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THE COMPARISON OF RESISTANCE OF KCL POLYMER POLYAMINE'S MUD TO HIGH TEMPERATURE

PERBANDINGAN RESISTENSI LUMPUR POLIAMINA POLIMER KCL TERHADAP SUHU TINGGI

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Abstract

PT. X is a company engaged in non-construction oil & gas services, namely water base mud (polyamine based) management services, supply of chemical materials, laboratory equipment, and drilling fluid engineers for oil and gas drilling. problems encountered when drilling through formations containing reactive clay and shale which can cause swelling clay problems and formation damage. This problem can be overcome with a high performance water based mud (HPWBM) mud system which has a super shale inhibition (polyamine) component. Mud which is formulated with the concept of total inhibitor, has inhibitory properties that can stabilize mineral clay and shale. The of this final assignment are to identify and study the high performance water base mud (HPWBM) mud system, then to know the ratio of good polyamines to be used in the KCL polymer polyamine mud formulation, then to look for the value of the physical properties of the KCL polymer polyamine mud formulation. to meet the oil company spec. This test begins with testing the mud properties of the KCl polymer polyamine mud sample from PT. Mitra Mandiri Saktitama before being exposed to Temperature and after being exposed to Temperature. Then analyze the changes in the value of the mud properties that have been made and the specifications of their physical properties, so that they can look for changes in the values of the mud properties of KCl polymer polyamine mud that fall within the specified range of mud properties. This test is carried out under the conditions of a room temperature of 78-300°F.

Keywords : Additive, Material, Mud, Drilling, Temperature.

Abstrak

PT. X di bidang jasa non kontruksi oil & gas yaitu jasa pengelolaan water base mud (polyamine based) penyediaan material chemical, peralatan laboratorium, dan drilling fluid engineer untuk pemboran minyak dan gas bumi. masalah yang dihadapi saat pemboran melewati formasi yang mengandung reaktif clay maupun shale yang mana dapat menyebabkan terjadinya masalah swelling clay dan rusaknya formasi. permasalahan tersebut dapat diatasi dengan sistem lumpur high performance water based mud (HPWBM) yang memilki komponen super shale inhibition (polyamine). Lumpur yang

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diformulasikan dengan konsep total inhibitor, memiliki sifat inhibitif dapat menstabilkan mineral clay maupun shale. Adapun tujuan yang dicapai dengan pelaksanaan tugas akhir ini untuk mengetahui dan mempelajari system lumpur high performence water base mud (HPWBM), selanjutnya Mengetahui perbandingan polyamine yang bagus untuk digunakan pada formulasi lumpur KCL polymer polyamine, kemudian mencari nilai sifat fisik dari formulasi lumpur KCL polymer polyamine untuk memenuhi spec oil company. Pengujian ini diawali dengan menguji mud properties sample lumpur KCl polymer polyamine dari PT. Mitra Mandiri Saktitama sebelum terkena Temperature dan setelah terkena Temperature. Kemudian menganalisa perubahan nilai properties lumpur yang sudah dibuat dan spesifikasi sifat fisiknya, sehingga bisa mencari perubahan nilai mud properties lumpur KCl polymer polyamine yang masuk dalam range mud properties yang telah ditentukan. Pengujian ini dilakukan dengan ketentuan temperature ruangan 78-300°F.

Kata Kunci : Additive, Bahan, Lumpur, Pemboran, Temperature.

1. INTRODUCTION

In drilling operations, drilling mud is one of the factors that determines the success or failure of drilling. If there are obstacles to drilling, the costs are even higher. One common problem is drilling formations containing reactive oil shale. Clay with a relatively large amount of clay has the ability to absorb water from the mud flow.

In the manufacture of KCL Polymer Polyamine mud, this is for an 8-1/2" route, because at a depth of 900 m (total depth) the temperature is very high from 200°F to 300°F and shale problems exist in formations such as swelling clay. and sloughing shales. To overcome the problems that exist in the formation on the 8-1/2” route we use KCL Polymer Polyamine mud because this mud is very effective.

