

Preliminary Assessment of Helium and Hydrogen Resource Potential in NE BC

Disclaimer

The terminology related to reserves used in this report is not intended to align precisely with official hydrocarbons reserves classifications. These terms are approximations, applied specifically for this project using the validity ranking system developed herein.

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Executive Summary

This report is a preliminary evaluation of helium and hydrogen concentration in natural gas samples obtained from wells located in NE BC, from the BC Energy Regulator (BCER)'s fluid analysis database. Samples were selected based on concentration thresholds and assessed against estimated economic cutoffs, informed by industry knowledge for helium and approximated for hydrogen due to limited data. Sample validity was ranked based on factors such as sample pressure as sampled and as received at lab, sample repeatability, and comparison to pool averages. Results, provided in tabular format, indicate limited helium and hydrogen reserves or prospects within the formations in the areas sampled, with minimal economic viability under current conditions. Note that the sampling and analyses in the database were obtained for the purpose of hydrocarbon exploration in the NE portion of the province. Sample collection and storage procedures may not be appropriate for hydrogen or helium.

Background

- Two fluid analysis data entry projects were completed, in late 2021 and mid 2023, that entered a total of approximately 17,000 legacy pdf records into the database, resulting in a grand total of 53,000 gas analysis.
- Late 2023 project completed to validate entered data by reviewing outliers for correction or deletion of record.

Objective

- Investigate measurable helium and hydrogen mole fractions in database sample records. Evaluate the validity of the samples that indicate concentrations above threshold limits for economic interest and develop preliminary estimates of potential reserves/resources.

Methodology

- Gathered samples with high concentrations
 - All He over 0.1% (approximately the database 99th percentile)
 - All H₂ over 0.04% (approximately the database 90th percentile)
- Estimated economic concentration cutoffs/thresholds.

Table 1: Economic Concentration Thresholds

Component	Potentially Economic	Economic	Highly Economic
Helium	>0.3%	>1.3%	>1.7%
Hydrogen	>0.5%	>1%	>3%

- Helium cutoffs estimated from a source with knowledge on pilot Helium projects in Saskatchewan
- No literature found on hydrogen economic cutoffs. Cutoffs were chosen somewhat arbitrarily based on the percentiles of hydrogen content in the database (between the 99th and 99.9th percentiles)
- Created a validity scheme for evaluating samples validity considering the following factors and assigned a numeric validity score for each sample.
 - **Existence of PDF:** Samples with an associated PDF source document for the record are considered more valid and have the possibility of having their database values cross-verified against the original PDFs (though cross-verification with original PDF was outside the scope of this project and was only done on a handful of samples).
 - **Sample Points:** A sample point of “Other” was deemed less valid compared to others. The sample may not have been obtained from the indicated formation.
 - **Pressure Received:** Samples with pressures below 200 kPa are considered less valid, as this may indicate a potential leak from the sample container.
 - **Pressure Discrepancy:** Evaluated the difference between the sample pressure and the received pressure; a significant difference suggests a potential leak and lowers the sample's validity.
 - **Number of Tests:** The number of tests conducted from the same well and formation was considered; a higher number of tests, especially with a result closer to a given sample, indicates a more reliable sample.
 - **Comparison to pool average:** A comparison between the sample's He/H₂ composition value and the sample gas analysis (a production-weighted pool average composition) provides insights into the sample's reliability.
- Obtain an “Overall Validity” by multiplying the above validities. Assigned a validity grade based on the resulting overall validity, A, B, C or D.
- Wells were either in pools with existing or depleted hydrocarbon reserves, or they may have been from formations that were only tested and never commercially produced (called “prospects”). Both pool and prospects were divided into 3 certainty categories, depending on their validity grades:

- Reserves (Pools):
 - Proven (A's)
 - Probable (B's)&(C's)
 - Possible (D's)
- Prospects (non-pools):
 - Probable (A's)
 - Possible (B's)&(C's)
 - Unlikely (D's)
- A well's inactive time prior to sampling was also investigated, as it was theorized that Helium or Hydrogen may build up in the top of the wellbore by gravity segregation if a well remains shut in. However, there was insufficient data to determine if this occurred, as nearly all samples are from initial production months, with nearly no cases of a sample being taken following a long shut in period.

Limitations

This project used broad criteria to assess sample validity based on available database values, which cannot provide the precision of individual scrutiny for each sample. Other factors may further evaluate sample validity. Additionally, the BCER's database was incomplete for all wells and tested formations at the time of this evaluation, as a compliance project was being initiated to add additional analysis as some analyses remain unscanned or unentered, and certain samples may not have been submitted. The location of oil and gas wells in British Columbia is limited to the northeast, with formations sampled being limited to those with hydrocarbon potential. Few samples from outside this region are in the database. As a result, this analysis does not capture all potential helium and hydrogen occurrences across the province.

