An Integrated Approach to Maximizing Production

Reducing Production and Total Well Costs

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ABSTRAK

As the drill bit enters the production formation, until the well is put on production, the reservoir formation is exposed to a series of fluids that will strongly affect the productive capacity of the reservoir. The invasion of filtrate and fine solids of drilling fluid, cement, completion, workover and stimulation fluids into the reservoir formation are a potential source of reservoir damage and reduce the well productivity. Many companies have been largely reservoir damage ignored and emphasis was placed on minimizing costs rather than maximizing productivity by minimizing reservoir damage.

Reservoir damage can be minimized by selecting fluids to contact the formation as drilling fluid, and continue with all fluids used as cement and completion fluids. With minimal intrusion of drilling fluid and cement filtrates, the perforations extend through the zone of damage intruded by these filtrates. Filtered, solids– freemonovalent brine completion fluids in a near or underbalanced condition can dramatically reduce reservoir damage and maximize well production.

Several circulation with a filtered solids – free fluid should be made until the returned fluid is clean, NTU < 30, prior to the placement of the filtered soilds – free monovalent brine completion fluid in the wellbore and perforation.

Compatibility and chemicals reaction of filtered solids – free monovalent brine completion fluid with resrvoir fluid must be tested in the laboratory. Some filtered solids – free divalent brine completion fluids can form stable scale and emulsion blocks within the reservoir. All drilling and completion fluids chemicals to be carefully selected to ensure reservoir damage is kept to a minimum.

The use of clean, less incompatible fluids during all post drilling operations plays an important role in maximizing well productivity. And one of the easiest and most economic methods of obtaining the required level of fluid clean – liness is through the use of a surface filtration system.

INTRODUCTION

Many companies have been largely reservoir damage ignored and emphasis was placed on minimizing costs rather than maximizing productivity by minimizing reservoir damage.

With the advent of low prices of both oil and gas, it is very important that the operator, i.e. Pertamina EP, concentrates on the bottom line, i.e. the necessity of producing the hydrocarbons at the lowest possible of production cost by minimize reservoir damage for maximize production of hydrocarbon from the reservoir. Awarding contracts for chemical and engineering services to those that offer the lowest prices is often considered to be the way to economize and to lower the cost of drilling and production. We must refers to this policy to that of " A PENNY SAVED COULD TRANSLATE INTO A POUND LOST ". What is more important is not only the proper selection of the chemicals and careful design of it liquid phase for a successful drilling operation as the shortest possible drilling time, cheap, etc., but, must emphasis on the need to minimize reservoir damage and optimize production of hydrocarbon from the reservoir.

Because repair of reservoir damage is very dificult and costly, the scientific, enginering and technology approach must be to minimize reservoir damage. To achieve this goal, the process of drilling, cementing, completion and production operations needs to be viewed as a whole, including extensive preplanning, execution, and follow – up. Failure to control chemicals properly of fluids that contact with reservoir will negate the maximized well productivity and a broad knowledge of how reservoir damage occurs is the first step in minimized reservoir damage.

TEORITICAL BASE

The continued low price of oil and gas in the world market emphasizes the need to reduce the cost of finding and producing these important energy resources. Improved cost – efficiency based on production rate by minimizing reservoir damage and maximizing hole stability in drilling, cementing, completion operations is the key to reducing these costs.When drilling through the reservoir, the quality, scientific engineering of drilling, cementing, and completion fluids and the pressure differential are critical to reservoir damage.

Reservoir damage defined as any barrier to production within the confines of the near wellbore reservoir or wellbore completion interval that restricts maximum natural production of fluids or gases. Reservoir damage is costly, millions of barrels of oil and cubic feet of natural gas are left behind as wells prematurely reach their economic limits. Reservoir damage also results in revenue generation delays due to reduced production rate and lost revenues of abandoned zones in exploratory wells.**THINK RESERVOIR. MINIMIZING RESERVOIR DAMAGE IS VERY IMPORTANT.**

Experience shows that stimulation treatment provide increases in well productivities by remove some form of reservoir damage and we seek better means of preventing reservoir damage by drilling fluid and removing it.

Drilling fluid is the most important influence on bore – hole stability and reservoir damage. It is the drilling fluid which is the first come into contact with the formation penetrated as shale and production zone. Improved hole stability together with reduced reservoir damage to the production formation through the careful selection and engineering of the chemical drilling and completion fluids phases, can achieve the efficiency of the entire operation and lower the total cost of production. Although the cost of drilling fluid products accounts for only a minor percentage, average 7%, of the total cost of the operation, its influence on well's productivity and the total cost of the well, from spudding to production, can be enormous. Stuck pipe, poor hole cleaning, formation stability, and many other drilling fluid – related problems, all contribute to lengthy drilling times, lost drilling days, poor cement jobs, and production problems. A poorly designed and engineered drilling fluid system can lead to the loss of expensive tubulars in the hole and loss of production potential of the well, and possibly, even loss of the well.

