

Human Health Risk Assessment for the Introduction of Lower Carbon Fuel at the Lafarge Exshaw Cement Facility

Janet Brygger, ET, B.Sc., LafargeHolcim
Déirdre Treissman, M.Sc. P.Biol., Millennium EMS Solutions (MEMS)



Talk about today....

- Project Objectives and Deliverables.
- What and Why LCF?
- Project team and process.
- HHRA Overview.
- Life Cycle Assessment Overview.

Objectives of the Process

Provide scientific data specific to the Exshaw cement plant.

Inform policy development.

Guide Lafarge as they adapt to lower carbon manufacturing practices.

Technical Reports

WSP

- Air Dispersion Modelling and Air Quality Assessment.

MEMS

- Detailed Human Health Risk Assessment and Stakeholder communication.

UofC, Queen's and Pembina

- Life Cycle Assessment of Low-Carbon Fuels.

What are Low Carbon Fuels?

- Fuels with high biogenic carbon content.
- Construction and demolition waste, railway ties, wood and shingles.



Why Low Carbon Fuels?

- Cement industry represents about 2.8% of Canada's carbon emissions.
- 30-40% of a cement plant's direct carbon emissions come from the use of fossil fuels.
- Reduce the consumption of natural resources.
- Use of alternative fuels that would otherwise be sent to landfill.



Cement Plants and LCFs

General characteristics of cement kilns that make them suitable for low carbon fuels (LCFs):

- Extremely high temperatures.
- Complete destruction of organic components.
- Process involves trapping of inorganic residues (including most heavy metals) in the clinker/cement matrix.
- Sorption of gaseous components (HF, HCl and SO₂) on alkaline reactants.

LCF Initiative Supporting Grants

- Emissions Reduction Alberta Industrial Efficiency Challenge
- Alberta Innovates
- Ontario Centres of Excellence
- Emissions Reduction Alberta
- Natural Sciences and Engineering Research Council of Canada (NSERC)

Contributors



- Project Advisory Committee (PAC)
- Millennium EMS Solutions (MEMS)
- WSP Ltd.
- University of Calgary (UofC)
- Queen's University (Queen's)
- Pembina Institute (Pembina)
- Lafarge experts

Who is PAC?

- Exshaw and Lac Des Arcs community members.
- Local environmental group representatives.
- Local politicians.
- Lafarge union.

Everyone had a Role

PAC

- Advise on key community concerns and questions.

Lafarge

- Management of project including stakeholder communication.
- Expertise in the cement plant industry.

WSP and MEMS

- Scientific assessment of air quality and potential human health risk.
- Stakeholder communication.

