Journal of Energy and Power Engineering 19 (2025) 133-140
doi: 10.17265/1934-8975/2025.04.002

RDV Protonic Activation for EOR in Active, Mature Reservoirs and Marginal Wells

William J. Jimenez[1], Carlos A. Rivera[2], Hector J. Sulvaran[3] and Hernan O. Gonzalez[1]

1. GQ-USA International LLC (Globalquimica), 1202 1st Street East, Humble, Texas 77338, USA

2. Valley Petrochemicals, LLC, 3804 S Radisson Ave #2 PHARR, TX 78577, USA

3. SC OilField Services LLC, 19330 Little Pine Lane Katy, TX 77449, USA

Abstract: This study documents pioneering results in marginal wells in Texas, where the application of RDV-00® restored production through delayed protonic activation catalyzed by reservoir energy. The product, based on RDV® (Vasoactive Dynamic Reactor) technology, operates via: Controlled protonation of molecular structures; Release of energetic carbocations; Autonomous transformation without external inputs. (a) Case 1 (Well #E2—Starr County): Certified as "dry" by RRC (2022) after 48 months at 0 BPD; 8 months post-injection of 5 gal RDV-00® (Fluid column: 37 bbl; Wellhead pressure: 80 psi (vs. 0 psi initially)). (b) Case 2 (Well #P1—Luling Field): Historical stripper well (0.25-0.5 BPD); 23 months of immobilization with 15 gal RDV-00®; Critical results: (1) Initial production: 42 BPD (8,400% above baseline); (2) Shut-in wellhead pressure: 40 psi (neighboring wells = 0-3 psi); (3) Current behavior: Continuous recharge from reservoir (well shut-in due to lack of storage). (c) Technically Significant Observations: (1) First case of self-sustaining reactivation in depleted wells; (2) Mechanism validated by Autonomous pressure generation (0 → 40-80 psi), and Continuous flow without additional stimulation; (3) No documented precedents in SPE/OnePetro literature to our knowledge.

Key words: Enhanced recovery, marginal wells, protonic activation, carbocations, RDV-00®, autogenous pressure, viscoactive rheology, delayed activation, autonomous EOR (enhanced oil recovery).

1. Introduction

The exploitation of marginal wells represents one of the most persistent challenges in contemporary petroleum engineering. In the United States, approximately 768,000 wells are classified as marginal (NSWA 2025), of which 400,000 are stripper wells producing < 15 BPD. This low-productivity infrastructure contributes over 7.4% to U.S. oil production but faces increasing abandonment risk due to unsustainable operating costs.

1.1 Current Technical Barriers

- Conventional CEOR methods require:

✓ Continuous intervention

✓ High CAPEX (> $50,000/well)

✓ Specialized monitoring

- 40% of stripper wells operate with negative financial margins (DOE (Department of Energy) 2024).

1.2 Proposed Alternative

The RDV-00® product, designed for light crudes, is developed under RDV® (Vasoactive Dynamic Reactor) technology and introduces a paradigm of delayed autonomous activation based on:

(1) Targeted protonation of molecular structures;

(2) Controlled release of energized carbocations;

(3) Catalytic transformation driven by reservoir energy (pressure/temperature).

Table 1 briefly summarizes what this manuscript describes about these two revolutionary cases.

1.3 Global Implications

- First phenomenon of "delayed chemical activation

Corresponding author: William J. Jiménez, M.Sc., technical director, research fields: enhanced oil recovery (EOR), protonic activation, carbocation chemistry, reservoir stimulation, autonomous pressure generation.

mechanism" validated in the field.

- Opportunity to reactivate > 2.1 million abandoned wells worldwide (IEA 2023) where traditional methods are unfeasible.
- Emerging research line for mature fields in:

✓ Venezuela (Orinoco Belt)

✓ Canada (Athabasca)

✓ Middle East (depleted fractured reservoirs)

1.4 Chemical Basis of RDV® Technology

RDV® Chemical Technology (Vasoactive Dynamic Reactor) is an innovation that applies protons and electron transfer to transform the molecular structure of hydrocarbons. Its mechanism of action, based on protonation and the release of high-energy carbocations, triggers a reaction that irreversibly enhances crude oil quality. This transformation ensures oil flow without the need for conventional solvents and enables EOR (enhanced oil recovery) under pressure and temperature reservoir conditions.

