HALLIBURTON ENERGY SERVICES

DUNCAN TECHNOLOGY CENTER - DUNCAN, OKLAHOMA
A HALLIBURTON COMPANY

PRODUCTION ENHANCEMENT PRODUCTS & PROCESSES

PROJECT REPORT

To: Dr. Steve Almond
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Title: **Evaluation of Mag-Well Magnetic Fluid Conditioner**

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PROJECT

The purpose of this project was to evaluate the Mag-Well Magnetic Fluid Conditioner using a calcium sulfate scaling test.

CONCLUSIONS

The majority of scale formed on heater element A was calcium sulfate. A moderate to large amount of sodium chloride and zincite were found on heater element B. Large chunks of white scale, identified as calcium sulfate were found directly behind tool A upon disassembly of the test system. No solid material was found behind tool B. There was a large difference in calcium and sulfate concentration between the original starting solutions and the samples collected at various test times. The calcium and sulfate concentrations of samples taken at the same time, from both sides A and B of the system, were very similar. Fine particulate material obtained from all test samples was identified as calcium sulfate. Neither tool prevented the formation of calcium sulfate. Tool B prevented the calcium sulfate from adhering to the heater element and forming large chunks of scale directly behind the tool in the flow line. Tool A appeared to have no effect at all on the precipitation of calcium sulfate either on the heater element or in the flow line.

RECOMMENDATION

Tool B, assuming that it is the functional magnetic fluid conditioner, should be further evaluated in the areas of scale dissolution, paraffin deposition prevention and paraffin dissolution. The team agrees that the magnetic fluid conditioner does show some merit in the prevention of scale deposits, not complete elimination of scale formation, and should be marketed accordingly.

DISCUSSION

Introduction

Halliburton had entered into an agreement with Mag-Well to market their downhole magnetic fluid conditioners. Mag-Well had no research data to show that this product worked but several successful field case histories. A team consisting of Halliburton and Mag-Well personnel was assembled to try and devise a method to evaluate the downhole magnetic fluid conditioner. The team consisted of Tance Jackson, Product Manager Subsurface Products Halliburton, Bill Ford, Principal Chemist Halliburton, Bill Dillard, Mag-Well, John Corney, Mag-Well and Mark Varel, Mag-Well. A calcium sulfate scaling test was decided upon to evaluate the effectiveness of the tool. Two tools, one functional and one nonfunctional, were to be marked "A" and "B" and delivered to Duncan for blind testing. Only Mag-Well was to know the true identity of each tool until this report was written.

Calcium Sulfate Scaling Test

Two fifty barrel tanks were filled with fresh water and heated until the fluid temperature was 150 °F. Approximately three hundred pounds each of calcium chloride and sodium chloride were added to Tank A while circulating. This would produce a solution that would contain 16.8 g/L calcium chloride and 15.0 g/L sodium chloride. Circulation was continued for fifteen minutes after all of the solids were in solution. Four hundred pounds of sodium sulfate and three hundred pounds of sodium chloride were added to tank B while circulating. This would produce a solution that would contain 15.0 g/L sodium chloride and 21.3 g/L sodium sulfate. Circulation was continued for fifteen minutes after all of the solids were in solution. When the two solutions were allowed to mix, a calcium sulfate scale would be produced. The contents of both tanks were allowed to gravity feed simultaneously to a Triplex pump operating at a twenty-five gallons per minute pump rate. A five foot long pipe was connected to the discharge side of the pump. A tee connection was installed at the end of the pipe to divert flow equally to the two magnetic fluid conditioner tools. One hundred foot lengths of pipe were connected to the end of each tool. A tee connection was placed at the end of each one hundred foot length of pipe. A one foot long pipe containing a hot water heater element was attached to one outlet side of each tee and sealed. The elements were connected to an electrical source. The open end of the tees were allowed to drain test fluid into a pit. Once the test began, the electrical source was activated as soon as test fluid exited the ends of the tees. A schematic of the test system is illustrated in Figure 1. An initial sample of test fluids were obtained from tanks A and B for calcium and sulfate determination. Samples were collected from the open ends of the tees at five, ten, fifteen and twenty-five minutes after the initial test fluid exited the tees. Samples were labeled A!, A2, A3, A4, B1, B2, B3 and B4 respectively. Each sample collected had a white, milky appearance.