) and will consider all existing monitoring frameworks that are in place or recognized by government or industry.

Source water monitoring programs offer the benefit of detecting environmental contaminants before they become a human health risk. With respect to environmental, or source water monitoring, there is no comprehensive data collection or monitoring program in the province for environmental water quality. The province operates the BC Environmental Monitoring System (EMS). This system is the province's primary environmental data repository, but because the system data come from either the BC Ministry of Environment or permittee samples related to licensed discharges, monitoring parameters and frequency vary from site to site. The system is designed to capture data covering physical, chemical, and biological analyses performed on water, air, solid waste discharges, and ambient monitoring sites throughout the province. The data in the EMS collection is not publicly accessible except by request, and a fee is charged. It is envisioned that practical recommendations to improving the system could be provided.

Health Outcome Measures

There are a number of health measure surveys that are in place around the world that seek to monitor local residents' health in relation to exposure to industrial activities. These programs can

go as far as including biomonitoring regimes wherein biological tissues are collected and analyzed for chemical constituents, markers of enzymatic induction and DNA damage (referred to as biomarkers). Such programs are costly to set-up and may be of little practical use in the identification of a causal link between industry and community health. That being said, through the jurisdictional review and findings of the risk assessment, the health team could propose specific health monitoring programs in northeastern BC to elucidate whether oil and gas activities are impacting individual or community health.

This final task may provide additional recommendations or protocols to be employed to assess the potential for future human health impacts in northeastern BC as a result of historical, continued or future oil and gas activities.

2.2 Project Manager, Contract Manager and Primary Point of Contact

The Intrinsic Team will be led by Bart Koppe, Vice President of Western Canada and senior scientist at Intrinsic Environmental Sciences. Mr. Koppe has over 15 years of experience in environmental risk assessment in Western Canada. Based on his proven track record of staff, project and office management, Mr. Koppe was promoted to Vice President at Intrinsic in 2011. We have proposed Mr. Koppe as Project Manager for this large undertaking, as it requires an individual with the right balance of oil and gas experience and management of multidisciplinary teams. Mr. Koppe has had the opportunity to work on environmental projects with all of the individual company Discipline Leads over the past couple of years.

Mr. Koppe will liaise with the BC MOH officials throughout the project and especially the MOH project manager. He is considered an authority in environmental health issues related to both conventional and non-conventional oil and gas sectors. He has led risk assessments and provided risk communication support for oil sands mining projects, in situ projects, upgraders, refineries and power plants (coal and natural gas).

Mr. Koppe has been involved in assessing environmental risks in Canada's western provinces and northern territories for the last 15 years, with a considerable amount of that time spent on large oil sands applications.

With his experience in risk assessment and environmental toxicology, Mr. Koppe regularly presents at technical conferences and workshops. He has developed risk assessment frameworks for specific industry and government initiatives and sat on expert panels for numerous provincial and federal applications (e.g., ERCB, NRCB and CEAA). Mr. Koppe has been retained by government agencies, industrial clients and First Nations to assist them in issues related to health and environmental risks. Given his extensive experience in managing large, complex oil and gas projects Mr. Koppe is an ideal candidate to manage Phase 2 of this undertaking.

In addition, Mr. Elliot Sigal, the President of Intrinsic Inc., will fulfill the role of Project Principal. In this role Mr. Sigal will provide project risk management support to the Intrinsic Team, Mr. Koppe and the government. Mr. Sigal has been working in environmental health consulting for over 25 years. He has extensive experience in managing small and large environmental health multi-disciplinary contracts, both for industry and government organizations. We believe that the appointment of Mr. Sigal to this role demonstrates Intrinsic's commitment to the successful completion of this project. In the unforeseen event

that the MOH representative is experiencing difficulties with the Intrinsik Team and its Project Manager, they will have direct access to Mr. Sigal to resolve issues.

2.3 The Intrinsik Team

The Intrinsik Team is comprised of Canadian experts in their respective disciplines. Each of the Scientific/Engineering Discipline Leads has over 15 years of experience in their respective fields and is supported by numerous qualified personnel. Table 3 provides the Intrinsik Team individuals, their role in the project and the number of years of experience in the field.

Table 3. Project Team, Role(s) and Responsibilities

Team Member	Role	Company	Years of Experience
Project Management / Oversight			
Bart Koppe, P.Biol.	Project Manager	Intrinsik	15
Elliot Sigal, QP _{RA}	Project Principal	Intrinsik	25
Human Health Risk Assessment and Toxicology			
Dr. Donald Davies, Ph.D., DABT	Discipline Lead HHRA, Toxicology	Intrinsik	30
Dr. Christopher Olsson, Ph.D.	Risk Assessor, Toxicology	Intrinsik	15
Karl Bresee, B.Sc., P.Biol.	Risk Assessment Modeller	Intrinsik	15
Karen Phillipps, M.Sc., DABT	Risk Assessor, Toxicology	Intrinsik	10
Kimberley McCarthy, MPH	Risk Assessor	Intrinsik	1
Community Medicine / Epidemiology			
Dr. Mary McDaniel, DO, JD, MPH	Discipline Lead – Medicine	McDaniel Lambert	25
Katie Butler, MPH	Epidemiology	McDaniel Lambert	6
Air Quality			
David Chadder, Hon.B.Sc., QEP	Discipline Lead – Air Quality	RWDI	34
Jeff Lundgren, M.Sc.	Senior Specialist	RWDI	12
Andres Soux, M.Sc.	Senior Scientist	RWDI	10
Nancy Chan, B.A.Sc., E.I.T.	Senior Engineer	RWDI	5
Water Resources / Geology / Geomatics			
James T. Freeman, M.Sc.	Discipline Lead, Water Resources, Geology, Geomatics	Matrix	25
David J. Van Vliet, M.A.Sc., P.Eng.	Water Resources Engineer	Matrix	20
Steve Shikaze, M.Sc., P.Eng.	Water Resources Modeller	Matrix	20
Engineering / Emergency Response			
Ian Dowsett	Discipline Lead – Engineering	Skystone Engineering	45
Legal			
Deborah Overholt	Discipline Lead – Legal	Borden Ladner Gervais	12
Brad Woods	Legal Associate	Borden Ladner Gervais	3
Intrinsik Advisory Panel			
Geoffrey Granville, B.Sc.	Industry Perspective	GCGranville Consulting	40
Ross Wilson, M.Sc., DABT	Consulting British Columbia	Wilson Scientific	21
Dr. Judi Krzyzanowski, Ph.D.	NGO Perspective	Krzyzanowski Consulting	7

2.4 Project Risk Management Strategy

Any multi-year government contract has a number of inherent potential risks to the project. This project in particular has received significant media interest, has the involvement of numerous stakeholders and high public expectations in northeastern BC on project outcomes. Having a strong Project Manager (Bart Koppe) with considerable experience managing large multi-disciplinary risk assessment projects is critical to ensuring early detection of potential project risks, identifying solutions and managing them effectively with the MOH. In addition, each of the Discipline Leads has considerable experience working on large, multi-disciplinary projects and will ensure that each of their teams identifies any project risks early.

As detailed in the Project Communications Plan (Section 3.2), there will be bi-weekly progress reports. Potential upcoming risks to the project will be detailed in these reports. In addition, the Project Manager will keep a project issue/risk tracking sheet to ensure that all potential risks are identified, one or more solutions are proposed, an issues manager assigned, and the issue tracked closely to ensure that it is resolved and/or does not unduly affect schedule or budget.

The following highlight a number of project risk issues that are of concern to the Intrinsic Team and a proposed approach to ensuring they will not impact the project scope, schedule or budget.

Issue: Perhaps the single largest risk to the management of this project is “scope creep”. This issue could arise given the number of experts involved, a timeline that spans over one year and the number of directions the project could take throughout its duration.

It is important to ensure that there is excellent communication between the Intrinsic Team's Project Manager and the MOH project lead. A number of checks and balances have been worked into the schedule, such that at major milestones, government review and clear direction for subsequent stages will be required.

Issue: There are multiple stakeholders that may have vastly different expectations to the level of effort, direction and objectives to be satisfied under Phase 2.

The primary management tool for expectations will be regular meetings of the stakeholders at major project milestones. At such meetings the findings of the Intrinsic Advisory Panel will be presented along with recommendations for proceeding provided by the Intrinsic Project Manager. Through these discussions it is anticipated that much of the competing interests can be managed. However, it will also be important that the MOH project lead is willing to support the Intrinsic Team and manage overall stakeholder expectations. Although there is a significant budget for this undertaking, it is highly unlikely that all stakeholders will be satisfied with the level of effort, deliverables or reports and will like to see more done than is technically or economically feasible under this project. Therefore, clear work scopes, timelines and undertakings provided by the Intrinsic Team will aid in managing these expectations.

Issue: There will likely be multiple BC ministry staff involved in reviewing key deliverables. Often timelines are compromised during this process and consulting teams may receive multiple comments, which at times could be contradictory. This could result in undue delays to the project schedule.

The Intrinsik Project Manager will ensure that the MOH is aware of upcoming project deliverables and review requirements at least one month in advance. We would request that the MOH Project Manager act as a single point of contact for all government comments on deliverables and provide a clear, single set of review comments to the Intrinsik Team. This will ensure that both schedule and budget are maintained throughout the duration of the project.

Issue: Through project discussions with the MOH, milestone review and stakeholder engagement, it becomes clear that the MOH would like the Intrinsik Team to alter approach or take a different tack than that envisioned at the proposal, which could have significant implications on timeline and budget.

The Intrinsik Team Project Manager will closely monitor budget and timelines throughout the project. In the event that changes to the scope of work are contemplated, a written authorization to change the scope of work will be provided to the MOH. However, we recognized that there is a firm fixed cost budget to undertake Phase 2 of this project. Therefore, any alteration to scope will require an approved change in level of effort expended in one task or group, rather than change to the budget. This will all be approved in writing prior to any alteration. This will ensure that the consulting team will fulfill the mandate of Phase 2, as approved by the MOH.

These are but a sample of potential project management risks that may arise in such a complex undertaking. Ultimately, these risks will be identified, tracked and communicated by the Intrinsik Team's Project Manager to ensure that they do not jeopardize delivery of the project.

