

# Onshore Gas Nova Scotia Context

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# Introduction

- **Dillon Consulting Limited**

- Founded in 1946, Canada-wide
- Operating in Nova Scotia since 1974
- Municipal Infrastructure, Permitting and Approvals, Environmental Science, Sustainable Design

- **Andrew Blackmer, M.Sc., P.Geo.**

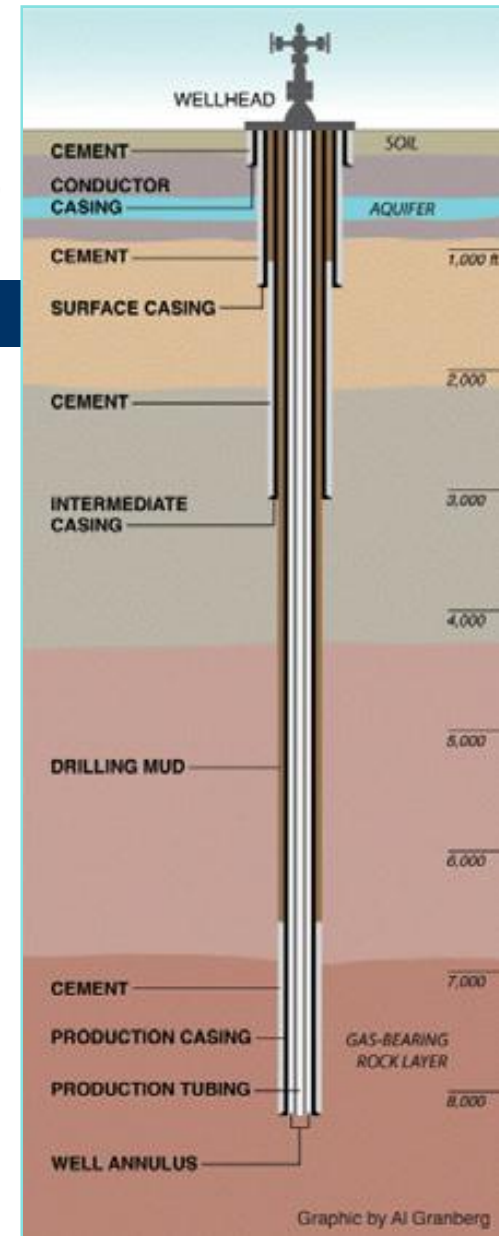
- Professional Geoscientist, Partner with Dillon
- 30+ years - water supply, environmental site assessments - public & private
- More recent involvement with energy/power sector - oil and gas and renewables

# Agenda

- Protection of Groundwater
- NS Context – Kennetcook Exploration Wells
- What is NORM??
- More Information available

# Protection of Groundwater

- Exploration and development is not sustainable without protection of potable groundwater
- Key Points
  - Well Construction – multiple sealed casings
  - Geological separation
  - Handling of materials at surface
- Growing body of research supporting protection of groundwater



# Triangle Petroleum - Kennetcook Exploration Wells

- Part of five well exploration program in East Hants – under license with Department of Energy and approval of NS Environment
- **KC 1 and KC 2**
  - Drilled in late 2007 early 2008
  - Vertical exploration wells (1330 m and 1900 m deep)
  - Lined holding pond for make up water
  - Water withdrawal permits from NSE (Kennetcook River)
  - Ponds being used to store flow-back water
  - Testing completed (2008) – formation brine returned

# Triangle Petroleum - Kennetcook Exploration Wells

- **KC 1 and KC 2**

- Options for management – reinjection (viable based on chloride content), treatment and disposal
- NSE - no permission for reinjection at this time – part of current review
- Treatment and disposal options approved by NSE, supported by Triangle
- NSE requested testing for NORM (2011) – further disposal on hold until NORM considered
- Conservative standards set based on human ingestion pathway.
- NORM treatment process tested and in place and approved by NSE pending OK from Municipality of Colchester

# Hydraulic Testing of KC 1 and KC 2

- Water
- Sand
- Surfactant and Friction Reducer – (sophisticated detergents) - used to improve injection into the rock formation.
- Material identification provided to Province
- 0.001% of total fluids

# What is NORM?

- Naturally Occurring Radioactive Materials
  - Potassium, Radium, Thorium, Lead
- NORMs are everywhere in small concentrations
- They happen to exist in the rock that is being explored
- The KC pond water has low concentrations
- At the request of NSE pond water is being treated to below the HC guideline that is derived for drinking water



# Putting NORM into Context

- Banana – 15 Bq
- Kg of coffee – 1,000 Bq
- Average person – 4,500 Bq
- Smoke detector (radioactive source) – 30,000 Bq
- Litre of KC 1/KC 2 water
  - Average Total - 7.4 Bq (Radium 226 – 4.7 Bq)
  - Treated – Radium 226 – 3 Bq
- HC unconditional derived release limit (UDRL) – 5 Bq/L (Radium 226)

# Summary

- Technology – Continues to advance
- Exploration phase in NS – long way to go to test the resource – a “proof of concept program”
- Exploration and development need to be protective of groundwater, environment and societal needs
- If feasible, the resource could have a significant positive impact on the Nova Scotia economy.

# Triangle - Open for Dialogue

Triangle Petroleum has provided a brief summary of additional information about onshore natural gas. Hardcopies are available here today.