Presentation to Select Committee Regarding the Risks and Benefits of Hydraulic Fracturing

An Overview of Public Health Impacts

November 22, 2013

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OUTLINE

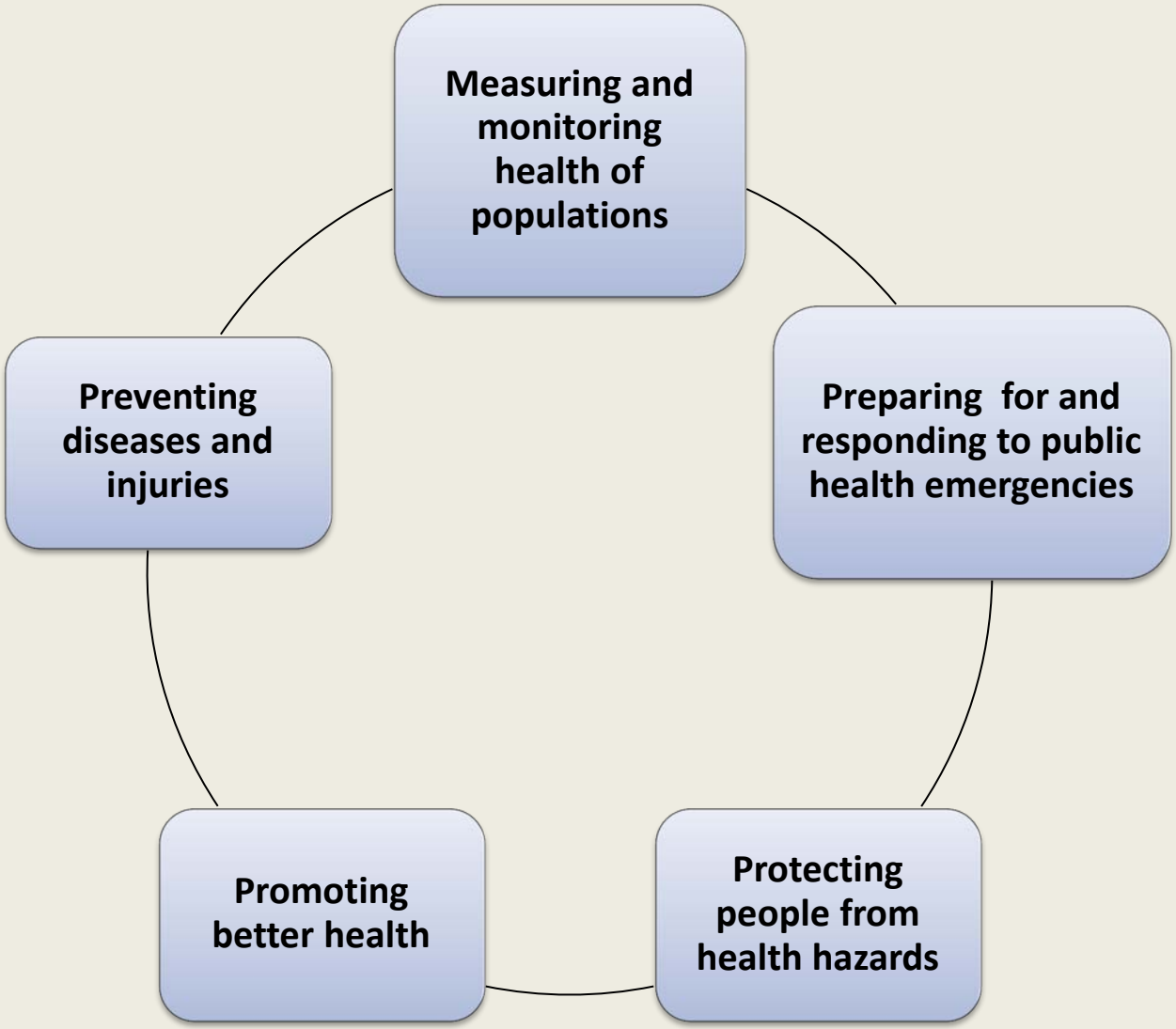
- Definition of health + determinants
- Health Impact Assessments
  - Experience + lessons from Keno HIA
  - HIA process
- Health Impacts
  - Environmental
  - Social
  - Physical
- Mitigating impacts through new technologies
- Conclusions
  - Yukon Energy Plan
  - Broad vision of Health
- Recommendations

What is Health?

