The Basics of Wells – Questions This Petroleum Engineer Would Ask Before Leasing Land for Exploration or Development

Development of oil and gas resources is a regulated, often intensive activity about which the public generally knows very little. There are reputable operators and a few that are not, plus a host of deal makers that put together large blocks of land and then lease the block to the highest bidder, without much regard for land and/or mineral owner rights. In the US, there are over three thousand oil and gas companies, most quite small, and some that could go bankrupt and leave the land owner an onerous legal or financial trail to make sure the existing wells are handled correctly. With these thoughts in mind, finding the reputable operators becomes a high priority.

Wells can be constructed in ways that will last for their entire working life and then can be easily plugged and abandoned when the active part of oil and gas recovery is finished. The first lesson of well construction is the best time to do well construction correctly is on the very first attempt in the very first well.

The following are a few of the questions are those I would ask before leasing land for mineral exploration. The answers will be a very strong indicator of the company's willingness to do the job right.

1. Will a basic site investigation be done to determine if there are abandoned wells, seeps, mines or other potential problem area near the well site and in the drilling path?
2. Will the well design and construction follow accepted engineering rules and adhere to state regulatory requirements. Some states may have lists of operators with whom they have had problems.
3. Is methane migration a potential problem in the area? (Methane migration is strongly linked to specific geologic regions with natural seeps and may be impacted by fresh water well construction, air drilling and construction quality of the oil or gas well.)
4. Will the operating company sample fresh water wells, to which access is granted by the landowner, within at least a quarter mile of the proposed well site prior to drilling? Several samples will form a baseline of the groundwater quality in the area.
5. Will air be used in drilling sections that isolate fresh water sands? (Air injection during drilling may temporarily disturb water quality near the drilling site and may lead to gas migration. If shallow, poorly cemented wells are present, communication may create surface flows.
6. Will potential for alternate means of frac water transport, including quick lay pipelines with leak-tight connections, be considered to transfer water and reduce truck traffic?
7. What water sources will be used for drilling, cementing and fracturing? (Small volumes used in cementing and shallow drilling is usually done with fresh water. Large water volumes used in some fracturing jobs can often be brackish water or salty produced water mixtures if allowed by local regulations. Using salt water for fracturing sharply reduces fresh water needs. Recycling can be effective in developments with large numbers of wells, but is generally uneconomic for the first wells drilled or in developments of only a few wells.)
8. How will salty water for fracturing and produced fluids be stored? (Most produced water in fractured wells is recovered in the first 5 to 15 days after fracturing. Will engineered tanks (above ground multi-layer vinyl lined tanks or enclosed steel tanks) be allowed during development and short duration water flow times? Engineered storage tanks with multiple layer containment reduce total truck traffic, assist with recycling and can function both as fresh water storage and later salt water storage with a small footprint and no ground penetration. Simple equipment such as gas separators can process gas from produced fluids before reaching the

tank to eliminate methane venting from water. Recycling produced water also reduces volumes normally sent to disposal wells – which reduced potential seismic activity.)

9. Are fracturing chemicals reviewed for safety using a company initiative or a standard government program? EPA's DFE (designed for the environment), UN's GHS effort, North Sea Gold Band chemical tests or other proven efforts are effective. Does the company have a list of chemicals they will not ordinarily use and a person on staff that can help identify and use more acceptable materials and smaller volumes of chemicals?
10. Will all chemicals, water volumes and water source used in a fracture treatment be listed on the www.fracfocus.org website after the job?
11. Will a surface pressure pop-off valve, connected to a catch-tank be used to prevent any over-pressuring of the surface or downhole pipe? (Near-surface rupture of the casing is rare. It generally has only occurred in old wells and in areas with surface treating pressures that are close to the working limits of the steel pipe.)
12. What is the setback distance from the proposed well site to houses and other buildings? Is this sufficient and acceptable to the landowner?
13. Will road access be routed to create minimum disturbances to homes in the area? A single horizontal wells with 10 to 15 small fracture treatments may require over 1,000 semi-truck loads of materials and water. Using alternate water transport such as short-term use of quick-lay pipelines can cut the number of truck trips by half or more.
14. Is the minimum distance between designed top of fracture and deepest fresh water zone more than 1500 ft? (Fracturing of deep wells poses no risk to fresh water sands. Shallower wells can be fractured but extra care and control including reduced rate and volume may be required.)
15. Can "green completions" or the regional-specific equivalent, or better alternative, be used? (Green completions sharply limit methane emissions and other releases and are preferred for development wells in areas where large numbers of wells make these completions practical.)
16. Can multi-well pads be used in the development phase instead of single well pads? (Multi-well pads may reduce the total footprint of a large development by over 90% in some cases. Some single well pads are always needed to define the reservoir prior to development and eliminate large numbers of nonproductive wells. Some geologic formations and well developments plans may make large numbers of pad wells inefficient.)
17. Under what conditions will gas be flared? Can this wasted gas be used to generate on-site power for electric drilling rigs, on-site equipment or reinjection for reservoir pressure support.
18. Is it possible to limit busy development activity to a remote area or a time of day that will minimize community conflict?
19. What is the well abandonment & site reconstruction plan and how soon after last production will it be implemented? Who will oversee and be responsible for the P&A performance over time?
20. Does the operator have a proven culture of effective maintenance? Care of wells, facilities and gathering lines is essential for effective, clean operations.

This is not a complete list, but it is a good start. Be sure to look at information specific to a local area and problems that have occurred.

Disclosure: George E. King is a Texas Registered Professional Engineer with over 44 years oilfield experience. His technical background includes fracturing, workovers, chemicals, acidizing, well integrity and horizontal wells.
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