With an emphasis on total economics, we must re – define the primary functions of a drilling fluid as follows :

- Maximized hole stability – **low solids inhibitive system**
- Minimized reservoir damage – **Barite Free, less ecd, less reactive**
- Have little or no adverse effect on the environment – **organic, biodegradable**

Even if the well finaly reaches total depth (TD), reservoir damage by the intrusion of drilling fluid particles as Barite and drilled solids, and incompatible drilling fluid filtrates into the producing formation are well known factors affecting well's productivity.

Most forms of reservoir damage by drilling fluid will reduce the native permeability of a formation, and figure A – 1 , loss of productivity due to shallow – penetrating damage around a wellbore (after Williams, Gidley, Schechter) shows this effect as related to depth of reservoir damage.

A reduction of permeability of 90 % near the wellbore by a distance of 12 inches, reduce the productivity a 62 %. But if the permeability reduction is 2 inches thick, reduce productivity by only 35 %. Therefore, if a well should produce 1000 barrels per day, open hole, but the permeability of the formation for one foot radially around the wellbore is only 10 % of its initial permeability, then the well will only produce 380 barrels of oil per day. For instance, by a thickness of only 2 inches, the well will produce 650 barrels of oil per day. This illustrates how important prevention of reservoir damage can be in every steps of operations.

The important lesson to remember is that every effort should be made to minimize both the severity and the depth of reservoir damage by drilling fluid. It is far better to confine damage to less than one half inch of the wellbore, even if the permeability is reduced by 90 %, then to allow it to invade one foot with a permeability reduction of only 50 %. See Table : HS – 11.

CEMENTING

Cements and cementing practices are not often considered in discussion of reservoir damage, however, poor cement jobs may be the most common cause of extraneous fluids invasion into productive zones. The following list are some of the ways that cement may cause reservoir damage :

1. Cement filtrates, fluid spacer, and preflushes lost to the formation increases fluid saturation near the wellbore and affects native clay.
2. Pipe reciprocation or rotation, the use of centralizers promotes fluid loss to the formation.
3. Incomplete isolation of zones by the cement allows fluids to communicate between zones during production and well treatment.

4. Gas cut cement promotes communication between zones.
5. Excessive cement weight causes fractures which may allow communication between zones.
6. Fluid loss during squeeze cementing is usually dirty which will both chemically and physically reduce the permeability of a formation.

Since cementing of productive intervals is so common and thought of as simply a means of plugging the annulus, it is seldom considered as a mean of reservoir damage. Cement particles, commonly sized from 20 to 100 microns, are too large to fit in most porethroat of reservoir or natural fractures, therefore, the cement itself is normally not the cause of reservoir damage – but the fluids that lost to the formation before and during cementing are a source for reservoir damage.

The interaction of fluid loss additives with salts, retarders, requires special attention and the amount of fluid loss needs to be kept low, and the chemicals composition of the filtrate to be controlled to reduce reservoir damage. For example, if a potassium based drilling fluid is used, it is advisable to use KCl in the cement slurry mix water to maintain the potassium ion balance in the cement slurry filtrate. Compatibility of drilling fluid and cement filtrate, as well as a minimization of reservoir damage, is thus maintained.

RESEARCH METHODOLOGY

Any fluids, drilling fluid, cement, which contact or enters reservoir are completion fluid. These fluids must be engineered design minimized resrvoir damage.Hence, completion fluids include tose used in such well activities as reservoir / pay zone drilling and / or under – reaming, perforating, gravel packing, hydrolic fracturing, cleanout, well killing, zone selectiv operations, and tubing replacement.

Clear brine, solids free, completion fluids reduce reservoir damage caused by plugging of porethroats in the producing formation. And a primary area of concern is the perforation tunnel and how its physical characteristics make it very susceptible to plugging by solid of dirty unfiltered completion fluid.A high level of quality control is necessary to provide clean, solids – free completion and perforation fluids to achieve high flow capacities of hydrocarbon .

Don't used Barite as weighting agent completion and workover fluids in completion, workover and perforation operations.

Existing literature states that invasion of fines solids from dirty unfiltered completion fluid into the compacted zone of the reservoir can reduce productivity of the tunnel to as low as 45 % of the original potential.