In a drilling operation, both oil and gas wells or geothermal wells, high temperatures are often encountered, this can result in changes in rheological properties, namely plastic viscosity, yield point, and gel strength. The effect of high temperatures generally causes a decrease in the physical properties of the mud, because the mud is not resistant to high temperatures, this causes a decrease in the viscosity of the mud resulting in an impact on cuttings, so additives are needed to control the physical properties of the mud.

Based on the above problems, it is necessary to carry out laboratory studies on the effect of temperature on rheological properties to condition the mud in the well at a predetermined high temperature in testing using a roller oven. In addition to rheology during testing on the roller oven it determines other physical properties of the mud.

a. Classification of Drilling Mud

1) Water Based Mud

Water Based Fluidsis the most widely used drilling fluid. These are generally easy to make, inexpensive to maintain, and can be formulated. Solve most drilling problems. To better understand the broad spectrum of Water Based Fluids, divide them into three main subclasses: (1) Non-inhibitive. (2) Inhibitive (3) Polymer Fluids.

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2) Oil Based Mud

According to Hughes, oil-based muds are used for deep drilling, high temperatures, clay and shale, etc. This mud is more expensive than WBM but can reduce drill pipe corrosion [3]. The advantage of oil-based muds is based on the fact that the filtrate is oil, as it does not hydrate shale or clay, which are sensitive to both conventional and manufactured forms (thus they can be used as make-up muds). Another benefit is eliminating clogged drill bits, which makes it easier to install casings and liners.

3) Gas Based Mud

This type of mud is essentially air dry and is used in hard or dry formations. This mud is also an aerated drilling mud which means a mixture of water and air or gas. This type of mud is often used in underbalanced drilling where the formation pressure is higher than the hydrostatic pressure. The advantage of using this mud is that it has a higher penetration rate, so drilling can be completed in a short time, but the presence of groundwater can cause the bit to catch fire. This mud is also great for a nice finish in low pressure areas.

4) Functions of Drilling Mud

The drilling process really needs mud, there are several main functions of drilling mud, namely:

a) Controlling Formation Pressure

The typical formation fluid pressure is around 0.465 psi/ft depth. At normal pressure, there is sufficient water and solids in the well to withstand this formation pressure. However, the pressure is greater than the normal pressure or abnormal pressure, the density of the mud must beminimized so that the mud is not lost into the formation. Conversely, for pressures that are greater than normal pressure (more than 0.465 psi/ft) or subnormal pressure, sometimes barite needs to be added to make the mud heavier and increase the pressure in the formation. The pressure caused by the mud column at a certain depth (D, ft) can be calculated using the formula:

$Ph = 0.0052 x \rho m x D$

According to Rubiandini, it should be noted that the dynamic fluid pressure (when flowing) to the formation is static pressure (using the above formula) plus pressure loss that occurs along the circulation path [2].

b) Lifting Drill/Cutting Flakes to the Surface

Lifting of the cutting to the surface depends on the velocity of the fluid in the annulus and also the capacity to hold the fluid which is a function of density, flow (laminar or turbulent), viscosity. Generally the speed is 100 – 120 rpm. The existence of drilling mud circulation with bit rotation is able to bring the results of drill bits to the surface so as to clean the results of the sculpture.

Chisel and drill cooling and lubrication Heat can be generated by friction between the drill bit and the drill in contact with the formation, the conductivity of the formation is very low, making it difficult to remove the heat generated, the mud flow is usually sufficient to cool the system and lubricate it.

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Protecting the walls of the drill hole The mud forms a mud cake or a thin solid layer on the surface of the permeable formation, the formation of this mud cake prevents fluid from entering the formation, the building properties of this wall can be improved by adding the colloidal properties of bentonite drill mud and adding chemicals, increasing distribution solids in the drilling mud, such as starch, CMC (carboxymethyl cellulose) and cypan, which can reduce filter loss and strengthen the mud cake.

Maintain hole stability. During drilling, it is avoided that the borehole wall does not collapse. Because if this happens, it can cause the pipe to become clogged. Hydrostatic pressure from the drilling mud acts as a seal in the borehole. The limiting force is obtained by forming a thin filter layer called a mud cake. The mud forms a mud cake on the wall of the borehole, and the mud exerts pressure on the wall of the borehole, preventing the wall from collapsing temporarily. Thick-coated or poor-quality drilling mud causes pipe blockage, difficulty in casing rotation, and poor cement quality.

