# MSE-BASED ENGINEERED COMPLETIONS

## Increase Production in Both New and Refractured Wells.

NexTier's LateralScience℠ method efficiently and effectively delivers information necessary to successfully engineer completions on every well. The technique leverages existing drilling data to derive mechanical specific energy (MSE) along the wellbore of any well, whether new or existing.

The LateralScience method provides visibility of the variations in rock hardness along the lateral. NexTier then uses this information to achieve the operator's goals by tailoring treatment and completion designs that are best suited for the prevalent fracture network.

LATERAL℠ SCIENCE

The tailoring process is achieved by considering the geomechanical properties of the reservoir rock to be treated, as well as the operator's goals regarding fracture half-length, complexity of the fracture network, etc. We then build a treatment that's designed to achieve a predictable response within each stage. In addition, LateralScience data can be used to optimize plugs and perforation cluster placement, as well as to plan full-field well spacing.

This results in increased production, proper diversion strategies, fewer screenouts, a significant reduction of frac hits, and maximum stimulated rock volume. There is no data-acquisition cost, and the method doesn't require additional rig time or equipment.

**The LateralScience method beats geometric designs hands down:**

- Tailored treatment designs (based on MSE characteristics of the stage)
- Consistent stage/treating response (to address complex vs. planar fracture behavior)
- Targeted perforation cluster and plug placement
- Significant mitigation of offset frac hits
- Identification of potential refracturing candidates
- No data-acquisition cost or additional rig time

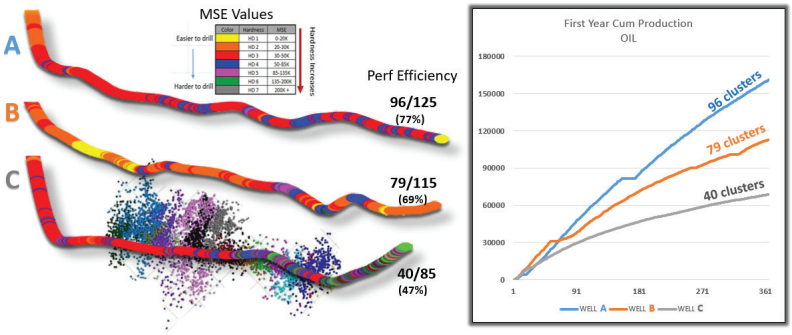



FIGURE 1

**More efficient clusters yield better production:** As indicated on the left, the LateralScience method shows the dramatic heterogeneity in each wellbore and the differences between wells in the same field. As shown on the right, improving perf-cluster efficiency vastly improves production.

| Geometric Perf Design | | | | | | |
|---|---|---|---|---|---|---|
| Stage | Plug | Cluster 1 | Cluster 2 | Cluster 3 | Cluster 4 | Cluster 5 |
| 1 | | 15,705 | 15,665 | 15,625 | 15,585 | 15,545 |
| 2 | 15523 | 15,505 | 15,469 | 15,433 | 15,397 | 15,361 |
| 3 | 15341 | 15,323 | 15,287 | 15,251 | 15,215 | 15,179 |
| 4 | 15159 | 15,141 | 15,105 | 15,069 | 15,033 | 14,997 |
| 5 | 14977 | 14,959 | 14,923 | 14,887 | 14,851 | 14,815 |
| 6 | 14795 | 14,777 | 14,741 | 14,705 | 14,669 | 14,633 |
| 7 | 14613 | 14,595 | 14,559 | 14,523 | 14,487 | 14,451 |
| 8 | 14431 | 14,413 | 14,377 | 14,341 | 14,305 | 14,269 |
| 9 | 14249 | 14,231 | 14,195 | 14,159 | 14,123 | 14,087 |
| 10 | 14067 | 14,049 | 14,013 | 13,977 | 13,941 | 13,905 |
| 11 | 13885 | 13,867 | 13,831 | 13,795 | 13,759 | 13,723 |
| 12 | 13703 | 13,685 | 13,649 | 13,613 | 13,577 | 13,541 |
| 13 | 13519 | 13,501 | 13,465 | 13,429 | 13,393 | 13,357 |
| 14 | 13335 | 13,317 | 13,281 | 13,245 | 13,209 | 13,173 |
| 15 | 13151 | 13,133 | 13,097 | 13,061 | 13,025 | 12,989 |
| 16 | 12971 | 12,953 | 12,917 | 12,881 | 12,845 | 12,809 |
| 17 | 12791 | 12,773 | 12,737 | 12,701 | 12,665 | 12,629 |
| 18 | 12611 | 12,593 | 12,557 | 12,521 | 12,485 | 12,449 |
| 19 | 12431 | 12,413 | 12,377 | 12,341 | 12,305 | 12,269 |
| 20 | 12251 | 12,233 | 12,197 | 12,161 | 12,125 | 12,089 |
| 21 | 12071 | 12,053 | 12,017 | 11,981 | 11,945 | 11,909 |
| 22 | 11891 | 11,873 | 11,837 | 11,801 | 11,765 | 11,729 |
| 23 | 11711 | 11,693 | 11,657 | 11,621 | 11,585 | 11,549 |
| 24 | 11531 | 11,513 | 11,477 | 11,441 | 11,405 | 11,369 |
| 25 | 11351 | 11,333 | 11,297 | 11,261 | 11,225 | 11,189 |
| 26 | 11171 | 11,152 | 11,110 | 11,068 | 11,026 | 10,984 |

