BRITISH COLUMBIA | Ministry of Aboriginal Relations and Reconciliation

BRIEFING NOTE FOR INFORMATION

DATE: February 24, 2015

PREPARED FOR: Honourable John Rustad, Minister of Aboriginal Relations and Reconciliation

MEETING: February 25, 2015 meeting with Honourable Ministers Lake, Coleman, Polak, Stone, Bennett, and MLA Bernier, MLA Pimm

ISSUE: Human Health Risk Assessment in Northeast Oil and Gas Development

SUMMARY:

- **The Human Health Risk Assessment (HHRA) on Northeast Oil and Gas Development is a three-phrase project led by the BC Ministry of Health to identify, explore, and assess concerns about human health risks relating to oil and gas activities in Northeast British Columbia (BC).**
- **The HRRA study area encompasses six Treaty 8 First Nations communities: Blueberry River, Doig River, Halfway River, McLeod Lake, Saulteau, and West Moberly First Nations.**
- **Opportunities for further enhancements to the provincial oil and gas policy and regulatory regimes have been identified, in order to strengthen the Province's capacity to prevent and mitigate human health impacts from oil and gas activities.**
- **Overall, this assessment project demonstrates that the existing policy framework within BC is extensive and broadly protective of human health.**

BACKGROUND:

The two primary study objectives of the HHRA are 1) to assess health risks associated with oil and gas activity in Northeast BC, and 2) where appropriate, provide recommendations to address potential public health risks.

The HHRA has used a widely accepted approach for assessing environmental risks that has been endorsed by regulatory agencies domestically and internationally. A total of 26 community locations in Northeast BC were evaluated individually within the HHRA along with areas of maximum predicted ground-level concentrations of each chemical of potential concern (COPC).

Phase 1 of the project has concluded, with the completion and release of the public and stakeholder engagement report, released in June 2012. Phase 2 has also been concluded, with the completion of the quantitative assessment report led by Intrinsik Environmental Sciences. Phase 3, yet to be initiated, is the public release of Phase 2 assessment results.

On Wednesday, February 25, 2015 Ministers from participating ministries have been invited to receive a presentation from Intrinsik on the project, and discuss options for Phase 3 public release.

DISCUSSION:

The primary source of gas production within BC occurs within Treaty 8 territory in Northeast BC.

With the prospect of multiple LNG plants being developed, it is expected that most of the natural gas feedstock for these LNG projects will be derived from gas production within Treaty 8 territory.

Phase 3 Options

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The Ministers will have the opportunity to consider options for public release of the HHRA public report. With a potential budget of s.17 two options have been developed by the Ministry of Health for consideration:

Option 1: Ministry of Health to hire a consultant to undertake community meetings in the northeast explaining the results of the study and responding to questions in spring 2015. Government response and actions could follow shortly after.

Option 2: A cross-ministry response to the report is prepared in spring 2015 (led by Ministry of Health or another ministry) with actions to address the recommendations. Consultants would undertake a public information campaign in late spring 2015 (including community meetings, as well as printed and web based information) providing information on the study and the cross-ministry actions to address the study recommendations.

The proposed advantages and disadvantages to each of the options above have been outlined in Appendix D.

Treaty 8 First Nations Engagement

Potential impacts of oil and gas activities to humans, wildlife, and water are concerns continuously expressed by Treaty 8 First Nations in Northeast BC, nested within their broader concern of cumulative impacts of natural resource development in the region. Specific concerns have included s.13,s.16
s.13,s.16

s.13,s.16

As Ministers review the proposed options for Phase 3 public release of the HHRA, consideration for reasonable and meaningful engagement with Treaty 8 First Nations would be valuable. s.13,s.16
s.13,s.16

Attachments (6):
1. Ministry of Health Information Briefing Note: Oil and Gas Human Health Risk Assessment
2: Appendix A: Quantitative Human Health Risk Assessment (Executive Summary)
3: Appendix B: Review Of Regulatory Framework (Executive Summary)
4: Appendix C: Recommendations Report (Summary)
5: Appendix D: Options For Phase 3 Of The Northeast Oil And Gas Human Health Risk Assessment
6: Intrinsik Presentation for Ministers: Phase 2 Human Health Risk Assessment of Oil and Gas Activity in Northeastern British Columbia

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PREPARED BY:	REVIEWED BY:	INITIALS:
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Phase 2 Human Health Risk Assessment of Oil and Gas Activity in Northeastern British Columbia

November 19, 2014

Presented by Bart Koppe, Intrinsik Environmental Sciences

Presentation outline

- Introduction to the study
- Key findings
- Recommendations
- Next steps

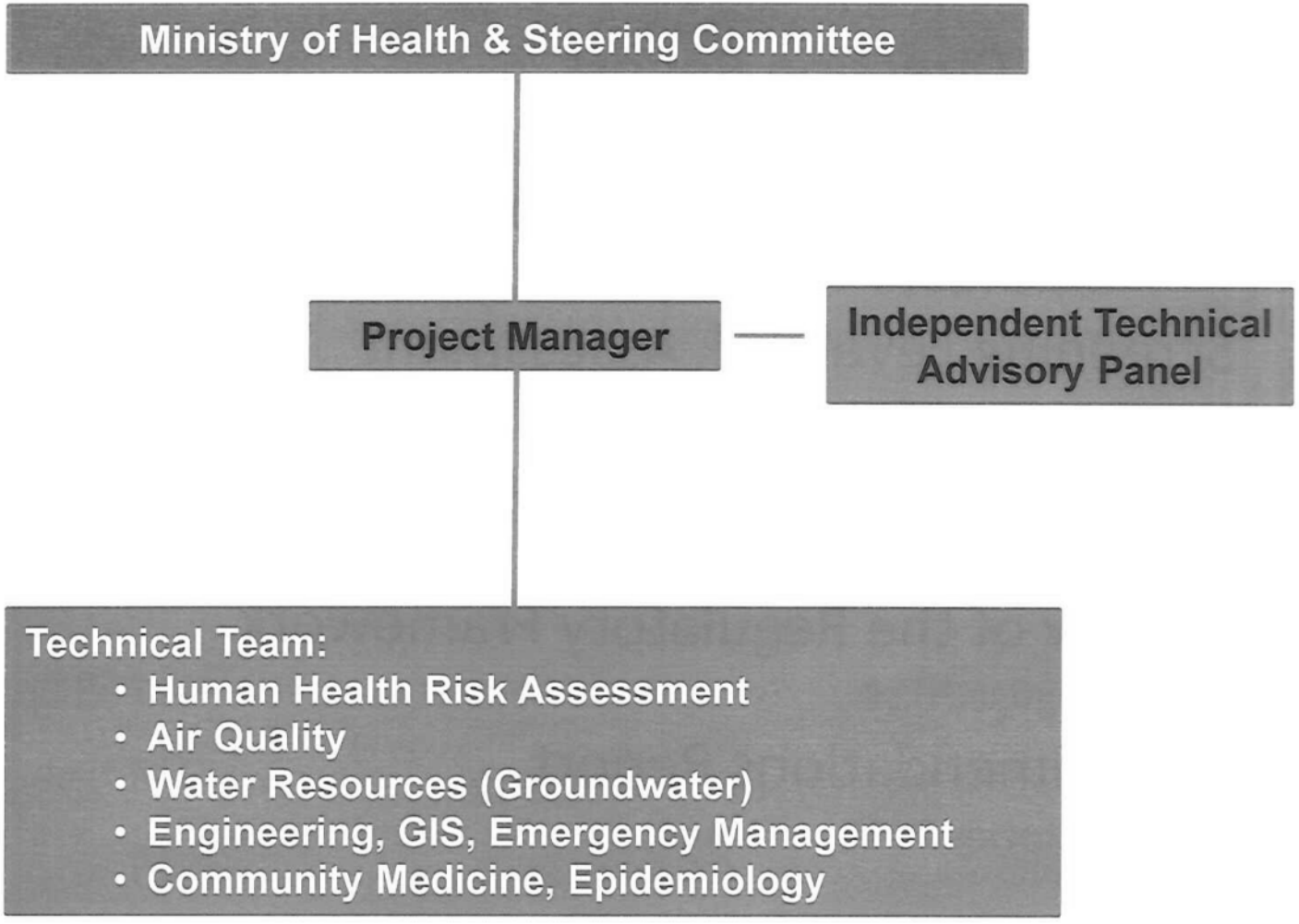
Study Objectives

1. *To assess the health risks associated with oil and gas activity in NE BC*
2. *Where appropriate, provide recommendations to address potential public health risks*

Overview of Project

- **Phase 1 HHRA.** Identification of Health Concerns Relating to Oil and Gas Development in NE BC. Completed in 2012.
- **Phase 2 HHRA.** Assessment of the potential health risks in NE BC (with emphasis on chemical emissions). Completed in 2014.
- **Phase 3 HHRA.** Communication of overall results. Timeline: To Be Determined.