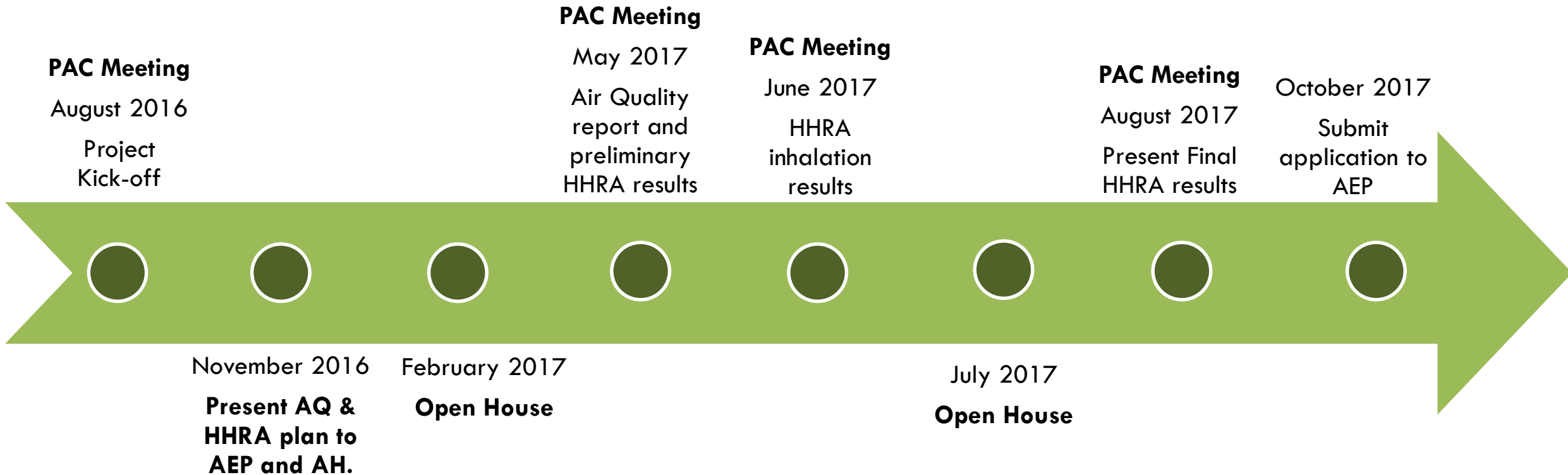
UofC, Queen's and Pembina

- GHG Life cycle assessment of LCF use.
- Stakeholder communication.

Regulators

- Guidance on application requirements.
- Attend PAC meetings as observers.

