



THE DOWNHOLE VISUAL
ANALYTICS COMPANY



CLEARVISION
DATA YOU CAN TRUST

The world's only integrated array video and phased array ultrasound scanning technology, providing the most advanced 4-dimensional evaluation system for wellbore applications.

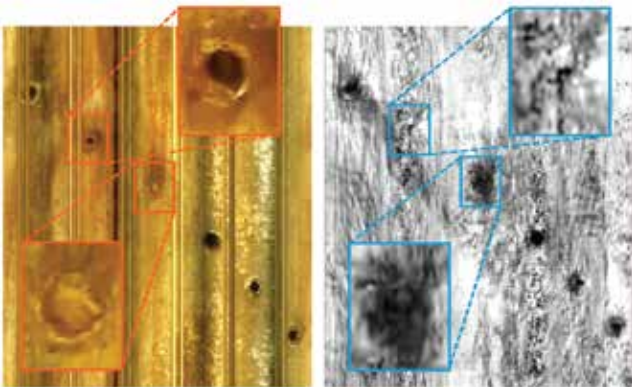
HART ENERGY
AWARD WINNER 2023

CLEARVISION

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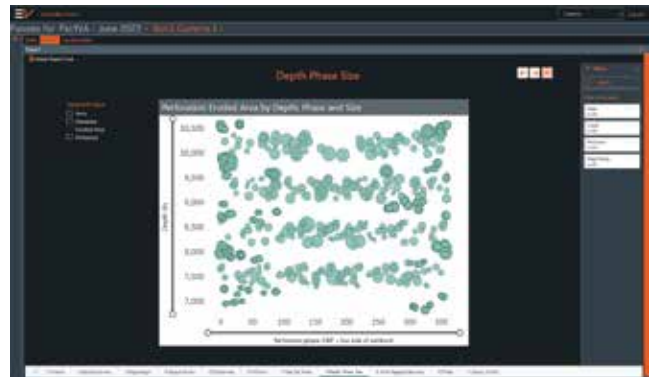
Imaging Without Compromise

ClearVision takes downhole imaging into another dimension. By combining our flagship array video imaging with state-of-the-art phased array ultrasound technology, ClearVision provides an instant, detailed understanding of complex wellbore issues in the widest range of fluid conditions. No matter whether oil, gas, water or brine, ClearVision provides accurate and intuitive 4D images to reveal the truth in any situation.



Data You Can Trust

By combining the superior measurement accuracy of array video technology with the radial geometry and pipe thickness measurements provided by phased array ultrasound scanning, ClearVision provides the most accurate measurements of any downhole geometry. And with two unique physics of measurement working in harmony, ClearVision successfully captures data where single-sensor technologies may fail, resulting in the most complete and trustworthy source of information on which decisions can be made with confidence.



Comprehensive Frac Diagnostics

ClearVision data from a single survey can be used to evaluate a range of frac performance criteria and diagnose frac-induced phenomena.



Charge
Performance and
in-situ Limited
Entry Parameters



Proppant
Placement and
Treatment
Uniformity



Plug
Performance
and Effective
Stage Isolation

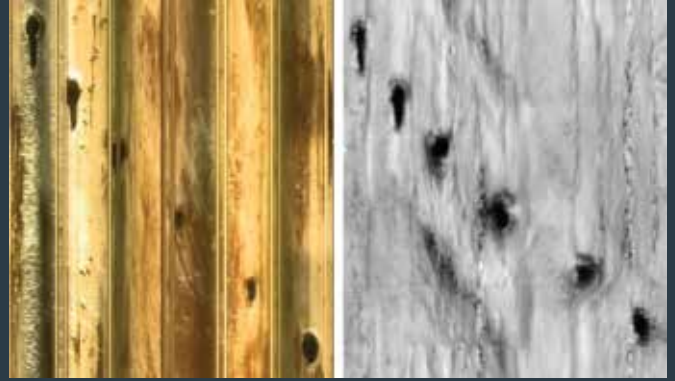


Fracture Driven
Interactions
and Wellbore
Deformation

PERFORATION

ClearVision uniquely combines array video imaging and phased array ultrasound to deliver the most comprehensive and precise view of the wellbore for all perforation-based diagnostics.

The combination of array video and phased array ultrasound technologies provides a significant performance advantage compared to their use in isolation. When downhole conditions are challenging the complementary nature of ClearVision's two sensors means that at least one technology is always able to provide the required answer. Complete and accurate data assures meaningful interpretation and credible conclusions, and since its first run, ClearVision has delivered a track record of >99% of perforations imaged and measured in every well.