| LateralScience℠ Perf Design | | | | | | |
|---|---|---|---|---|---|---|
| Stage | Plug | Cluster 1 | Cluster 2 | Cluster 3 | Cluster 4 | Cluster 5 |
| 1 | | 15705 | 15665 | 15629 | 15587 | 15545 |
| 2 | 15523 | 15502 | 15472 | 15433 | 15397 | 15361 |
| 3 | 15341 | 15318 | 15283 | 15247 | 15213 | 15179 |
| 4 | 15159 | 15139 | 15110 | 15078 | 15037 | 14994 |
| 5 | 14977 | 14957 | 14923 | 14886 | 14855 | 14819 |
| 6 | 14795 | 14777 | 14743 | 14709 | 14674 | 14634 |
| 7 | 14613 | 14595 | 14559 | 14527 | 14495 | 14458 |
| 8 | 14431 | 14413 | 14377 | 14341 | 14307 | 14274 |
| 9 | 14249 | 14227 | 14192 | 14154 | 14121 | 14087 |
| 10 | 14067 | 14047 | 14013 | 13980 | 13938 | 13901 |
| 11 | 13885 | 13866 | 13831 | 13793 | 13759 | 13725 |
| 12 | 13703 | 13683 | 13646 | 13613 | 13577 | 13541 |
| 13 | 13519 | 13500 | 13463 | 13424 | 13388 | 13361 |
| 14 | 13335 | 13316 | 13281 | 13247 | 13215 | 13177 |
| 15 | 13151 | 13129 | 13090 | 13058 | 13022 | 12986 |
| 16 | 12971 | 12953 | 12918 | 12881 | 12846 | 12811 |
| 17 | 12791 | 12773 | 12737 | 12704 | 12665 | 12627 |
| 18 | 12611 | 12592 | 12557 | 12521 | 12485 | 12449 |
| 19 | 12431 | 12413 | 12383 | 12346 | 12309 | 12270 |
| 20 | 12250 | 12233 | 12197 | 12161 | 12128 | 12092 |
| 21 | 12071 | 12053 | 12012 | 11973 | 11940 | 11909 |
| 22 | 11891 | 11873 | 11836 | 11792 | 11761 | 11729 |
| 23 | 11707 | 11688 | 11658 | 11618 | 11589 | 11551 |
| 24 | 11531 | 11513 | 11474 | 11437 | 11405 | 11369 |
| 25 | 11350 | 11333 | 11297 | 11261 | 11225 | 11189 |
| 26 | 11171 | 11152 | 11110 | 11068 | 11026 | 10984 |

| Design | Est. Cluster Efficiency |
|---|---|
| Geometric | 60% |
| Optimized | 94% |

| Color | Hardness | MSE |
|---|---|---|
| | HD 1 | 0-20K |
| | HD 2 | 20-30K |
| | HD 3 | 30-50K |
| | HD 4 | 50-85K |
| | HD 5 | 85-135K |
| | HD 6 | 135-200K |
| | HD 7 | 200K + |

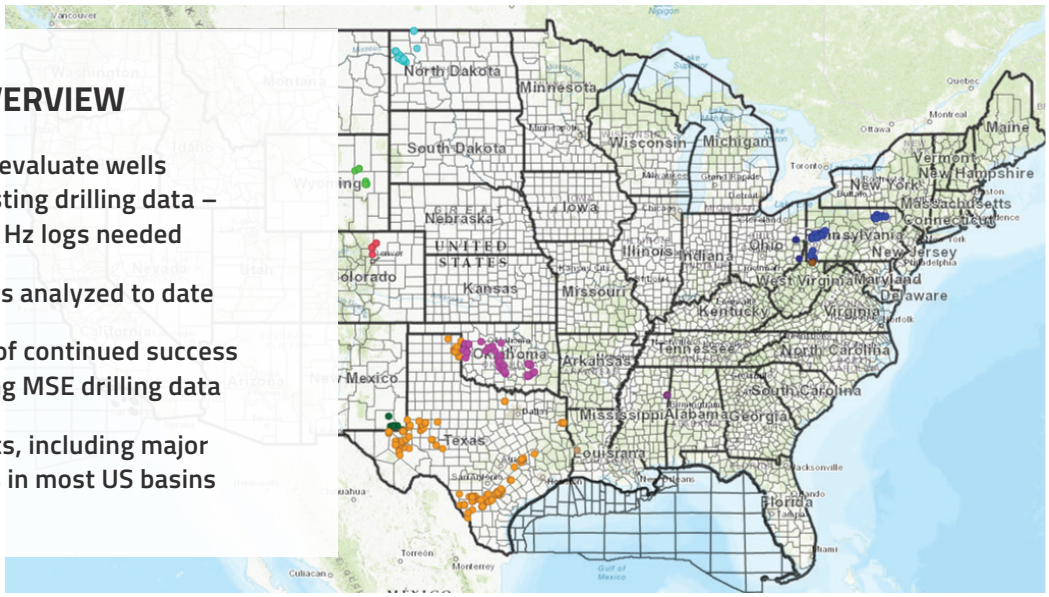
Hardness Increases

FIGURE 2

**Tailored treatments for different rock:** This design optimizes the completion by grouping perf clusters along the wellbore based on changes in rock hardness. The treatment is then tailored specifically to the characteristics of the stage, as well as the objectives of the operator. In this case, softer rock (indicated in red) would receive a different treatment than the harder (blue) rock.

## OVERVIEW

- Ability to evaluate wells using existing drilling data – No added Hz logs needed
- 675+ wells analyzed to date
- 5+ years of continued success integrating MSE drilling data
- 75+ clients, including major operators in most US basins




**To improve the effectiveness of your completion designs, stimulate more rock and boost production, contact us at LateralScience@NexTierOFS.com.**