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STATISTICAL ANALYSIS OF CRUDE OIL RECOVERY AND RECOVERY EFFICIENCY

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TABLE I-2
SECONDARY RECOVERY EFFICIENCIES

Secondary Recovery Method	Lithology	State	Primary Plus Secondary Recovery Efficiency at Average OOIP*, percent	Ratio of Secondary to Primary Recovery Efficiency at Average OOIP*, percent
Pattern Waterflood	Sandstone	California	35	0.33
		Louisiana	51	0.40
		Oklahoma	28	0.62
		Texas	38	0.50
		Wyoming	45	0.89
Pattern Waterflood	Carbonates	Texas	32	1.05
Edge Water Injection	Sandstone	Louisiana	55	0.33
		Texas	56	0.64
Gas Cap Injection	Sandstone	California	44	0.48
		Texas	43	0.23

*OOIP = Original oil-in-place, refer to Appendix D, Nomenclature.

The Subcommittee, with completion of this study, concludes that a reliable statistical correlation cannot be achieved for the prediction of recovery and/or efficiency for individual reservoirs based on the readily definable and available reservoir parameters. An important factor, reservoir heterogeneity, cannot be readily defined, certainly not by the assignment of a mere numerical value. It is believed that not being able to include heterogeneity and possibly other factors as independent parameters contributes to the inability to develop valid statistical correlations.

The accuracy of definable parameters such as porosity and initial water saturation is limited by the quality of measurement techniques available at the time of discovery and development. Such measurements have been subject to constant appraisal and improvement, but there is no simple way to correct older measurements. The Subcommittee did not attempt such corrections nor did they request respondents to do so. The impact of older, less accurate measurement techniques on such a study as this can be appreciated when it is recognized that approximately 75% of anticipated ultimate oil production from presently known U.S. fields will be derived from fields discovered prior to 1951.

The recoverable oil to be expected from a given reservoir can be estimated with reasonable accuracy only after a thorough engineering study of that reservoir is undertaken. Such estimates of recoverable oil are improved by matching the performance of a reservoir model to the reservoir's production history and then using the matched model to predict ultimate recovery.

Although statistical correlations of recovery efficiency based on readily definable reservoir and fluid parameters fall short of being able to predict accurately the recovery of an individual reservoir, the calculated average recoveries in a single geological trend are significant. Comparison of these calculated averages shows substantial recovery efficiency differences between reservoirs with different indigenous drive mechanisms, with the application of different secondary recovery techniques, and in different producing areas.

The Subcommittee on Recovery Efficiency cautions against continued use of the correlations from API Bulletin D14: A Statistical Study of Recovery Efficiency, October 1967, to predict recovery or recovery efficiency for any one reservoir. Further, to avoid any undue significance being attached to the correlations developed in the current study, only those results required to substantiate the expressed conclusions are cited in this report.