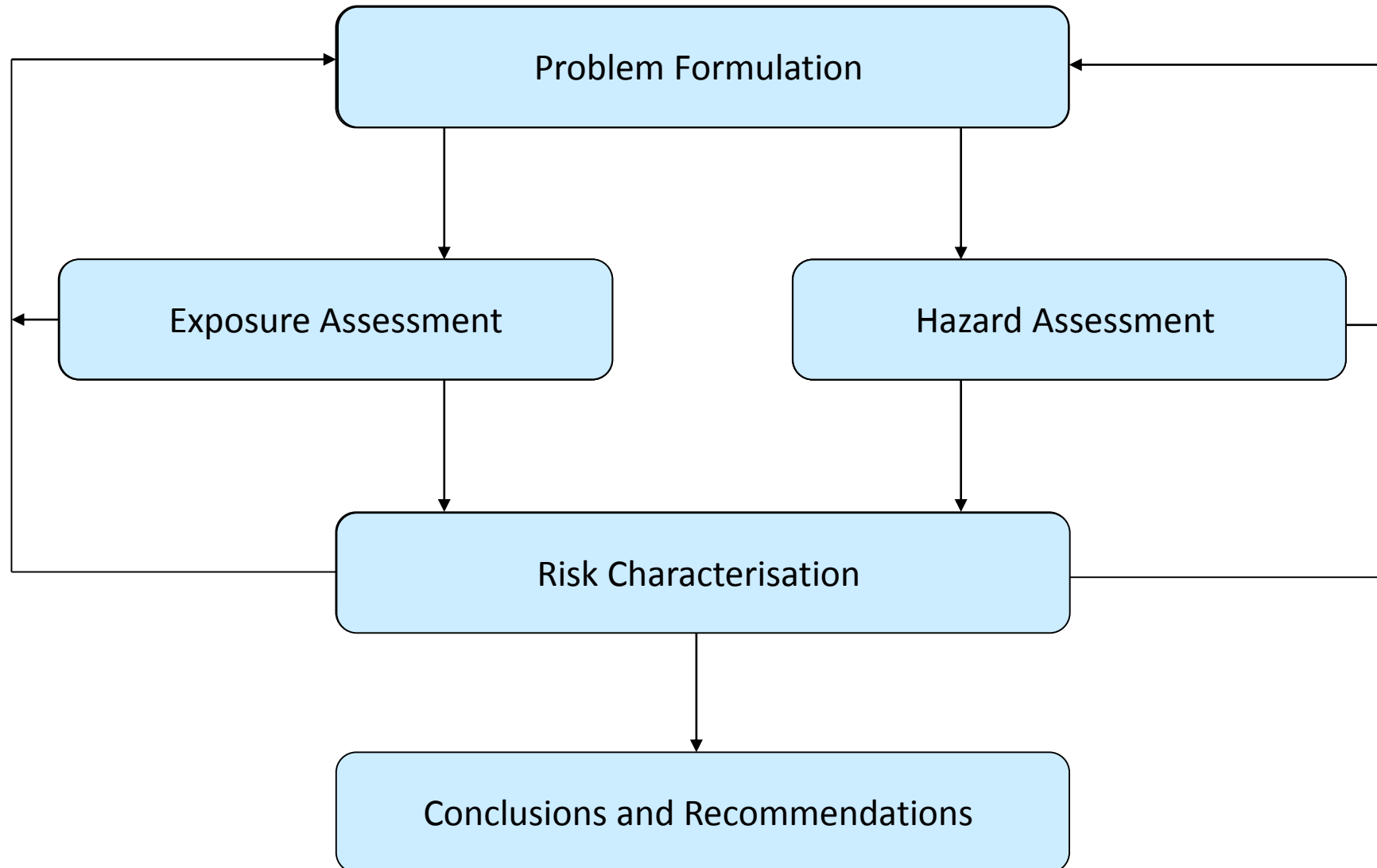
Communication Timeline



HHRA - Key Question

- Does use of LCF fuel result in health risk?