Through its unique design features and integration of multi-sensor technology, ClearVision overcomes several potential challenges when imaging and measuring small features such as perforations in unconventional wells:

Challenges:

Clear Vision Benefit:

Measurement Accuracy	10x higher resolution than any other sensor to provide the most accurate perforation erosion measurements and greatly improves the precision of the metrics derived from them such as cluster efficiency and proppant uniformity.
Unseen Perforations	Identification and capture of even the smallest perforations, eliminating the risk of unmeasured erosion, and enabling definitive conclusions as to the location and quantity of proppant placement.
Poor Optical Fluid Clarity	Two unique sensor technologies working in harmony, magnifying their strengths and mitigating their weaknesses, enabling imaging without compromise in all conditions, and delivering comprehensive data you can trust.
Proppant Filled Perforations	With the ability to capture images across the entire visible spectrum, ClearVision can distinguish sand from steel, thereby enabling measurement of proppant-filled perforations and ensuring maximum data validity.
Inaccurate Measurements Due to Motion Effects	With high frame rates and fast shutter speeds, array camera images are immune to the stick/slip motion effects that lead to the distortion of perforation entry hole geometry from stand alone ultrasound imaging technologies.

Missing or inaccurate data points can have a huge impact on the interpretation of perforation measurements. With modern completion designs containing as few as 20 to 40 perforations per stage, the impact of two or three unmeasured perforations on the interpretation of proppant distribution can be significant, with the potential for key metrics being completely reversed, leading to incorrect decisions on perforation and stage design.

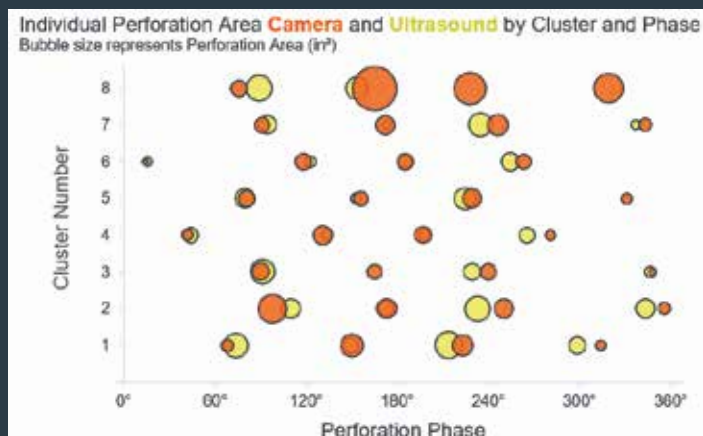


Figure 1: Eroded area per perforation

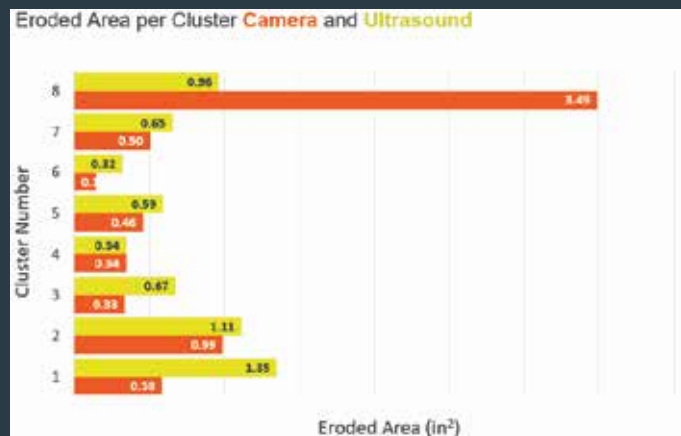


Figure 2: Total eroded area per cluster

Figure 1 shows that two perforations were missed by one of the sensors in Cluster 8 of this stage. The impact of those missing data points on the eroded area and inferred proppant placement for the stage is seen in Figure 2 on the right. In Figure 3 below we see the missing data reverses the calculated trend in proppant placement from a heel trend to a toe trend, and in Figure 4 that the same missing data changes the interpretation of proppant placement from more uniform than average to less uniform than average.