Supports drill weight. The buoyancy of the drilling fluid supports part of the weight of the casing or drill pipe. The calculation is 65.4 minus the weight of the sludge divided by 65.4 lb/gal.

Transmits mud hydraulic power to the chipper. Hydraulic horsepower (HHP) is generated in the drill by the flow of drilling fluid and pressure drop through the drill bit. This energy is converted to mechanical energy, which eliminates cutting from the bottom of the borehole and increases the rate of penetration (ROP).

Prevention and prevention of corrosion. Corrosion control makes it possible to reduce errors in the drilling process by eliminating or neutralizing contamination with corrosive substances, special control agents must be added to the mud.

c) Drilling Mud Circulation

According to Adreas, in general, drilling mud can be circulated in the following order: mud in the steel mud pit is sucked by the pump - pressure pipe - stand pipe - rotary hose - swivel head - kelly - drill pipe - drill collar - bit - annulus drill collar - annulus drill pipe – mud line/flow line, shale shaker – steel mud pit – pumped again and so on [3].

d) Physical Properties of Drilling Mud

✓ **Rheology**

The nature of rheology is the study of fluid flow. The tool used for rheology is the rheometer. Rheology in the mud field consists of:

Plastic viscosity is a resistance to flow caused by friction between solids or particles in the sludge system.

PV = RPM600 - RPM300

Yield pointsis the ability of the fluid to lift the cutting to the surface.

YP = RPM300 – PV

Strength gelis the fluid property whose role is to hold the cutting and ballast material of the drilling mud from sinking when the mud is not circulating.

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LSRYP is the ability of the fluid to lift cuttings to the surface during horizontal or directional drilling.

LSRYP = (RPM3 x 2) – RPM6

✓ **Density**

The weight of the mud itself functions to control formation pressure, preventing formation collapse and loss of liquid. The presence of a mud density that is too large will cause mud to be lost to the formation (lost circulation). Mud density can also describe how the hydrostatic gradient of the drilling mud is in units of psi/ft. While in the field using ppg (pounds per gallon) units, the new mud volume can be found by adding up the solid volume (bbl) and the old sludge volume (bbl). The tool used for testing is Pressurized Mud Balance.

✓ **Filtration Loss**

Filtration lossis the liquid phase that goes into the formation while the solids attached to the walls of the formation are called mud cake. The materials used are Soltex, Resinex, PAC-LV, Starch. when there is contact between the mud and the porous and permeable rock, the rock will act as a filter that allows fluid and small mud particles to pass through. The fluid lost into the rock is called filtrate, while the layer of particles retained on the surface of the borehole wall is called mud cake.

✓ **pH**

pH as one of the physical properties of drilling mud is an important factor in controlling drilling mud in drilling mud situations. pH is used to determine the alkalinity and acidity of the mud, the pH degree that is commonly used for drilling is that it has an alkaline nature.

✓ **Solid Content**

Solid Contentis the solids content in the drilling mud. Solids are materials that are added to the mud system (bentonite, barite, and other materials) and can be materials produced from the drilling process (active and inert). Excessive solids can be an undesirable contaminant in drilling mud. There should not be too much solids in the drilling mud because it can affect the mud properties and can cause problems in the drilling process. Solid content, especially bentonite (clay solids) originating from cuttings dispersed into the mud, greatly influences drilling speed, tool usage, and drilling time. Solid content in addition to slowing down the speed of the drill, also stimulates the occurrence of pipe clamps, increase the specific gravity unnecessarily, and cause damage to the formation. In other words, drilling mud must have the rheology and filtration properties required to carry out its functions.

(Vol.Retort-Vol.fasa Cair)/10 x 100%

✓ **Methylene Blue Test**

Methylene blue testThis function is to determine the clay content in the mud.

✓ **Chloride Ions (Cl-)**

Chloride ion content is the amount of salt content contained in the sludge, or sludge that has been contaminated with salt. Then this will do the Chloride Ion test.