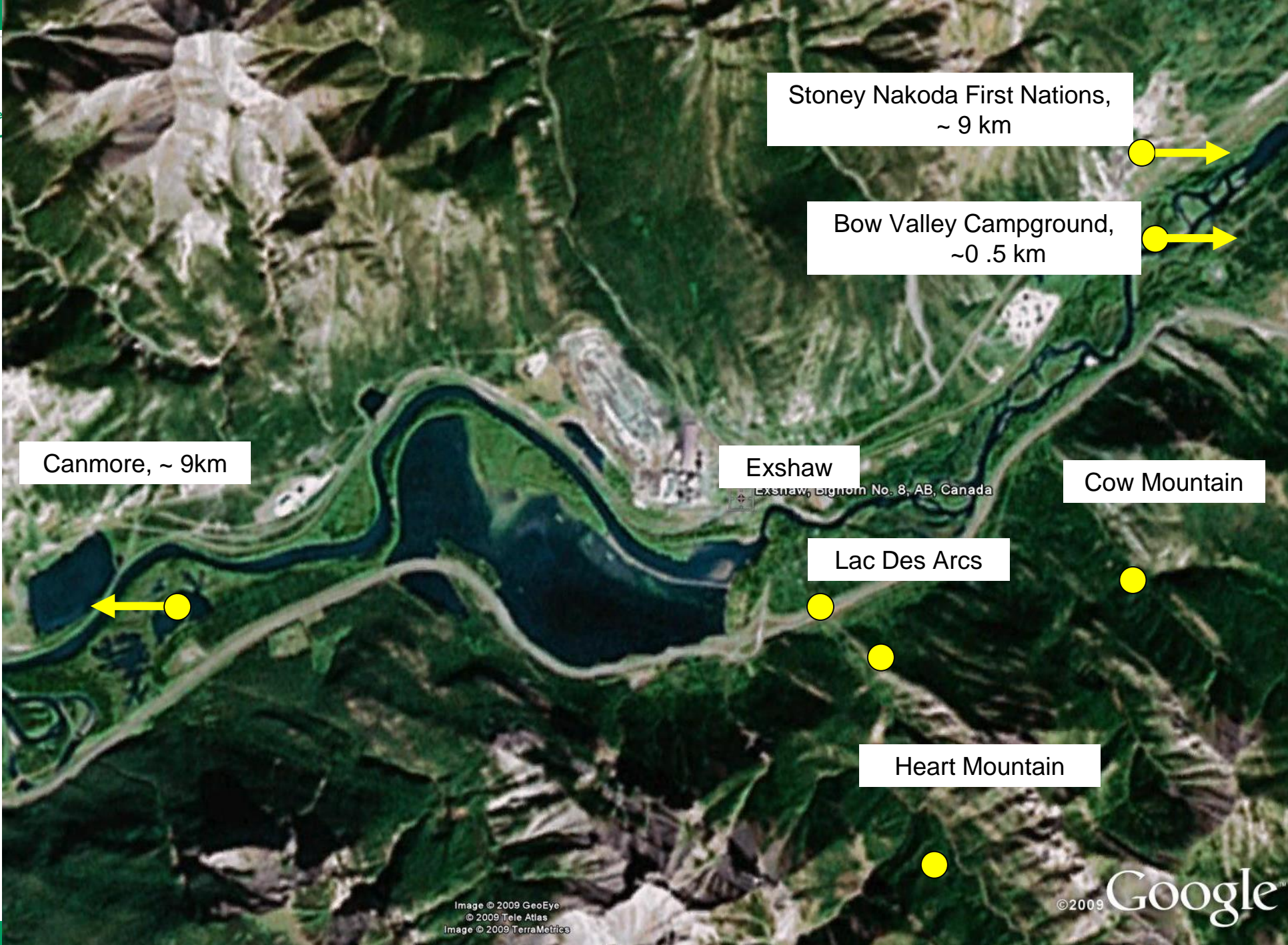
HHRA Overview



RECEPTORS CONSIDERED

- Residents in the area
- Recreational users
- A hypothetical person exposed to the maximum of everything

