CHAPTER I

INTRODUCTION

A discovery of an oil reservoir involves a high investment. Therefore, if a particular reservoir is economically proved, the production from that reservoir should be made in a manner that the optimum ultimate oil recovery is obtained. The optimum ultimate oil recovery refers to the maximum ultimate oil recovery under certain economic limit within appropriate time period. To achieve that purpose, the behavior of reservoir and its fluids must be well studied so that a proper resource management plan could be arranged and implemented at the appropriate time.

Ultimate oil recovery is defined as total amount of oil that can be produced from a reservoir. The ultimate oil recovery is a function of several parameters and variables. For convenience, those parameters and variables could be classified as controllable and uncontrollable factors. Controllable factors include control of production operations, secondary and tertiary oil recovery implementations, and other operations that can be done, for example, well stimulation to increase permeability. On the other hand, uncontrollable factors include natural occurrences, for instance, reservoir heterogeneity, reservoir drive mechanism, and fluid properties. The uncontrollable factors could not be altered under current economic limit while the controllable factors can be managed such that the ultimate recovery is optimized, in both technical and economical aspects. Therefore, the controllable factors, which will be collectively mentioned as production control, should be given much attention.

In this work, a proper production scheme is defined as a control of surface-readable quantities which finally yields the optimum ultimate recovery of oil from a certain reservoir. The surface-readable quantities can be observed routinely without any significant additional expenditure, e.g., production rate and flowing tubing head pressure. So far, these variables have not been fully utilized for reservoir monitoring and planning purposes. Mostly, they are used as indicators for production rate adjustments and are kept for reporting purposes. However, it is believed here that the indication of the reservoir behavior could be, at least, qualitatively described by using surface readable quantities. With proper observations, a suitable production control of the reservoir could be made and implemented at the appropriate time.

In production of oil and gas, surface-readable quantities are considered as outputs from the reservoir in which can be considered as a production process occurs. These two quantities, production rate and flowing tubing head pressure, are generally mutually dependent, thus controlling of one quantity affects the other. Production rate is selected to be controlled in this study.

Petroleum reservoir drive mechanism which refers to the source of energy that enables a reservoir to produce can be generally classified into four main types[1] as gas cap drive, solution gas drive, water drive, and gravity drive mechanisms. Though, one drive mechanism is dominantly active in a reservoir, some of other drive mechanisms are also usually active at lesser level. The production behavior of each drive mechanism is typically different from those of others. For example, Cosse[1] stated that recovery factor of oil reservoirs with dissolved gas drive is approximately 5-25% and those of reservoirs having other drive mechanisms vary from 10 - 60%. Therefore, a proper production control which is suitable for one drive mechanism may not yield the

same result when being implemented to other drive mechanisms. Hence, a proper close observation to production performance of producing well is then necessary for determining a proper control for particular drive mechanism.

For a particular reservoir drive mechanism, a proper production control is expected to contribute the optimum ultimate oil recovery. The control scheme probably needs occasional revisions as the production proceeds. Production history may be used as an indicator for selecting time that the revision may be required.

The main purpose of this work aims at determining possible guidelines to generate a proper production scheme from an oil reservoir in order to gain maximum ultimate oil recovery from the natural depletion process within the shortest time period. This study focuses on solution gas drive reservoir type. However, the influences of various parameters on the ultimate recovery will be investigated before reaching the main goal of this study.

Reviews of the literature reveal that there is no unanimous conclusions about the effect of production rate on the ultimate recovery. It was decided then that the relationship of these two variables be investigated thoroughly. In addition, the effects of both fluid properties and reservoir heterogeneity on this relationship was also considered. After that the surface production data were studied to see if they could be used for controlling production rate or maximum allowable rate for obtaining optimum oil recovery. The method to achieving the optimum recovery was shown.