**CHALLENGE**
Remove scale buildup restricting production in Colombia well.

**SOLUTION**
Mill scale using Neyrfor TTT* thru-tubing turbomill run on 2-in coiled tubing.

**RESULTS**
- Cleaned out production liner to TD.
- Reduced torque on coiled tubing.
- Minimized HCl expense.
- Provided access to producing formations.
- Removed scale buildup from 858 ft of production liner at an average rate of 163.43 ft/h.

"The many advantages of using the thru–tubing turbomill in our cleaning applications included higher liquid and gas circulation, effective flow rates and smaller cutting sizes, which lowered the risk of a stuck BHA."

Daniel Segura
Well intervention company man
ECOPETROL

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**Remove scale buildup to improve production**

When scale buildup in a well in Colombia’s Cupiagua Sur field restricted production from the Mirador and Barco formations, Ecopetrol attempted to resolve the problem using a scale removal service with more than 300 bbl of 5% hydrochloric acid (HCl). After cleaning out calcium carbonate from 315 ft of production liner at a rate of 36 to 60 ft/h, the jetting assembly was unable to gain further access. Thus, Ecopetrol cancelled the operation and sought another way to complete the scale removal and improve production.

**Clean out production liner to TD**

A 2½-in Neyrfor TTT thru-tubing turbomill attached to a 2-in coiled tubing and driving a high speed mill at more than 2,200 rpm were used in two runs to clean out the 4½-in, 3.998-in ID production liner to TD, giving access to the formations. Two-phase fluid—water-base mud (WBM) injected with N2 and 5% HCl—was used on both runs at a flow rate of 2 bbl of WBM and 1,100 ft³ of N2 per minute. The equivalent flow rate on bottom was between 2.47 and 2.5 bbl/min.

On the first run, which began at 16,472 ft, the turbomill driving a 3¾-in i-MILL* PDC whipstock mill was used to mill 81 ft of scale at an average rate of 54 ft/h before being pulled out of hole. On the second run, a customized 3¼-in turbomill was used to mill 777 ft of scale—from 16,553 ft to a TD of 17,330 ft—at an average rate of 207.2 ft/h.

**Save time and HCl expense**

The Neyrfor TTT turbomill removed scale buildup from 858 ft of production liner in 5.25 h at an average rate of 163.43 ft/h. Only 60 bbl of 5% HCl were pumped during the turbomill runs, which when compared with the 300 bbl pumped during the jetting operation, resulted in a lower rate of 36 to 60 ft/h. The turbomill also put less torque on the coiled tubing than the jetting operation did.