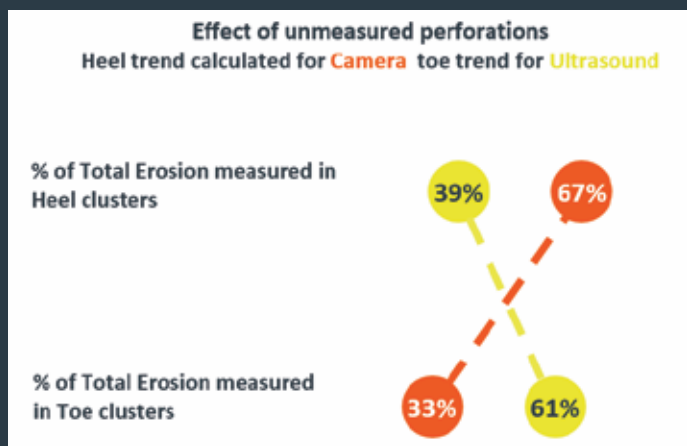


Figure 3: Heel to Toe trends reversed

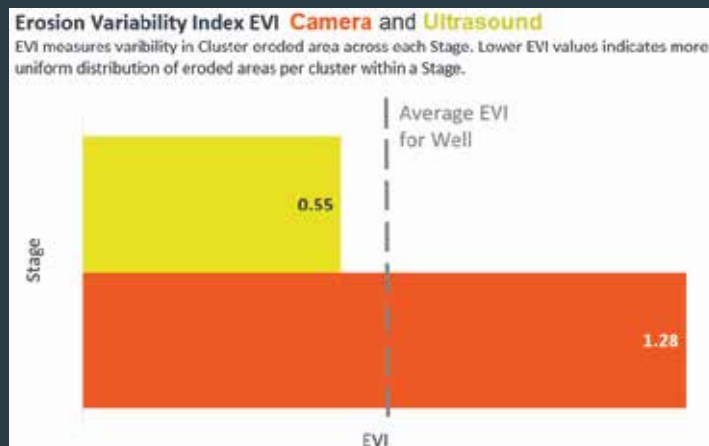
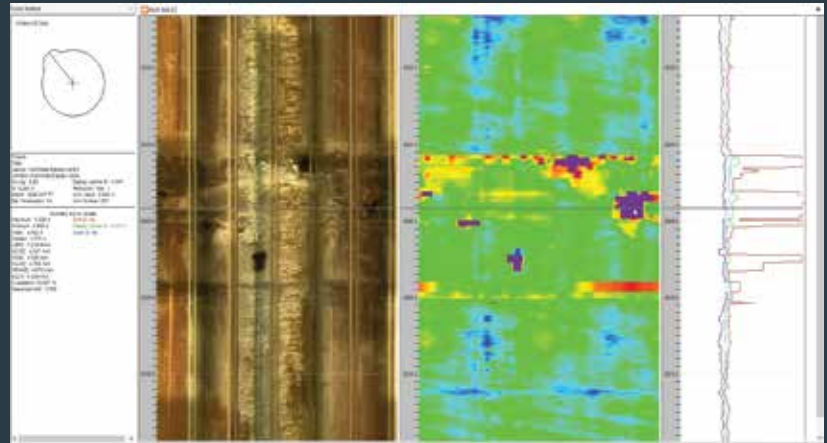


Figure 4: Proppant placement variability

PLUGVA

A full understanding of plug performance during hydraulic fracturing can help prevent issues with well integrity, ineffective stimulation, reduced productivity and even well-to-well interactions.

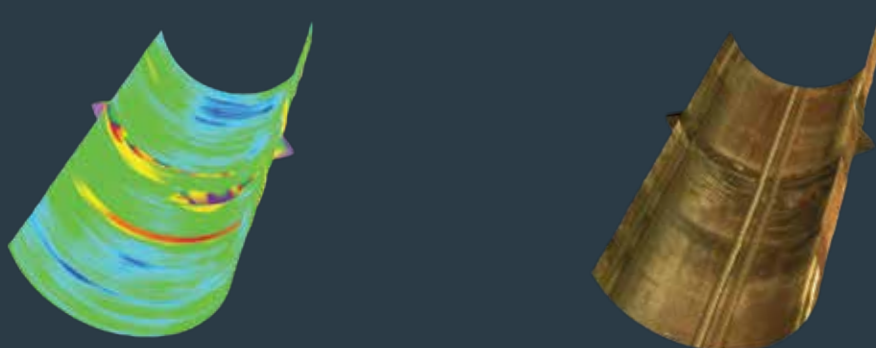
ClearVision and EV's PlugVA service provides invaluable diagnostics to confirm stage isolation or identify casing erosion or breaches from high pressure fluid bypass. Distinctive patterns on the casing ID created by plug anchor setting and later milling are identified in 360° circumferential images from both array ultrasound and array camera sensors. Analysis provides confirmation of setting depths and evidence of whether plugs were securely in place both before and after fracture treatment.