1.4.1 Core Mechanism: Targeted Protonation and Carbocations

Three-phase validated process in the cases:

(1) Active Proton Generation

Controlled release of H^+ in confined media, catalyzed by reservoir conditions (T > 50 ℃, P > 200 psi).

(2) Formation of Energized Carbocations

Electrophilic attack on C-C/C-H chains, generating [R^+] ions with high reorganization energy (>80 kJ/mol).

(3) Autonomous Molecular Restructuring

- Breakdown of asphaltenes/paraffins → lighter fractions (ΔAPI: +5°-8°).
- Neutralization of polar compounds (H_2S/CO_2 reduction).

1.4.2 Modulated Viscoactivity: Adaptation to Depleted Reservoirs

Table 2 shows the chemical properties of RDV® technology that stood out in these case studies.

1.4.3 Delayed Activation: The Autonomous Paradigm

1.4.3.1 Chemical Basis vs. Traditional CEOR

Table 3 compares the parameters offered by RDV® versus those of conventional methods.

Table 1 Initial reservoir conditions and RDV-00® activation scenarios in dry and marginal wells.

Scenario	Initial limitation	RDV® solution
Case #1 (dry well)	48 months 0 BPD, RRC "dry hole" certification	Autonomous reactivation observed post-treatment (37 bbl + 80 psi in 8 months)
Case #2 (stripper well)	Historical production: 0.5 BPD, Forced inactivity: 23 months	42 BPD sustained (+8,400%) with autogenous pressure (40 psi)

Table 2 Key chemical properties of RDV-00® enabling microfracture access and thermal resistance in reservoir conditions.

Property	Impact on formation	Case evidence
Enhanced capillary penetration	Access to irreducible porosity (0.1-5 μm)	Mobilization of ~37 bbl in previously certified dry well
Adaptive rheology	Reduces interfacial tension (72 → 5 mN/m)	Spontaneous flow without pumping
Thermal stability	Operates at 60-150 ℃ without degradation	Activation in repose (23 months)

Table 3 Operational contrast between RDV-00® autonomous activation and conventional CEOR methods.

Parameter	RDV® technology	Conventional CEOR methods
Energy	Catalyzed by geothermal and reservoir pressure (0 kWh)	Requires mechanical pumping and constant external injection
Time	Weeks to months: maximum efficiency ≥ 12 months	Hours to days: accelerated agent degradation
Monitoring	Autonomous: no intervention or technical follow-up	Continuous monitoring with sensors + operational adjustments

Table 4 RDV® product portfolio and field-specific mechanisms for light, medium, and extra-heavy crude applications.

Product	Crude type	Specific mechanism	Field validation
RDV-00®	Light/medium/condensates (30-45 °API)	Cold molecular fragmentation	Cases #1 and #2 (Texas)
RDV-01L®	Heavy/extra-heavy/bitumen (<20 °API)	Demetallization + viscosity reduction	Orinoco Belt (Venezuela)

1.4.3.2 Demonstrated Latent Mechanism

"The molecular reorganization in repose (Case #1: 8 months; Case #2: 23 months) confirms that carbocations maintain catalytic activity without degradation, transforming the rock matrix via cyclic desorption/reaction."

1.5 RDV® Products and Strategic Applications

Table 4 shows the products manufactured under RDV® technology adapted to each crude oil type.

2. Application in Marginal Wells

2.1 Case #1: Reactivated Dry Well (E2)

2.1.1 Technical Context

- Location: Kelsey South Field (Starr County, TX), Frio Sand Formation.
- Initial Status: Declared "dry well" by RRC Texas (Oct. 2022) after 48 months without production/activity. Confirmed by Echometer: 0 psi pressure, no fluids in producing zone (5,398'-5,722').
- Intervention (Nov. 2024):

(1) 5 gallons of pure RDV-00® injected via annular space.

