Summary

Four years after the “discovery” of the Eagle Ford shale play, most operators have shifted their efforts from appraisal and delineation, to full-field development. This commonly involves drilling multiple (three to four) horizontal wells, simultaneously from one common surface location (or pad). Inter-well spacing ranges from 330 – 1000 feet across the trend as industry searches for the optimal well spacing for a range Eagle Ford shale thickness, rock-quality, pressure and thermal maturity windows. Pioneer Natural Resources (PXD) has followed this same transition and routinely drills three well pads with approximately 500 foot spacing between wells, which are completed with “zipper-frac” treatments. This paper presents a tool-kit designed in-house and currently employed to monitor well interference, communication and pad performance/drainage efficiency. The ultimate goal of this project is to better understand the reservoir response during hydraulic fracture treatments (at 500 foot spacing) and use these learnings to positively impact the full field development and by achieving an optimum well spacing.

A multidisciplinary technical team has designed an integrated data acquisition “tool-kit” to address the above issues. Essential to the tool-kit are chemical and radioactive tracers, pumped during the stimulation of one or more wells in a given pad. These data help our interpretation of fracture generation, fracture growth and fluid flow/propellant placement (i.e. proppant distances, fluid distances, and fracture geometry). Several microseismic surveys also assist in the recognition, quantification and distribution of stimulated rock volume. A major portion of this tool-kit includes the monitoring of pressure communication in offset wells during fracture stimulation and flowback/production. Subsequent interference tests over a period of several months allow for a better understanding of the changes in fracture conductivity and effectively propped fractures.

Collectively, these data are helping refine our geologic model and confirming the significance of attributes extracted from our 3D seismic data-set. We detail design parameters and practical applications of these tools, while discussing pitfalls and learning from project to date. Our findings have implications for development well planning, well spacing and frac-design.

Introduction

The Eagle Ford shale is currently being exploited in ~20 counties in south Texas (Fig. 1). Most operators are currently drilling pad wells with spacing ranging from 330’ – 1000’ between producers. With an increasing number of wells being drilled in the Eagle Ford shale it is critical that we understand the proper spacing for optimally draining the resource in place with each well.