Any movement of the plug or indications of fluid bypass during treatment are also observed in the images. Radial measurements from ClearVision's ultrasound sensor can quantify the extent of any casing erosion - from minor damage to full breach of the casing wall. Radial measurements can also reveal the root cause of plug failures - for example anchor failures due to casing out of roundness.



EV's PlugVA service provides a highly cost-effective evaluation of plug performance as it is acquired simultaneously with PerforationVA and requires no additional operating time. Knowledge of plug performance and stage isolation further improves the understanding of under and over-stimulated clusters and stages measured during PerforationVA.

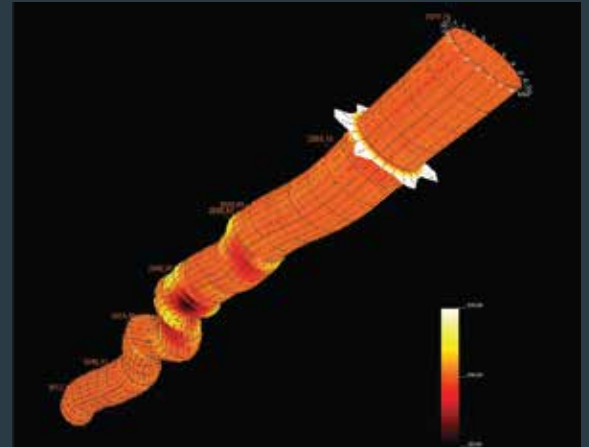


RESTRICTIONVA

RestrictionVA is the ultimate solution for understanding and overcoming downhole restrictions. With a focus on identifying root causes and determining severity, RestrictionVA offers a proactive approach to de-risking well interventions and is a powerful aid in modelling subsurface behaviour.

Thanks to its ability to capture precision radial measurements while simultaneously imaging the wellbore, ClearVision provides accurate identification and quantification of anomalies in casing geometry such as ovalization and deformation caused by fracture-driven interactions. And with more than seven times the number of sensors compared to standard multi-finger calipers, ClearVision has the ability to resolve even the smallest of features, and track their change with respect to time.

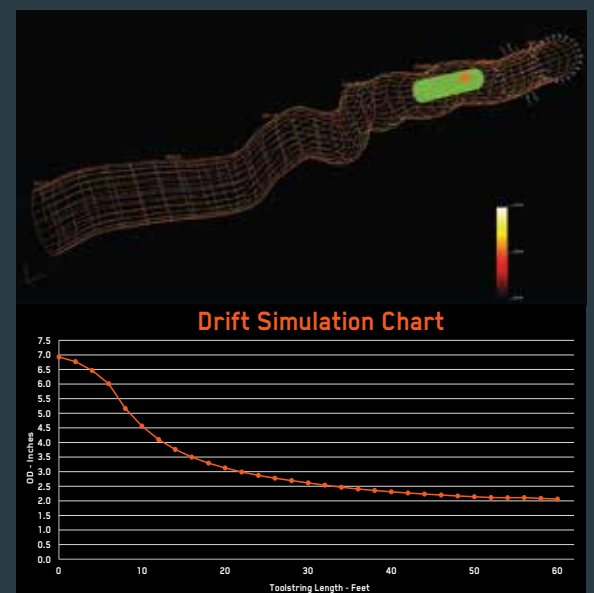
And by virtue of its solid state sensor array, combined with single-run data acquisition capability during perforation evaluation surveys, ClearVision provides powerful, early diagnosis of casing deformation events with minimal operational risk and maximum operational efficiency.



In the event that severe restrictions are encountered, or if more detailed analysis is required, then dedicated surveys and RestrictionVA analysis can be performed using EV's Integrated Video Caliper (IVC) technology. Images from the IVC's high definition down-view camera can be used to provide instant assessment of severe restrictions, confirm their cause, and enable measurements of minimum cross-well diameters.

Should the cause of the restriction be less clear-cut, more complex, or observed over an extended depth interval, then EV's patented Pipe Deformation Analysis (PDA) may be performed to provide a definitive answer. Using the IVC's multi-finger caliper measurements, and by analysing changes in toolstring eccentricity as the IVC navigates the restriction, PDA creates a model to resolve small changes in wellbore trajectory, providing a direction and magnitude that can be used to refine subsurface stress models.

