

PDVSA

Case Study

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COST-BENEFIT ANALYSIS

MORICHAL CASE / WELL: MPG222

TEC-10-003

Morichal, February 22nd 2010.

To: Reservoir Manager – Morichal District

From: Technology Manager – Morichal District

**SUBJECT: FINAL ASSESSMENT OF CORROSION INHIBITOR TOOL IN WELL
MPG-222**

The following annex is the Study made in Well MPG-222, belonging to Zone 1 of the heavy oil area at the Morichal District, with the purpose of assessing the usage of a Corrosion Inhibitor Tool, which allows through the contact with the fluid to inhibit corrosion in production tubing, increasing its service life.

It is worth mentioning that the said tool has been installed in the Well for Twelve (12) months. During this time, an operational follow-up has been carried out, through tests, measuring the tool performance as Corrosion Inhibitor Agent.

It is also important to highlight, that the good results of this tool represent savings because it increases the productive life of the well, reducing the number of interventions for service bit, generating savings for this fact; therefore, its usage and massification is recommended in wells presenting bottom hole corrosion problems and conditions similar to heavy oils found at the Morichal District.

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PDVSA EXPLORATION AND PRODUCTION

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MORICHAL DISTRICT

TECHNOLOGY MANAGEMENT

CORROSION INHIBITOR TOOL ASSESSMENT

IN WELL MPG-222.

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1.- STUDY OF WELL MPG-222

Currently located at Zone 1 of heavy oil production at Morichal District, it is associated to MOR-1 Flow Station, Category 1 (Active), after being serviced on February 13, 2009, when the Corrosion Inhibitor Tool was installed, producing by Progressive Cavity Pumping with diluent. Well production is shown in Fig. N°.1.

- **Fluid Production:** Since 2004 the well kept an average production of 250 BBPD and 180 BNPD. Nowadays, it shows a rate of 348 BBPD and 25 BNPD, according to test made on March/28/2009.
- **Water Production:** This well started with low water percentages (20%), however, since 2005 is showing water cuts in the order of 90%. Nowadays the well produces 329 Bls of water per day.
- **Gas Production:** Since 2004, the well has kept a behavior of approximately 180 PCND (scf/d) with an associated GOR of 550 PCN/BL (scf/bl). Nowadays, 21 PCND (scf/d) with an associated GOR of 53 PCN/BL (scf/bl).

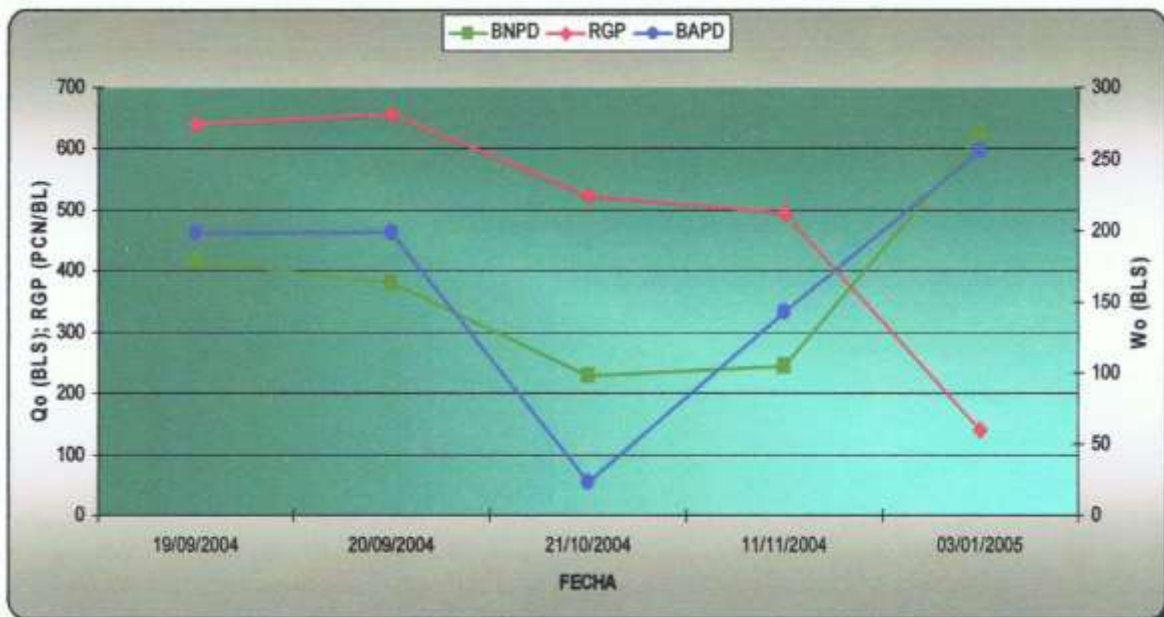


Fig. N° 1.- Production behavior of Well MPG-222.