2.5 BC Government Resource Requirements

One of the keys to the successful delivery of this project will be the commitment of BC government staff throughout the process. It is difficult to estimate the exact amount of time that will be required from government officials over the duration of the project. It is anticipated that at project initiation, ministerial staff from the MOH, Ministry of the Environment (MOE), Ministry of Energy and Mines (MEM), and the Oil and Gas Commission (OGC) will participate in the kick-off meeting and be able to provide the Intrinsik Team with baseline or background information important to the success of the project.

During the project initiation meeting, clear lines of communication with MOH, MOE and other departmental staff will be established. It is anticipated that this project will require significant involvement from at least one full-time equivalent (FTE) from MOH, while it would be beneficial if each of the other ministries were to appoint a "point person" to deal with this project over its timeframe.

During Task 2, the Intrinsik Team's Project Manager will provide the MOH with an Information Request (IR) for existing environmental, emissions and health data. It is anticipated that the MOH lead will be able to coordinate our information request and work with each of the other ministries. This first task will be critical to the overall success of the human health risk assessment, as the quantitative assessment of risk to health of residents in northeastern BC needs a strong foundation in existing and modeled data.

3.0 WORK AND COMMUNICATIONS PLANS (10 POINTS)

3.1 Detailed Work Plan

Table 4 provides the tasks required to complete Phase 2 and details the estimated hours that will be spent by individual Intrinsik Team members. All tasks will be overseen by the Intrinsik Team Project Manager (Bart Koppe), with assistance from the Project Principal (Elliot Sigal). Each of the Discipline Leads will be responsible for the timely delivery of their speciality team's input and deliverables to the overall task completion. A comprehensive work plan and explanation of task requirements are provided in Section 2.1 of this proposal.

Almost 5,000 person hours will be expended over the course of this project. This is the equivalent to 2.6 person years of effort. In addition, funds have been allocated in the budget for the completion of geographic information system (GIS) / geomatics that may involve approximately 250 person hours or purchase of existing databases and mapping to support the risk assessment. This support will either be provided by Matrix Solutions or Skystone Engineering, or some combination thereof.

Table 5 provides a project schedule, major milestones and reporting (interim and final) dates. The RFP envisions a completion date of March 31, 2014. However, the Intrinsik Team believes that a more aggressive schedule of completion no later than December 15, 2013 is achievable. This schedule hinges on timely transfer or disclosure of readily-available baseline/background information being provided to the Intrinsik Team. The primary advantage of the shortened timeline is that it will help to avoid issues surrounding "scope creep".

It is anticipated that the tasks, scope, milestones, reporting requirements and timeline will all be reviewed with MOH at the project kick-off meeting. The Intrinsik Team reserves the right to extend the schedule for a completion date absolutely no later than March 31, 2014 in the event that the scope of work is altered from that envisioned in this proposal, if timely transfer of existing background/baseline data does not occur, or if events beyond the project team's control arise.

Table 4. Project Hours by Personnel

Task Number	Task Description	Intrinsic						RWDI					Matrix			Skystone	McDaniel Lambert		BLG LLP		Panel		
		Elliot Sigal	Bart Koppe	Dr. Don Davies	Karl Bresee	Karen Phillips	Kimberly McCarthy	David Chadder	Jeff Lundren	Andres Soux	Nancy Chan	Junior Engineer	James Freeman	David J. Van Vliet	Steve Shikaze	Ian Dowsett	Dr. Mary McDaniel	Katie Butler	Deborah Overholt	Brad Woods	Ross Wilson	Geoff Granville	Judi Krzyzanowski
Management	Project Management, Meetings and Limited Stakeholder Engagement (Total Hours)		443			125																	
	Biweekly Report		25			25																	
	Biweekly Conference Call		30																				
	5 face-to-face Project Update Meetings and stakeholder meetings		288																				
	Project Management		100			100																	
Task 1	Kick-off meeting and Scope Review	4	40	4		4		40						40		40	40		4		4	4	4
Task 2	Review of Phase 1 document, Gap analysis, Information request	20	40	16		60	110	8	6	2	12		4	16	20	16	8				18	10	20
Task 3	Jurisdictional Scan	20	40	20		60	100						5	10	20		16	60					
Task 4	Screening Level Risk Assessment	20	80	30	40	140	100	20	32	16	50	140	8	40	120	20	16				20	20	32
Task 5	Human Health Risk Assessment (Quantitative / Qualitative)	20	100	40	100	280	300	20	32	24	162	350	8	30	30	20	16	0			40	40	40
Task 6	Review of BC Statutory, Regulatory and Policy Frameworks	20	40	40		40		20	20				4	8	18	20			20	40	40	40	50
Task 7	Recommendations on Monitoring and Managing Health Concerns	20	80	40		20	32	38	20	16			8	30	20	40	16				20	10	20
Total Hours		124	863	190	140	729	642	146	110	58	224	490	37	174	228	156	112	60	24	40	142	124	166

Table 5. Project Schedule, Major Milestones and Reporting

Task Number	Task Description	Timeline		Reporting	
		Start	End	Interim Report	Final Report
Management	Project Management, Meetings and Limited Stakeholder Engagement (Total Hours)	October 2012	December 2013		
Task 1	Kick-off meeting and Scope Review	October 2012	October 2012		
Task 2	Review of Phase 1 document, Gap analysis, Information request	October 2012	November 2012		
Task 3	Jurisdictional Scan	November 2012	December 2012	January 15, 2013	February 15, 2013
Task 4	Screening Level Risk Assessment	January 2013	March 2013	April 1, 2013	April 30, 2013
Task 5	Human Health Risk Assessment (Quantitative / Qualitative)	April 2013	June 2013	July 1, 2013	August 15, 2013
Task 6	Review of BC Statutory, Regulatory and Policy Frameworks	July 2013	July 2013	August 15, 2013	September 15, 2013
Task 7	Recommendations on Monitoring and Managing Health Concerns	September 2013	October 2013	October 30, 2013	December 15, 2013

3.2 Project Communications Plan

The success of this project will rely on a well developed and executed communications plan. This Phase of the project will extend beyond a one year timeframe. Therefore, it is important that the Intrinsic Team Project Manager maintains active communication with the MOH lead throughout the undertaking.

The RFP provides the following:

For costing purposes only, the Ministry estimates that travel to the northeastern part of the province may involve, on average, one trip per month for 5 business days (for one person) for an estimated total of 18 trips. Proponents may adjust the timing, frequency and number of persons per trip, to best suit their proposed solution and approach.

And requests that

Limited engagement of key stakeholders to validate the phase 2 approach and process (should be defined in the communication plan with details of activities identified in the workplan). A report summarizing the extent and nature of the engagement is required.

The Intrinsic Team has modified the travel estimate to best suit the needs of our proposed approach and to allow for more time to be spent on proposed tasks. The project kick-off meeting will be attended by the Project Manager and four Discipline Leads in northeastern BC. Therefore, this constitutes 5 business days for 5 individuals. As detailed in Section 2.1.2, this will be the first opportunity to engage key stakeholders to validate the Phase 2 approach and process being proposed by the Intrinsic Team.

As detailed in Table 6 an additional five trips will be made to northeastern BC in the study area by the Intrinsic Team Project Manager. Each of these meetings is scheduled to be conducted at the completion of Tasks 3 through 7. During each of these meetings the Project Manager will review the findings of the completed task and seek input in conducting the subsequent task of the project. During each of these visits it is envisioned that key stakeholder input will be sought and documented. For those key stakeholders that cannot attend in-person a conference call number or WEBEX will be provided.

Budget has been allocated to the Project Manager at each task milestone to prepare a brief report summarizing the extent and nature of these engagements. These reports will be rolled up into a final key stakeholder report that will be included as an appendix to the final report. Therefore, a total of 10 person trips have been deemed adequate to ensuring the successful completion of the project.

A key component of the project communications plan involves the Project Manager providing written bi-weekly updates and participating in conference calls with the MOH. A standard bi-weekly update template will be developed in cooperation with the MOH to ensure that pertinent details on progress are provided.

The Intrinsic Team Project Manager (Mr. Koppe) will be responsible for internal project team communications and updates and communications to MOH. Early in the project, the Project Manager will establish an external communications protocol with MOH representatives. We believe that it is important that key stakeholders are engaged first through the MOH, prior to dealing individually with the Intrinsic Team. However, it is likely that we will need direct access to a number of BC ministry officials to obtain baseline environmental data. The formal Information Request will be provided to the MOH for distribution

to relevant ministerial colleagues. Points of contact within each organization will be identified to ensure timely dissemination of information.

Given the high public profile of this project it is anticipated that there may be several media inquiries. In the event that the MOH would like the Intrinsic Team to conduct media interviews they will be handled by Mr. Koppe or Mr. Sigal, both of whom have the requisite training and experience to do so on behalf of clients. Alternatively, if the MOH would like to handle all media inquiries, the Intrinsic Team will pass all media requests to the appropriate MOH representative.

Finally, all members of the Intrinsic Team understand the need to maintain confidentiality of the details of the project throughout its duration. At no point will any individual team member disclose any conversations, discussions, draft reports, process or protocols to a third-party without consent from the Project Manager and the MOH.

The project work plan and communications plan will be updated monthly throughout the project by the Project Manager. These updates will form part of the bi-weekly summaries to be provided to MOH throughout the project.

