SUMMARY

This report covers work performed under Contract Number DE-AC01-79ET10104, Task 11, Subtask 10 entitled "Solids Withdrawal from Three-Phase Fluidized Bed Reactors". Data presented here were collected during the first four months of 1981. Tests to establish the repeatability of the original data were performed as needed from April through June, 1981 while the original data were being analyzed.

Initial work dealt with examining the behavior of a two phase (air-water) system to shake down the equipment and prove the feasibility of the experimental techniques. Independent variables included gas superficial velocity (0.47 to 10.5 cm/sec), liquid superficial velocity (0.69 to 4.4 cm/sec), and liquid surface tension (33 to 70 dyne/cm). It was found that gas holdup decreased slightly with increasing liquid superficial velocity and increased with decreasing surface tension. The variation of gas holdup with gas superficial velocity was the same as that predicted by existing correlations in the literature, especially that of Akita and Yoshida.[9]

Three-phase experiments were conducted with solid particle size (400 mesh silica, 100-180 mesh sand, 70-140 mesh glass beads), solids concentration (0, 5, 10, 15 wt.%), slurry superficial velocity (0.69 to 4.4 cm/sec), and gas superficial velocity (0.47 to 9 cm/sec) as the independent variables. Gas holdup decreased with decreasing particle size and the presence of solids. However, increasing solids concentration had little effect on gas holdup up to 15 wt.% solids. The measured gas holdups in general are consistent with those predicted for the Demonstration Plant dissolvers. The extent

of solids accumulation, as determined by sampling, was found to be significantly affected by both gas and slurry superficial velocity, the latter having the greatest influence.

Solids withdrawal studies were performed to develop a basic understanding of the design needs for such a system. It was found that the presence of a solids withdrawal system had no significant effect on gas holdup or general flow behavior. It was concluded that, at atmospheric pressure, a continuous withdrawal system was superior to an intermittent on/off system.

Qualitative tests to characterize the degree of backmixing were conducted using a methyl-orange dye tracer. Photographs were taken at set time intervals to capture the dispersion of the dye when injected at the top and middle of the vessel in the absence of liquid flow. It was found that the degree of backmixing is not as extensive as expected and concluded that quantitative tests are needed to further characterize this behavior.