(2) No pumping, recirculation, or subsequent monitoring.

2.1.2 Critical Results (July 2025)

Dual Echometer readings of Well #E2 (Starr County, Texas), recorded in July 2025, showing emergence of fluid column and pressure recovery following RDV-00® activation. These results contrast with the RRC dry hole certification issued in October 2022 (Fig. 1).

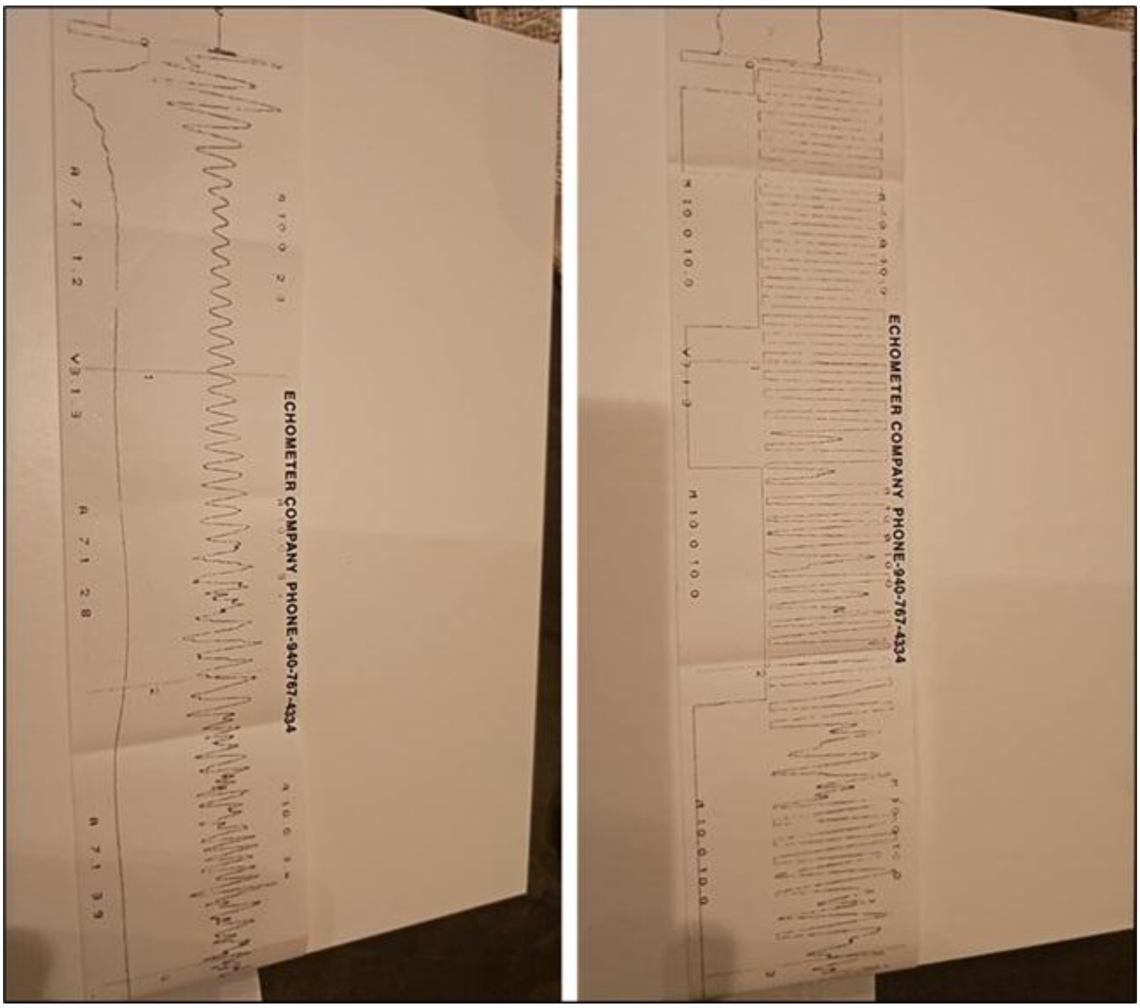

Fig. 1 Echometer readings of Well #E2 (July 2025).