Should access through the restriction be of paramount importance then further drift simulation modelling can be performed to determine the limits of passage with respect to BHA length and diameter, or to determine clearance for specific BHA. The result enables the optimal configuration to be determined quickly and effectively, reducing costly down-time and reducing operational risk.



Array Video

Array video has proven to be revolutionary, not just evolutionary. ClearVision's solid-state array of four azimuthally aligned video sensors enables full circumferential coverage, providing a unique 360 degree perspective of the wellbore. With high-resolution, high-frame rate video, ClearVision captures even the smallest of details, and any changes that may occur over time, enabling precision measurements and time-lapse capability.

Thanks to its patented optical arrangement and unique lighting arrangement, ClearVision achieves a step-change in spatial differentiation and industry-leading image clarity – even in challenging fluid conditions. And with Gigapixel image processing, the information captured by ClearVision can be combined to create a continuous 2-Dimensional image to provide a complete picture of the wellbore.

The Ultimate 4D dataset

With over 132 million datapoints recorded every second, array camera technology captures data with pin-point resolution around the circumference and along the length of the wellbore. This enables unrivalled, high-precision measurement and evaluation of perforations, flow ports and orifices, pitting and corrosion, completion components, and tubing connections.

In All Conditions

Where conditions permit, the camera array acts as the primary imaging device providing the highest quality images of any downhole sensor technology in gas, water and optically clear brines. And with industry leading low-light performance, ClearVision provides superior video information in the widest operating range.

Beyond a Picture

By capturing data across the full visible spectrum ClearVision delivers vivid color images that enable the differentiation of materials such as sand, scales or varying fluid types. And with a high temporal sampling rate, ClearVision has the ability to capture and track the motion, direction and relative speed of fluids and objects flowing into or along the wellbore.





Phased Array Ultrasound

By stimulating multiple array elements simultaneously, ClearVision's phased array ultrasound scanner emits a highly focused and controlled beam of sonic energy from a solid-state array. By sweeping this pattern around the array, and analyzing the resulting echoes at varying depths of investigation, ClearVision merges layers of beam-formed data to create a 3-D point cloud to obtain images and measurements even in conditions where your eyes cannot see.

With 100% circumferential coverage, and determination of radial distance through time-of-flight processing, ClearVision's phased array ultrasound scanner enables radial and thickness measurements to complete the picture of your well. And with data captured at multiple depths of investigation, ClearVision enables you to evaluate what lies within or behind structures to reveal and assess components and features that are hidden from sight.

The Ultimate 4D dataset

By creating a point-cloud of over 270,000 datapoints every inch, ClearVision enables precision measurements in the radial direction to augment the 2-Dimensional images captured by the video array. This enables detailed measurements of wellbore geometry, pipe thickness, metal loss, and pit depth to provide comprehensive evaluation of structures and their integrity.

In All Conditions

When conditions become challenging for optical imaging, ClearVision's phased array ultrasound scanner provides an alternative physics of measurement to continue visualization of the wellbore. Whether in oil or high turbidity well fluids, ClearVision extends imaging and measurement capability beyond the visible range.

Beyond a Picture

With the unique ability to image beneath the surface of an object, and reveal details hidden from sight, ClearVision enables a range of advanced diagnostics, including the location of cable clamps and determination of their orientation, detection of cracks and material imperfections, and the identification of damaged or incomplete casing connections.

THE WEB PORTAL

The EV Web Portal revolutionizes the way you access and analyse well data, surveys, and logging passes. By consolidating all this valuable information into one centralized cloud-based platform, our user-friendly portal empowers you to effortlessly harness the power of comprehensive data analysis. Gain easy access to your data from anywhere in the world, at any time.

Advanced Visualization Capabilities

With the simultaneous data viewing capabilities of camera data, log data and processed video data, the EV Web Portal allows you to compare and gain a comprehensive understanding of your well. Dive deeper into the knowledge pool with just one click, with the Web Portal you can navigate depths and explore 3D displays of video data and conventional log data, with smart play-back tools to zoom-in and examine the features that matter most to you.



The Web Portal utilises the powerful analytics and reporting capabilities of Microsoft PowerBI. Visual Analytics and Multi-finger caliper analysis results are easily interpreted and comprehended with our statistical analysis that helps you identify crucial trends and visualize the results.