Study Team


Ministry of Health & Steering Committee
Project Manager
Independent Technical Advisory Panel
Technical Team:
• Human Health Risk Assessment
• Air Quality
• Water Resources (Groundwater)
• Engineering, GIS, Emergency Management
• Community Medicine, Epidemiology

Timeline of Phase 2 HHRA

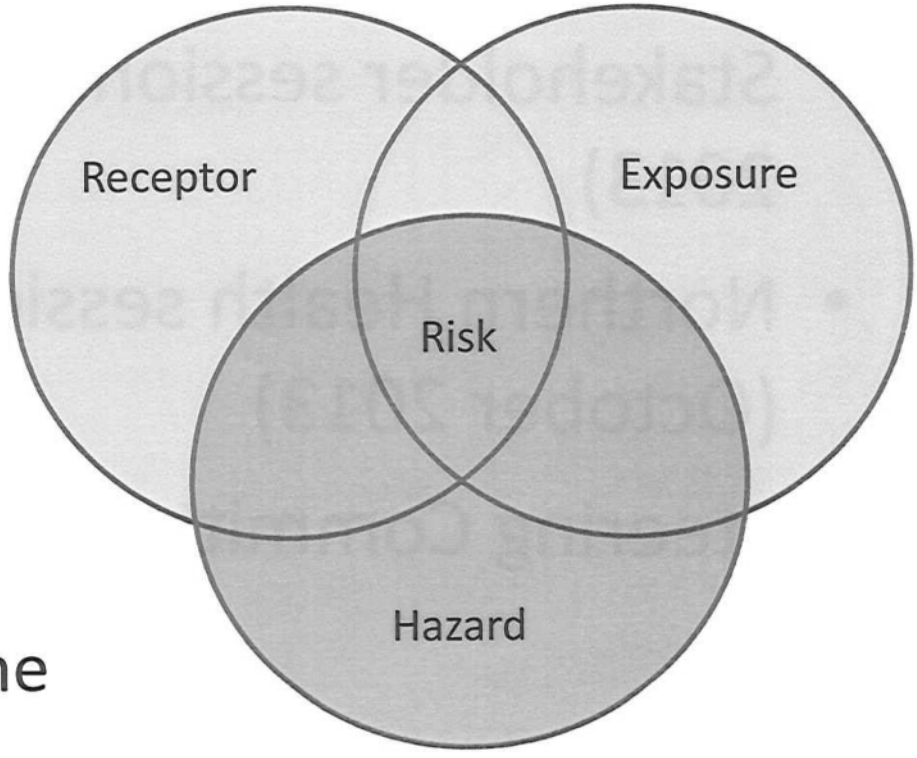
1. Phase 2 Direction Report
   - January 2013
2. Literature Review of Possible Health Effects
   - March 2013
3. Screening Level Risk Assessment
   - January 2014
4. Detailed Human Health Risk Assessment
   - August 2014
5. Review of the Regulatory Framework
   - August 2014
6. Recommendations Report
   - October 2014

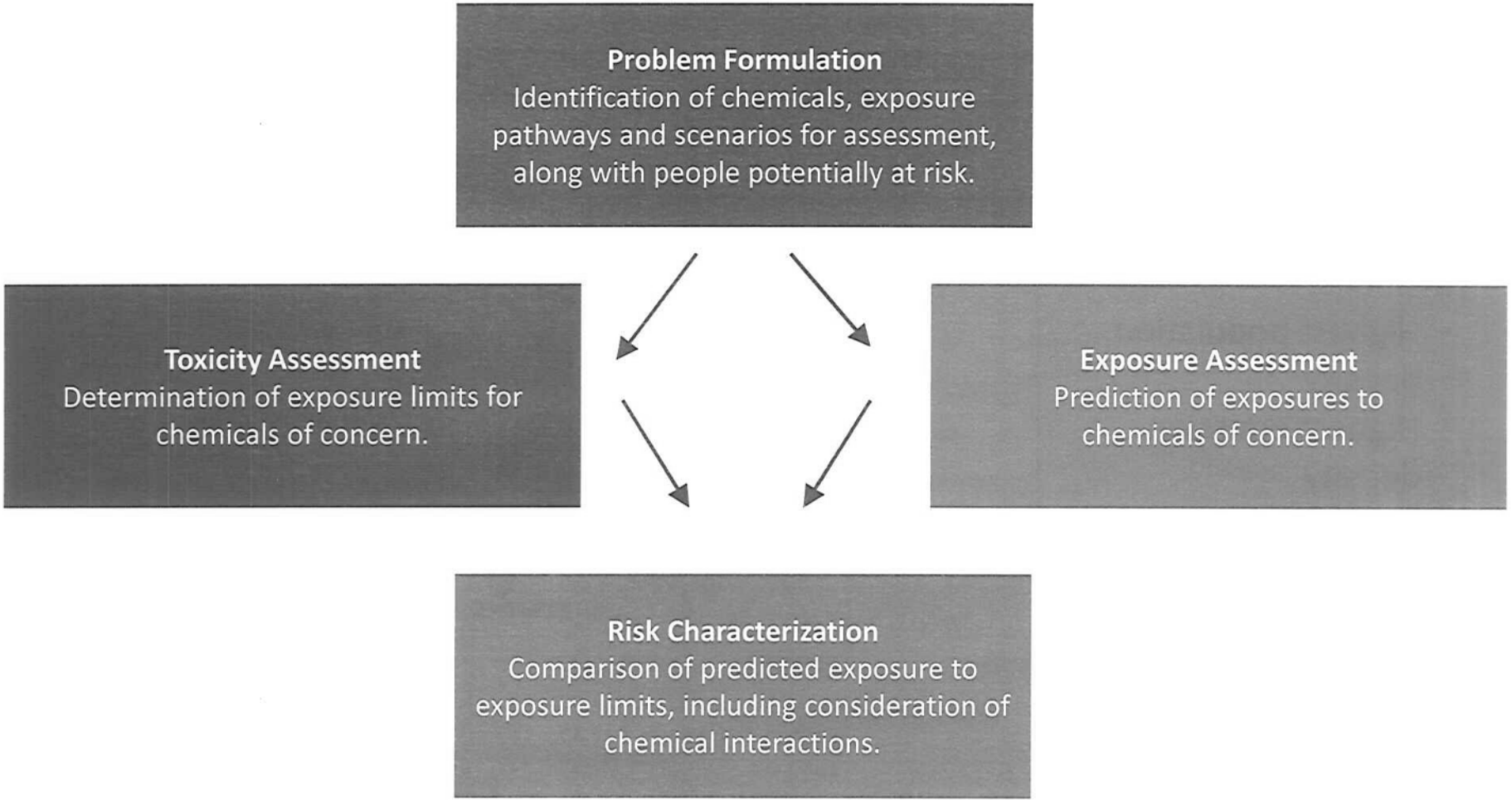
Communication

- Stakeholder sessions in Fort St. John (January 2013)
- Northern Health session in Fort St. John (October 2013)
- Steering Committee sessions throughout

How was the HHRA conducted?

- Standard risk assessment approach
- Developed by regulatory agencies (Health Canada, US EPA, World Health Organization)
- "When in doubt, err on the side of caution"



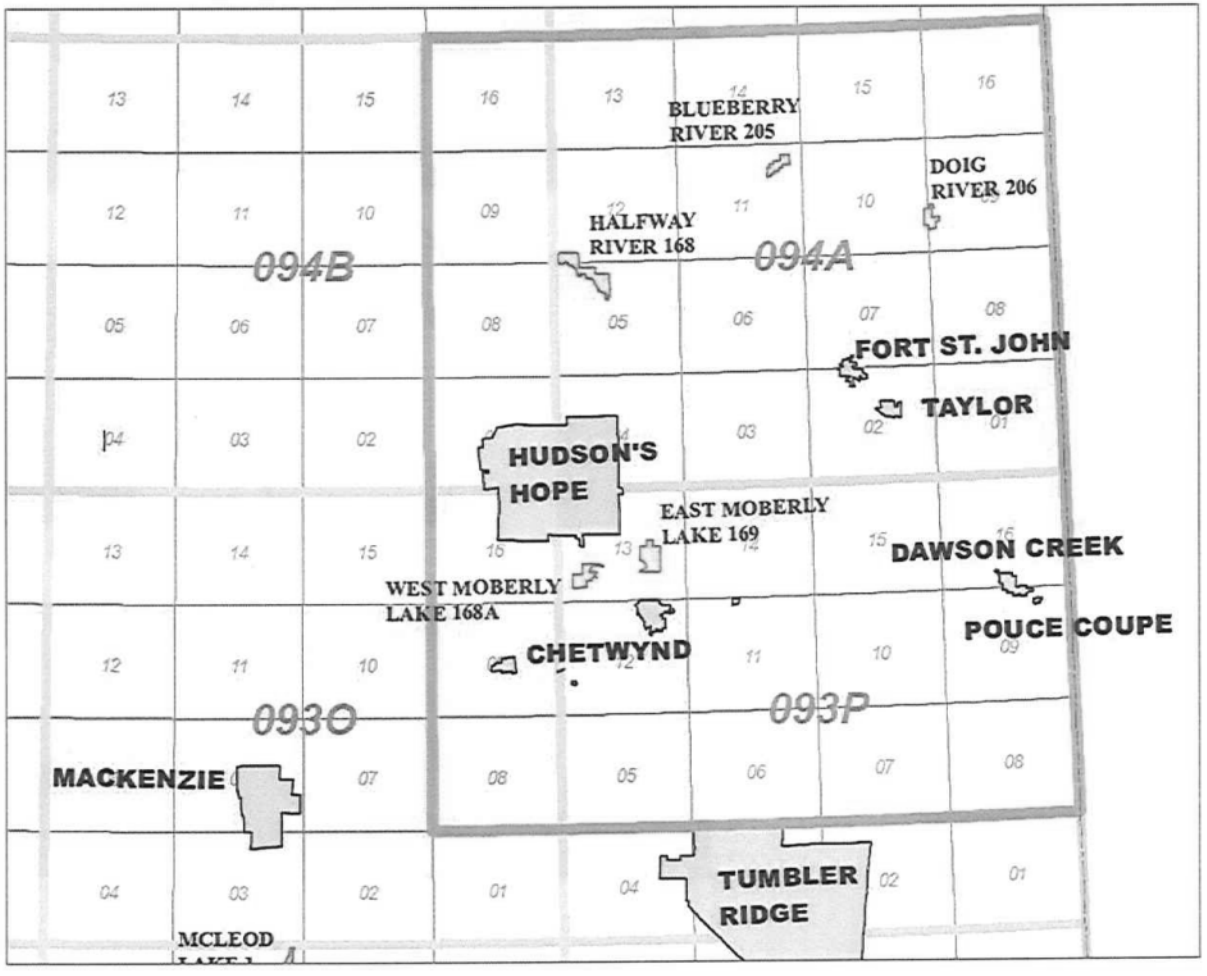

Problem Formulation
Identification of chemicals, exposure pathways and scenarios for assessment, along with people potentially at risk.
Toxicity Assessment
Determination of exposure limits for chemicals of concern.
Exposure Assessment
Prediction of exposures to chemicals of concern.
Risk Characterization
Comparison of predicted exposure to exposure limits, including consideration of chemical interactions.