Table 5 shows a comparison between the well conditions before and after RDV® technology treatment.

2.1.3 Key Opportunities

(1) Pressure Recovery: The emergence of 80 psi suggests reservoir energy restoration, possibly due to associated gas release or phase recombination.

(2) Fluid Dynamics: Fluid located +1,500 ft above perforations indicates vertical upward migration not explained by natural influx.

(3) Reactivation Potential: The recovered volume (~37 bbl) justifies an immediate production test to evaluate composition (water/hydrocarbons).

(4) Submerged perforations (5,398'-5,722') recovered communication with the producing zone.

2.1.4 Lessons Learned

“The absence of post-injection monitoring prevents determining the exact recovery mechanism, but the state change (dry → fluid + pressure) is technically significant.”

2.2 Case #2: Stripper Well with Delayed Activation (P1)

2.2.1 Technical Context

- Location: Luling Field (Caldwell County, TX), Edwards Limestone Formation.
- Initial Status: Marginal well (0.25-0.5 BPD), out of service due to pump failure (Aug. 2023).
- Intervention:

(1) 15 gallons of RDV-00® + 36°API crude (homogeneous mixture).

(2) Injection via casing above reservoir level.

(3) Critical failure: Inoperable pump → static pill for 23 months without active contact.

Pressure gauge reading 40 psi at the wellhead of Well #2 (Luling, Texas), confirming autonomous pressure recovery following RDV-00® activation (Fig. 2).

Fig. 2 Pressure gauge reading 40 psi at the wellhead of Well #2 (Luling, Texas).

Table 5 Well #E2: Pressure recovery and fluid emergence following RDV-00® activation.

Parameter	Pre-intervention	Post-intervention (8 months)
Wellhead pressure	0 psi	80 psi
Fluid level	Absent	3,700-3,900 ft (above perforations)
Estimated volume	0 barrels	~37 barrels

Table 6 Well #P1: Production increase after prolonged repose and RDV-00® treatment.

Parameter	Pre-intervention	Post-reactivation
Production (24 h)	0.25-0.5 BPD	42 barrels
Production (48 h)	-	42 barrels
Productivity increase	-	Approximately 100× increase compared to historical baseline

Fig. 3 Sequential frames showing free-fall flow into surface tank from Well #2 (Luling, Texas).

Table 7 Comparative technical summary of RDV-00® activation in dry and marginal wells.

Indicator	Case #1 (dry well)	Case #2 (stripper well)
Inferred mechanism	Energy reestablishment	Damage removal + mobility improvement
Response time	8 months (slow)	23 months (delayed activation)
Pending monitoring	Production test + fluid analysis	Pressure measurement + decline curve
Economic potential	Reactivation of abandoned wells	Extension of marginal well lifespan
Risks	Unverified fluid origin	Temporary vs. sustainable effect

2.2.2 Post-workover Results (July 2025)

Sequential frames showing free-fall flow into the surface tank from Well #2 (Luling, Texas), following RDV-00® activation. The visual sequence illustrates sustained production behavior in a well previously limited to 0.25–0.5 BPD, now reaching 42 BPD (Fig. 3).

Table 6 shows the production rate levels of well P1 before and after RDV® technology application.

2.2.3 Key Opportunities

(1) Efficiency with Prolonged Contact: The "repose time" (23 months) enabled chemical interaction with the formation, removing damage (paraffins/scales) or improving relative permeability.

(2) Profitability in Marginal Wells:

- Investment: ~15 gal RDV-00® + workover.
- Return: 84 barrels in 72 h (equivalent to 336 days of historical production).

(3) Activation Mechanism: Mixing with native crude may have facilitated surfactant dispersion in the oil phase, even without recirculation.

2.2.4 Lessons Learned

"Production exceeded storage capacity, highlighting the need to redesign surface facilities when applying RDV-00® in marginal wells. The absence of pre/post pressure data limits mechanism analysis, but the productivity surge is undeniable."

