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WATER-GAS FLOODING

It is to study the effect of water/gas flooding on remaining oil in the reservoir to enhance production recovery.

Keyword: water-flooding, gas-flooding, heat flooding

Introduction

Reservoirs. "Secondary recovery" refers to the use of water to improve oil production. It usually comes after "primary production," which produces oil using the reservoir's natural energy (fluid & rock expansions, solution-gas drive, gravity drainage, and aquifer influx). An oil reserve is typically waterflooded in order to boost oil output and, eventually, oil recovery. This is done by "voidage replacement," which involves injecting water to raise the reservoir pressure to its starting level and keep it there. Oil is removed from pore spaces by water, although the effectiveness of this removal depends on a variety of circumstances (e.g., oil viscosity and rock characteristics). When the reservoir pressure was reduced during primary production, the high porosity of the uncemented sandstone reservoirs in the Wilmington oil field and the soft chalky reservoir rock in the Ekofisk oil field were significantly compacted.

Gas-flooding

Gas flooding is the addition of hydrocarbons or other substances to oil reservoirs that are generally waterflooded to remove any remaining petroleum (and perhaps in some cases as a primary or secondary method). At atmospheric pressure and temperature, injected components are typically vapors (gas phase) and may contain mixes of hydrocarbons from methane to propane as well as nonhydrocarbon components like co2, nitrogen, and even sulfur compounds or other unusual gases like SO_2. At reservoir pressure and temperature, even though these ingredients are typically vapors at air pressure and temperature, certain of their characteristics may resemble liquids more strongly. For instance, at most reservoir conditions, carbon dioxide has a viscosity more akin to vapor yet a density comparable to that of oil. Nowadays, gas injection most frequently refers to the storage or sequestration of CO_2 from the environment as well as the injection of rich hydrocarbon gas or CO_2 to recover residual oil. The mass transfer of oil components between the flowing oil and gas phases, which increases as the gas and oil become miscible, is the main process for oil recovery by high-pressure gases flooding. Oil can swell and become less viscous as intermediate gases in the gas condensed into the oil as secondary recovery mechanisms. Gas flooding relies on contacting as much of the reservoir as feasible with gas and recovering the majority of the oil after contact. Injection gases are made to be mixable with the oil in order to mix with the oil that has already been drawn in by capillary forces. The oil components are subsequently transported to the production well by the co2 injection or hydrocarbon phase.

GAS FLOOD DESIGN:

Depending on whether a gas flood is a minor project or a major one, different engineering processes must be taken. There is more risk associated with large projects, so there are three essential parts in the process: screening, design, and deployment. The following are the fundamental design procedures for a major flood:

1. Economic and technological screening to rule out potential reservoirs before a further in-depth analysis
2. A study of the geology and reservoirs, which includes a 2-D and 3-D reservoir modeling to forecast performance;
3. Economic analyses where important input factors are altered to evaluate related risks;
4. Wells and surface facility design was based on predicted fluid quantities, compositions, and reservoir continuity;
5. Application of the gas flood design through wellbore modifications as necessary, field facilities installation, the installation of any necessary recycle facility (if one is not already nearby), and initial gas injection. Standard document (or disapproval) of the gas flood relying on uncertainly and economical aspects.