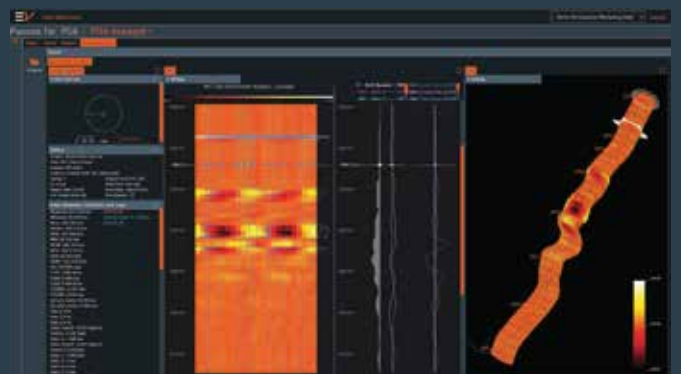
Are you achieving uniform proppant placement?

The Web Portal provides an integrated report that showcases the results from PerforationVA analysis. Gain a comprehensive understanding of perforation erosion and its variability from stage level down to the perforation level. Results from ClearVision can be compared and analysed between the camera and ultrasonic array tools, enabling optimization in perforation efficiency and maximized economic recovery.



Ensure Well Integrity with Confidence

With the Web Portal's multi-finger caliper reporting, you can gain valuable insights into the integrity of your well. Our multi-finger caliper measurements deliver statistical results on a joint-by-joint basis, providing essential integrity information. Explore minimum restrictions, scale volume, metal loss, and wall penetration to gain a comprehensive understanding of well integrity. Leave nothing to chance and gain clear insight into your well.



SPECIFICATIONS

Max Outer Diameter	3.0 in	76.2 mm
Length	244.5 in	6,210.3 mm
Pressure Rating	7,500 psi	517 Bar
Temperature Rating	257°F	125°C
Sensor Types	Array Video and Phased Array Ultrasound	
Frame Rate	Video 25 fps. Ultrasound 22 fps.	
Vertical Resolution ^{1 2}	Video 0.005 in Ultrasound 0.090 in	Video 0.1 mm Ultrasound 2.3 mm
Circumferential Resolution ¹	Video 0.005 in Ultrasound 0.050 in	Video 0.1 mm Ultrasound 1.3 mm
Radial and Thickness Resolution	0.004 in	0.1 mm
Inclination Measurement Accuracy	±5.0°	
Azimuth Measurement Accuracy	±5.0° (Dev ≥ 5.0°)	
Reccomended Logging Speed ¹	15 ft/min	4.6 m/min
Pipe ID Operating Range	4.0 in to 13.0 in	101.6 mm to 330.2 mm
Well Fluid Compatability	Oil, Gas, Water, Brine, Completion Fluids, Production Fluids	
Recording Capacity	Up to 16 hrs continuous recording with programmable intervals	
Power	Lithium or Alkaline battery	
H2S/CO2	Compatible with corrosion resistant materials throughout	

1 Based on typical 5.5in OD #15.5 tubing

2 Based on recommended logging speed of 15 ft/min (4.7 m/min)



North America Contact

USA REGIONAL HQ

1557 W Sam Houston
Parkway N, Suite 100,
Houston
TX 77043
T +1(281)-492-1300

CANADA REGION

890, 736-8th Av SW
Calgary,
Alberta
T2P 1H4
T +1-(403)-263-6144

ROCKIES

8100 S. Akron St, Suite 315
Centennial
CO 80112
T +1 (303)-284-5929

MID CONTINENT

7701 N. Broadway Ext,
Suite A6, Oklahoma City,
OK 73116
T +1 (405) 464-9398

EAGLEFORD

T +1 (713)-295-1112

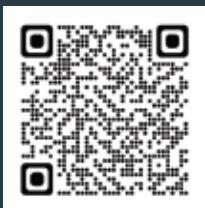
PERMIAN BASIN

3107 Antelope Trail
Unit #5 Midland
TX 79706
T +1 (432)-559-9459

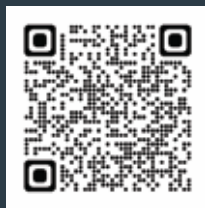
GULF OF MEXICO

T +1 (713)-231-8995

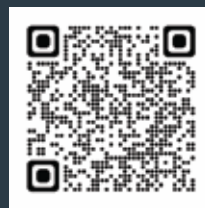
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