Table 6. Project Communications Plan

Task Number	Task Description	Communications Meetings	Date
Management	Project Management, Meetings and Limited Stakeholder Engagement (Total Hours)	Bi-weekly Teleconference	
Task 1	Kick-off meeting and Scope Review	Discipline Leads Meeting in NE BC	Late October 2012
Task 2	Review of Phase 1 document, Gap analysis, Information request	Bi-weekly Teleconference	
Task 3	Jurisdictional Scan	Project Manager Meeting in NE BC	January 21, 2012
Task 4	Screening Level Risk Assessment	Project Manager Meeting in NE BC	April 8, 2013
Task 5	Human Health Risk Assessment (Quantitative / Qualitative)	Project Manager Meeting in NE BC	July 8, 2013
Task 6	Review of BC Statutory, Regulatory and Policy Frameworks	Project Manager Meeting in NE BC	August 19, 2013
Task 7	Recommendations on Monitoring and Managing Health Concerns	Project Manager Meeting in NE BC	November 15, 2013

4.0 QUALIFICATIONS AND EXPERIENCE (35 POINTS)

As detailed previously within this proposal Intrinsik has assembled an expert roster of companies and individuals that have the collective experience to deliver the highest quality project for the MOH. This section provides corporate profiles for each company, individual team member cameos highlighting their expertise and experience and concludes with a number of client references that detail the diverse range of service offerings that collectively will contribute to the team's performance on this undertaking.

All of the Scientific/Engineering Discipline Leads have at least 15 years of professional experience, with many having over 25 years of experience in tackling complex environmental health problems. Expanded details for each individual are provided in their full curriculum vitae provided in Appendix A. In an attempt to keep the length of this proposal reasonable the Intrinsik Team has listed only one back-up individual for the key position of Discipline Lead – Human Health Risk Assessment. However, all participating companies have the depth of personnel to replace individual Discipline Leads or supporting staff if an unforeseen event arises. None of the proposed project personnel will be replaced on the project without prior written consent from MOH.

4.1 Corporate Profiles of Intrinsik Team

4.1.1 *Intrinsik Environmental Sciences*

Intrinsik Environmental Sciences Inc. (Intrinsik – formerly Cantox) is Canada's premier employee-owned environmental health sciences firm with a track record reaching back over 26 years in assisting our clients achieve their goals. Toxicology, risk assessment and stakeholder engagement are Intrinsik's strengths. The company is recognized across Canada, and internationally, as being a leader in providing expert scientific opinions regarding the health and environmental impacts of industrial activities, as well as advice and guidance regarding the mitigation of chemical hazards and the management of environmental risks. Intrinsik has been working in the oil and gas industry for over 20 years. Over that time we have been involved in the most controversial of these projects and pioneered the Canadian risk assessment methodology under which to evaluate the potential human and ecological health impact from oil and gas activities.



Our work in this field has involved the use of computer programming and modelling to provide estimates of the total exposure of specific human and wildlife receptors to chemicals in various environmental media through all potential environmental exposure routes (e.g., air, surface and ground water, sediments, surface and subsurface soils, dusts, plants, and agricultural/aquatic food chains). Intrinsik's scientific staff is extremely knowledgeable of federal and provincial air, water, sediment and soil quality guidelines, objectives and criteria, and the procedures employed by various Canadian, American and European government agencies to develop these targets. At Intrinsik our vision is for a world of healthy people and ecosystems. We aid our clients in achieving this shared vision through applying the best available science for our partners so that they can make informed choices to protect health, safety and environmental quality.

Our experience involves working for oil and gas and other industries or government agencies. However, we also have experience in working directly for, or engaging with, First Nations communities to ensure that they are an integral part of the risk assessment process. Our team of scientists continues to provide services that effectively address issues related to air, water, land, and biota including:

Human health risk assessment

Toxicology

Exposure modelling

Biomonitoring

Public consultation and risk communication

Development of “responsible products programs” (e.g., fracturing fluids)

Ecological risk assessment (including livestock health assessments)

Community health assessment

Expert testimony

Intrinsik has conducted assessments for a diverse array of oil and gas activities, specifically as these relate to potential risks to the environment and human health. Examples of these include assessments of:

Sour gas wells (e.g., risks associated with operational and upset emissions)

Gas pipelines

Oil sands operations (mining and *in situ* projects)

Drilling, completions & testing, and production stages of oil and gas wells

Flaring activities

Decommissioning of well sites, gas plants, compressor stations and retail sites (*i.e.*, contaminated sites)

Upgrading and refining of petroleum products (e.g., bitumen upgraders and petroleum refineries)

Shale gas developments

Intrinsik continues to be a leader in applying the best available knowledge and methods to all its assessments of oil and gas related projects. Finally, the members of the technical team that are proposed for the BC MOH HHRA have extensive experience in working with provincial and federal government departments. We pride ourselves that our work is successfully third-party peer reviewed by other consultants, academics and government agencies.

4.1.2 *McDaniel Lambert*

Founded in 1997, McDaniel Lambert, Inc.'s interdisciplinary health sciences staff specializes in the assessment, communication and management of risk. From our headquarters in Venice Beach, California we service clients around the world, including a long track-record in Canada.

McDaniel Lambert is unique in that we have epidemiologists and a board certified physician on staff. We critically review available health data, conduct interviews, and make recommendations to improve quality of life for employees and communities. Our services include occupational health and safety trainings, and evaluations of existing medical surveillance data. We also work with community members or labor unions to address disease cluster concerns and occupational health issues.



Our epidemiologists not only provide critical analysis and interpretation of epidemiological data to supplement human health risk assessment, but also design and implement studies to investigate diseases related to environmental or chemical exposures. This work has included performing cancer cluster analyses, cross-sectional studies, and conducting meta-analyses and meta-regressions of data from clinical studies.

McDaniel Lambert has a long history of working on health risk issues surrounding the oil and gas sector. In fact the firm's principals Drs. McDaniel and Lambert worked as in-house physician and toxicologist for a major oil producer in California. Since starting their firm they have worked for industry, state, federal and international governments in assessing and communicating the risks associated with living in proximity to oil and gas activities.

4.1.3 *RWDI Air Inc.*

RWDI is a leading Canadian consulting engineering firm concentrating in the areas of waste management, air quality, and risk analysis. RWDI is part of the RWDI Group of Companies, which has Canadian offices in Vancouver, Calgary, Guelph, Thunder Bay, Ottawa and Windsor, and international offices in the United States, United Kingdom, Abu Dhabi, India, and China. Since opening its offices in 1972, the firm has grown to over 295 employees and enjoys a trusted 40-year reputation for our deep knowledge and sophisticated technology solutions for complex environmental and wind engineering problems. Our consultants meet the world's most complex challenges with experience, knowledge and superior service.



RWDI AIR Inc.'s western offices (Vancouver and Calgary) successfully complete over 150 flare management programs per year, and as such have established a solid reputation as an industry leader in conducting flaring permits and approvals as per the Alberta Energy and Resource Conservation Board (ERCB) guidelines and directives. This expert level of experience is the reason why RWDI has been retained to train regulatory board employees in understanding the application of dispersion models and the interpretation of results. RWDI has worked closely with regulatory boards (such as the ERCB) and industry to develop acceptable flare management approaches and methodology. RWDI also has considerable experience with hazardous risk assessments for the oil and gas industry in Alberta and has

assisted clients with environmental assessments and approvals for oil and gas facilities in northeastern BC.

RWDI has provided technical assistance to regulatory agencies, such as ERCB, OGC, Alberta NRCB and BC Ministry of Environment (MOE) for the development of regulatory policy, rules and guidelines. Some of this experience includes: the editing and drafting of the Air Quality Model Guideline for the BC MOE; review of existing odor management programs and recommendations of best approaches for BC technical assistance for the development of an emission policy for the Greater Vancouver Transportation Authority; and providing input and comments regarding an early version of the AEUB proposed hazard modeling protocol for evaluating sour gas wells and pipelines in Alberta.

RWDI follows a hierarchical management structure and places a high degree of importance on quality control and uses extensive procedures and documentation to ensure that the final product meets our high standard of quality. Our staff use advanced engineering tools and carefully defined consulting processes to deliver focused and proven results.

4.1.4 *Matrix Solutions Inc.*

Founded in 1984, Matrix is a 100% Canadian owned, Alberta-based environmental and engineering consulting company specializing in providing practical solutions to its clients, both domestically and internationally. Over the years, Matrix has expanded both our service and geographical base and has become a recognized leader in:



- Environmental and social impact assessments and audits;
- Environmental management, planning and regulatory compliance;
- Environmental site assessment, remediation and reclamation;
- Environmental monitoring;
- Hydrology and hydrotechnical engineering; and
- Overburden characterization and oil sands delineation.

Matrix staff are recognized as leading environmental practitioners in western Canada, having directed many large and small projects. Matrix's 25 years of corporate experience includes work completed by its predecessor companies and is backed by the professionals who worked directly on these projects. Matrix is proud of its ability to retain these professional staff and bring the combined team experience to new projects. Matrix has a considerable amount of water resources and water quality experience in the Oil and Gas sector in Western Canada. Our work in the region ranges from environmental remediation, design of pipeline crossings, aquatic monitoring, and large water licensing projects. We maintain an office in Fort St. John to service hundreds of projects in the region.

4.1.5 *Skystone Engineering Inc.*

First Response Emergency Services Ltd. is a division of Skystone Engineering Inc., a speciality firm that offers comprehensive engineering, technical and management services and solutions. Our purpose is to assist clients of all sizes in enhancing their effectiveness in maintenance and management of their process



containment systems, while fulfilling corporate governance specifications, industry codes and regulations.

Our clients have unique needs and our diverse team of engineers, inspectors and software developers enable our solutions to be customized to meet those unique needs. With ever changing variable and conditions in the world of oil and gas production, we understand that a comprehensive approach to maintenance is essential. Skystone excels at maintenance process consulting and assessment services.

Skystone Engineering recently acquired First Response who is recognized by industry, the regulators and the public as a leading provider of Emergency Management products, services, and training. Our client list includes major oil and gas, and industrial companies throughout Western Canada with overlapping work into United States, Europe and Australia.

4.1.6 Borden Ladner Gervais LLP

Borden Ladner Gervais LLP (BLG), a pre-eminent full-service, Canadian law firm, is driven to help achieve the best possible results for all our clients. With more than 750 lawyers, intellectual property agents and other legal professionals in six offices, BLG provides corporate, litigation and intellectual property solutions to a wide range of clients nationally and internationally. And as a bilingual English-French firm, BLG excels under both the common and civil law systems in Canada. In addition, BLG provides insight and clarity to regional, national and multinational corporations across a variety of business sectors. BLG is also proud to represent public institutions such as universities, governments and governmental agencies, and healthcare facilities, as well as private business, trade and charitable groups.