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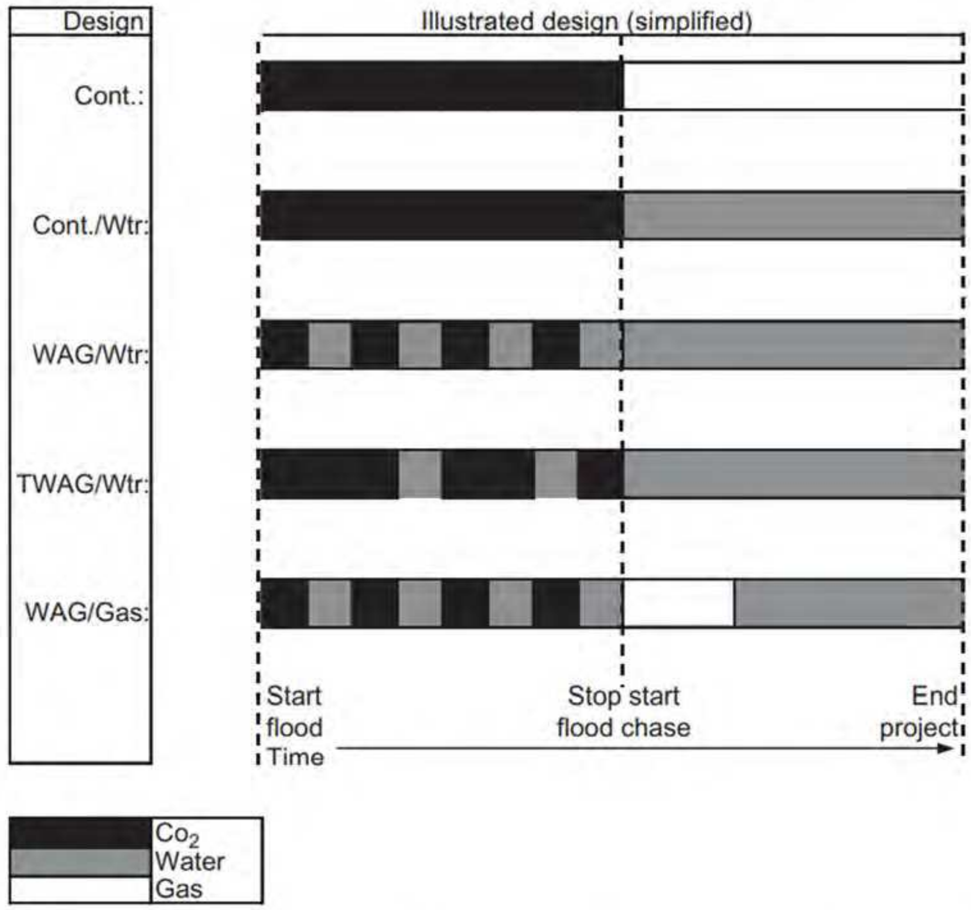

FIGURE 1.1 Water-alternating-gas floods can take on many forms (illustration for CO_2 from

Water-flooding:

Waterflooding refers to the use of water injection to boost oil reservoir output. "Primary production," which employs the reservoir's natural sources (fluid and rock expansion, solution-gas drive, gravity drainage, and aquifer influx) to generate oil, is usually followed by "secondary recovery," which uses water to increase oil production.

Rational for waterflooding:

An oil reservoirs is typically waterflooded in order to boost oil output and, eventually, oil recovery. This is done by "voidage replacement," which involves injecting water to raise the reservoir pressure to its starting level and keep it there. Water removes oil from the pore spaces, however the effectiveness of this removal depends on a variety of circumstances (e.g., oil viscosity and rock char-acteristics). Voidage replenishment has also been utilized in oil fields like Wilmington (California, US) and Ekofisk (North Sea) to reduce further surface subsidence.

Reservoir geological consideration:

Understanding the reservoir rocks is the most crucial component of appraising a field waterflooding project. Knowing the sedimentary sequence at the pore and reservoir levels, as well as potentially multiple levels in between, is the first step in developing this understanding. Second, it is necessary to determine the diagenetic history of the reservoir rocks. The construction and faulting of the reservoir must then be identified in order to comprehend the connections between the different components of the reservoir, especially the connectivity between the injector and producer. The characteristics of the water, oil, and rock must also be understood because these factors affect wettability, residual oil saturation during water flooding, and relative oil permeability at greater water saturations. Due to these requirements, the waterflood-evaluation team should always include a developmental geologist.