Helium Results

Table 2: Helium Reserves

	Cumulative Helium Produced (e ³ m ³)	Helium Reserves (e ³ m ³)	Number of Pools
Proven	5,119	148	1
Probable	24,452	1,196	2
Possible	698	35	2

*Note all reserves fall under "potentially economic" category

- Note the substantial cumulative helium production relative to the remaining reserves

- Most “Helium Reserves” identified have been wasted, eventually vented to atmosphere as plants are not deep enough cut to recover Helium

Table 3: Helium Prospects

	Potentially Economic (>0.3%)	Economic (>1.3%)	Highly Economic (>1.7%)
Probable	3	0	0
Possible	4	0	0
Unlikely	23	1	4

Table 4: Source Formation of Helium Reserves and Prospects

Period	Formation names	Proven Pools	Probable Pools	Possible Pools	Probable (Prospect)	Possible(Prospect)	Unlikely (prospect)
Cretaceous	DUNVEGAN	0	0	0	0	0	1
Cretaceous	CADOTTE	0	0	0	0	0	2
Cretaceous	NOTIKEWIN	0	0	0	0	0	1
Cretaceous	FALHER	0	0	0	0	1	1
Cretaceous	BLUESKY	0	0	2	1	0	3
Cretaceous	GETHING	0	0	1	0	0	2
Jurassic	DUNLEVY	0	1	1	0	1	1
Triassic	BALDONNEL	0	0	1	0	0	4
Triassic	CECIL	0	0	1	0	0	3
Triassic	BOUNDARY LAKE	0	0	0	0	0	1
Triassic	COPLIN	0	0	0	0	0	1
Triassic	NORTH PINE	0	0	0	0	1	0
Triassic	HALFWAY	0	0	0	0	1	1
Permian	BELLOY	0	0	0	0	0	1
Mississippian	MISSISSIPPIAN	0	0	0	0	0	1
Mississippian	BANFF	0	0	0	0	0	1
Devonian	WABAMUN	1	2	0	1	0	1
Devonian	SLAVE POINT	0	0	0	1	0	2

Hydrogen Results

Table 5: Hydrogen Prospects

	Potentially Economic (>0.5%)	Economic (>1.0%)	Highly Economic (>3.0%)
Probable	1	0	1
Possible	19	13	7
Unlikely	32	36	8

Table 6: Hydrogen Reserves

	Cumulative Hydrogen Produced (e ³ m ³)	Hydrogen Reserves (e ³ m ³)	Number of Pools
Proven	7,088	51	1
Probable	9,162	222	1
Possible	2,296	785	6

*Note reserves fall under all three economic categories. The combined total is shown above.

Table 7: Source Formation of Hydrogen Reserves and Prospects

Period	Formation names	Proven Pools	Probable Pools	Possible Pools	Probable (Prospect)	Possible(Prospect)	Unlikely (prospect)
Cretaceous	CADOTTE	0	0	1	0	4	26
Cretaceous	NOTIKEWIN	0	0	1	0	1	6
Cretaceous	BLUESKY	1	0	0	1	13	33
Cretaceous	GETHING	0	0	0	0	5	27
Cretaceous	CADOMIN	0	0	0	0	8	17
Jurassic	DUNLEVY	0	0	0	0	6	27
Triassic	PARDONET-BALDONNEL	0	0	0	0	2	8
Triassic	BALDONNEL	0	0	0	3	33	64
Triassic	CHARLIE LAKE	0	0	0	2	1	12
Triassic	SIPHON	0	0	0	0	0	4
Triassic	CECIL	0	0	0	1	3	8
Triassic	BOUNDARY LAKE	0	0	0	0	1	3
Triassic	COPLIN	0	0	0	0	1	5
Triassic	MICA	0	0	0	0	0	0
Triassic	NORTH PINE	0	0	0	2	2	8
Triassic	BEAR FLAT	0	0	0	0	0	1
Triassic	HALFWAY	0	0	1	7	47	78
Triassic	LOWER HALFWAY	0	0	0	1	1	0
Triassic	DOIG	0	1	2	0	4	25
Permian	BELLOY	0	0	0	1	7	24
Mississippian	TAYLOR FLAT	0	0	0	0	0	9
Mississippian	MISSISSIPPIAN	0	0	0	0	1	5
Mississippian	LOWER KISKATINAW	0	0	0	0	0	0
Mississippian	DEBOLT	0	0	0	0	15	27
Mississippian	SHUNDA	0	0	0	0	1	3
Devonian	TETCHO	0	0	0	0	0	1
Devonian	JEAN MARIE	0	0	0	1	4	11
Devonian	SLAVE POINT	0	0	1	1	9	40
Devonian	SULPHUR POINT	0	0	0	0	2	2
Devonian	KEG RIVER	0	0	0	0	1	0
Devonian	PINE POINT	0	0	0	0	8	16

Conclusion

This project conducted a preliminary evaluation of high-concentration helium and hydrogen samples from the BC Energy Regulator’s fluid analysis database to assess their economic potential. Samples were reviewed based on concentration thresholds, estimated economic cutoffs, and a validity ranking system considering factors like pressure integrity and pool comparison. Results suggest that both helium and hydrogen reserves and prospects are limited in the sampled areas and formations in the NE portion of the province where oil and gas activity has occurred. Most identified reserves have already been produced, with few samples meeting economic viability criteria. Overall, helium and hydrogen potential appear minimal under current conditions.

Gas analysis data can be accessed in the [BCER Data Center, Drilling Data for All Wells in BC](#), gas_anal.csv

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