At Borden Ladner Gervais LLP our approach to the practice of environmental law is multidisciplinary and comprehensive. We are committed to the provision of timely and efficient service to our clients in all areas of environmental compliance, civil and regulatory disputes, and transactional work.

The Environmental Law Group of Borden Ladner Gervais LLP draws upon the diverse range of practice orientations and experiences in each of our regional offices. All our offices also have strong commercial practices with experience in the environmental aspects of acquisitions, financing and re-organizations.

4.2 Intrinsic Team Member Cameos and Experience

The Intrinsic Team is comprised of highly accomplished experts in their respective fields of practice. Collectively the team has a strong balance of government and private sector consulting experience. Details of this experience (especially over the past five years) are found in the individual curriculum vitae provided in Appendix A. Intrinsic prides itself in letting the science of risk assessment detail the answers to the posed question and ultimately to provide appropriate risk management, mitigation or monitoring recommendations for the protection of human health.

In addition, we have brought together a balanced Intrinsic Advisory Panel to review major project milestones and provide advice and guidance for the direction of the project to the Intrinsic Team's Project Manager. We believe that there are a considerable number of checks and balances with the overall team composition to ensure credible delivery of Phase 2 of the project.

The Intrinsic Team organization chart is provided in Figure 2, with individual team member cameos provided below and detailed curriculum vitae provided in Appendix A.

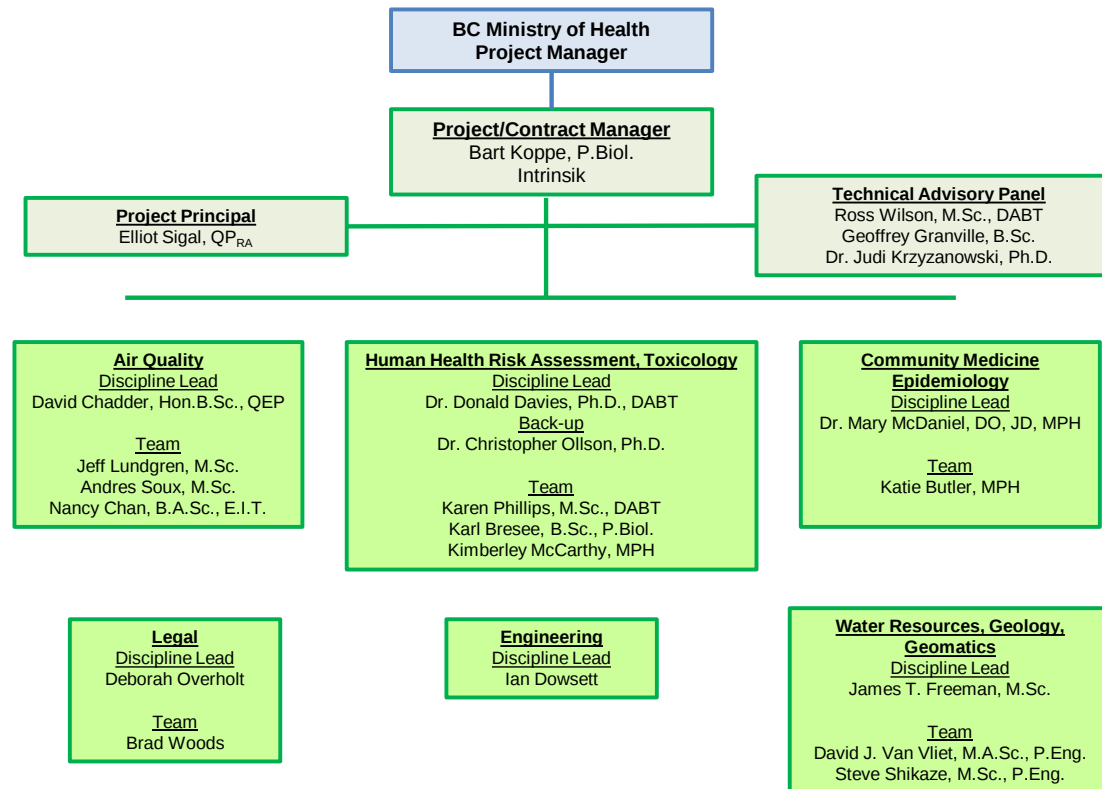


Figure 2. Intrinsik Team Organization Chart

4.2.1 Project Management

Project Manager/Contract Manager - Bart Koppe, Vice President Western Canada

Bart Koppe is Vice President of Western Canada and senior scientist at Intrinsic Environmental Sciences. Mr. Koppe has been involved in assessing environmental risks in Canada's western provinces and northern territories for the last 15 years, with a considerable amount of that time spent on large oil sands applications.

With his experience in risk assessment and environmental toxicology, Mr. Koppe regularly presents at technical conferences and workshops. He has developed risk assessment frameworks for specific industry and government initiatives and sat on expert panels for numerous provincial and federal applications (e.g., ERCB, NRCB and CEAA). Mr. Koppe has been retained by government agencies, industrial clients and First Nations to assist them in issues related to health and environmental risks.

Mr. Koppe is currently acting as a technical advisor to Alberta Environment and Sustainable Resource Development's planned health risk assessment of the Athabasca oil sands.

Other relevant experience includes the following:

- Considered an authority in environmental health issues related to both conventional and non-conventional oil and gas sectors. He has led risk assessments and provided risk communication related to large oil sands mining projects, in situ oil sands projects, upgraders, refineries and power plants (coal and natural gas).
- Provides technical support for quasi-judicial regulatory hearings, including research, consultation, and testimony.
- Invited to participate on technical advisory committees for the development of environmental risk assessment frameworks and exposure modelling practices.
- Specializes in risk communication, stakeholder engagement and public consultation. Called upon to provide peer review services for other consulting firms, industry and government agencies.
- Successfully managed over 50 environmental risk assessments, including contaminated sites, decommissioned mine sites and large industrial oil and gas applications.

Project Principal – Elliot Sigal, President Intrinsic

Elliot Sigal is President of Intrinsic Environmental Sciences Inc. and Intrinsic Health Sciences Inc. Mr. Sigal graduated with an Honours B.Sc. in Toxicology from the University of Toronto in 1988 and has over 20 years of experience in risk assessment and toxicology, specializing in human health related issues. Mr. Sigal is a full member of the Society of Toxicology and qualifies as a QPRA under Ontario's Record of Site Condition Regulation (O. Reg. 153/04).

Mr. Sigal is responsible for leading risk assessment teams in determination of potential for exposure of and risk to receptors associated with complex contaminated sites, military base closures, underground

storage tanks, incinerator emissions, landfill sites and industrial processes. He also has been involved in the use of toxicological principles to facilitate the risk assessment process, such as development of a health-based method for the evaluation of total petroleum hydrocarbons (TPH), and provision of a benchmark comparison of remediation alternatives, in order to determine economically feasible and scientifically sound solutions to risk management problems.

Mr. Sigal has conducted interpretive reviews of toxicology and mechanistic databases for a variety of chemicals including metals (*i.e.*, arsenic, nickel), chlorinated organics (*i.e.*, vinyl chloride, PCBs, dioxins and furans), volatile organic compounds (*i.e.*, benzene, toluene), combustion gases (NOX, SOX), and PAHs (*i.e.*, benzo[a]pyrene). Mr. Sigal has conducted peer reviews on many risk assessments in jurisdictions across Canada and the U.S., as well as conducting reviews of site-specific risk assessments on behalf of the Ontario Ministry of Environment.

Recently, Elliot led the Flin Flon Soils Study, which involved a comprehensive human health risk assessment, a biomonitoring study for lead, arsenic and inorganic mercury, an integrated risk management plan and extensive consultation with all stakeholders, including the public and regulatory community.

Mr. Sigal has extensive project management experience. He is responsible for managing both small (a few thousand dollars) and large projects (over a million dollars). Many of these initiatives involved integration of multi-company teams composed of engineering services, analytical services, as well as other technical and scientific efforts. His role as a project manager has included responsibility for project budget, allocation of technical personnel, adherence to project schedule, and senior responsibility for ensuring that a quality, scientifically defensible product is received by the client. Example projects include:

- Flin Flon Soils Study-Human Health Risks Assessment of smelter-related emissions in the Flin Flon, MB and Creighton, SK areas;
- Toxicological Risk Assessment Pertaining to Potential Occupational and Related Exposures Associated with Herbicide Spraying Operations at CFB Gagetown;
- Human Health and Ecological Risk Assessment in the City of Greater Sudbury and Its Surrounding Area;
- Human health risk assessment for the area around La Oroya, Peru, impacted by smelter emissions;
- Human health risk assessment for the community around the Port of Callao, Peru, impacted by emissions from a mineral concentrate storage and handling facility;
- Provision of expert advice, on behalf of Algoma Steel, to the Environmental Steering Committee, implemented by Ontario Ministry of the Environment, regarding an arsenic contamination issue in Wawa, Ontario

Mr. Sigal provides expert advice to both industry and government. Example projects include:

- Provision of expert advice and review of risk assessments on behalf of the Ontario Ministry of the Environment, in the areas of human health risk assessment and toxicology (1997 - present);
- Human Health Toxicologist and Contaminated Sites Risk Assessor Expertise Standing Offer for Health Canada (2004-present);
- Critically analyzing toxicological literature to develop inhalation and oral Reference Exposure Limits (RELs);
- Reviewing and updating soil guideline documents;
- Reviewing supporting information for toxicity reference values;
- Assisting Ontario Ministry of the Environment with report entitled: Soil Investigation and Human Health Risk Assessment for the Rodney Street Community, Port Colborne: October 2001;
- Peer reviews, and reviews on behalf of the Ontario Ministry of the Environment, of risk assessments completed by more than 25 consulting firms.
- Appointed to the Ontario Independent Fact-Finding Panel on 2,4,5-T.