Selected HHRA Study Area

Area:
~175 x 150 km

Includes:

- Highest population density
- Highest emission density
- Greatest variety of emission sources
- First Nations

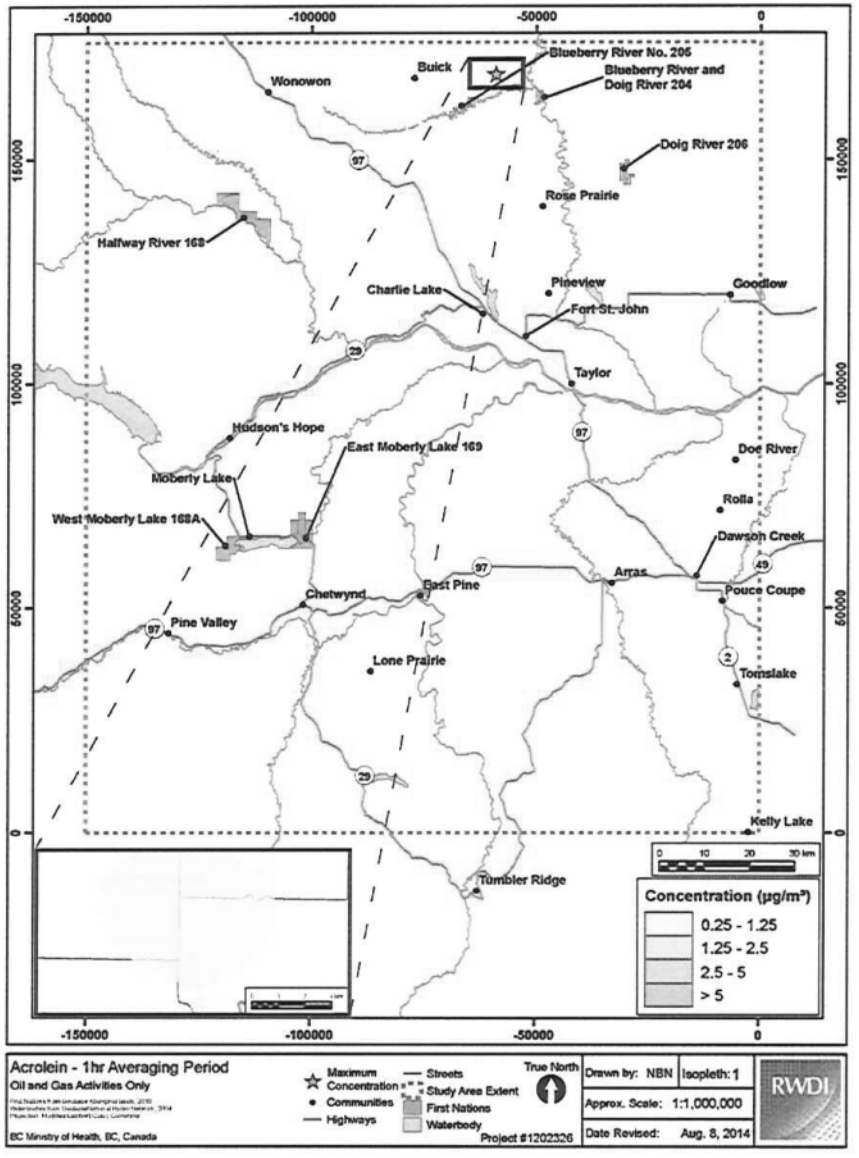


HHRA: Assessment Scenarios

- **Oil and Gas Scenario:** includes all ongoing air emissions from gas processing plants and various production facilities (e.g., compressor stations, fugitive emissions from tank storage)
- **Cumulative Scenario:** includes air emissions from O&G, other industries, transportation and community sources

