The Lease Pumper's Handbook

CHAPTER 15

ENHANCING OIL RECOVERY

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Section A

ENHANCED RECOVERY

A-1. Introduction to Enhanced Recovery.

The primary function of the lease pumper is to produce the most possible oil and gas at the lowest effective lifting cost. This purpose governs most of the pumper's daily activities. To this end, the pumper must learn how each individual well has produced in the past and study each independently to maintain and enhance recovery.

When the drilling industry was young in the United States, kerosene for lamps was big business. Gasoline was in low demand because the automobile industry was just beginning. The first oil wells were shallow and were produced as hard as possible to achieve the most production in the shortest possible time. These same objectives still apply to some degree today, but the pumper must learn how to extend the producing life of the well better than in the past through enhanced recovery practices.

In the past, natural gas in the reservoir was depleted very rapidly, and the wells went dry in some fields after producing less than 15% of the available crude oil. When gas was depleted in the formation, pressure was gone, and the oil stopped flowing to the well bore. The field had played out.

As a better understanding of what was happening downhole became known and better production methods came to be practiced, the percentage of available crude oil recovered steadily increased. Today, with good enhanced recovery practices, more than 60% of the available oil in a reservoir can be recovered. In some fields, even a higher percentage can be recovered. This still leaves a huge amount of oil waiting in the formations for tomorrow's enhanced recovery technology.

Names have been attached to the reservoir stripping processes to give meaning to the various stages of controlled depletion. New names or different meanings to the same process keep appearing in print with various writers, but this chapter will adhere to the older, more common terminology.

A-2. Enhanced Recovery Terminology.

The first step to understanding enhanced recovery is to review a few basic terms and to understand their meanings and implications.

- **Enhanced recovery.** This is an umbrella term that includes all recovery processes. The word *enhanced* in general means good, better, or improved recovery practices and does not identify the procedure used or the level of success achieved.
- **Flood**. The use of the word *flood* in describing an enhanced recovery practice indicates that the recovery force is

injected in one well and must be recovered from a different well after it has been pushed across the reservoir. With flood there are issues with controlling injection volumes, studying injection patterns, slugging volumes or applying alternating forces, controlling fluid channeling, and trying to achieve the best possible sweep efficiency.

- **First-stage or primary recovery**. This begins with the completion of a new well. It includes all forms of naturally flowing and artificial lift systems that produce fluids from the well bore to the tank battery. It can be a flowing well, have a pumping unit, plunger lift, gas lift, hydraulic lift, electrical submersible lift, or any other lift system. First-stage recovery also includes many forms of good well completion, treating, and stimulation practices that are performed on most wells to achieve optimum production.
- **Secondary recovery.** This term almost always refers to simple water flood or reservoir pressure maintenance through gas injection. Either is added as a continuous force to the formation outside the perforations. The force must go out through the casing perforations into the formation, be pushed through the formation, and produced back through a different well.
- **Tertiary or third-stage recovery.** To be referred to as tertiary or third-stage recovery, two or more forces are added to the formation, such as steam (heat and water), carbon dioxide and gas, water and chemicals, and slugging practices (the alternate injection of two types of fluids). This may or may not be a final recovery technique. Slugging is common in tertiary recovery, and one of the two forces is usually water.

A-3. Technology Keeps Changing.

With each year that passes, new technology makes some commonly used field procedures obsolete or less desirable. At the same time, these new procedures cost money to implement and may be too expensive to be practical for low producing, stripper, or marginally producing oil and gas wells.

Some things, however, always remain constant. Gas still rises to the top and water falls to bottom, leaving oil in the middle. Consequently, the pumper can still understand what is happening regardless of the systems or methods that are introduced. The pumper must also keep up with how these innovative procedures work and when they need to be added to the wells.

A-4. Not All of Yesterday's Procedures Will Become Obsolete.

With the invention of the rotary drilling bit before 1920 and the jackknife rotary rig in the 1930s, the cable tool rig was declared obsolete. However, for the foreseeable future, a few cable tool rigs are still searching for oil. Cable tool water well drilling units are still being manufactured and operating. The cable tool rig remains an economical system for drilling shallow wells.

Present-day drilling procedures will be replaced with techniques that permit wells to be drilled in much less time, to greater depths, and with more accuracy, resulting in greater production than is possible today.

Yet, many of the procedures common in today's oilfields will still be recognized and used far into the future. The skill developed by the lease pumper in understanding what may have caused a shortfall in oil production and how to restore production will continue to be important to the oil producer and to the welfare of the lease.