4.2.2 *Intrinsic Advisory Panel*

Retired Oil and Gas Industry Toxicologist - Geoffrey Granville

Geoff worked for 34 years at Shell before retiring to become a private consultant in 2006. He was initially an experimental toxicologist in the UK, but took a temporary assignment with Shell Canada in 1981 and later decided to permanently transfer to Canada. In 1984 he became Manager, Toxicology and Product Stewardship for Shell Canada. His responsibilities included managing and advising on a broad range of occupational and environmental health issues relating to chemical substances, including toxicity testing, health risk assessments and regulatory compliance. His particular interests include research on air pollution; health effects of chemical substances such as styrene, benzene and hydrogen sulfide; prioritization and communication of population health risks, and the regulation of chemical hazards. He was an adjunct professor at the University of Alberta and the University of Toronto for a number of years, and regularly gave lectures at both universities.

In 1991, Geoff took a temporary assignment with Health Canada's Environmental Health Directorate in Ottawa on a 2-year executive exchange program. In his role as an Associate Director, he was second in charge of a Bureau of 150 staff with a \$30 million annual budget, and had direct responsibility over 8 professional health scientists and over the bureau's \$4+million annual research program.. This position allowed him to better understand how government agencies operate, and resulted in the creation of ongoing relations with many bureaucrats in Ottawa, and particularly with staff at Health Canada and Environment Canada. The major piece of national legislation dealing with health and the environment is called "CEPA" (Canadian Environmental Protection Act) and given his experience in government, until his retirement, Geoff played a leadership role in numerous meetings and multistakeholder committees in discussions about how CEPA should be used, interpreted and updated. He chaired the Industry

Coordinating Group (ICG) for CEPA, and in that role had close contacts and detailed discussions with industry and regulators on how best to manage chemicals in today's world

Since the mid 1990s, he has become increasingly involved in numerous environmental health (also called "population health") issues, particularly with respect to the impacts of industry's facilities and products on the health of local populations, plus the broader issues relating to sustainability. He was engaged in "CASA" (Clean Air Strategic Alliance, an Alberta multistakeholder organization through which all health and environmental issues relating to ambient air quality are discussed and managed) and sat on numerous CASA committees, including a role as the industry co-chair of the Human and Animal Health Team. He is a major proponent for the use of multistakeholder processes to assist in the management of most issues relating to public health and the environment. He was extremely active in Alberta's Public Safety & Sour Gas (PSSA) process in the early 2000s, and led the CAPP team on technical issues associated with human health concerns.

After retiring in 2006, Geoff became an independent consultant, and now consults to various corporate and government clients. He works on a wide range of health-related issues, including analysis of HSE regulatory issues, health and environmental impact assessments, and reviews of toxicology.

Senior British Columbia Risk Assessment Consultant - Ross Wilson, M.Sc., DABT

Mr. Wilson is a board-certified expert in toxicology with 21 years of experience in the human health risk assessment of chemicals found in air, soil, water and food. He has completed more than 200 risk assessment projects examining potential human health risks from exposures to both carcinogens and non-carcinogens. Mr. Willson has peer reviewed numerous human health risk assessments on behalf of Health Canada and the BC Ministry of Environment. On behalf of Health Canada, he developed environmental quality criteria for protection of human health for various metals and organic chemicals and developed guidance documents for acute/subchronic risk assessment, air quality risk assessment and exposure amortization. Mr. Wilson is a member of the CCME Toxicity Reference Value Subgroup for Canada-Wide Standards for Petroleum Hydrocarbons. Mr. Wilson has published and presented numerous technical papers on human health risk assessment of chemicals. Mr. Wilson has also been appointed to the British Columbia Contaminated Sites Roster of Professional Experts as a risk assessment specialist.

Academic and Non-Government Organization Advisor - Judi Krzyzanowski, Ph.D.

Judi is an environmental scientist by training, and has knowledge, understanding and experience in the biological, physical, chemical and earth sciences. An air pollution expert, she has research experience spanning the fields of agricultural science, molecular biology, meteorology, and public policy allowing her to provide comprehensive analyses and solutions. Judi has worked with governments, industry, non-profit organizations and First Nations groups on topics of emissions reporting and control, acidification, eutrophication, air pollution monitoring, forest health, human health, ecosystem fragmentation, sustainable forest management, conservation, energy policy, climate change and impact assessment frameworks. Her work with First Nations has allowed the incorporation of traditional and social values into contemporary scientific and political means of assessing environmental impacts. Judi also has experience with the oil and gas sector, as is reflected not just in her publications, but also in her active and continued engagement with the Northeast Oil and Gas Health Advisory Committee –a multi-stakeholder group tackling issues related to oil and gas, and human and environmental health, in BC's northeast.

4.2.3 *Human Health Risk Assessment Team – Intrinsik Environmental Sciences*

Discipline Lead – Dr. Donald Davies, Ph.D., DABT

Dr. Davies is Senior Vice-President and Chairman of the Board with Intrinsik Environmental Sciences Inc. He is a recognized authority in the science of Toxicology, having spent more than 32 years identifying, interpreting and communicating the health risks associated with chemical exposures.

Based in Calgary, Alberta, Dr. Davies is well-recognized for his understanding of the potential health impacts of oil and gas exploration and development activities, and is regularly sought out by industry, the government, and members of the public to provide advice on the health effects of oilfield chemicals. His experience extends to both conventional and non-conventional oil and gas operations, with much of his time devoted recently to identifying and understanding the chemical hazards associated with shale gas development activities.

During his career, he has studied the health effects of a number of different categories of chemicals, including commodity and specialty products, plastics and resins, pesticides, fertilizers, incidental food additives as well as volatile organic compounds (VOCs), products of incomplete combustion (PICs), criteria air contaminants (CACs), heavy metals and a host of other environmental contaminants. Based in Calgary, Alberta, Dr. Davies also is highly-versed in the toxicity of oilfield chemicals, and has completed numerous assessments of the potential impacts of oil and gas development, both conventional and non-conventional, on the health of humans, livestock and other ecological receptors. His knowledge in this regard extends to the chemicals associated with all aspects of oil and gas development, from the drilling and completion of wells, to the construction and operation of pipelines and processing facilities. He is especially well-versed in the toxicology of hydrogen sulphide (H₂S), sulphur dioxide (SO₂) and reduced sulphur compounds, and the potential health hazards associated with sour oil and gas operations. Dr. Davies is regularly sought out by industry, the government, business groups, the legal community and professional associations for both his technical know-how and his ability to effectively communicate the principles and results of his work to audiences of all types. He has appeared as an expert witness before the courts and adjudicatory boards in several jurisdictions across North America, including the Court of Queen's Bench Alberta, the British Columbia Environmental Appeals Board, the Alberta Energy Resources Conservation Board, the National Energy Board, and the Alberta Environmental Appeals Board.

Dr. Davies' experience spans a diversity of different work environments, with roles ranging from technical specialist, to project manager, to senior administrator. Early in his career, he served as a toxicologist with the Health Protection Branch of Health and Welfare Canada, after which he advanced to the position of Research Associate (Toxicology) with Dow Chemical Canada Inc. Since joining Intrinsik, he has fulfilled a number of technical and managerial roles, including Senior Scientist, Vice-President (Western Operations), Vice-President (U.S. Operations), Senior Vice-President, and most recently Chairman of the Board. Dr. Davies' educational qualifications include a B.Sc. Honours (Biochemistry), M.Sc. (Nutrition) and Ph.D. (Nutrition/Toxicology) from the University of Guelph, Guelph, Ontario. He has been a Diplomate of the American Board of Toxicology since 1980. He has served as an adjunct professor and lecturer within the Faculty of Dentistry and Medicine, University of Western Ontario, the Faculty of Medicine, University of Alberta, and the Department of Environmental Studies, Mount Royal College. He is a full member of the Society of Toxicology.

- Recognized as an authority in toxicology and human health risk assessment. He has designed, conducted and managed a large number of risk assessment projects aimed at identifying, understanding and mitigating the health impacts associated with oil and gas activities, power generation facilities (coal- and natural gas-fired), forestry operations (OSB mills, sawmills, co-generation facilities), and mining operations.
- Has conducted in-depth reviews of the toxicology of a number of different chemicals on behalf of industry, professional associations and regulatory agencies, including detailed assessments of the toxicity of hydrogen sulphide (H₂S), sulphur dioxide (SO₂) and nitrogen dioxide (NO₂).
- Considered a leading authority in Canada on matters related to the toxicology of oilfield chemicals and the assessment of the potential health impacts associated with oil and gas operations, with expertise extending to conventional (both sweet and sour oil and gas) and non-conventional (shale gas, tight oil and CBM) resources.
- Currently leading a team on the development of a hazard-based screening tool for classifying hydraulic fracturing fluids in terms of their potential health and environmental impacts for use on an industry-wide basis across North America.
- Has appeared before (and has been qualified) as an expert in toxicology and health risk assessment by a number of courts and adjudicatory boards across North America.
- Broad-based work experience, both in terms of work environments and duties performed. He has served in technical, managerial and senior leadership roles over the course of his 35-year career, with experience gained in regulatory, industrial and consulting work settings.
- Widely known for his expertise in toxicology and health risk assessment, having authored numerous reports and publications. Regularly invited to speak at meetings, conferences and workshops hosted by professional societies, business groups and communities on matters related to toxicology and health risk assessment.
- Diplomate of the American Board of Toxicology (DABT) and full member of the Society of Toxicology

Dr. Davies holds a Ph.D. in Nutritional Toxicology from the University of Guelph, Guelph, Ontario.

Alternative Discipline Lead – Dr. Christopher Ollson, Ph.D.

Dr. Ollson is Vice President, Strategic Development and a senior environmental health scientist at Intrinsik Environmental Sciences. He brings fifteen years of international consulting experience in environmental health sciences and toxicology to the firm. His Canadian experience spans from coast-to-coast-to-coast, having worked in all Provinces and Territories. Dr. Ollson has been conducting air quality, environmental assessment and contaminated site risk assessment project in British Columbia since 2000.

Dr. Ollson is considered an authority in environmental health issues related to the energy sector. He has led risk assessments and provided risk communication support for wind turbine projects, natural gas fired

stations, energy-from-waste facilities, oil sands environmental assessments, refineries, pipelines, gas plants and coal power plants.

