A Geologic Play Book for Utica Shale Appalachian Basin Exploration

Abstract

Regional Drilling Activity and Production

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Through the end of May 2015, approximately 2,425 permits have been issued to drill horizontal wells to the Upper Ordovician Utica/Point Pleasant Shale, mainly in eastern Ohio, but with approximately 253 in Pennsylvania and 29 in the northern panhandle counties of West Virginia. Chesapeake is by far the biggest player in the trend (860 wells permitted) with Hilcorp and Gulfport following next (222 and 214, respectively). Drilling has been concentrated in the liquids-rich core area of eastern Ohio that includes Carroll, Harrison, Belmont, Monroe, Noble, Guernsey and Columbiana counties. Activity extends to Tioga County, Pennsylvania (east); Wood County, West Virginia (south); Licking County, Ohio (west); and Ashtabula County, Ohio (north). At this point in time, there have been no horizontal Utica/Point Pleasant horizontal wells drilled in Kentucky or New York. Increased drilling and production in southern Ohio may eventually extend the play into northern Kentucky. Currently there is a horizontal drilling moratorium in New York. Oil, condensate and natural gas liquids (NGLs) are driving production growth. As midstream operations (pipelines, fractionation and gas processing plants) continue to expand, additional drilled wells are being placed into production mode.

Annual and quarterly production data reported in Ohio have shown a marked increase over the past 4 years. In 2011 the cumulative annual production was approximately 46,000 barrels of oil (bbl) and 2.5 billion cubic feet of gas (Bcf) from nine producing wells. This represented only 1% of the total oil production and 3.5% of the total gas produced in Ohio. By 2014, 786 Utica/Point Pleasant wells had yielded approximately 15.3 million bbl oil and 518 Bcf gas, which represented 70% of the total oil and 85% of the total gas produced in Ohio. The total reported cumulative production in Ohio for the Utica/Point Pleasant from 2011 through the first quarter of 2015 was approximately 19.5 million bbl oil and 744 Bcf gas. Production numbers are expected to continue increasing in the upcoming years as mid-stream operations expand out and additional drilling continues.

A map of cumulative production per well was constructed for data through the end of the first quarter 2015. Gas production was converted to barrels of oil equivalent (boe) and added to the barrels of oil produced to determine cumulative production per well in boe. Approximately 143.5 million boe were produced from 2011 to the end of the first quarter 2015. A northeast-southwest trend of higher production is seen extending through Columbiana, Carroll, Harrison, Belmont, Noble and Monroe counties in Ohio. The best ten wells produced over 600,000 boe during this time and are located in Belmont, Monroe and Harrison counties. Higher pressures in this region are thought to be a factor in these higher rates. The highest cumulative producing well through the end of the first quarter 2015 was the Chesapeake Buell well (API#340672I 0570100) in Harrison County, which produced approximately 829,945 boe. Range Resources recently completed the Claysville Sportsmen Club well in Washington County, Pennsylvania (API#3712527333), reporting an initial production rate of 59 million cubic feet (MMct) of gas per day. This is the highest producing well in the dry gas region of the play to date.

Results have been less encouraging to the north and west of these better producing areas. The northern portion of the trend in Ashtabula and Trumbull counties has shown lower producing rates and is reflected by the decline in permitting and drilling. Thus far, drilling further west in the updip portion of the oil window also have had less encouraging results as seen by the nonproductive Devon wells drilled in Coshocton, Knox, Medina, Wayne and Ashland counties. Clearly, the economic producing extents of this play are still being developed.

A gas-to-oil (GOR) map was constructed using the reported production data in Ohio. A northeast-southwest trend separating the oil from the dry gas window is evident using a GOR of 10,000 standard cubic feet of gas/barrel of oil (scfg/bo). A GOR map used in conjunction with bitumen reflectance and RockEval mapping from this project has helped to better refine the oil and gas window in this unconventional shale play.

Citation

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