The Cardium Formation has been one of the most important Cretaceous hydrocarbon exploration and production targets in the Province of Alberta for the last 60 years. Most fields reached maturity in the early 1970's; however with the debut of multi-stage horizontal drilling and the successful completion in 2008 of the well Bonterra Nexstar 4-25-47-03W5/1-25-47-03W5, excitement in the formation was restored. In spite of the increase in drilling activity in exploratory halos of the fields, the recent developments have been inconsistent because some wells end up in zones with very high Gas to Oil Ratios (GOR). In part this has been the result of wells having been positioned too close to existing oil producing zones. On the other hand, unexpectedly high GOR have also been encountered at approximately the same stratigraphic level across areas were previous drilling and production was sparse. These difficulties arise in significant measure because there is much more limited geological understanding of these marginal areas. In this study, we are characterizing GOR trends, working on production forecasts and developing a GOR screen capable of assessing exploration risk. For that purpose, we have compiled a production & injection database with 15626 non-commingled wells. Risk assessment begins with the recognition of production values in the third month (IP3) versus net-pay cut offs, overall field performance and the postulation of a mappable variable to avoid areas with high GORs. Highlighted among the results is the recognition that production of horizontal wells demonstrates bypassed pay and compartmentalization in the legacy areas of most fields, early stage production forecasting from horizontals is much more difficult to predict than late stage production and that GOR behaviour can be assessed if tested against net pay, IP3, core and lithofacies distributions in the subsurface. The methodology developed here can be applied to any field in Alberta targeting the Cardium Fm. reservoir.
This study explores the general production trends of Cardium Fm. wells with contrasting GOR values. These wells are located in the periphery of most producing fields in AB.

**SUMMARY**

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**PRODUCTION DATABASE AND GOR**

Frequency plots illustrating the total number of wells with recovery rates below the Alberta average of 118 barrels of oil per day in the third month of production (IP3). The plot compares the performance of multistage, fractured, horizontally drilled wells in seven of the largest oil & gas fields in Alberta. The fields are Caroline, Ferrie, Harriman East, Larched, Pembina, and Williston Green. Sixty percent of the well populations in the Caroline, Harriman East, and Larched fields have performed better than the expected value.

**PRODUCTION TRENDS**

Oil and gas production decline models of the expected prod. life of a modern multistage, fractured, horizontally completed well in the Cardium Fm. These stages are characteristic: 1) Exponential flow back stage during months one and two. 2) Exponential downturn in productivity lasting an average of six months. 3) Long term shallow harmonic decline in productivity.

**NET PAY VS. IP3**

Illustration of the steps involved in the calculation of a mappable variable, designated as 'low gas oil' (LGO), capable of high grading the location of areas with high exploration risk in the Cardium Formation. LGO is the ratio of the cumulative oil production under low gas flow rates and the cumulative oil produced over time.

**PRD. DECLINE HORIZONTALS**

Distribution of the avg oil prod. values in the third month (IP3) as gathered from 136 multistage fractured, horizontally drilled wells. The data shows a near natural log character in which 134 barrels of oil per day represent the mode of the distribution. The characterization of the GORs was completed in relation to the province wide mean and median, calculated at 118 and 102 barrels of oil per day respectively.

**CORE DESCRIPTION - GENERALIZED SCHEMATIC STRATIGRAPHIC COLUMN**

Sample Cardium Fm. wells with contrasting GOR values:
10-25-44-09W5 F12MoGOR -> 25000 scf/bbl
06-32-46-12W5 F12MoGOR -> 691 scf/bbl

**DIMENSIONS**

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