Dr. Ollson has spent countless hours in community and stakeholder consultation on behalf of clients. He has developed stakeholder mapping, developed and implemented communications strategies and policies, and then led knowledge transfer communications exercises that brought lay people into the conversation. Through proper risk communication he ensured that communities became part of the decision-making process on issues surrounding atmospheric, soil and water contaminant issues. Dr. Ollson is often called on to meet with ENGOs to discuss the science behind project decisions being made. He is also well versed in briefing municipal councils, committees and provincial/federal stakeholders. Dr. Ollson has taken media training and has the ability, with client approval, to speak to media about potential health issues surrounding energy projects.

Risk Assessment Modeller – Karl Bresee, B.Sc., PBD, P.Biol

Mr. Bresee specializes in human and ecological risk assessment with extensive experience in exposure modelling. Mr. Bresee has 15 years of experience in human, aquatic and wildlife toxicology, fate and transport modelling and exposure modelling.

Mr. Bresee has considerable experience with risk assessments and environmental impact assessments in the oil and gas industry, oil sands industry, power generation and mining sectors.

Other noteworthy projects include the development of probabilistic models for the wide-area ecological risk assessment of Teck Cominco's lead/zinc smelter in Trail, British Columbia, and the ecological risk assessment related to smelter emissions in the City of Greater Sudbury and surrounding area in Ontario. He has been the technical lead on both human and ecological risk assessments of contaminated sites in urban areas. Mr. Bresee's role in these projects was project management, multiple pathway exposure assessment, chemical toxicity assessment, risk characterization and public/stakeholder consultation. He has conducted deterministic and probabilistic risk assessments across Canada and the United States for both industry and government.

Mr. Bresee holds a Minor in Geology, a B.Sc. in Biology, a Post Bachelor's Diploma in Ecotoxicology and is a member of the Alberta Society of Professional Biologists.

Human Health Risk Assessor – Karen Phillipps, M.Sc., DABT

Karen Phillipps is a Human Health Risk Assessor and Toxicologist at Intrinsic. Ms. Phillipps obtained her BSc.(Hon) in Biomedical Toxicology and her MSc. Toxicology and Food Safety from the University of Guelph. In 2009, after a rigorous examination process, she obtained her status as a Diplomate of the American Board of Toxicology.

Ms. Phillipps has over 11 years of experience as a consultant, and has been responsible for human health risk assessment, exposure modelling, technical report writing, toxicological literature reviews, and project management. She has been actively involved in human health risk assessments related to environmental impact assessments associated with proposed oil, gas and mining projects in Alberta; human and livestock health risk assessments related to sour gas projects, contaminated sites in Ontario

and Western Canada, evaluations of chemical, food and pharmaceutical products as well as occupational exposures.

She was actively involved in working with an aboriginal community through their engagement in developing and completing a health risk assessment related to water. In addition, she has participated in the review and development of guideline values, guidance documents or technical methodologies for various governmental agencies, including Health Canada. Further, she has had significant involvement in reviews and development of risk assessment methodology, toxicological profile compilation, various forensic and environmental litigation cases, and product safety and efficacy assessments (drugs, natural health products, chemicals) for both public and private industry clients.

Junior Human Health Risk Assessor - Kimberley McCarthy, MPH

Ms. McCarthy's role at Intrinsik includes providing support and technical assistance to intermediate and senior environmental risk assessors (both human health and ecological) in the following areas:

- Review of site characterization data pertaining to air, soil, vegetation, groundwater, and surface water.
- Screening of analytical chemistry data against regulatory guidelines.
- Critical review of scientific information and preparation of toxicological profiles.
- Risk modelling and statistical treatment of the data, using spreadsheets and computer models.

Her education and past work experience gave her experience analyzing quantitative data through statistics software (STATA) and experience analyzing qualitative data. Her graduate program enhanced her ability to review literature, search academic databases, and prepare reports for diverse audiences. Additionally, she has knowledge in the areas of risk assessment, risk management, and toxicology principles.

Through practicum work on evaluating the success of the Serving Safer Food Alberta (SSFA) project she gained project management experience. She conducted phone interviews, developed a logic model, developed surveys, analyzed qualitative data, and produced an evaluation report. She has experience with field and laboratory work and gained community-based research experience through her work with the Canadian North *Helicobacter pylori* Working Group, conducting interviews, increasing community awareness, and collecting breath samples.

Ms. McCarthy has a Bachelor of Science in Immunology and Infection and a Masters of Public Health in Environmental and Occupational Health from the University of Alberta.

4.2.4 *Community Medicine / Epidemiology – McDaniel Lambert*

Discipline Lead – Dr. Mary McDaniel, DO, JD, MPH

Mary McDaniel is a board-certified physician, licensed attorney, and risk and crisis communication expert. Dr. McDaniel brings more than 15 years of experience in environmental health assessment, risk

communication, risk management, and occupational and environmental medicine to McDaniel Lambert, which she co-founded in 1997. Dr. McDaniel is also involved in developing risk communication and crisis communication strategies for public agencies and companies in the United States and overseas. She is a member of the faculty of the UCLA Occupational and Environmental Medicine Program and serves as a member of the Residency Advisory Board.

During her career, Dr. McDaniel has developed and supported industry and community involvement programs in a variety of settings worldwide. She has planned, facilitated, and served as a health expert at public meetings throughout the United States, where she seeks to integrate the expertise of health agencies, elected officials, industry, and community members in order to enhance the communication and decision making process.

Dr. McDaniel has played a major role on many high-profile health and environmental projects. She established and provided oversight for a community health clinic, which provided medical care to over 1200 people following a chemical release. She has worked extensively with industry in Southeast Asia, where she has developed strategies for reducing the health and environmental impact of industrial facilities on residential and commercial areas.

Epidemiologist – Katie Butler, MPH

Ms. Butler specializes in occupational and environmental epidemiology and human health risk assessments. She has an interdisciplinary background in environmental sciences, toxicology, epidemiology and statistics to investigate environmental health risk factors.

Ms. Butler manages and provides key technical direction on health assessment projects, including the development of statistical approaches to analyze health data. She has experience leading disease cluster investigations and analyzing health data trends to address community and stakeholder concerns.

Ms. Butler has experience conducting risk assessments and assessing community health impacts for public and private sector clients at a variety of sites in the US and abroad, including oil refineries, military training facilities, mining operations, and natural gas processing plants. These projects involve developing communication strategies and tailoring key messages to explain study results to communities, agencies and other stakeholders. She served as the lead risk assessment advisor for environmental site investigations conducted by the U.S. Army Corps of Engineers in South Korea. In this role, she was responsible for addressing potential health and environmental hazards at U.S. military installations to support remedial investigations. To improve the site assessment process in South Korea, Ms. Butler developed and facilitated a 5-day training course in risk assessment and risk communication for the U.S. Army Corps of Engineers and its contractors.

Before receiving her M.P.H., Ms. Butler graduated from the University of Notre Dame with a B.S. in Environmental Sciences and a minor in Latin American Studies. While earning her bachelor's degree, she studied abroad in Santiago, Chile and is fluent in Spanish.

4.2.5 *Air Quality – RWDI Air Inc.*

Discipline Lead – David Chadder, Hon. B.Sc., QEP is a Principal and Senior Consultant at RWDI AIR Inc. with experience in environmental consulting dating back to 1978. His area of specialty as Senior

Consultant involves the technical supervision of engineering teams involved with air quality, hazard modelling and public safety (toxic gas or flammable gas releases) and quantitative risk assessments, Environmental Impact Assessments (EIA's) industrial approvals emission sampling and ambient monitoring. David works closely with clients helping to develop winning strategies for receiving approvals and best environmental management practices.

Recently, he has supervised engineering teams that have provided air quality, fugitive dust and odour assessments, GHG and SO_x/NO_x emission audits, facility approvals (ERCB, AESRD, OGC, BC MOE, NEB, AUC) and assessments over a broad range of applications. These have included continuous, emergency and intermittent flaring, sour gas handling and compression facilities, sour wells and batteries, SAGD and oil sands extraction, bitumen upgrading, land use planning, pipeline transmission, roadways, airports, pulp and paper facilities, hospitals, universities, and power generation plants.

He is a long-time member of the Air and Waste Management Association (AWMA) and the Canadian Meteorological and Oceanographic Society (CMOS). David is accredited as a Qualified Environmental Professional (QEP) and is recognized as an expert witness by the ERCB (air quality, hazard and risk), AUC (air quality and climate change) and NEB (air quality).

Air Quality Team

Jeff Lundgren, M.Sc. joined RWDI in 2004 as an Air Quality Meteorologist. In 2008 he was promoted to a Senior Scientist position and is currently the lead air quality and meteorological modeller for RWDI. In this role, Jeff is responsible for mentoring, training and development of RWDI air quality staff in all office as well as advancement RWDI's technical modelling capabilities. In 2010 he was named Technical Director for the Advanced Modelling group at RWDI. He is involved in large scale modelling studies using a variety of photochemical and meteorological models including CMAQ, MM5 and WRF.

He has been actively involved in the application of meteorological models for local scale climate change, wind stresses on super-tall structures and sustainable design. Additionally, Jeff's work at RWDI has also included numerous applications of regulatory models such as CALPUFF and AERMOD for projects such as large-scale environmental impact assessments for power production facilities and Alberta oil sands developments and flaring reports for the oil and gas industry. He has conducted numerous air quality workshops, seminars and training courses for clients in government and industry. Before joining RWDI, Jeff had four years of experience as an air quality meteorologist in Canada and the United States, and worked as a lab instructor/lecturer while pursuing his graduate degrees.

Andres Soux, M.Sc. joined RWDI in 2010. Prior to joining RWDI, Andres has led many ambient air quality and meteorological monitoring installations and reviews. He has experience with a wide range of air quality and meteorological instrumentation and is knowledgeable in siting requirements of different organizations (EPA, WMO, BC MOE). He has also been involved in modelling studies using WRF and CALPUFF in a number of different locations. Additionally, Andres work at RWDI has involved the microclimate and air quality components of the Environmental Impact Statement for the BC Hydro Site C Clean Energy Project Prior to joining RWDI, Andres was employed by the Pacific Climate Impacts Consortium where he collaborated with personnel in the BC ministries, with several regional climatologists and geographers to identify existing data networks for the monitoring of the variability and trends in the climate system in BC and Pacific North America.