- WHO: “A state of complete physical, mental, social well-being and not merely the absence of disease or infirmity’’

- Wellness: “Wellness is a positive state of feeling good and functioning well that enables people to achieve their full potential, enjoy quality of life, and contribute positively to their community’’

Core Functions of Public Health

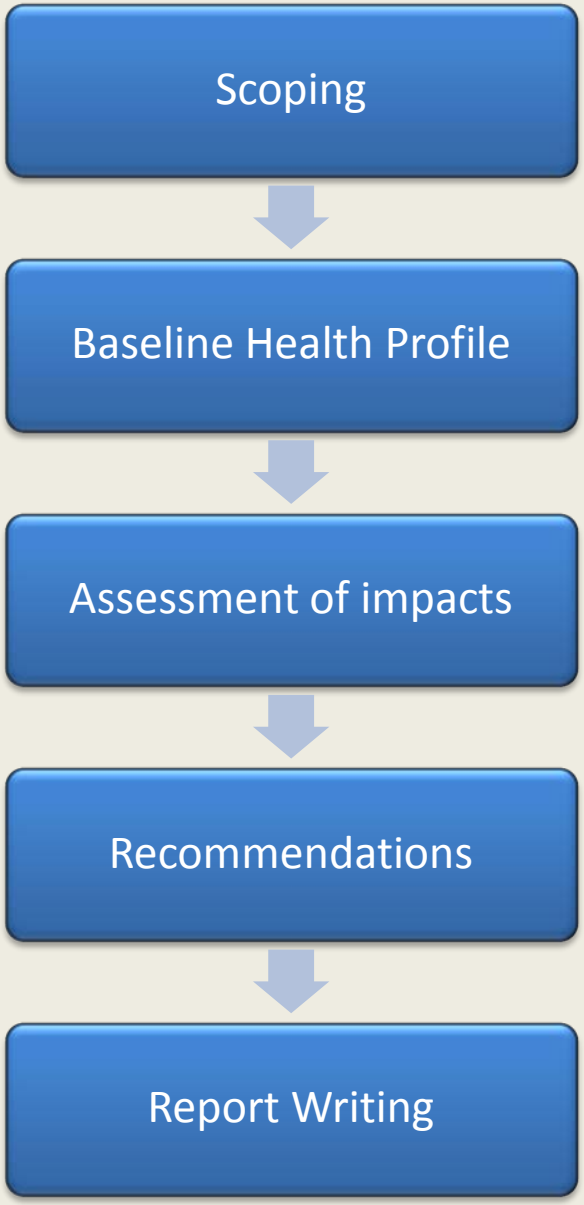


BC Health Officers Council, Dr. Eilish Cleary, October 9, 2013

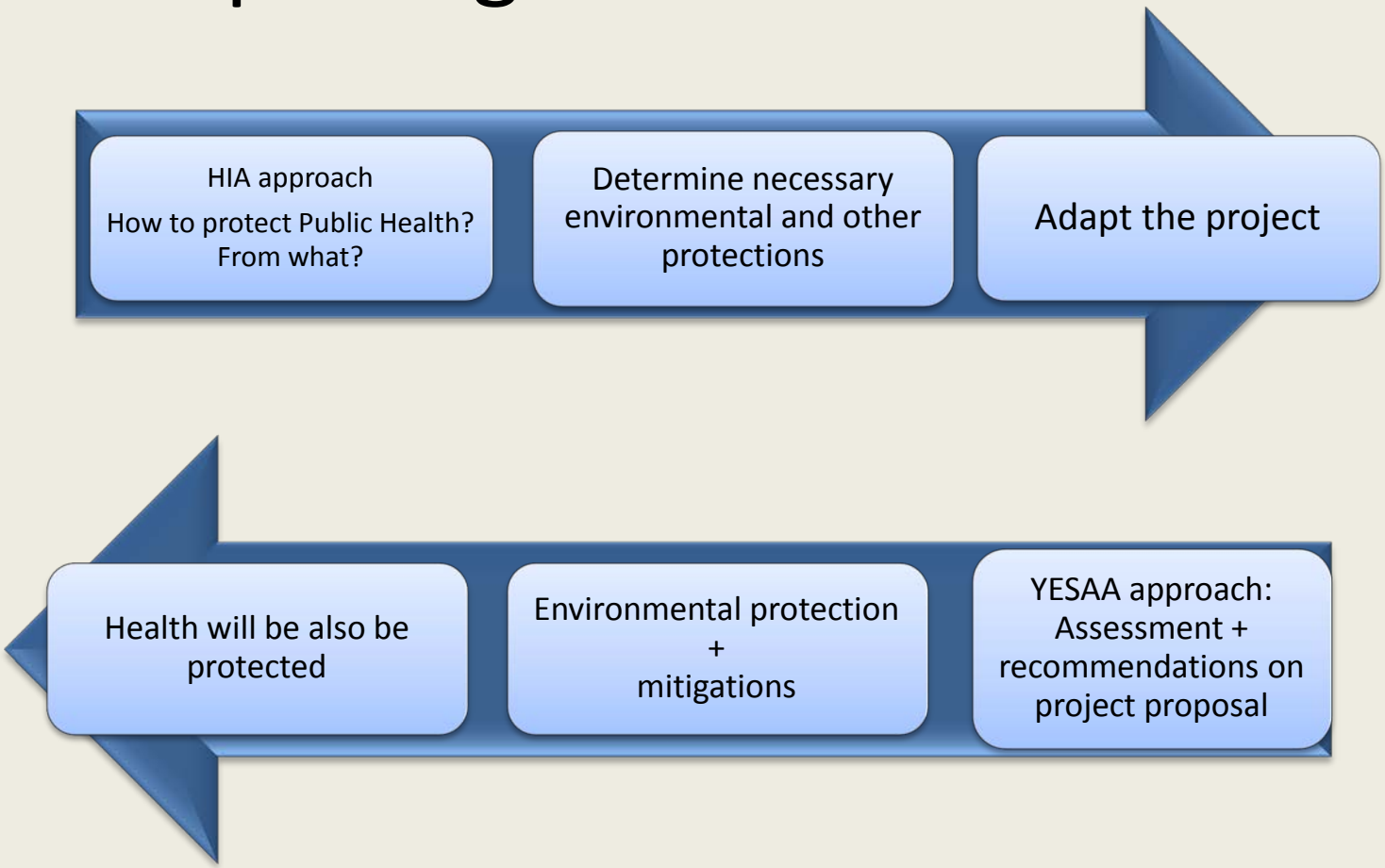
Health Determinants

- **Income and Social Status**
- **Social environments**
- **Physical Environments**
- Social support networks
- Education and literacy
- Employment/working conditions
- Personal Health practices
- Healthy child development
- Biology and genetic endowment
- Health services
- Gender
- Culture

Health Impact Assessment



HIA vs. YESAA: putting Health first



Adapted from Public Health Considerations in Energy Development , Dr Eilish Cleary, CMOH, November 2013

Lessons Learned from Keno

- DEVELOPING A PROCESS
- HSS LEAD ON HIAs
- YG CORPORATE RESPONSE/APPROACH

Assessing Public Health Impacts: Challenges

- Fracking would be a new industry for Yukon
  - We have to learn from other jurisdictions
- Data gaps limit ability to assess risks to public health
  - Difficult to forecast extent, locations, rate development
  - Focus on chemicals, not so much on other PH issues
  - Methodological obstacles (ex: prospective studies = many years)
  - Lack of exposure data
  - Few long term studies

Socio-Economic Impact