At the moment of the intervention for installing the Corrosion Inhibitor tool, this well showed levels of more than 10% of CO2 and approximately 2.5 ppm of H2S; levels considered of high tendency to corrosion in contact with water, which was the case when started production, being one of the closest to the Water-Oil Contact.

2.- TOOL ASSESSMENT IN WELL MPG-222

Well MPG-222 was originally completed in August 01/2004, since then, a total of six (6) work-overs have been performed, for an average of one (1) service every 8 months, all of them by hole in tube (AS-HT) and services every 4 months for minor repairs also referred to this phenomena, and in all cases it was determined that the failure was due to existing Corrosion, as shown in Fig. N° 2.-

DATE	OPERATIONAL STATUS	COND.
03/13/2005	PIPE CHANGE	AS-HT
03/06/2007	PIPE CHANGE	AS-HT
08/01/2007	PIPE CHANGE	AS-HT
02/29/2008	PIPE CHANGE	AS-HT
02/13/2009	PIPE CHANGE	AS-HT

Fig. N° 2.- Work-Overs made to Well MPG-222

After the last well service, where the Corrosion Inhibitor Tool was installed for recommendation of personnel from the Morichal Technology Management, Department of Subsoil, the values of Iron present and corrosive indexes of the well were high from the beginning due to the equipment work, which generates sequential alterations in corrosive processes as they appear in the bottom-hole, which at the same time, cause an increase in those values until stabilized, and later on reduces them until almost imperceptible values of corrosion reactions in the well. An important case is the CO2 percentage levels which fell down to values of less than 3%, when initially they were above 10%. Fig. N°3.- shows corrosive values of operational tests.

ANNEX N° 1.- Diagram of the Corrosion Inhibitor Tool Installation in Well MPG-222, shown below in Fig. N°. 4.