HHRA: Inhalation Results

- Findings of interest identified for the following chemicals of potential concern:
  - NO_2
  - $PM_{2.5}$
  - SO_2
  - Acrolein
  - Formaldehyde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Pouce Coupe
Pine Valley
Lone Prairie
Tomslake
Kelly Lake
Tumbler Ridge
0 10 20 30 km
Concentration (µg/m³)
0.25 - 1.25
1.25 - 2.5
2.5 - 5
> 5
Acrolein - 1hr Averaging Period
Oil and Gas Activities Only
Maximum Concentration
Communities
Highways
Streets
Study Area Extent
First Nations
Waterbody
True North
Drawn by: NBN
Isopleth: 1
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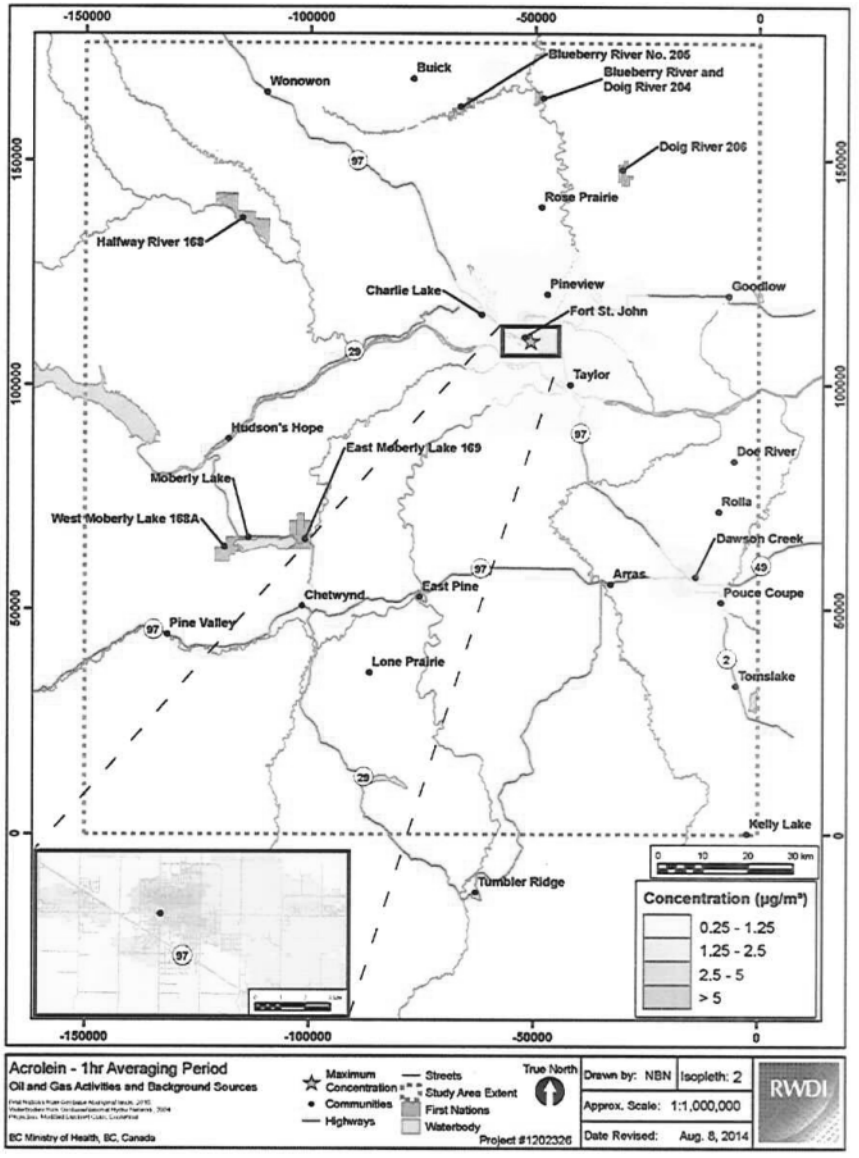
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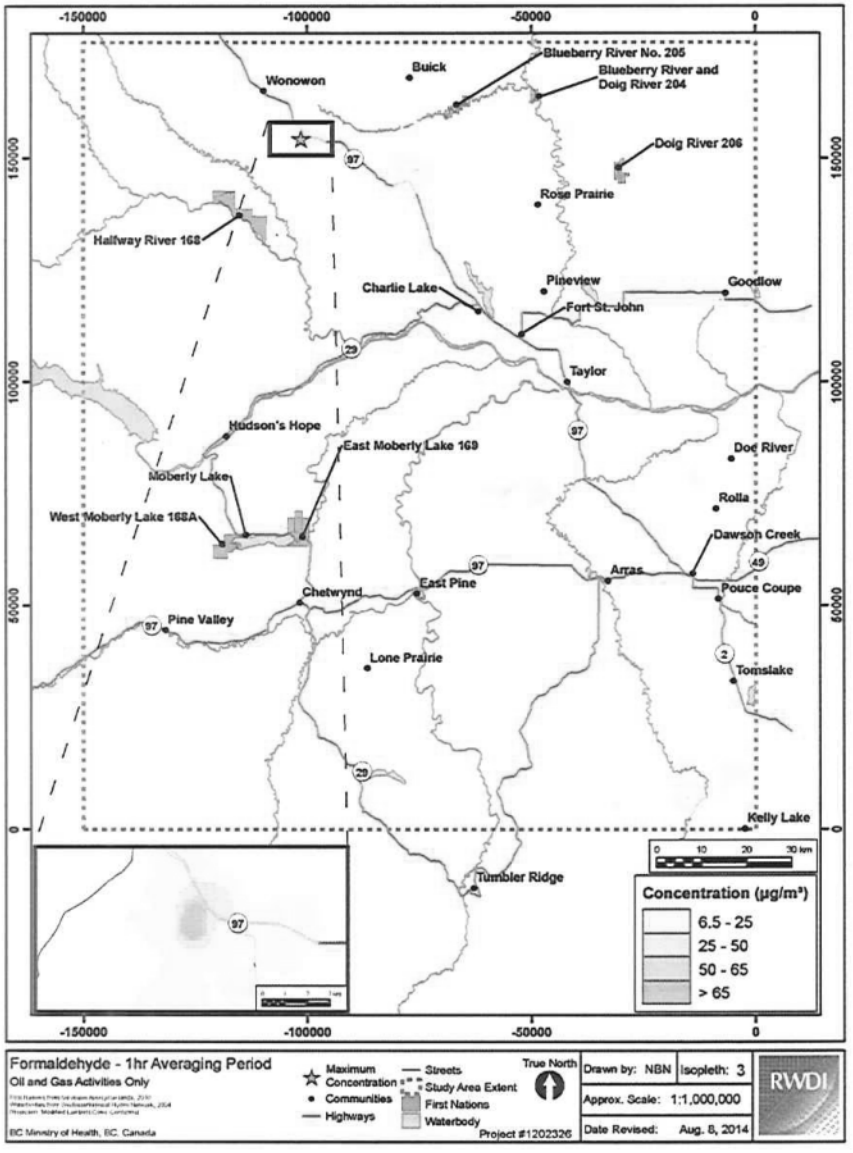
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0 10 20 30 km
Concentration (µg/m³)
6.5 - 25
25 - 50
50 - 65
> 65
Formaldehyde - 1hr Averaging Period
Oil and Gas Activities Only
Maximum Concentration
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Study Area Extent
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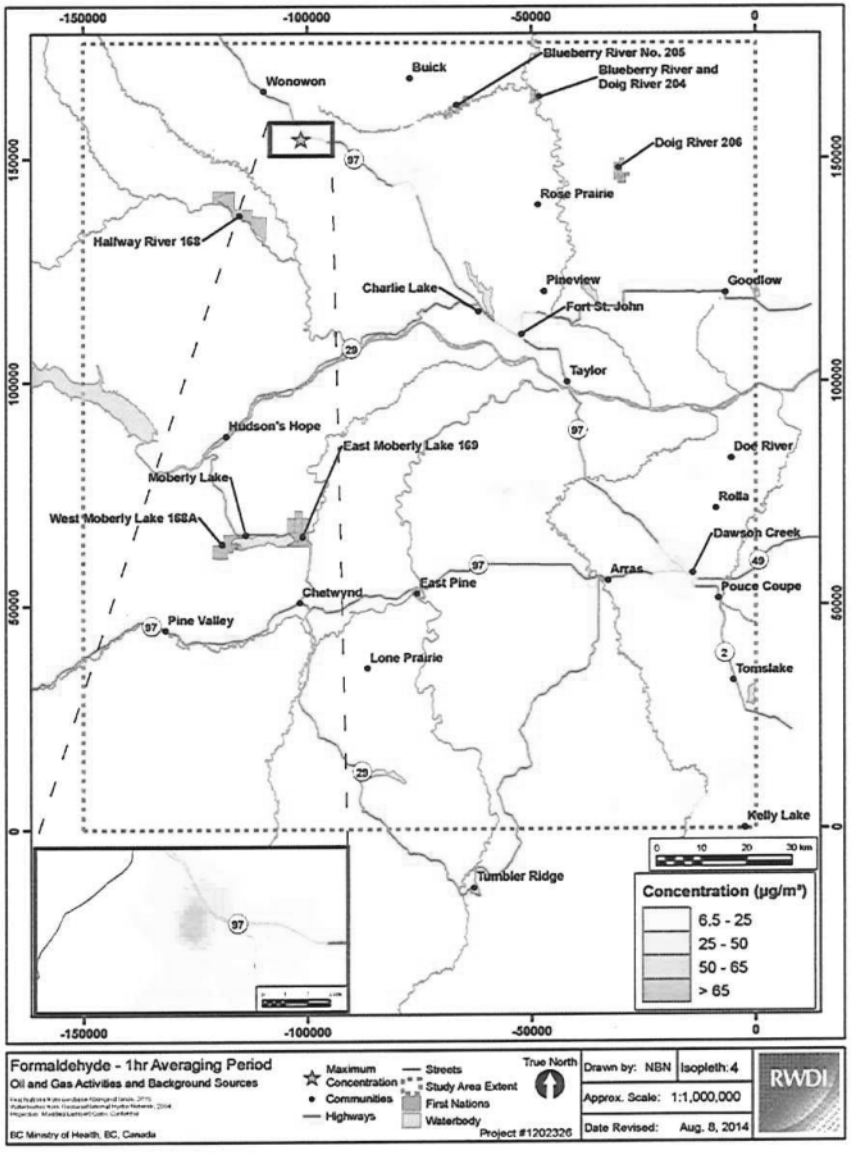
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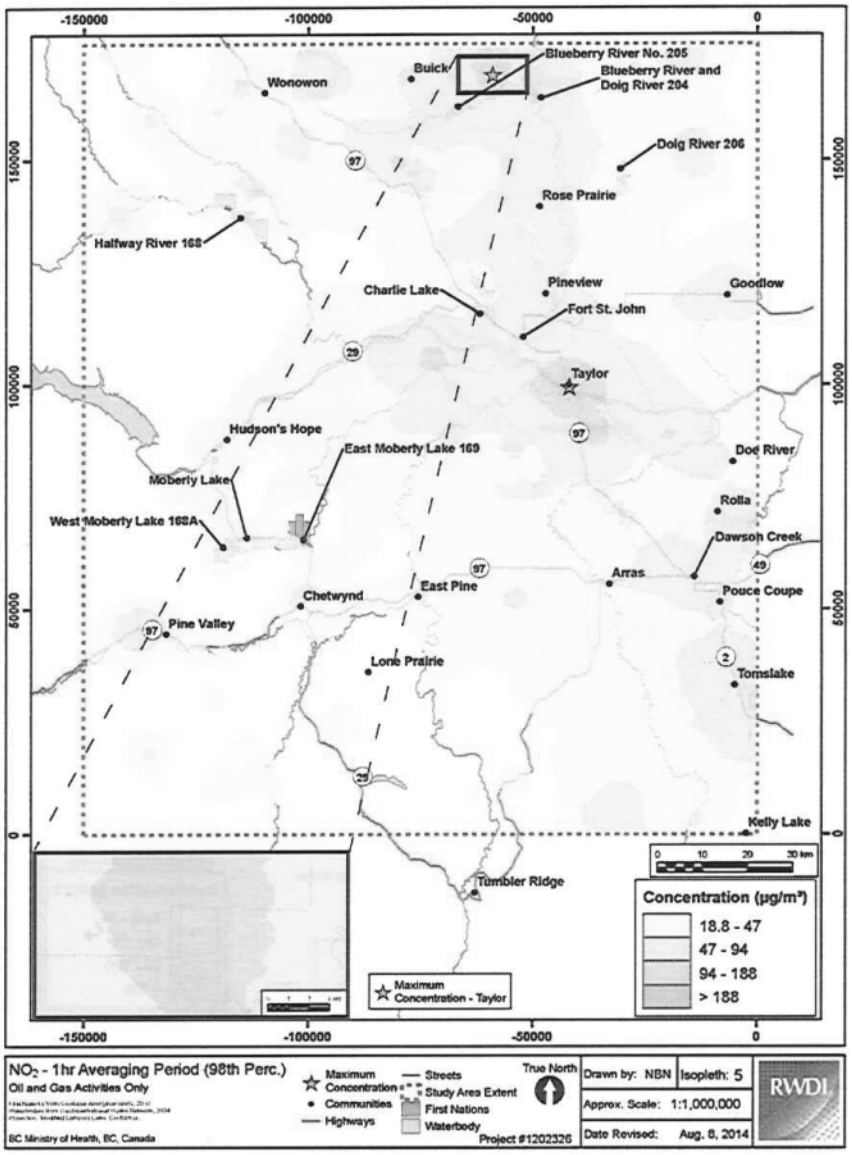
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Concentration (µg/m³)
18.8 - 47
47 - 94
94 - 188
> 188
Maximum Concentration - Taylor
NO2 - 1hr Averaging Period (98th Perc.)
Oil and Gas Activities Only