- Direct Economic Benefits:
  - Royalties, ↑ Income
- Boomtown Effect
- Inequitable distribution of risk and reward
  - Jobs, land acquisition

Greenhouse Gas Emissions

- GHG: Methane + CO2 + NO2
- ↓CO2 emissions compared to diesel oil
- Fugitive methane emissions
- Combustion: methane+ NO2 + CO_2
- Methane 25 times impact as GHG but shorter lived
- NO2: 298 times impact as GHG

Figure 3: IPCC TEAP 2005 Global Warming Potentials for a 100 Years Horizon

Greenhouse Gas (GHG)	Global Warming Potential
CO_2	1
CH_4	25
N_2O	298
SF_6	22,800

Figure 3: Yukon Power Plant Fuel Life cycle Analysis, Final Report, ICF International, July 2, 2013

Air Quality

- Emissions through all lifecycle of shale gas exploitation
- NOx, VOC, PM 2.5, Methane, CO2, Diesel PM, (SO2)
- NOx +VOC+Methane+Sunlight = O3 = Asthma aggravation, Decreased lung function
- VOC (Benzene): Known carcinogenic effect (leukemia)
- Caveat: no data on exposure risk related to shale gas exploitation
- Unknown effects when mixed in atmosphere

Source	NOx	VOC	PM	Air Toxics	Data Quality
Well development					
Drill Rigs	●	○	●	●	Medium
Frac Pumps	●	○	●	●	Medium
Truck Traffic	●	○	●	●	Medium
Completion Venting		●		●	Poor
Frac ponds		○		?	Poor
Gas Production					
Compressor Stations	●	●	○	●	Medium
Wellhead compressors	○	○	○	○	Medium
Heaters and dehydrators		○	○	○	Medium
Blowdown venting		○		○	Poor
Condensate Tanks		●		○	Poor
Fugitives		?		○	Poor
Pneumatics		○		○	Poor

● = major source ○ = minor source

FIGURE 5-1 Sources of emissions.
SOURCE: Robinson, 2012.