Darcy's Law shows that restriction caused by plugging fines solids in perforation tunnels precludes any significant flow through the plugging fines of solids. Plugged perforations are the potential cause of many wells producing far below full potential. The amount of differential pressure required to initiate flow through any perforation depends upon the amount of plugging that exists in the tunnel. The greater the pluggimg, the higher the differential pressure required to start flow. **HIGH PRESSURE DROP. FASTER TO DECLINE THE PRODUCTION RATE.**

STUDY

Reservoir damage can be minimized by selecting fluids to contact the formation as drilling fluid, and continue with all fluids used as cement and completion fluids. With minimal intrusion of drilling fluid and cement filtrates, the perforations extend through the zone of damage intruded by these filtrates. Filtered, solids– freemonovalent brine completion fluids in a near or underbalanced condition can dramatically reduce reservoir damage and maximize well production.

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The use of clean, less incompatible fluids during all post drilling operations plays an important role in maximizing well productivity. And one of the easiest and most economic methods of obtaining the required level of fluid clean – liness is through the use of a surface filtration system.

Any completion or workover fluid that is prepared with dirty fluid or low quality salts will contain solids that plug the porethroat of reservoir and reduce its permeability. Reduce potential well productivity.The small pores in most reservoir producing formations are very good downhole filters. All solids, larger than the reservoir pores, must be removed. Brines should be prepared with clean water and with high quqlity salt because of all completion and workover fluids is imperative to minimized reservoir damage and loss of well productivity. And all completion and workover fluids must be tested for compatibility with the native reservoir fluids and matrix.

Effective use of clear, solids free completion and workover fluids and test procedures, performance, to define quality, requires that all personnel understand and support the objective of maintaining clean systems and solids – free fluids. Personnel must understand how their actions and equipment affect job outcome. Specific criteria must be established to define successful performance of each job step. **Checks must be made of fluid quality at each point of processing, transits, storage to avoid introducing contaminated fluids into the well.** Management must provide adequate resources as time, equipment, and personnel, to ensure a successful job.

CONCLUSION

This paper documents to emphasize the necessity of every department within the operating company to work together towards maximizing production and lowering production and total well costs by taking the integrated approach in the selection of chemicals and fluid system.

The task of drilling supervisor, driling manager and driller is to drill a hole quickly, safely, and with minimal expense to the desired depth. They are judged on these criteria, and the better they are able to achieve these goals, the greater their rewards will be. This task is not true and counterproductive to well productivity. Objectives and process of team, not group, all working toward a common and shared goal as maximizing well productivity by minimizing reservoir damage. **THINK RESERVOIR.**

Sucess drilling must based on maximizing production from the reservoir drilled by minimizing reservoir damage during drilling, cementing and completion operations. This steps will be achieve in strong effective communication of multi discipline integrated team of reservoir, production, subsurface and drilling engineers focused minimize reservoir damage.

There are numerus examples of departments, drilling, cementing, completions, and even purchasing, working independently with the result that production of the well and costs has not been optimized. To drill a fast, inexpensive hole, but failing to selects drilling fluid to minimize reservoir damage or leave the wellbore or drilling fluid in a poor condition which prevents a sucessful cement job, is an example of poor coordination between departments. A purchasing department may be pressured by the financial considerations to purchase the lowest priced chemical which, in the long run, can be more costly to the operations because more of the product was required, or it was inefficient to perform effectively. The drilling department may chose a low priced drilling fluid system / poorly supported engineering expertise in an attemp to save money. It has been proven many times that one pays for what one gets and that doing it the cheapest way up front is the most expensive route to take.

In every phase of the operation, from spudding to production, the incorrect choice of drilling and completion fluids chemicals, fluid system and related field equipment and engineering techniques, together with the failure to integrate each with the other, can have a serious effect on long – term well production and total costs. A jointly coordinated engineering plan with strong communication links between all departments – an integrated approach, **COOPERATION, NOT COMPETITION, AS ATEAM, NOT A GROUP**, in the design and implementation of all the chemicals and fluid systems is synergistic and would help maximize the production from the reservoir and reduce the production and total costs**. LET'S WORK TOGETHER IN AN INTEGRATED MANNER.**

NOBODY BUYS DRILLS – HOLE. THEY BUY HYDROCARBON. PEOPLE MAY BUY DRILLING RIG, BUT IT IS THE HYDROCARBON THEY WANT. PROVIDE MINIMIZE RESERVOIR DAMAGE, COSTS EFFECTIVE WAY OF PRODUCING THE HYDROCARBON, AND PEOPLE WILL BUY IT.

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