Andres received an M.Sc. degree in urban climatology from UBC, and has supported field projects in Canada, Japan, and Switzerland. Subsequently, he completed substantial postgraduate work at UBC. His M.Sc. research involved creating a model to predict what a remote sensor “views” of an urban surface and his post M.Sc. research focused on developing a new instrument for measuring infrared radiative divergence in the lowest layers of the urban atmosphere.

Nancy Chan, B.A.Sc graduated from Chemical Engineering at the University of British Columbia in 2005 and joined RWDI as a Junior Air Quality Scientist. In 2007, she was promoted to an Intermediate position and in 2010 she was promoted to a Senior Engineer. Since joining RWDI, she has conducted emission inventories, air quality dispersion modelling and meso-scale meteorological modelling for numerous projects. She has also assisted with third-party reviews of air quality assessments.

4.2.6 Water Resources – Matrix Solutions

Discipline Lead – James Freeman, M.Sc., P.Geol.

Mr. James T. Freeman has over 25 years of hydrological consulting experience. During this time, he has participated in hydrologic investigations ranging in scope and size. From locating single water supply wells to providing litigation support for U.S. EPA Superfund sites to conducting technical and project management for major groundwater investigations and remediation activities. He is particularly experienced in the analysis and interpretation of hydrologic data.

Mr. Freeman develops technical direction and provides scientific guidance for Matrix in areas of geochemistry, hydrogeology, environmental contamination, water supply, environmental modelling, well design/testing, dewatering and environmental impact assessment (EIA). He also conducts marketing and training, prepares and reviews proposals and reports, serves on the Matrix Board of Directors and provides senior management for the company.

Clients have included several levels of government, First Nations, landowners, irrigation districts and companies involved in petroleum exploration, production and distribution, agriculture, mining, power generation and distribution, waste management, railroads, chemical manufacturing and tourism. Mr. Freeman has also provided expert testimony and public consultation on a number of hydrologic issues.

Senior Water Resources Engineer – David Van Vliet, M.A.Sc., P.Eng.

Mr. David Van Vliet has 20 years of experience as a water resources engineer, most recently with AquaResource Inc., which merged with Matrix in late 2011. He has experience in various areas relating to water resources including watershed hydrology, groundwater and surface water interactions, hydrologic impact assessments, climate change and information management. Mr. Van Vliet was actively involved in the development of the water quantity framework relating to the Province of Ontario's *Clean Water Act*.

Mr. Van Vliet is recognized as an expert in the development and implementation of environmental data management and GIS solutions. These solutions approach environmental and water resources data from the 'life cycle' perspective and address all data management aspects including field data automation, laboratory data coordination, database management, visualization, statistical analysis and reporting.

He has provided services on numerous types of water resources and environmental consulting projects including source water protection, dewatering for mining and aggregate resources development, mine tailings impact assessment, mine tailings consolidation, wetland impact assessment, soil and groundwater remediation and watershed based erosion and sedimentation assessments.

4.2.7 *Engineering / Emergency Response – Skystone Engineering*

Discipline Lead – Ian Dowsett

As the vice president of FIRST RESPONSE Emergency Services (a newly formed division of Skystone Engineering), Ian is responsible for the business and financial success of the division, for the development and implementation of new technologies and for the direct management of the engineering support group.

Ian has over 40 years of experience in oil and gas and pipeline industries in areas of public safety, emergency response management, pipeline design and operations, well performance modeling, dispersion modeling, hazard and risk analysis, auditing, and the development of data management systems and related computer-based technologies. Ian has worked extensively in both the regulatory and public domains and is recognized as an expert in these areas. He has provided advice and direction to numerous companies, the public and the regulators through participation at numerous regulatory hearings, public meetings and open house events, and through the preparation of papers and the conducting of numerous courses.

4.2.8 *Legal Expertise – Borden Ladner Gervais*

Discipline Lead – Deborah Overholt

Deborah Overholt is a Partner at BLG's Vancouver office. She was admitted to the British Columbia Bar in 1990 after graduating from the University of British Columbia with a Bachelor of Laws in 1989. Prior to that, Deborah received a Bachelor of Arts (Double Major in English and History) from the University of British Columbia in 1985, followed by a Diploma in Legal Studies from Keble College at Oxford University in 1987. Deborah practises in the areas of environmental law, energy-related transactions and general commercial transactions. Ms. Overholt was selected by her peers for inclusion in *The Best Lawyers in Canada* 2012 (Environmental Law; Natural Resources Law). Deborah has previously served as the Regional Managing Partner of the BLG Vancouver office and has served on the firm's National Management Committee and National Council.

Legal Associate – Brad Woods

Brad Woods is an associate at BLG's Vancouver office. Brad was admitted to the British Columbia Bar in 2009. He graduated from the University of British Columbia with a Bachelor of Law in 2008. Prior to attending law school, Brad obtained a Bachelor of Applied Science (Honours) in Systems Design Engineering from the University of Waterloo and worked as a systems integration consultant for the manufacturing sector. Brad practices corporate/commercial law with an emphasis on construction, energy and environmental matters. Brad's experience in environmental law includes providing clients with general regulatory advice, assessing permitting risk for proposed mining and

other industrial projects, advising on contaminated sites liability and assisting with both provincial and federal environmental assessments.

4.2.9 Information Specialist – Kaitryn Campbell, BAH, Bed, MILS

Kaitryn Campbell is an Information Specialist at PATH Research Institute, affiliated with St. Joseph's Hospital/McMaster University, Hamilton, and a part-time Assistant Professor at the Department of Clinical Biostatistics and Epidemiology, McMaster University. Kaitryn is an expert searcher, with more than 12 years of experience designing, running and critically appraising hundreds of bibliographic search strategies for health technology assessments and systematic reviews of health sciences topics. Ms. Campbell provides instruction on search resources and methods on an ongoing basis to graduate students, industry and the health sciences library community. She holds undergraduate and teaching degrees from Queen's University and a Master of Library and Information Science (MLIS) degree from the University of Western Ontario.

4.3 Intrinsik Team Project and Client References

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Description of Project

The team of Intrinsik, Matrix Solutions and RWDI worked on the environmental impact assessment of Statoil's proposed Kai Kos Dehseh Project. The Project is designed to ultimately produce approximately 220,000 barrels of bitumen per day using steam assisted gravity drainage (SAGD) technology. Statoil's oil sands leases fall within the Rural Municipality of Wood Buffalo and Lakeland County in northeast Alberta (*i.e.*, within Alberta's Athabasca oil sands).

Due to the intensity of the industrial activity in the area, potential impacts on the air shed and nearby water bodies, along with the accompanying risks to human health, are some of the most common concerns raised by the surrounding communities. In fact, air quality and human health are consistently ranked as two of the primary environmental concerns in the region.

Each of the proposed heavy oil extraction projects was required to submit a full Environmental Impact Assessment (EIA). In accordance with the Terms of Reference set out by Alberta Environment, each project also had to conduct a detailed analysis of its potential impact on public health. Intrinsik conducted the health risk assessment of the Statoil Project, which relied heavily on the air quality assessment conducted by RWDI and the groundwater assessment completed by Matrix Solutions.

In addition to the Statoil project, Intrinsik has assessed the potential health impacts for multiple *in situ* and mining oil sands projects in the region. In doing so, Intrinsik has applied a "weight of evidence" approach, wherein it

Human Health Risk Assessment of the Statoil Kai Kos Dehseh Project in Northeast Alberta

considers regional health statistics (including incidence rates of cancer and respiratory disease), community health studies and baseline monitoring data. As well, each application included its own comprehensive health risk assessment. Common to all community health studies is their inability to address health effects at the individual level. The health risk assessments conducted by Intrinsic attempted to characterize the cumulative health risks posed to the area residents by the development of the Statoil Project and the oil sands as a whole.

The risk assessments followed a regulatory-endorsed, four-stage paradigm (problem formulation, exposure assessment, hazard assessment and risk characterization). In conducting its analysis, Intrinsic relied heavily on environmental baseline studies (air, water, soil and vegetation) and predictive air quality and water quality assessments. The scope and focus of the work was developed, in part, through consultation with regional stakeholders.

The health risk assessment of the Statoil Project was a comprehensive analysis of the potential effects of the Project's and region's industrial emissions. Risks were characterized for regulated compounds (e.g. SO₂ and NO₂), volatile organic compounds (e.g. benzene, toluene, ethylbenzene, xylenes, 1,3-butadiene, etc.), polycyclic aromatic hydrocarbons (e.g., benzo(a)pyrene) and heavy metals. The health risk assessment considered all routes of exposure relevant to an actively farmed region. This included air inhalation, dust inhalation, skin contact with soil, inadvertent ingestion of soil, consumption of locally grown crops and livestock, ingestion of water and consumption of fish from the nearby water bodies. Further, health risks were assessed for multiple locations in the area, including agricultural, residential, community and public use areas.

Intrinsic, Matrix and RWDI's work on this project was reviewed by Alberta Environment, Alberta Health, the Energy and Resources and Conservation Board and technical representatives of the neighbouring First Nations. As well, Intrinsic's work has been reviewed by academic researchers (University of Alberta, Department of Public Health Sciences).

Description of Project

Intrinsic was retained by ConocoPhillips Canada to conduct an assessment of the potential human health risks associated with the emissions released during the course of a well fire that occurred during the drilling of an exploratory natural gas well in the Chetwynd area of British Columbia in November 2008. The incident was traced to the rupture of a choke hose from which gas escaped and caught fire, with the flames eventually engulfing the entire drilling rig. The well remained on fire and out of control for several days.

The assessment of the potential human health risks associated with the well fire was performed on both a retrospective and prospective basis. As part of a retrospective analysis, the potential health impacts that might have occurred among people found in the area at the time of the incident from short-term inhalation of the emissions were examined. The analysis extended to both people living in the area as well as random users who may have been frequenting the area for work, recreation or other purposes. As part of a prospective analysis, the potential health risks that could result from longer-term exposure to the chemicals contained in the emissions through secondary exposure pathways (including exposure *via* the food chain) were examined.