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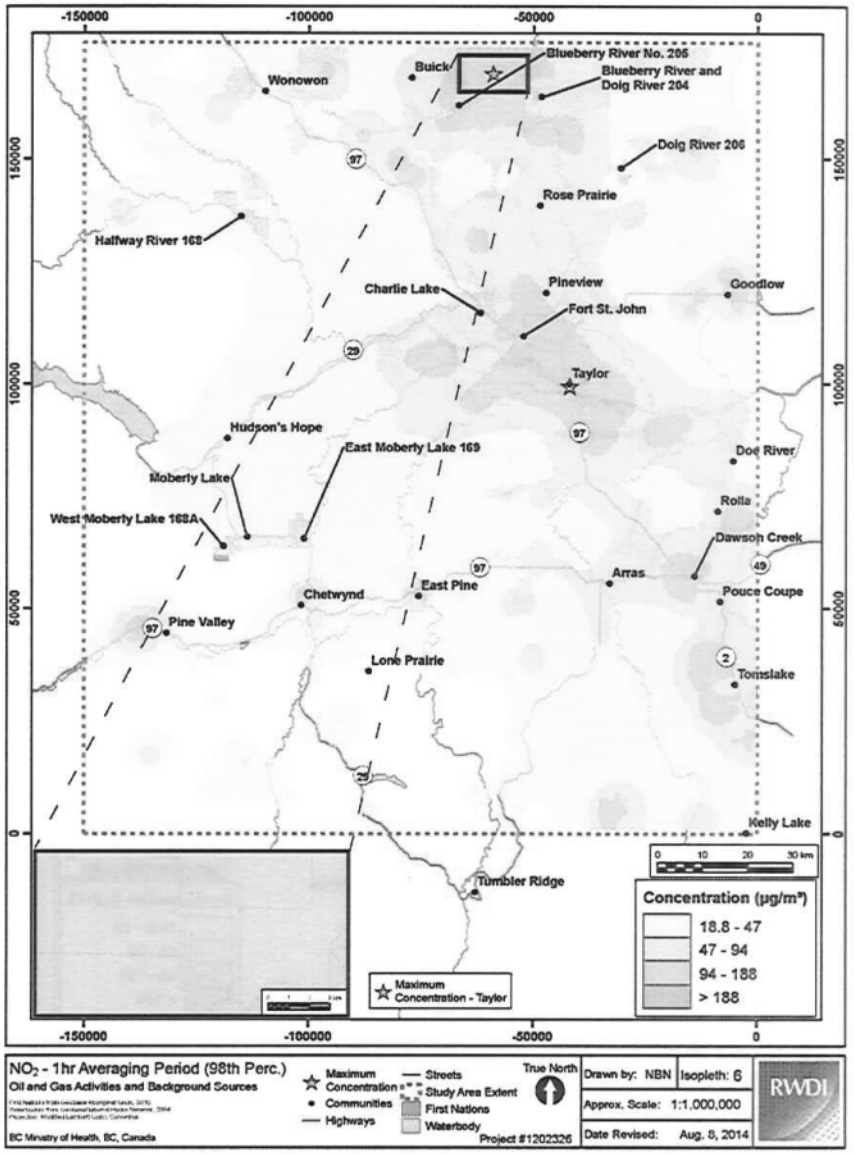
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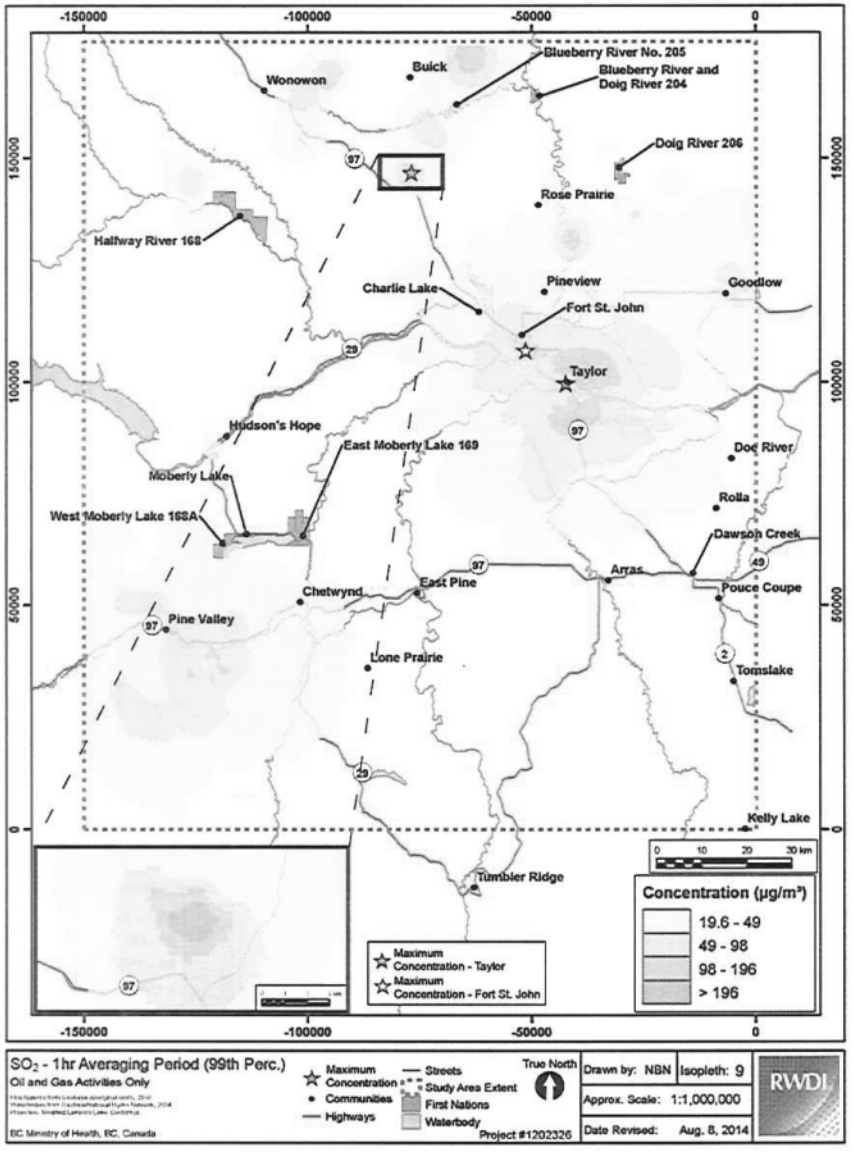
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Concentration (µg/m³)
19.6 - 49
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98 - 196
> 196
Maximum Concentration - Taylor
Maximum Concentration - Fort St. John
SO2 - 1hr Averaging Period (99th Perc.)
Oil and Gas Activities Only
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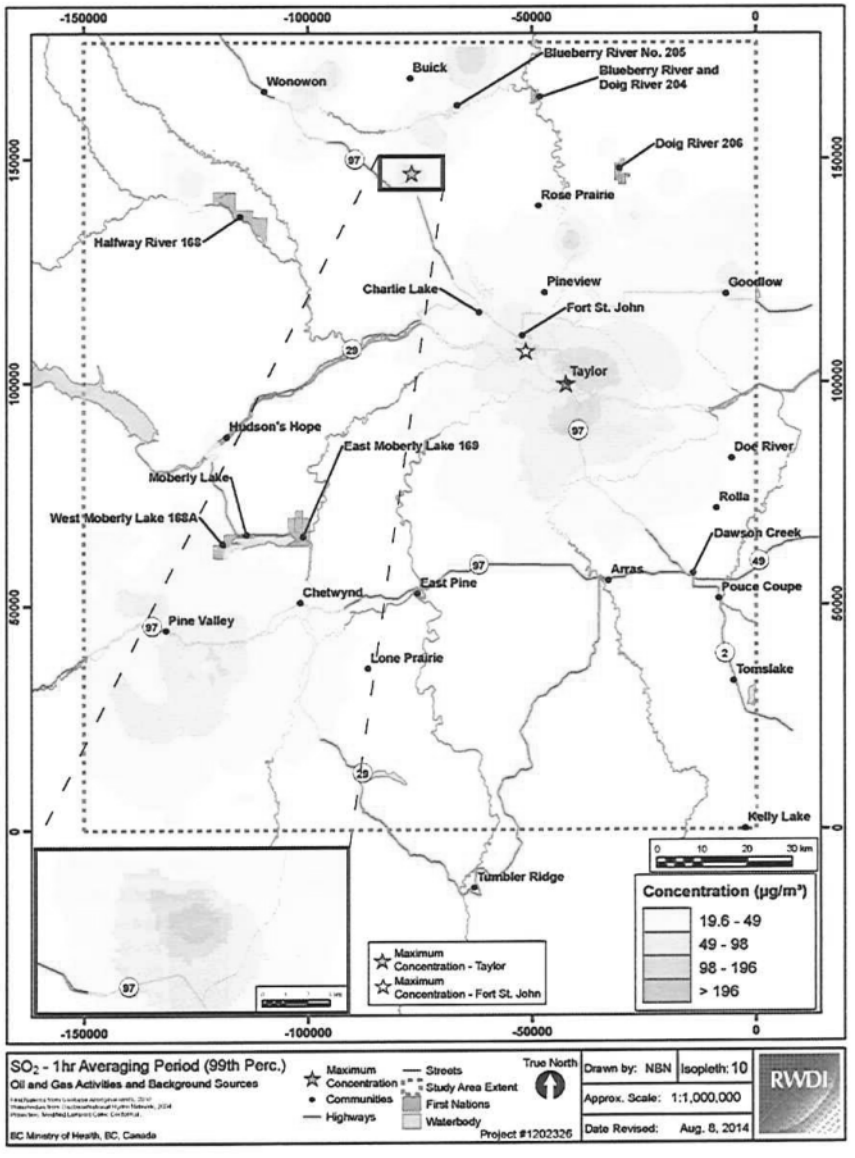
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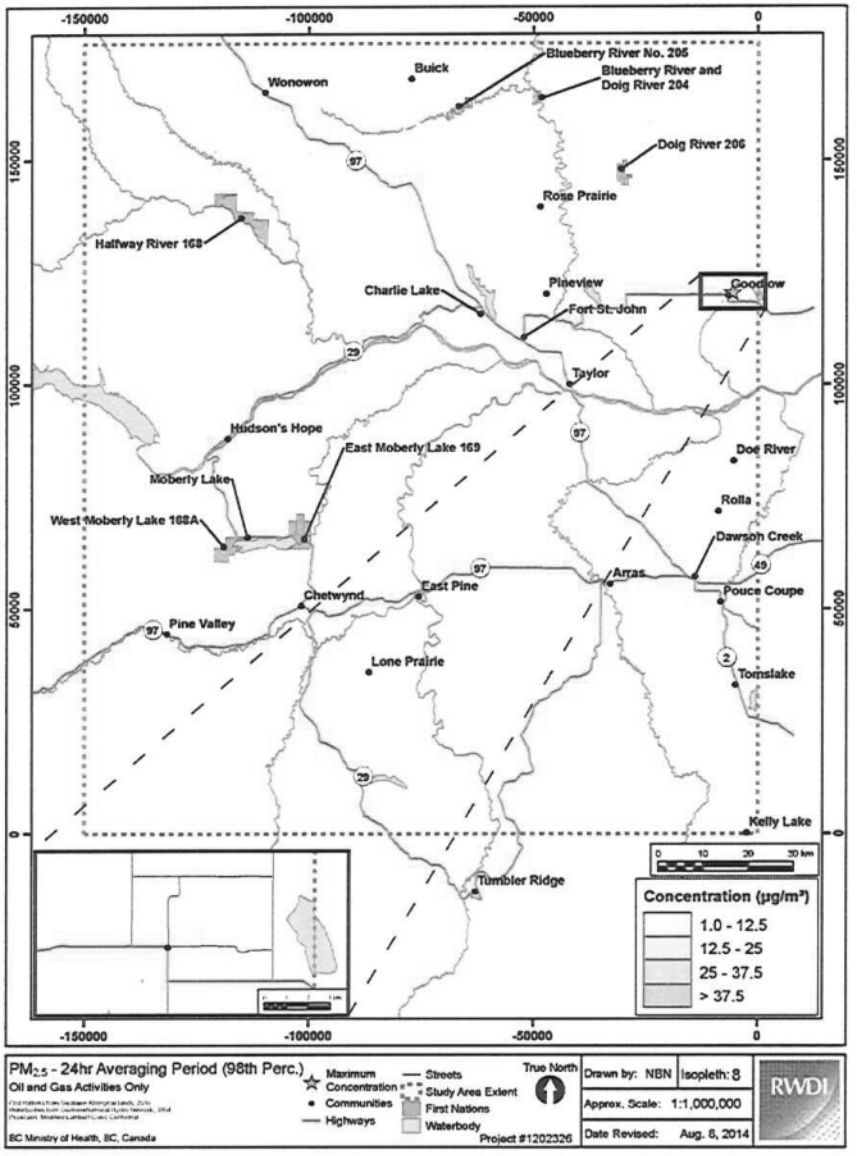
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Concentration (µg/m³)
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12.5 - 25
25 - 37.5
> 37.5
PM2.5 - 24hr Averaging Period (98th Perc.)
Oil and Gas Activities Only
Maximum Concentration
Communities
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Study Area Extent
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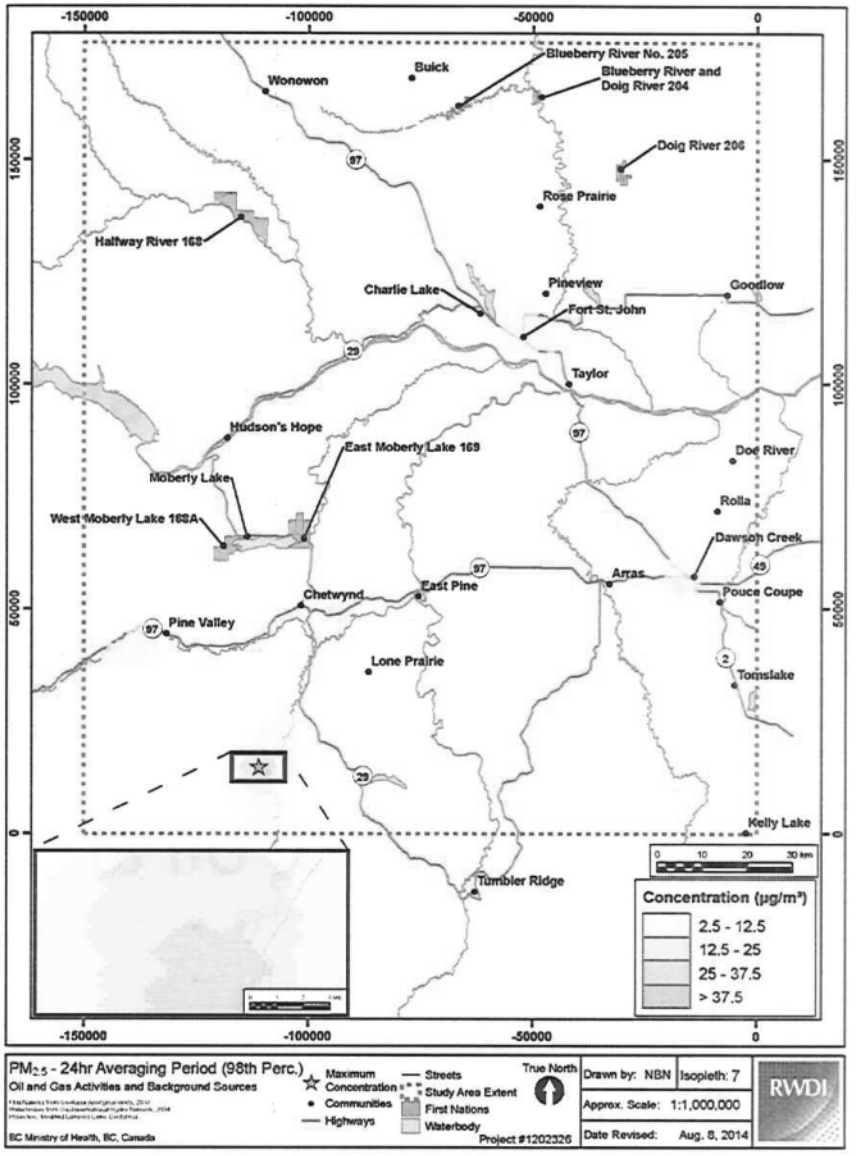
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Concentration (µg/m³)
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PM2.5 - 24hr Averaging Period (98th Perc.)
Oil and Gas Activities and Background Sources
Maximum Concentration
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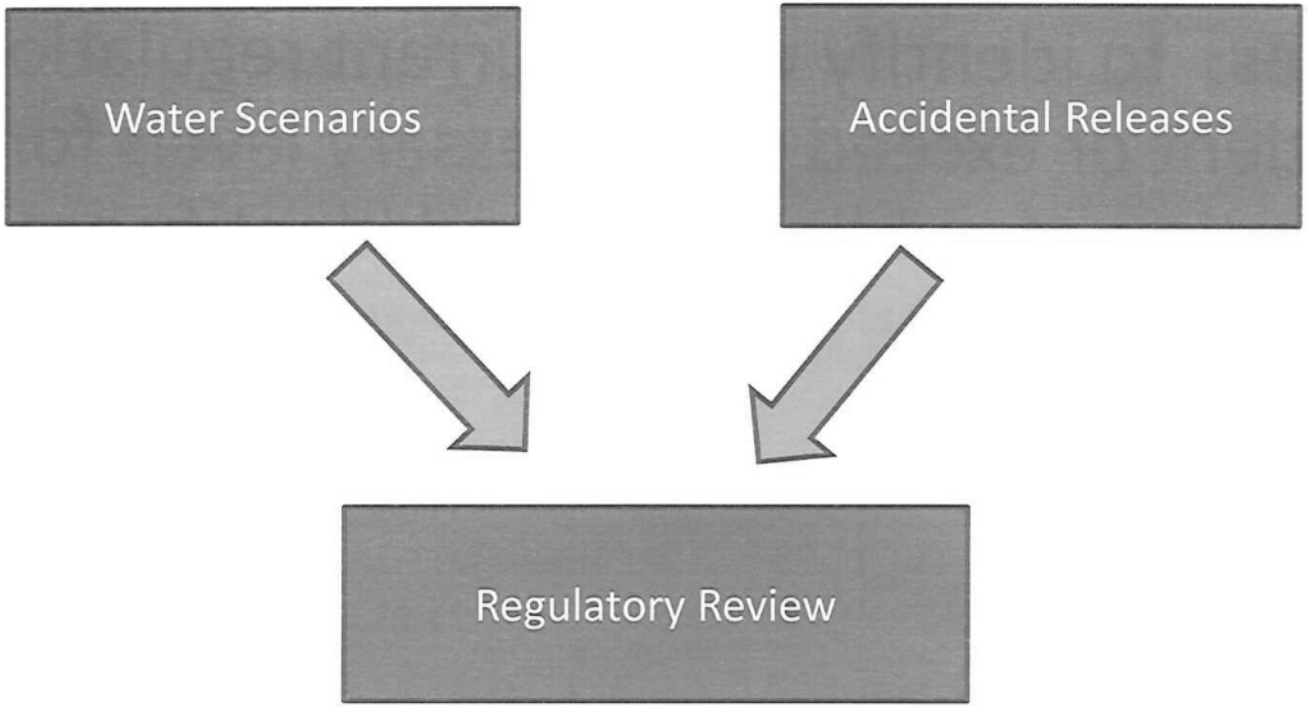
HHRA: Conclusion