Health Impact Assessment of Shale Gas extraction: Workshop Summary, Roundtable on Environmental Health Sciences, Research, and Medicine Board on Population Health and Public Health Practice, 2013

Water Impacts

- Consumption
  - 12 to 20 million litres/well
  - Effect depends on local sources, demands and conditions
- Contamination
  - Possible mechanism: hydraulic connectivity, wells malfunction, surface spills
- Disposal: Ideal solution yet to be found
  - Lagoon or Tank + waste water treatment
  - Infrequently reused (precipitates)
  - Deep-well injection

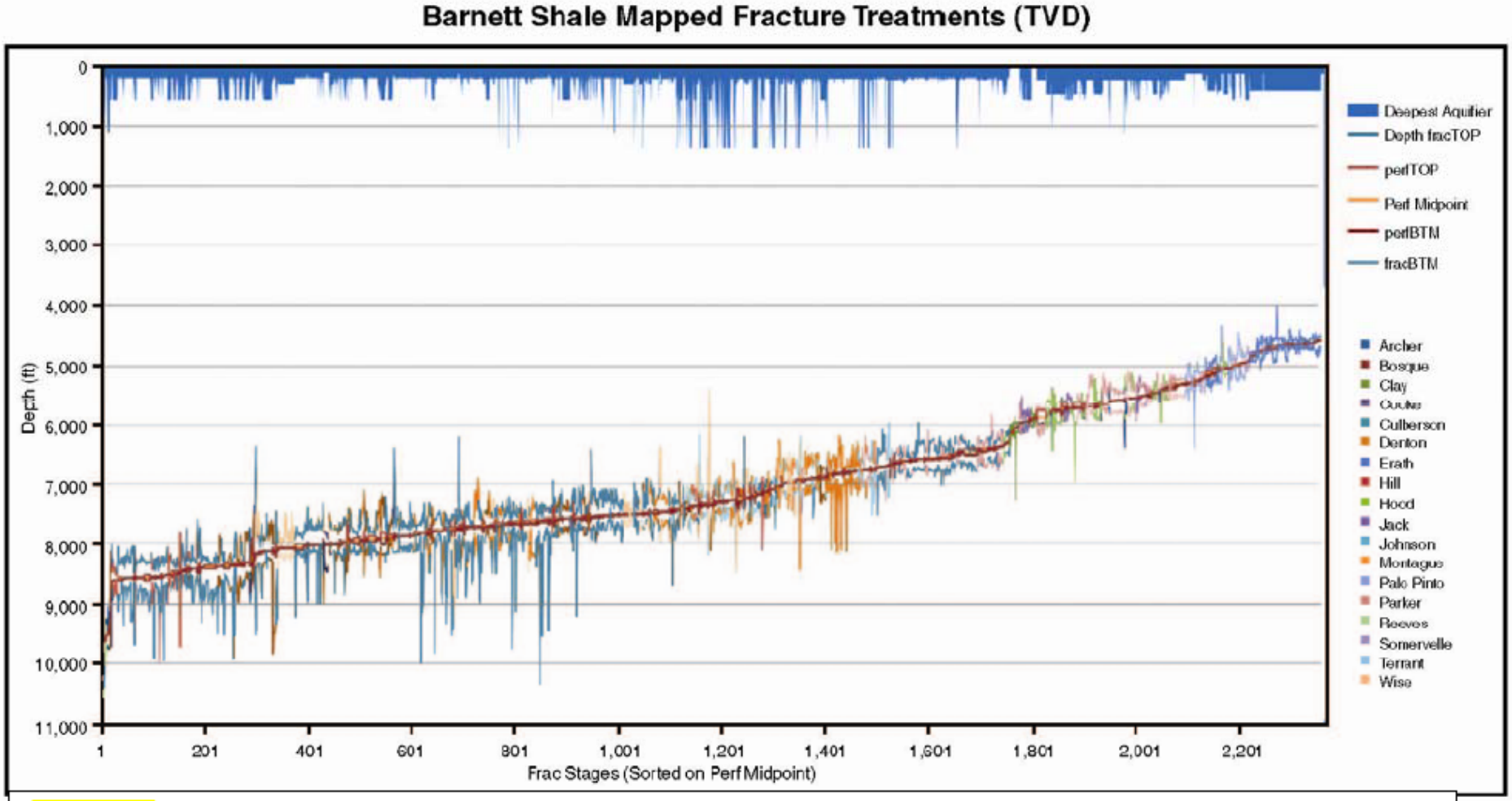


Figure 18 (Reprinted from the July 2010 issue of The American Oil & Gas Reporter with permission from Pinnacle, A Halliburton Service)