The work proceeded step-wise following a conventional health risk assessment paradigm, with consideration given to the types of chemicals that may have been emitted, the human receptors who could have been potentially exposed to the emissions, and the pathways by which the people could have been exposed. A number of different chemicals and classes of chemicals were examined, including criteria air contaminants, volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), aliphatic and aromatic hydrocarbons, aldehydes and ketones. The receptors examined included people living in the area as well as people who might use the area, including First Nations people who follow a traditional lifestyle involving hunting, fishing, trapping and/or gathering local natural foods. Exposure estimates were developed for each of the chemicals across the various exposure pathways examined based on the results of air dispersion modelling of the emissions. The exposure estimates were compared to the exposure limits established for the chemicals by reputable scientific and/or regulatory authorities in order to determine the potential health risks involved.

A report summarizing the work, including the methodology that was followed, the results that emerged, and the conclusions that were reached, was prepared. The findings were shared with the local health authority as well as individual landowners and communities located in the area.

s.21

Description of Project

Intrinsik was retained by the County of Lambton to conduct a systematic literature review to identify potential health impacts associated with community level exposures to emissions from petrochemical industries. The objectives of the literature review were to:

- Systematically search and summarize the scientific literature that has examined community level health impacts associated with living in proximity to petrochemical industries;
- To use the literature review to identify health outcomes that should be explored in the event that a community health study of Lambton County residents is to be initiated; and
- Identify potential challenges in examining identified health outcomes in a study of Lambton County residents.

The systematic review consisted primarily of three separate elements – the literature search strategy, the inclusion/exclusion criteria for the analysis of the search results, and the framework for documenting, evaluating and interpreting results. These three elements combined provided a transparent framework to support the consistent review of articles.

The final report, entitled “*A Systematic Literature Review of Health Outcomes Associated with Living in Proximity to Petrochemical Industries*” (2010) was prepared by Intrinsik (Elliot Sigal and Dr. Douglas Bryant) and Stantec (Dr. Christopher Ollson – while at Stantec, now Intrinsik). The report provided a perspective on the current knowledge relating to petrochemical facilities and human health in the communities with which they are associated. A discussion of strengths and weaknesses associated with the various studies and conclusions were presented.

This work is relevant to the current project, as a systematic process was developed to conduct a comprehensive literature search of primary and grey literature, on the topic of health outcomes related to petrochemical exposures.

s.21

Description of Project

"Expert Advice in Toxicology and HHRA" for Health Canada (2005-2012). Intrinsic has completed several different types of projects for Health Canada under this contract. These projects have included:

- Critical review and analysis of the toxicological literature on 1,4-dioxane and perchlorate to develop inhalation and oral Reference Exposure Limits (RELs) (Dr. D. Bryant);
- critically review the recent inhalation toxicological literature on trichloroethylene (TCE) (Dr. D. Bryant);
- Review and update the technical supporting document for the Human Health Soil Quality Guideline for Dioxins and Furans (Dr. D. Bryant and E. Sigal);
- Review and update the technical supporting document for the Human Health Soil Quality Guidelines for Cadmium and Mercury (E. Sigal);
- Provision of summary information for TRVs provided in the PQRA/DQRA guidance documents (E. Sigal);
- Peer review of Health Canada Guidance Manual on Consideration of Oral Bioavailability of Chemicals in Soil for Use in Human Health Risk Assessment (E. Sigal);
- Peer review of Pie Island Lighthouse Station human health risk assessment (E. Sigal);
- Toxicological review of recent literature regarding dioxins and furans (Dr. D. Bryant);
- Toxicological review of recent literature regarding methyl naphthalene (Dr. D. Bryant);
- Development of interim guidance for evaluating human health risks associated with direct exposure to contaminated sediments at federal contaminated sites in Canada (E. Sigal);
- Facilitation of a Health Canada consultation webinar: Options on the assessment of human health risks posed by substances present in indoor dust and the derivation of dust screening concentrations in residential environments that may be impacted by contaminated sites, January 31, 2011 (E. Sigal)
- Completion of the Toxicological Risk Assessment related to historical herbicide exposures at CFB Galetown (E. Sigal)

This long-term contract was managed by Elliot Sigal.

This work is relevant to the current project, as it illustrates the depth of experience in the critical review of human health-related toxicological literature, and its application to HHRA.

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Description of Project

McDaniel Lambert provided communication support during National Oceanic and Atmospheric Administration's (NOAA) Natural Resources Damage Assessment (NRDA) process. NRDA is the legal process through which the damages resulting from the Deepwater Horizon Oil Spill are identified to determine compensation to affected Gulf States. We developed and conducted three risk communication trainings. We provided medical and occupational health support by researching health studies on Gulf Spill workers and provided communication support for NOAA's public scoping meetings. Communication support included the review of Gulf Spill workers health studies, media and website contents, meeting posters banners, handouts, communications materials, presentations, talking points and the development of key messages.

s.21

Description of Project

On behalf of Metro Vancouver, RWDI performed detailed CALMET-CALPUFF modelling examining air quality within communities along the inner and central harbours of Burrard Inlet. A high- resolution MM5 prognostic model re-forecast was completed to provide meteorological inputs for the model study. MM5 was applied on a nested grid down to a fine grid at 1.33 km resolution covering Burrard Inlet and the North Shore mountains for the entire 2005 model year. This represents among the finest scale prognostic meteorological modelling run over annual time scale to date within Metro Vancouver. MM5 model output was then used along with surface measurements from the Metro Vancouver monitoring network to develop high density CALMET fields at a resolution of 250 m. Detailed information was collected about major emission sources in the Burrard Inlet area and translated into CALPUFF model inputs. CALPUFF model results may be used, in conjunction with ambient monitoring, to perform human health risk studies in the region.

Phase 2: Valuation of Health Impacts from Air Quality in the Lower Fraser Valley Airshed

s.21

Description of Project

The BC Lung Association retained RWDI and Marbek Resource Consultants to estimate the benefits of improving ambient air quality in the Lower Fraser Valley in terms of reducing morbidity and mortality associated with poor air quality. The dollar value of the reduced health outcomes associated with improved air quality was also estimated. The work was conducted for a Steering Committee that comprised the Greater Vancouver Regional District (now Metro Vancouver), the Fraser Valley Regional District, BC Ministry of Environment, Environment Canada, Health Canada and the BC Centre for Disease Control. The results of this study were to be used by the Steering Committee members to help rationalize and plan future air quality management activities.

5.0 MANDATORY REQUIREMENTS

5.1 Mandatory Criteria

The Intrinsic Team agrees to the Mandatory Criteria as outlined in Section 5.1 of the RFP. Specifically, we agree that:

- A. the Proposal be received at the closing location before the specified closing time
- B. the Proposal be in English and delivered by hand or courier
- C. eight (8) hard copies and one electronic copy on CD be submitted with unaltered, completed Request for Proposals cover page including an originally-signed Proponent Section with the first copy
- D. Intrinsic declares that we will use the General Service Agreement (GSA) with no modification (as outlined in Appendix I of the RFP)
- E. Intrinsic has provided an all-inclusive fixed price for the requirements that does not exceed \$900,000 CDN, and that all pricing and cost information is in a separate sealed envelope
- F. False or misleading information in our proposal will automatically disqualify us.

5.2 Statement of Potential Conflict of Interest

It is difficult to undertake a project of this nature with internationally recognized experts in the field of oil and gas environmental fate and potential health effects, without recruiting individuals that have worked, or are currently working, for industrial or government clients. All companies, and many of the individual members, of the Intrinsic Team have worked directly for numerous oil and gas clients in BC, Alberta and internationally. In addition, the individual companies or team members may have conducted paid consulting work for industry associations that are involved in the formal advocacy of the oil and gas industry in Canada and internationally. That being said, the Intrinsic Team companies and individuals have also provided paid consulting work to numerous provincial, state and federal governments in the same field. Regardless of whether consulting work has been conducted on behalf of industrial or government clients, our work is almost always subjected to a rigorous public peer-review process. At no time has any company or individual of the Intrinsic Team engaged in formal “advocacy” or “lobbying” on behalf of an individual client or organization involved in the oil and gas industry.

Of particular note are the individuals on the Intrinsic Advisory Panel. Although these individuals may have perceived strong ties to one or more industrial clients, industry groups, government organizations or non-government organizations (NGOs), each has confirmed with the Intrinsic Team Project Manager that they are not in actual conflict of interest with their current consulting or non-profit activities. However, all three individuals have confirmed that they will sign a BC MOH confidentiality agreement and will not disclose any project details, discussions, conversations, documents or any other material to any third-party, either during the course of the project or upon its completion, that are not publically available to all.

Each of the individuals and companies that comprise the Intrinsik Team is prepared to comply with Section 4 p) requirement of the RFP that stipulates that we *“Be prepared for all proposed team members to sign a confidentiality/non-disclosure agreement.”* To the best of his ability the Intrinsik Team Project Manager will ensure throughout the project that at no time any member of the team breaches BC MOH confidentiality agreement, nor will team members allow conflict of interest to arise. It should be noted that many of the individual team members may be actively engaged over the next 18 months in oil and gas projects in northeastern BC, Alberta or internationally under environmental assessment or other such activities. Team members will in no way use knowledge gained as part of this project in an untoward manner during these activities.

Given the long and proven track-record of each of the individuals and companies that comprise the Intrinsik Team in ensuring beyond reproach professional conduct we are confident that all individuals will conduct themselves in an appropriate manner.

6.0

CLOSURE

The Intrinsic Team would like to take this opportunity to thank the Ministry of Health for allowing us to submit this proposal. Please do not hesitate to contact either of the undersigned if you have any questions about the proposal. If required, the Intrinsic Team would be pleased to discuss the contents of our proposal in an interview process at your convenience. We are also prepared to start the project immediately upon contract award.

Sincerely,

INTRINSIK ENVIRONMENTAL SCIENCES



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APPENDIX A

CURRICULA VITAE

Pages 102 through 243 redacted for the following reasons:

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