First objective was to assess the health risks associated with oil and gas activity in NE BC …

Conclusion = The overall findings of the detailed HHRA suggest that the public health risks associated with oil and gas activity in NE BC are low

Notable omissions from the HHRA



Review of Regulatory Framework

Objectives: to identify where current regulations are sufficient or exceed the necessary levels for the protection of public health and identify areas where critical aspects of the framework are lacking

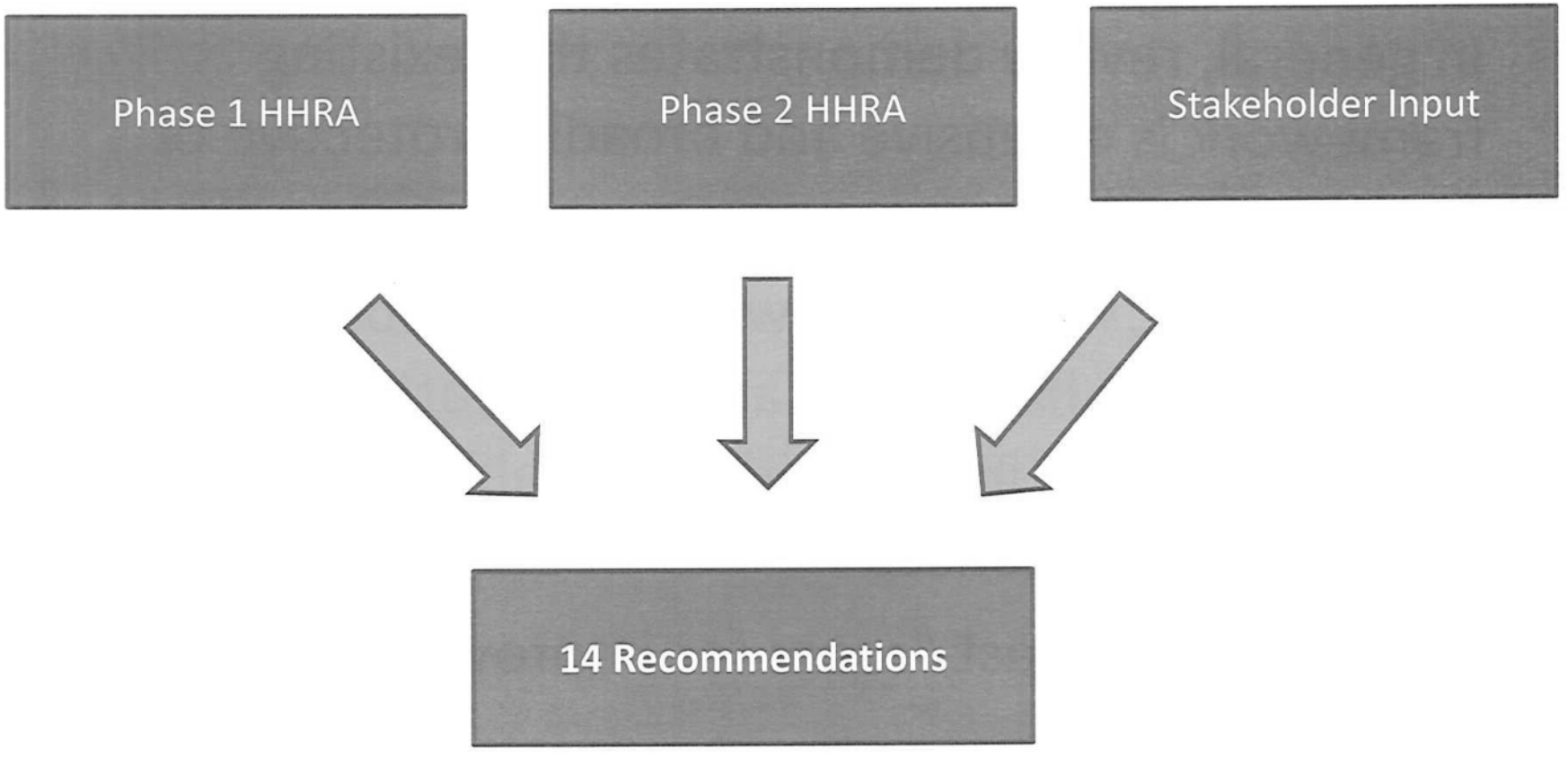
Review considered:

- Relevant regulations, guidelines, directives
- Industry best management practices (e.g., CAPP)

