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To: AP-114 Records Package, ERMS# 541153

Subject: Changes to Culebra T-Field Calibration Procedure under AP-114 Task 7

Calibration of Culebra T-fields under Task 7 of AP-114 began in December 2008 using steady-state freshwater heads for May 2007 reported by Johnson (2008a; ERMS# 548227) in February 2008. In April 2009, as we were nearing calibration of 150 base fields, we determined that inaccurate fluid densities had been used in the freshwater head calculations for five wells: ERDA-9, H-5b, H-6b, H-10c, and SNL-8 (Johnson, 2009; ERMS# 551116). Furthermore, we found that an April 2008 revision to many of the freshwater heads (Johnson, 2008b; ERMS# 548746) that should have been used all along had been overlooked.

Fortunately, only the head at SNL-8 was different enough to affect the T-field calibration. Most of the other heads were within a meter of the values used in calibration, and the calibration results obtained up to that time included the correct values in their ranges. For ERDA-9, the calibrations always produced values higher than the input value, and raising the input value to its correct level improved the fits. The head difference at SNL-8, however, required a change in the calibration procedure.

As we had planned to calibrate 200 base T-fields, the 50 remaining fields were fully calibrated (both transient and steady state) using all of the correct heads. The 150 fields that had been calibrated using inaccurate heads were recalibrated as follows. Because SNL-8 is in a low-T area of the model and did not respond to any of the transient events used for model calibration, the recalibration in most cases involved only the steady-state heads, although the transient responses were still included to ensure numerical stability and consistency. Correct head values were input for all wells, but only the pilot points in the immediate vicinity and upgradient of SNL-8 were allowed to be active during the calibration. After recalibration to the new steady-state heads, a forward run was performed to allow calculation of the sum of squared errors (SSE) for both the steady-state and transient data. Using this method, the SSE values generally improved and we wound up with ~10 more T-fields meeting our tentative SSE acceptance criteria than we had had before discovering our head error.

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With the final 50 base fields calibrated and the initial 150 fields recalibrated to steady state, we are still 12 fields short of the 100 calibrated fields meeting our SSE acceptance criteria that we need, although 14 other fields are very close. We are now initiating a full (all pilot points, transient and steady state) recalibration of those 14 fields plus the next best 15 fields (if needed) for a maximum of 10 iterations to see if we can obtain the 12 good fields we need.

While the recalibration procedures we are using are not as straightforward as simply performing full calibrations from scratch, the results are nevertheless comparable and valid for the following reasons:

1. All T-fields start from base fields created by the same process
2. All calibrated T-fields are evaluated in exactly the same way, compared to exactly the same transient and steady-state data
3. Using different methods to achieve the same ends may in fact provide a better representation of uncertainty than using a single method

All T-fields calibrated in different ways are managed in separate directories to ensure full traceability. A complete description of all calibration procedures will be included in the AP-114 Task 7 Analysis Report.

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