2.2.5 Comparative Table of Technical Opportunities

Table 7 presents a comparative technical summary of the results observed in these two case studies.

3. Technical Discussion

Table 8 demonstrates the technical evidence and scientific implications of the observed phenomena.

3.1 Chemical Basis of RDV-00®

3.1.1 Key Contribution

"Protonation reaction with the release of highly energetic carbocations, modeled via quantum physics, generating latent molecular activation under reservoir conditions (HP/HT)."

3.1.2 Translation to Observable Mechanisms

3.1.2.1 Case #E2 (Fluid Formation)

• Carbocations alter interfacial tension, enabling the coalescence of micro-dissolved hydrocarbons trapped in the rock matrix.

• The pressure (80 psi) suggests associated gas release during phase recombination.

3.1.2.2 Case #P1 (Productivity Surge)

• Prolonged contact time (23 months) facilitates surfactant diffusion into low-mobility zones, reducing viscosity and releasing residual oil.

3.1.3 Singularity in Technical Literature (CEOR/SPE)

• Inverted Paradigm: Conventional EOR methods require continuous injection/monitoring; RDV-00® operates in an "inject-and-wait" mode.

• UField evidence not previously documented in SPE literature:

(1) "Spontaneous generation of hydrostatic column where fluid absence was certified (RRC Texas)."

(2) "Volumetric response without mechanical stimulation post-intervention."

3.2 Industrial Projection: Scalability Scales

3.2.1 Luling 2023 Program Results and Operational Projection for Marginal Wells in Texas

3.2.1.1 Luling 2023 Program (7 Treated Wells)

Table 9 summarizes the technical results and impact of RDV® chemical technology in the well treatment program executed in marginal wells in Luling, TX.

3.2.1.2 RDV® Massification Scenarios in Marginal Wells, Texas

Table 10 presents projected scenarios for large-scale application of the technology in marginal wells across Texas, based on the field results summarized in Table 9.

3.3 Unified Technical Hypothesis

"The latent molecular activation of RDV-00®—via carbocations generated in situ—reshapes fluid thermodynamics in the porous medium, inducing:

(1) Critical reduction of interfacial tension (releasing trapped hydrocarbons).

(2) Phase recombination (generating autogenous pressure).

(3) Wettability alteration (increasing relative oil permeability)."

3.4 Strategic Conclusions

3.4.1 Technology Validation

The cases demonstrate that RDV-00® operates under physicochemical principles not contemplated in traditional EOR methods.

3.4.2 Opportunity in Abandoned Assets

Certified dry wells (like #E2) could be revalued as strategic reserves.

3.4.3 Critical Recommendation

Advanced instrumentation: Implement bottomhole pressure sensors and pre-/post-intervention fluid sampling to quantify mechanisms.

4. General Conclusions

4.1 Disruptive Technology Validation

RDV-00® has demonstrated autonomous activation in wells certified as "dry" (Case #E2) and stripper wells (Case #P1), without requiring pumping, recirculation, or continuous monitoring.

Documentary evidence: Acoustic logs (Echometer), wellhead pressures (0 → 80 psi), and verified production (84 bbl in 72 h).

4.2 CEOR Paradigm Shift

Technology operates via unprecedented physicochemical mechanisms (carbocation release catalyzed by reservoir energy), contrasting with traditional EOR methods that rely on. Table 11 shows the contrast between RDV® technology (Vasoactive Dynamic Reactor) mechanisms and conventional EOR methods.

Table 8 Scientific implications of autonomous activation and productivity surge in treated wells.

Observed phenomenon	Case #E2 (Dry Well)	Case #P1 (stripper well)	Scientific implication
Autonomous activation	Fluid + pressure after 8 months	Significant production increase after 23 months	Delayed chemical action without external stimulus
Response magnitude	37 bbl (from 0 bbl) + 80 psi	84 bbl in 72 h (100 × baseline)	Efficiency in mobilizing residual reserves
Operational singularity	No pumping/recirculation	Mechanical failure → prolonged static contact	Minimizes CAPEX/OPEX requirements

Table 9 RDV-00® field program results in marginal wells: Production metrics and statistical correlation.