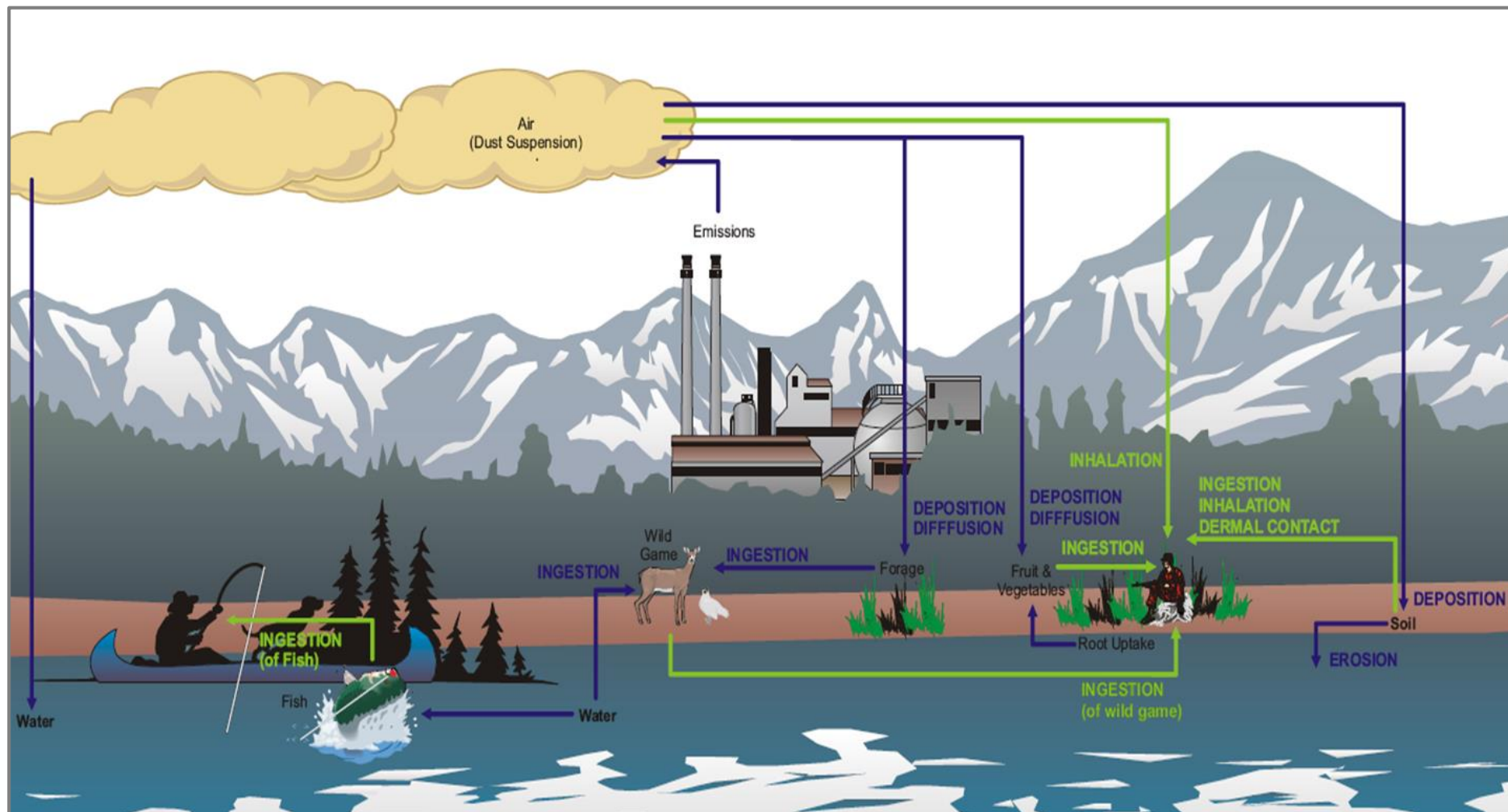




Contaminants of Potential Concern (COPC)

- Criteria air Contaminants (particulate matter, SO₂, NO₂)
- Metals
- Volatile organic compound (VOCs)
- Poly Aromatic Hydrocarbons (PAHs)

HHRA Conceptual Site Model



Three Emissions Scenarios

- Business-as-usual (coal).
- Substitution rate of 50%.
- Substitution rate of 80%.

HHRA Results

- No substantial change between Baseline and LCF options.
- The majority of COPCs were below safe exposure limits.
- A few COPCs were greater than exposure limits. These were not considered great enough to pose adverse health effects.
- Primary COPCs in the acute inhalation assessment were: SO_2 , NO_2 , $\text{PM}_{2.5}$ and PM_{10} .
- Primary COPCs in the chronic inhalation assessment were: NO_2 , $\text{PM}_{2.5}$ and PM_{10} .

SO₂ – 10 min

Concentration (SO ₂) µg/m ³	Endpoint
175	Guideline (protective of sensitive population)
13,101	Dryness in the throat and nose
26,203	Sneezing, coughing and eye irritation
131,014	Extreme discomfort with no lasting injury if < 30 min exposure
2,620,286	Fatal concentration

Thienes, C., and T.J. Haley. Clinical Toxicology. 5th ed. Philadelphia: Lea and Febiger, 1972., p. 198



SO₂ – 10 min Lac Des Arcs

SO₂ - 10min Time Series from 2002 to 2006



Life Cycle Assessment of LCFs

- LCA of the GHG associated with switching from natural gas to low carbon fuels.
- Nine alternative fuels were considered
- Fuels composed of biogenic carbon showed largest reductions in GHGs and highest avoided landfill emissions.
- 50% substitution of primarily biogenic fuels resulted in 9-12% reduction in total GHG emissions

Meeting PAC needs

- Demonstrate no increase health risks.
- Life Cycle Assessment specific to Exshaw.
- Other non-health/air issues which also impact quality of life
 - No railroad tie shredding
 - No on-site shredding
 - No increased rail traffic

Lafarge Links

- Lower Carbon Fuel Project:

<http://www.lafargeexshaw.ca/lower-carbon-fuel-project/>

Helpful video:

<https://www.youtube.com/watch?v=WF39wutYwE8>

- Technical reports: <http://www.lafargeexshaw.ca/reports/>
- HHRA: <http://www.lafargeexshaw.ca/wp-content/uploads/2017/11/Main-Report.pdf>
- On-line air quality communication:
http://airquality.ca/clients/Lafarge_Public/

Questions