Micro-seismic monitoring of upper and lower limits of thousands of fracture heights growth relative to the position of fresh water in Barnett well. None of the frack penetrated within 3 thousand feet of the deepest fresh water sands in the area. (Hydro Fracturing 101, SPE International, February 2012)

Chemicals + Frac Sand

- Industrial chemicals
  - carcinogenic potential: estimates vary (INSPQ, 2010)
  - Other possible health effects: respiratory, gastrointestinal, dermatological, ocular, neuro-,immuno-, nephrotoxic and endocrine disruptors (Colborn 2011)
  - Real risk due to exposure is unknown

- Natural waste water chemicals
  - Also carcinogenic potential (INSPQ)
    - Heavy metals, radionuclides(radium-226), brine
  - Managing radioactive waste is a dilemma

- Frac sand:
    - water+silica sand+chemicals: silicosis, lung cancer, COPD
      - Higher risk: workers and nearby communities

Physical Environment

- Noise
  - Air compressors
    - Psychological impact
- Light
  - 24hr/24 for exploration, drilling and exploitation
- Traffic →Vibration
  - Estimated 2,000 truck trips / well
    - ↑ Risk of road accidents
    - Deterioration of roads

Impacts are not Equal

- Vulnerable Populations
  - Children
    - Higher rate of metabolism
    - Closer contact with environmental contaminants
  - Prenatal
    - Airborne benzene = NTD, cognitive impairment, childhood leukemia
  - Low-Income households
    - ↓ financial ability to mitigate exposures

Mitigating Impacts: Evolving Industry Technologies

- Can GHG emissions be reduced?
  - "Green technologies"
    - EPA estimates ↓ 40% of methane emissions with new technologies
    - Carbon capture and sequestration strategy
- Water Disposal
  - On site waste water treatment
  - Deep-well injection of waste water
- Caveat: New technology does not replace risk assessment

Conclusions: Context

- A complex case for public health consideration:
  - Lack of studies
  - Public Health not often at table
  - Difficult to assess certain risks due to lack of data
  - Rapidly evolving industry technologies
    - Forecasting difficult
  - Best considered in context as an alternative fossil fuel industry.

Conclusions

- Shale Gas development and other Oil and Gas projects deserve Health Impact Assessments (HIA)
- HIA need to be integrated into government approval processes along with implementation plans.
- Shale Gas projects can bring economic benefit if carefully managed and if the boomtown effects are avoided.
- Greenhouse Gas contributions are significant and must be factored into an energy strategy.
- Other health risks can be managed in a climate of progressive legislation and best industry practices.

Recommendations

- Optimize Socioeconomic effects
- Reduce Greenhouse Gases
- Anticipate and Mitigate Physical effects
- Optimize Mental Health and Wellness
- Formalize HIA and Implementation Processes

Optimize Socioeconomic Effects

- Keep regional/community planning ahead of the boom
  - Land use planning should precede development

- Ensure equitable sharing of risks and rewards
  - Community planning: ensure benefit to all
  - Consider vulnerable populations
  - Royalty and Revenue sharing: Community, First Nation, Yukon

Anticipate and Mitigate Physical Effects

- Air and water quality monitoring
- Dust monitoring and management
- Improving waste water management
- Full disclosure of chemicals used
- Monitoring and mitigations for noise, vibration, and light
- Traffic management
- Promote and protect workers' health

Optimize Mental Health and Wellness

- Support and encourage community and land use planning
- Maximize transparency and accountability
- Validate and respond to citizen concerns
- Encourage industry to support health and wellness
- Pay attention to inequities and protect the vulnerable
- Include crisis and emergency planning

Formalize HIA and Implementation Processes

- High-level scenario based HIA
- Specific HIAs integrated with YESSA
- Implementation Process for recommendations
- Public accountability
- Monitor health of persons living, working, attending school in proximity with industry

Reduce Greenhouse Gases

- Set goals for reducing carbon footprint and fossil fuel usage
- Review, monitor and publicize achievement of Energy Goals
- Adapt and update Yukon Energy Strategy
  - Sustainability, Self-sufficiency
  - Increase renewable energy supply in Yukon by 20% by 2020 and reduce GHG
  - Reduce energy consumption from housing (Green Homes) and transportation (e.g. invest in local agriculture)

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