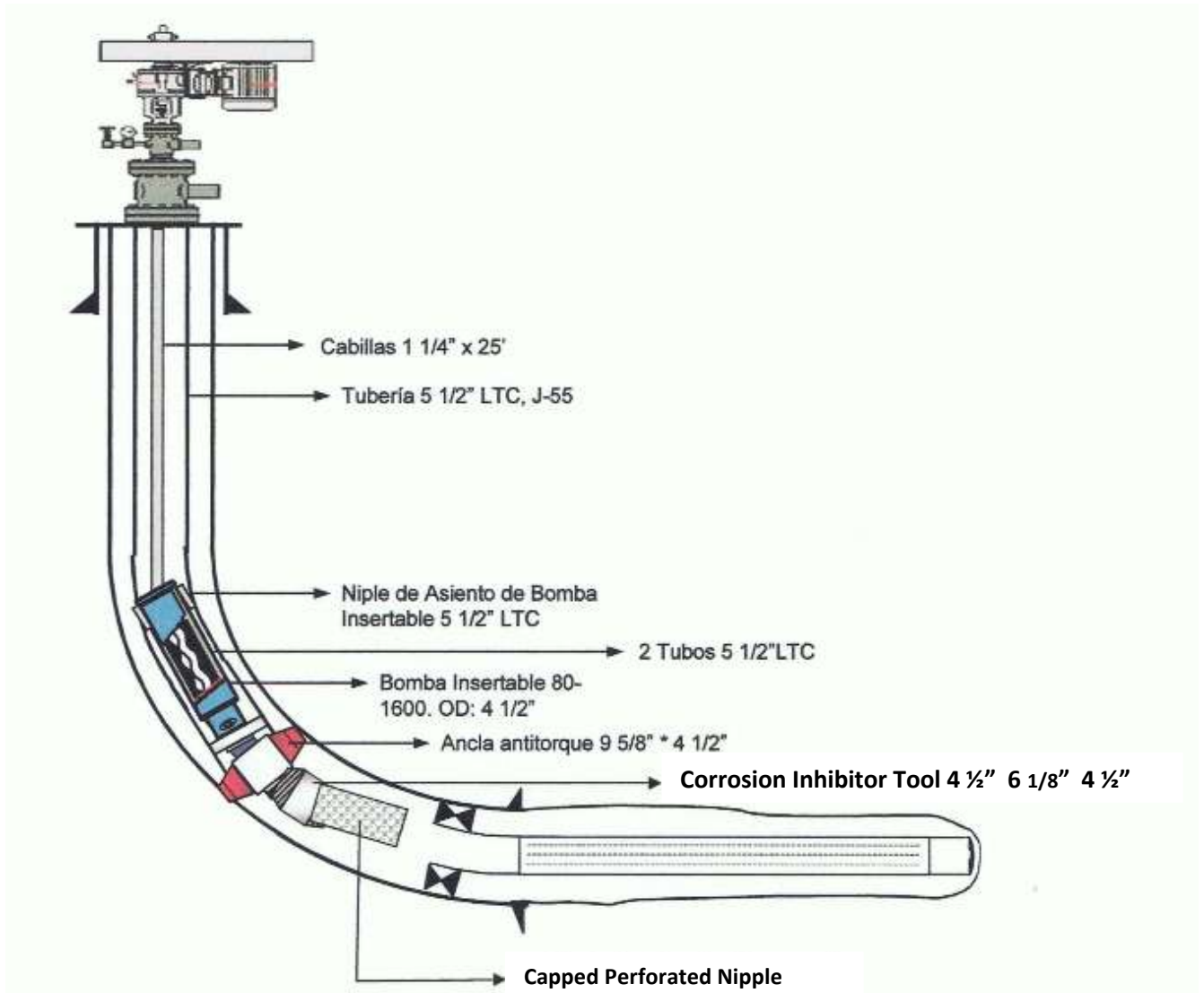


Fig. N° 4.- Completion Diagram proposed for Well MPG-222

PARAMETERS and LEVEL LOGS								
Parameters	Date							
	26-08-07	26-03-09	27-03-09	10-04-09	15-05-09	12-06-09	10-07-09	01-12-09
RPM	100	80	80	100	100	100	100	100
HP	75,0	75,0	75	75	75	75	75	75
AMP	65	65	65,0	70	55	55	40	33
VOLT	-	-	-	-	-	-	-	-
HZ	-	-	-	-	-	-	-	-
LBF/FT	215	215	215	220	220	220	200	179
N. de Fluid								
HIERRO(ppm)	> 60,00	> 30,00	6,4	6,2	4,2	2,3	1,5	1,3
SULFATOS(ppm)	5	3	1	1	1	1	0	0
CLORURO(ppm)	17039	15040	13078	13065	13322	13565	14465	15621
DUREZA(ppm)	65,00	59,04	32	32	32	32	31	30
DUREZA CALCICA (ppm)	40,00	37,44	20,3	20,1	20	20	19,2	17,1
DUREZA MAGNÉSICA (ppm)	21,6	21,6	12,53	12,48	12,48	12,5	12,55	13,13
INDICE DE LANGELIER	-3,1	-1,99	-2,49	-2,6	-1,5	-0,5	0,1	0,23
INDICE DE RIZNAR	13	11	12	12	11,00	10,12	8,23	6,57
INDICE DE LANSOR	-	12152	10565,9	10488	5440	200	50,2	31,1

Fig. Nº 2.- Table of Parameters and Levels from Tests made to Well MPG-222

Monthly monitoring shows the performance of the tool through time, and the way it adjusts its process to well conditions. No pump efficiency assessment was made for not having representative data.

DESCRIPTION OF THE CORROSION INHIBITOR TOOL.-

The Corrosion Inhibitor Tool alters the equations of Chemical Reactions for scale formation, metal corrosion and wax (paraffin) sediments.

Made out of nine (9) different metals, the tool acts as a catalyzer allowing a change in the electrostatic potential of the reaction equations. This change in the electrostatic potential produces a polarization effect at electron level of molecules. This polarization effect on molecules of oil fluid solutions prevents the formation of scale, metal corrosion and paraffin wax sediments.

Besides, the edge is set to prevent flow restriction, while provides a high grade of turbulence and physical contact, increasing among ions, water molecules thus enhancing catalytic effectiveness.

All metals release electrons from its external atomic core. Therefore, metal is an excellent electric conductor. Note: The highest the electro-negativity, the better the (atom) element acquisitively, which affects electrons due to their external shell to comply with its own valence.

Electro-negativity of the edge alloy is less than all the electro-negativity of Oil fluid solution. Therefore, the core loses (releases) more electrons required by the elements, such as the Hydrogen Ion (H^+) and radicals like SO_4^{2-} and CO_3^{2-} (which have more negative electrons than the core alloy).

- This CIS System is made out of nine different metals, which are: copper, zinc, and nickel among others, which combined under a patented process, form a special catalyzer.
- This Catalyzed metal alloy allows a change in the electrostatic potential and reduces polarization effect in molecules or liquid minerals.
- The polarization effect alters chemical reactions in oil fluids, as well as suspended solids and inhibits scale, paraffin (waxes) and corrosion.

ANNEX Nº 2.- Diagram of Fluids Production in Well MPG-222, shown below in Fig. Nº. 5.