Technical indicator	Recorded value
Number of treated wells	7
Average production increase	+500%
Typical pre-treatment production	0.25 to 0.5 BPD
Post-treatment production (real cases)	1.5 to 3 BPD
Statistical correlation time-contact vs. mobilization	$R^2 = 0.89$
Average repose time	≥ 12 months

Table 10 Projected scenarios for RDV-00® massification in marginal wells across Texas.

Simulation scenario	Estimated treated wells	Estimated additional production	Technical projection basis
Conservative (500%)	40,000	100,000 BPD	Average recorded in Luling Program
Case #P1 Replication (8,400%)	20,000	840,000 BPD	Field-demonstrated success in well #P1

The Case #P1 scenario assumes that 10% of wells would replicate the success of #P1 (8,400% increase).

Table 11 Technical contrast between RDV® physicochemical mechanisms and traditional EOR methods.

RDV® technology	Traditional EOR Methods
Operates via unprecedented physicochemical mechanisms: carbocation release catalyzed by reservoir energy	Operational dependency on: • Continuous injection • High CAPEX (> $10,000/well) • Complex infrastructure

Table 12 Global opportunity and strategic scope of RDV-00® technology in marginal well reactivation.

Scope	Opportunity	Technical basis
U.S.	Reactivation of 400,000 stripper wells	NSWA (2025), RRC Texas
International	>2 million marginal wells	International Energy Agency
CAPEX/well	< $500	Cases #E2 and #P1

5. Global Scalability Potential

Table 12 shows the opportunity and potential scope of RDV® technology (Vasoactive Dynamic Reactor) not only in the U.S. marginal well market but also globally.

6. Scientific Originality

To our knowledge, there are no documented precedents in SPE literature for:

- The spontaneous generation of a hydrostatic column in wells certified as dry.
- Explosive production responses (> 100 ×) following delayed chemical activation over extended repose periods (e.g., 23 months).

References

[1] Green, D. W., and Willhite, G. P. 1998. "Enhanced Oil Recovery." In *SPE Textbook Series* (Vol. 6). Richardson, TX: Society of Petroleum Engineers.

[2] International Energy Agency. 2024. *Global Inventory of Marginal Oil Wells*. Paris: IEA.

[3] Jimenez, W., Rivera, C., Sulvaran, H., and Gonzalez, H. O. 2025. "Latent Activation in Marginal Wells: RDV® in Texas." (to be submitted)

[4] Lake, L. W., Johns, R. T., Rossen, W. R., and Pope, G. A. 2014. *Fundamentals of Enhanced Oil Recovery*. Denver: SPE.

[5] National Stripper Well Association (NSWA). 2025. “U.S. Stripper Well Census.” www.nswa.us.

[6] Olah, G. A. 1994. “Carbocations and Electrophilic Reactions.” *Angewandte Chemie International Edition* 33 (22): 2258-74.

[7] Patel, H., Zhang, Y., and Thomas, S. 2021. “Mechanistic Interpretation of Polymer Retention in CEOR Systems.” *Journal of Petroleum Science and Engineering* 204: 108661.

[8] Railroad Commission of Texas (RRC). 2022. “Dry Hole Certification Guidelines.” Rule 3.14.

[9] Sheng, J. J. 2013. *Enhanced Oil Recovery Field Case Studies*. Houston: Gulf Professional Publishing.

[10] Stripper Well Consortium. 2023. *Technical Reports on Inactive Wells*. DOE/NSWA Partnership.

[11] Thomas, S. 2008. “Enhanced Oil Recovery—An Overview.” *Oil & Gas Science and Technology* 63 (1): 9-19.

[12] Zaitoun, A., Bertin, H., and Bazin, B. 2012. “Novel Chemical EOR Technologies for Low Permeability Reservoirs.” *SPE Journal* 21: 154064.