Application of Centrifuge Technology in Evaluating Fluid Distribution and Movement in Sediment

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Background/Objectives. The centrifuge method is a versatile and efficient technology that can determine a number of physical properties relative to fluid distribution, content, retention, and movement. A variety of centrifuge systems have been developed to conduct a broad array of analyses including physical soil experiments, geotechnical testing, and contaminant transport experiments. Although many advantages of the centrifuge have been recognized, many variables are known to influence the results of the analyses. These variables require consideration in designing and evaluating centrifuge studies. The centrifuge has been applied to evaluate the content and movement of NAPL within the pore network of soils and rock. In particular, within the petroleum industry centrifuge technology has been widely utilized to understand fluid movement in rock within a high pressure setting. Centrifuge applications have also been utilized in the environmental industry to better understand NAPL movement within soils.

Approach/Activities. This paper describes the challenges of applying centrifuge technology in sediments, given that many sediments are loosely consolidated with a high porosity and high water content. Understanding the implications of these physical conditions under the centrifugal force induced by the centrifuge is important in evaluating the results from the testing. Studies were conducted evaluating the applicability of centrifuge technology to NAPL-containing sediments.

Results/Lessons Learned. Preliminary results of the studies document that approaches that have been widely utilized for soils may not be applicable for sediments, particularly fine grain sediments with high water contents. In particular, lower spin rates over longer periods of time appear to provide more reliable results than high spin rates of short duration. Recommendations on the application of centrifuge technology are provided.