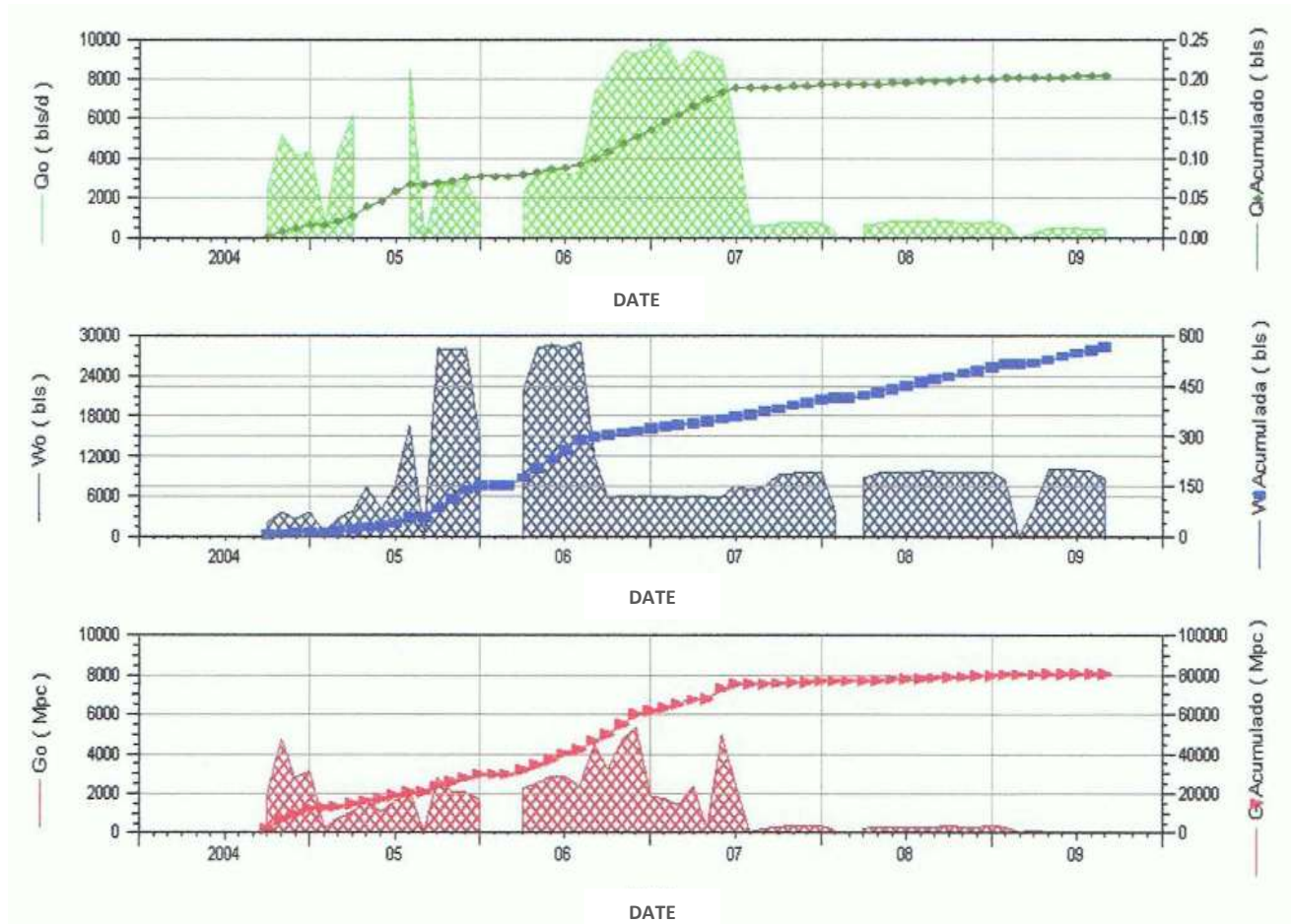


Fig. Nº 5.- Fluids Production Diagram for Well MPG-222

3.- CONCLUSION

- The performance of the Corrosion Inhibitor Tool SH500, belonging to “Control Integral MM C.A.” has demonstrated to control and minimize corrosive effects in heavy crude oil wells, with high water cuts.
- In order to see the effects of minimizing corrosion levels in the well, it is necessary a stabilization period, for the tool to adapt to the specific conditions of the well.
- A bold effect in reducing corrosion levels was demonstrated when having a 10% initial CO₂, achieved less than 3%, which are levels below the minimum required for generating corrosive bottom-hole processes.
- Keeping the well active for more than 12 (twelve) months, represents a considerable increase in its service life, which implies savings not only in reducing well services and minor work-overs, but also in additional production, for preventing well fall to the service basket and differed production.

4.- RECOMMENDATIONS

- It is recommended the massive usage, acquisition and implementation of this Tool for wells in the Morichal District, as well as in those areas with similar conditions of heavy crude oil.
- Assess this type of Tools to handle corrosive problems as surface level, and determine its applicability within operational districts.
- Keep a monthly follow-up program to determine stabilization period required per field.