Key Findings of the Regulatory Review

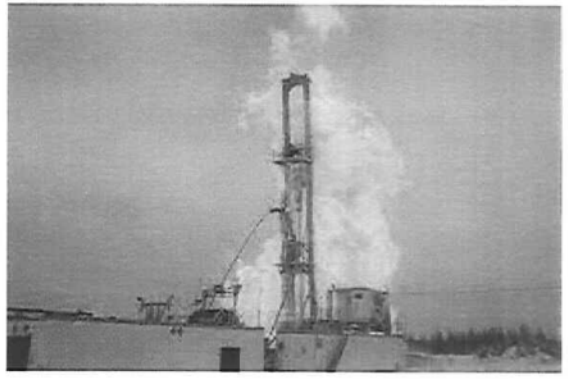
- In general, review demonstrates that existing framework is extensive and broadly protective of health
- Generally, BC regulations were comparable to the measures that have been adopted in other jurisdictions and in line with applicable best management practices
- Findings do suggest "room for improvement" in certain areas

Recommendations Report

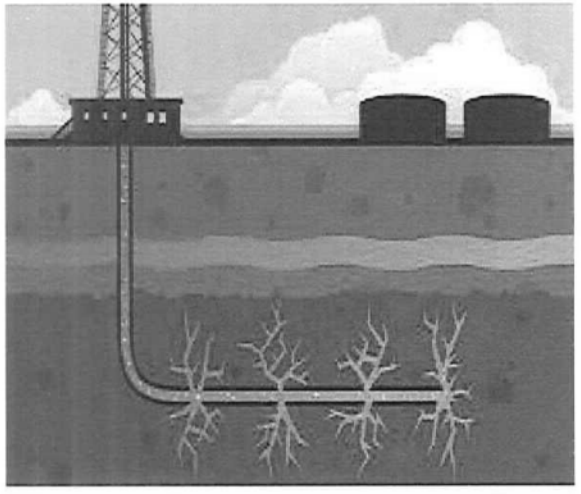


Public Safety

- The current tools applied to the calculation of Emergency Protection Zones (EPZ) and setback provisions should be updated
- Consider the implementation of a *reciprocal agreement framework for setbacks* between the oil and gas industry and BC's communities



Hydraulic Fracturing

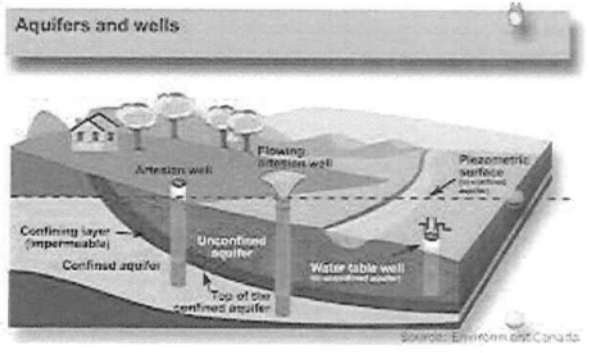


- Consider the implementation of *baseline, pre-drilling* groundwater testing requirements
- Consider refining the fracture fluid disclosure process to aid authorities and health professionals in accessing information about fluid ingredients

Environmental monitoring

- **Air:** Consider using the information from the air quality study and HHRA to help:
  - Identify the location of future monitors
  - Select the types of pollutants to be monitored.

- **Water:**
  - Existing aquifer mapping should be expanded for NE BC
  - Additional study of groundwater and surface water interactions within shallow aquifers and local groundwater flow conditions should be completed in NE BC



Information Management

- Review objectives and efficiency of various databases managing permits, facility information, wells and flares data

Next steps

?

MINISTRY OF HEALTH
INFORMATION BRIEFING NOTE

Cliff # 1023582

PREPARED FOR: Honourable Terry Lake, Minister - **FOR INFORMATION**

TITLE: Human Health Risk Assessment on Northeast Oil and Gas Development

PURPOSE: Provide update on the Northeast Oil and Gas Human Health Risk Assessment Project and provide options for Phase 3 for discussion at the Ministers' meeting on February 25, 2015.

BACKGROUND:

The Human Health Risk Assessment (HHRA) on Northeast Oil and Gas Development is a three-phase project led by the Ministry of Health to identify, explore and assess concerns about human health risks relating to oil and gas activities in northeastern British Columbia. The Phase 1 report, summarizing concerns raised by the public and stakeholders in the region, was released in June 2012. Phase 2 was initiated in November 2012 and key deliverables, undertaken by Intrinsik Environmental Sciences (Intrinsik), include a literature review, screening level risk assessment (SLRA), detailed human health risk assessment, a review of the regulatory framework and a recommendations report. Phase 3, yet to be initiated, is the public release of the Phase 2 results.

The detailed HHRA followed a standard scientific process (recognized by Health Canada and the US Environmental Protection Agency) to estimate the nature and probability of adverse health effects in humans who may be exposed to chemical contaminants in environmental media. It focused on continuous air emissions from gas processing plants and production facilities, which were identified as priority exposure scenarios through a screening level risk assessment (SLRA). The results of the detailed HHRA suggest a low probability of adverse health impacts from exposures to air contaminants related to oil and gas activity (see Appendix A for more details).

The Review of the Regulatory Framework aimed to identify areas for improvement in the Province's existing oil and gas regulatory framework as it relates to the protection of human health. Findings suggest that the existing framework is extensive and broadly protective of health but indicates there is room for improvement in selected areas (see Appendix B for more details).

The Recommendations Report, finalized in November, is based on the findings of Phases 1 and 2, the study team's collective experience and the concerns raised by stakeholders throughout the project. They do not consider feasibility, enforcement, future regulations, responsibility, or economics. They are intended for government's consideration. The recommendations (see Appendix C for more details) relate to:

Public Safety (Emergency Management and Setbacks)

- Update methods for calculating hazard distances and emergency planning zones.
- Update land use and setback provisions and consider equal application to both oil and gas and land development activities.

Flaring, Venting and Fugitive Emission Management

- BC Ambient Air Quality Objectives should guide the development of regulations, directives and policies pertaining to flaring, venting, and fugitive emissions.

Hydraulic Fracturing

- Consider baseline pre-drilling groundwater testing requirements.
- Consider refining the fracturing fluid disclosure process.

Legacy Sites

- Use Provincial Site Classification Tool and Contaminated Sites Regulation framework together in the assessment and management of legacy sites.

Information Management

- Review objectives and efficiency of various databases managing permits, facility information, wells and flares data.

Environmental Monitoring and Health Surveillance

- Continue to follow principles outlined in the Framework for the BC Air Monitoring Network and use the results of the HHRA to inform its expansion, including monitoring of additional contaminants.
- Verify air quality predictions and human health risks as new monitoring data becomes available.
- Expand aquifer and vulnerability mapping.
- Expand study of groundwater and surface water interactions within shallow aquifers and ground water flow conditions to assess potential contaminant fate and migration.
- Expand environmental monitoring to include other media, such as biota, soil and water quality
- Tailor health surveillance to study health outcomes in areas with highest predicted air concentrations.

Standards Development

- Review and update various BC's Ambient Air Quality Objectives, including consideration of other chemicals of potential concern.

An HHRA project steering committee (including representatives from Northern Health, the Oil and Gas Commission, and Ministries of Natural Gas Development, Environment, Aboriginal Relations and Reconciliation, Transportation and Infrastructure) has met regularly to provide technical input and comment on the study design and findings.

DISCUSSION:

There is a public commitment to publicly report out on the Phase 2 findings and recommendations. Options include a series of community meetings to explain the study results and a cross-ministry response to the recommendations with a number of government initiatives/actions to address them (see Appendix D for more details). MOH is preparing a list of stakeholders to receive embargoed copies of the reports in advance of the public release.

ADVICE:

It is recommended that the Ministers from participating ministries hear a presentation from Intrinsik on the project and discuss options for Phase 3 (public release of Phase 2 reports).

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Date:	February 19, 2015

APPENDIX A:
QUANTITATIVE HUMAN HEALTH RISK ASSESSMENT
(EXECUTIVE SUMMARY)

The Ministry of Health (MoH) has contracted a team led by Intrinsik Environmental Sciences (Intrinsik) to complete Phase 2 of the Human Health Risk Assessment (HHRA) of oil and gas activities in northeastern British Columbia (NE BC). In addition to Intrinsik itself, the companies that make up the study team include: RWDI Air, Matrix Solutions and Skystone Engineering. The team also includes a three member Advisory Panel to provide an independent perspective on the design and approach of the Phase 2 HHRA project, and the interpretation of the results. In accordance with the terms of reference compiled by the MoH, the Phase 2 HHRA is intended to investigate the potential impact of oil and gas activities on human health in Local Health Areas 59, 60 and 81 (the Region).

This report presents the detailed HHRA component of the Phase 2 project. The objectives of this HHRA are to provide a comprehensive and focused assessment of potential health risks that may exist for people living in proximity to oil and gas activities in NE BC.

A Screening Level Risk Assessment (SLRA) was completed with the objective of guiding the scope of work for the detailed HHRA. As part of this SLRA, a qualitative risk-ranking exercise was completed for 50 different oil and gas emission scenarios. From this analysis, two air emission scenarios were selected for further evaluation in the detailed HHRA:

1. Continuous air emissions from gas processing plants.
2. Continuous air emissions from production facilities.

These two scenarios and the numerous associated emission sources within each category are considered together to represent continuous emissions from oil and gas activity within this detailed HHRA. By combining the emissions from the gas processing plants and production facilities into a single emission scenario representing oil and gas activities, the potential influence on air quality (and consequently human health) was addressed on a cumulative basis. In addition, information regarding potential emissions from regional sources from other non-oil and gas activities was incorporated into the detailed HHRA.

The HHRA used a widely accepted approach for assessing environmental risks that has been endorsed in the past by regulatory agencies throughout Canada and across the globe. The HHRA was performed step wise following a conventional paradigm and involved the following main steps:

- Problem formulation
- Exposure assessment
- Toxicity assessment
- Risk characterization

A large study area (150 km by 176 km) was defined for the purposes of the HHRA, and was selected such that the most densely populated areas and several First Nations in the NE BC

region were included, and also the most concentrated oil and gas development in the region was captured. The major communities in the study area include Fort St. John, Dawson Creek and Chetwynd, along with smaller communities and First Nation lands.

A comprehensive emission inventory of the continuously emitting oil and gas facilities was compiled for the study area. This inventory incorporated several thousand individual emission sources. In addition, to further characterize air quality on a cumulative basis and in order to compare air quality associated with oil and gas activities with those associated with non-oil and gas emission sources, two scenarios were considered in the HHRA:

1. **Oil and Gas Scenario:** includes all on-going emissions from gas processing plants and various production facilities within the HHRA study area. These sources include, but are not limited to significant emitters such as, sweet and sour gas plants, compressor stations, and fugitive emissions from tank storage.
2. **Cumulative Scenario:** includes the oil and gas sources from the oil and gas scenario, as well as emissions from background sources such as other industries (*e.g.,* forestry and mining), transportation, and community activities (*e.g.,* residential wood burning).

