CHAPTER - 1

INTRODUCTION

CHAPTER - I

Since independence India has achieved great progress in the process of hydrocarbon finding and oil and gas production. The success of this progress can be measured by the demonstrated ability of the oil industries, operating in an environment of competition and free enterprise to satisfy the Nation with a stable supply of petroleum and natural gas. The progress of this industry is the direct outgrowth of the global technological improvements in the field of oil exploration and development activities.

To meet the Nation's ultimate aim of self sufficiency in oil, it is essential that the development and operation of newly discovered reserves should be conducted with maximum efficiency and economy through energy conservation programs. Emphasis should also be given to increase the ultimate recovery of oil from the reserves already discovered and developed.

1.1 GANDHAR FIELD

Gandhar field in Cambay basin of Gujarat discovered in 1984 is one among the major discoveries in the country during the last decade. The exploration and development activities by the Oil and Natural Gas Commission established that there is a significant potential for hydrocarbon production from this field.

Studies carried out in this field revealed that the reservoir is multlayered one having thirteen sands of interest between the depth of 2700 and 3200 meters. Out of these three have been identified as gas bearing and seven as major commercial oil producers. The pressure associated with them is hydrostatic. The reservoir fluid varies from heavy oil to gas condensate. The permeability of the reservoir rock varies from 5 to 300 milli darcies. The viscosity of the oil at reservoir conditions varies from 0.38 to 0.42 centipoise and the gravity ranges from 35 to 40 degrees API.

During the initial stages of production it was observed that there was a sharp increase in gas liquid ratio and sudden decline in static bottomhole pressure. This behavior of the field demanded the early start of pressure maintenance system. The scientists and engineers involved in the development of this field were thrown a challenge to find an optimum way of production from this field. Keeping this in mind different well completion systems have been tried.

The following factors are normally considered in a good well completion technique that involves selection and installation of equipment for continuous optimum production from a well.

- Maximum reservoir protection.
- Minimum remedial work.
- Ease of workover operations.
- Maximum operational effectiveness
- Minimum lifting cost
- Maximum ecological protection
- Maximum degree of safety always
- Maximum protection in corrosive environment

One of the main objectives of production engineers is to produce oil spending minimum amount of natural energy that is spending minimum amount of free gas energy that is the major driving force for the flow of fluid from the reservoir to the stock tank. To achieve this objective it is required to have an improved flow control technique for multiphase flow through the production tubing string.

The normal way to control the flow rate from the well is to install a choke at the wellhead. Choke is a straight hole nozzle and called as bean. The choke can also be installed at the end of the tubing string known as bottomhole choke.

Normally bottomhole choke is used to reduce the surface handling pressure and to avoid hydrate formation in gas wells. The provision of a choke excludes the following troubles due to excessive withdrawal of fluid from the reservoir :

- Damage of bottomhole zone
- Incursion of rock particles into the well
- formation of sand plugs
- Damage to equipment
- Uncontrolled blowout
- conning and fingering due to bottom or edge water encroachment resulting in flooding, clogging and corrosion
- High pressure decline within the well
- Intensive vibration of the equipment due to high turbulence.

Many empirical and theoretical correlations are available in the literature for the prediction of flow rate and tubing head pressures through surface choke. However, the flow rate and tubing head pressure predictions of these models showed a large deviation when compared with the measured flow rate data from Gandhar field. Further, the suitability of the correlations developed for surface choke system to predict the performance of bottomhole choke system has not been studied in detail.

A multilayered reservoir can be exploited more economically using a commingling flow system when the zones are close and have similar reservoir properties. However, for production from Gandhar field, conventional commingling system is not recommended as the zones are far away from each other. But it is possible to produce from more than one zone through a single tubing string if the flow from each zone is regulated. This can be achieved by providing chokes at the fluid entrance to the tubing string from each zone.

This investigation has been undertaken with the following objectives:--

- **To suggest a suitable empirical correlations for the performance of surface choke by conducting field trial tests**

- **To develop a theoretical model for the multiphase flow through chokes and test the same with the data obtained from the field trial tests**

- **to extend the theoretical model to bottomhole choke and to study the performance of bottomhole chokes**

- **To suggest a procedure for the selection of bottomhole choke size for a particular well through system analysis**

- **To study the performance of commingling production using bottomhole chokes.**

- **to develop a procedure for choke size selection for commingling flow and**

- **To compare the performance of commingling production with that of non-mingled production system.**