- Rock formations that are diverse make up all oil reservoirs. Determining the type and extent of heterogeneities present in a specific oil field is the main geological consideration in waterflooding evaluation. Reservoir heterogeneities can appear in a variety of ways, such as
- Impermeable layers such as shale, anhydrite, or others that partially or entirely separate the porous and permeable reservoir layers.
- Interbedded strata that contain hydrocarbons but have sandstones or carbonates as their main types of rock.
- Variations in the reservoir's porous and permeable layers' spatial extent, connectivity, and continuity.
- Directional permeability trends brought on by diagenetic or depositional environment changes.
- Fracture patterns caused by regional tectonic forces on the rock as well as burial and uplift impacts on a specific rock layer.
- Fault trends that interfere with the flow of oil between a portion of a reservoir and its surrounding surroundings, either because they act as flow barriers or because they are open conduits that permit unrestricted flow along the fault plane.

Another geological factor is the reservoir's structure and how it impacts the performance of waterfloods. Structure produces dipping beds that dip in different directions. The relative vertical and horizontal flow behaviors at reservoir conditions are greatly influenced by the interaction of the bed angle, gravity, and the differential in oil/brine density. The presence of an underlying aquifer or an overlaying gas cap, which can both greatly affect the chances of successfully waterflooding the oil column, is another structural factor.

Such geological and structural elements of a reservoir must be evaluated by geologists and geophysicists. To comprehend the depositional environment, post-depositional diagenesis, and characterize the internal architecture of the reservoir, geologists employ cores and routine core analysis data. As cores and well logs are effectively pin pricks into the entire reservoir, geophysicists can identify the main faults and trends in rock quality using seismic data.

A geologist and a geophysicist should be on the technical team that is assessing and tracking waterflood performance. A geostatistician's inclusion on the technical team will help to guarantee that engineering calculations, whether they be straightforward calculations or intricate numerical reservoir simulations, accurately translate the geoscientists' reservoir description.

The reservoir description for a waterflood must be created on the scale necessary for the quantitative evaluation (i.e., it must be "fit-for-purpose"). Several strategies (such object- and pixel-based ones) can be applied [5]. Geologists regularly refer to the "flow unit" and engineers could benefit from this idea. A flow unit is a volume of the total reservoir rock where the geological and petrological characteristics that affect fluid flow are internally consistent and predictably distinct from those of other rock volumes (such as flow units), according to the definition.

The evaluation of a reservoir's geology starts as soon as it is discovered and put into primary production. The production- and injection-well data provide additional information into the internal characteristics of the rock volume that is being inundated once a waterflood has been started. The water and oil rates as a function of time from the waterflood production wells are actually crucial because they are the first data to directly relate to interwell connectedness within the reservoir and to validate or alter the geoscientists' ideas of the different levels of reservoir heterogeneities.

During a waterflood, tracers can be injected to track which injector/producer pairs are well connected and which are poorly connected. Other monitoring techniques include the use of specially drilled observation wells and 4D-seismic interpretations to track the directionality and shape of the higher-pressure water-swept reservoir areas that are centered on the injection wells.

Conclusion

Water-flooding and gas-flooding is effective method in moving the residual oil remained the reservoir into the well

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PATH TO PROTECTION: RISK ASSESSMENT IN ENGINEERING IN INDIAN AND SOUTH AFRICAN CONTEXT

INTRODUCTION

Engineering sciences have with increased technological advancements the opportunities for innovation have grown in leaps and bounds. Engineering is indeed a physical and intellectual field which has come a long way in India and South Africa in terms of the practical development of applications of structural and technological principles. However, with such progress comes a new set of challenges that need to be addressed. In recent years, there have been several incidents that have highlighted the need for better safety measures and regulations.

One such incident was the collapse of the bridge on the Mumbai-Goa highway in 2016. The bridge was built just a few years before and was supposed to last for at least 100 years. The collapse resulted in the loss of many lives and highlighted the need for better safety measures in infrastructure projects. This highlights the issue that the substandard materials and equipment, which are a major concern in South Asian countries, and lack of proper training and certification for engineers and technicians can lead to unqualified workers and substandard work.

DETECTING FAULT LINES: RISK ASSESSMENT MAPPING

Risk assessment is a process used to identify and evaluate potential hazards and risks associated with a project or process. It helps to develop strategies and measures to mitigate or eliminate potential risks to ensure safety, reduce costs and improve project success. India and South Africa are two developing countries with a fast-growing economy, and the engineering research and development phase in both countries is crucial for the growth and development