

7.3 **Estimation of Flow Geometry, Swept Volume, and Surface Area from Tracer Tests**

Paul Reimus¹ and G. Michael Shook²

¹Los Alamos National Laboratory, Los Alamos NM, United States, ²Chevron Exploration Technology Company, Houston, TX, United States

Tracer test analysis using the Method of Moments has long been shown to give accurate estimates of total volume swept by injected fluids. More recently the method has been extended to use the residence time distribution of the tracer rather than just the mean residence time. Using the whole distribution of residence times allows for the calculation of flow geometry (as described in Flow Capacity – Storage Capacity or F- Φ curves), and swept volume as a function of time. This information provides the means of calculating sweep efficiency histories from tracer tests. Average saturations can be estimated from partitioning tracers; here we extend those methods to estimating fracture surface area using sorbing tracers. The methods are straightforward to implement and have been developed in spreadsheet application tools.

In this paper the underlying mathematical formulation is presented, and various examples of the application given. We show the accuracy of the methods by comparing sweep efficiency histories estimated with these methods against analytical solutions, and give examples of estimating fracture surface areas. The assumptions and limitations of the analysis method – which include steady state flow behavior – are also discussed.