A total of 26 community locations were evaluated individually within the HHRA along with the maximum predicted ground-level concentrations of each chemical of potential concern (COPC) (*e.g.*, the maximum point of impingement or MPOI).

A brief review of existing health status in the region conducted as part of the HHRA revealed that there are a number of possible sensitive sub-populations in the area.

To account for potential differences in exposures between individuals in the area, consideration was given to differences in exposure parameters (*e.g.,* body weight, types and amounts of foods consumed) between age groups and community type (*e.g.*, residents in Aboriginal, rural/agricultural, or more urban communities).

Results were presented and described for inhalation on a short-term and long-term basis, and for all possible routes of exposure on a long term basis. The predicted risk estimates involved the comparison of estimates of exposure with health-based exposure limits developed by various regulatory organizations (*e.g.,* Health Canada, United States Environmental Protection Agency, World Health Organization). Separate assessments were completed for short-term and long-term exposures, and for carcinogenic and non-carcinogenic COPC.

A brief summary of the results is as follows:

- In general, the predicted short-term air concentrations of the COPC were less than their health based exposure limits. As well, the potential combined risks of these COPC were not predicted to result in adverse health effects in people living or visiting the study area. However, the predicted exposures at some locations were found to exceed exposure limits for certain individual COPC (acrolein, formaldehyde, NO2, SO2, PM2.5) and the mixtures that these COPC were part of (the eye, nasal and respiratory irritants). The exceedances for formaldehyde, NO2 and SO2 were found to be attributable to Oil and

Gas emission sources, with some contributions from other sources in the area. Due to the rare nature of these exceedances and the margin of safety built into the HHRA, these exposures are not expected to result in adverse health effects.

- Overall, long-term inhalation exposures to the COPC were predicted to be associated with a low potential for adverse health effects. For fine particulate matter (PM2.5), exceedances of the BC Ambient Air Quality Objective were predicted for only the Cumulative Scenario at two remote locations where people are unlikely to be regularly exposed. For formaldehyde, potential cancer risks were predicted for a remote location in close proximity to an oil and gas site. However, further analysis of this exceedance indicating that the probability for people to be exposed to formaldehyde concentrations at the predicted level over a lifetime was very low. When the potential combined, additive effects of the COPC were evaluated, nasal and respiratory irritant mixtures were predicted to have elevated risk estimates. However, given the locations of where the maximum concentrations for these chemicals were expected to occur (*e.g.,* formaldehyde), and the degree of conservatism incorporated into the assessment, the potential mixture risks were determined to have a low potential for adverse health effects.
- In the assessment of potential exposures to the COPC that people in the area might receive over the long term through the consumption of locally-grown foods, drinking water, *etc.*, it was determined that the potential for adverse human health effects is low.

The overall findings of the detailed HHRA of oil and gas activity in NE BC suggest that, while there is some possibility for elevated COPC concentrations to occur at some locations, the probability that adverse health impacts would occur in association with these exposures is considered to be low.

APPENDIX B:
REVIEW OF REGULATORY FRAMEWORK (EXECUTIVE SUMMARY)

This report presents the results of a review of the existing statutory, regulatory, and policy framework that contributes to the protection of health for individuals living in proximity to oil and gas development and/or activities in northeastern British Columbia (NE BC). The objective of this review was to offer an overview of the relevant regulations with respect to oil and gas in NE BC and to identify any potential deficiencies in the existing regulatory framework as it relates to the potential influence of oil and gas development on public health in NE BC.

The scope of oil and gas activities considered in this review includes potential emissions to air and water from operational sites, historical sites and transportation of both products and waste. For these activities, regulations related to both normal operations and emergency scenarios were reviewed based on their potential to protect human health. How these regulations and policies compare to those in related jurisdictions (e.g., Alberta, United States) as well as to best management practices recommended by the Canadian Association of Petroleum Producers (CAPP) and the American Petroleum Institute (API) are also discussed.

In general, this review demonstrates that the existing policy framework in BC is extensive and broadly protective of human health. However, some policy and regulatory measures were identified that may warrant further consideration with respect to their potential to strengthen the Province's capacity to prevent and mitigate human health impacts from oil and gas activities. The proposed measures for consideration include:

- Ensuring that air quality objectives are reviewed regularly with consideration of new information on exposure and toxicity, public concerns, and regulatory decisions made by other agencies.
- Clarifying the linkage between permitted emissions to air from oil and gas activities and compliance with existing BC air quality objectives.
- Updating the methods used to calculate hazard distances and emergency planning zones in BC.
- Implementing requirements for predrilling water well testing under an expanded number of scenarios.
- Refining the fracturing fluid disclosure process to ensure that designated authorities and health professionals are provided with needed information about fluid ingredients without compromising confidential business information.

Note, some of these measures may already be addressed in practice under the permitting process described in the Oil and Gas Activities Act, which authorizes the BC Oil and Gas Commission (BC OGC) to impose conditions on oil and gas activity permits that the Commission considers necessary (including conditions that maintain public safety and health). The Province should evaluate each measure in light of existing practices, pending or proposed regulatory changes (not considered in the present review), and province specific factors (e.g., geography, economy, level of activity in various oil and gas sectors) in order to determine which measures are likely to result in a meaningful increase in health protection in the Province.

APPENDIX C:
RECOMMENDATIONS REPORT (SUMMARY)

The overall findings of the Phase 2 HHRA indicate that the health risks associated with oil and gas activity in NE BC are generally low. A review of the Province's existing statutory, regulatory and policy frameworks was completed in tandem with and as an adjunct to the detailed HHRA. The primary objective of the review was to identify potential deficiencies in the existing regulatory framework as it relates to the potential influence of oil and gas development on public health. Overall, the review found that the existing regulatory framework in BC is extensive and broadly protective of human health. However, some policy and regulatory measures were identified that warranted further consideration with respect to their potential to strengthen the Province's capacity to prevent and mitigate health impacts from oil and activities.

Along with the health-related concerns that were shared during consultation on the Project, the final recommendations are based on the findings of the detailed HHRA and the Review of the Regulatory Framework. The final recommendations put forward to the Province include:

Recommendation 1: The tools applied to the calculation of EPZs representing the range of hazards associated with oil and gas infrastructure and activities should be updated and use scientifically supportable methods and emergency-based consequence endpoints.

Recommendation 2: Land-use and setback provisions applied in BC should be updated and use scientifically supportable methods along with individual and societal risk-based endpoints consistent with accepted risk norms, guidelines and standards applied in other developed industrialized countries. Further, it is recommended that these land-use and setback provisions be applied equally to both oil and gas and land development activities.

Recommendation 3: The BC Ambient Air Quality Objectives should guide the development of regulations, directives and policies pertaining to venting, fugitive emissions, flaring limits, flaring notification and reporting, and flaring performance requirements. This should be done in a transparent manner that demonstrates how the objectives are considered.

Recommendation 4: The implementation of baseline, pre-drilling ground water testing requirements for oil and gas activity in BC should be considered. Whenever possible, the process for collecting the information should be transparent, and the results publicly available, and reviewed on a regular basis. To facilitate the interpretation of results, it may also be beneficial to encourage the collection and reporting of well information in addition to sample data.

Recommendation 5: The Province should consider refining its fracturing fluid disclosure process so that designated authorities and health professionals can gain access to needed information about fluid ingredients, without compromising confidential business information.

Recommendation 6: When possible, the site classification tool and the existing framework for the management of contaminated sites should be used together in the assessment and management of legacy sites in NE BC.

Recommendation 7: The overall objectives and efficient use of the various databases that manage permits, facility information, wells and flare data should be reviewed, with the aim of identifying means to make the systems more accessible and user-friendly.

Recommendation 8: The Province's on-going air monitoring program in NE BC should continue to follow the principles outlined in BC MoE's Framework for the British Columbia Air Monitoring Network. Consideration should be given to the air quality contour maps provided in the detailed HHRA in the placement of future air quality monitors. As well, the identification of specific air contaminants for inclusion in the air monitoring program should consider the findings of the detailed HHRA.

Recommendation 9: Once additional data for the NE BC region are available from new monitoring stations or are made available from regulatory submissions, the air quality predictions and human health risk estimates from the detailed HHRA should be revisited.

Recommendation 10: While some aquifer mapping has been completed in NE BC, it is recommended that the existing aquifer mapping (and vulnerability mapping) be expanded for the NE BC region to help enhance the protection of groundwater resources in relation to oil and gas development. This information would aid in regional and site-specific assessments of potential risks to groundwater. As one of the limitations with the current aquifer mapping relates to an overall absence of subsurface data, it is suggested that surficial geology mapping (on an appropriate scale) for the region be completed as well.

Recommendation 11: Additional study of groundwater and surface water interactions within shallow aquifers and local ground water flow conditions in the NE BC region should be completed. This information could contribute to a better understanding of potential contaminant fate and migration. As well, studies could be carried out to investigate the location and sources of groundwater recharges.

Recommendation 12: Consideration should be given to the overall goals of the existing environmental monitoring programs for soil, water, and biota, along with the presentation and quality of these data within the existing databases, specifically as these relate to the value that these data could provide with respect to human and environmental health.

Recommendation 13: The Province should explore tailoring their health surveillance to determine whether or not there are any differences in disease rates in those areas identified in the HHRA with the highest predicted air concentrations. If possible, such future health surveillance would help verify the conclusions of the HHRA.

Recommendation 14: The BC air quality objectives should be reviewed and updated based on the existing provincial framework for developing air quality objectives.

APPENDIX D:
OPTIONS FOR PHASE 3 OF THE NORTHEAST OIL AND GAS HUMAN HEALTH RISK ASSESSMENT

Phase 3 will be a public reporting out of findings and any suggestions for improvement (Oct 31, 2012, Ministry of Health News Release)

Potential Budget: s.17

Option 1: MoH to hire a consultant to undertake community meetings in the northeast explaining the results of the study and responding to questions in spring 2015. Government response and actions could follow shortly after.

s.13

Option 2: A cross-ministry response to the report is prepared in spring 2015 (led by MoH or another ministry) with actions to address the recommendations. Consultants would undertake a public information campaign in late spring 2015 (including community meetings, as well as printed and web based information) providing information on the study and the cross-ministry actions to address the study recommendations.

s.13