(Volume Silver Nitrat x 10.000)/(Volume Filtrat Yang Digunakan)

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Potassium Ions(K+)

Potassium ions in the drilling fluids are used to stabilize the water-sensitive shale. Maintaining the proper concentration of potassium is the key to successful use of potassium based sludge.

K+(mg/l)=((Endapan(ml)+0,02625)/0,063214)x 1500

5) Material Water Based Mud

- ✓ Aquadest fresh water is pure water or H2O which is distilled or distilled water. This H2O contains almost no minerals. At the same time, mineral water is a universal solvent that easily absorbs or dissolves various particles of inorganic minerals, microorganisms and heavy metals that come into contact with it. Drilling Mud feature is the main component of the Water Based Mud type.
- ✓ Bentonite Bentonite is in powder form, not hydroscopic, and has a specific gravity (SG) of 2.5. Bentonite is packaged in 100 lb packs. (45.4 kg).
- ✓ NaoH
  Caustic soda(NaOH) is an additive that functions as an alkaline agent or keeps the drilling mud in an alkaline condition, so that the equipment used in the drilling mud does not suffer damage such as rust and corrosion. Solid material, odorless, 98% purity, easily soluble in water, specific gravity 1.5, temperature limit >260 0C.
- ✓ Biocide
  Biocideis an effective additive to reduce polymer fermentation or additives in drilling mud. Biocide is a specially formulated biodegradable and environmentally friendly product which can be seen in Figure 5.13, which is mostly used as a prevention of the growth of bacteria in water based mud.
- ✓ PAC-LV
  PAC-LV is a low viscosity polyanionic cellulose polymer. PAC-LV is resistant to microorganisms. The specific gravity of PAC-LV is 1.55 and is packaged in 25 Kg packages. Function Controls the filtrate in the mud and increases the viscosity value.
- ✓ PAC-R
  PAC-R is a polymer which is a highly substituted synthetic long-chain polyanionic cellulose that increases viscosity and reduces water filtering properties (sludge base). PAC-R is thermally stable in outdoor conditions up to 300oF (149oC). PAC-R is easily soluble, resistant to bacterial degradation and effective in saturated NaCl salt solutions. PAC-R has a specific gravity of 1.55 and is packaged in 25 kg packages.
- ✓ XCD polymer
  XCD polymer is a polysaccharide compound, the polymer used in drilling muds usually has a high molecular weight. This material is granular, white in color, this material acts as a viscosity and increases the yield strength and low yield (LSYP) used in horizontal drilling.

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- ✓ KCL
  KCL (potassium chloride)is a salt that dissolves in water and has beneficial properties in drilling mud. KCL is used in drilling muds as a shale stabilizing agent and to control the rheological properties and viscosity of the mud.
- ✓ CaCO3
  Calcium carbonate(CaCO3) is a high purity ground limestone. It has a specific gravity of 2.7 to a hardness index of 3. This material is easily suspended than barite, and it is easier to reduce formation damage.
- ✓ Barite
  Barium sulfate(barite) comes in powder form, which is a completely inert material. Barite is inert, which does not cause or increase the viscosity or cause other changes in the rheological properties of the mud. Barite spreads easily and requires no special care when mixed with slurry systems. Barite has a specific gravity of 4.25 and is usually packaged in 100 lbs bags.
- ✓ Resinex
  Resinexis a material for mixed water base drilling, dark brown in color in the form of powder which can be seen in Figure 2.15, resinex is able to control mud at high temperatures and has a specific gravity of 1.5 g/m3. Serves to control filltrat in drilling mud and control shale stability.
- ✓ Soltex
  Additivesthis is sodium asphalt sulfonate, it is one that stabilizes shale formations, significantly improves lubricity, and in drilling additives it enhances or forms a strong mud cake. The function of the soltex is to keep the mud at high temperatures and create a thin but strong mud cake.
- ✓ Polyamine
  In the context of drilling mud, polyamine refers to a type of chemical additive used in the oil and gas industry to control the physical and chemical properties of drilling mud. Polyamines are used as emulsifying agents, colloid protectors, and viscosity equalizers in drilling mud systems. Polyamine as a water-soluble shale inhibitor, separates the amino groups with the distance between the clay layers, can be embedded into the crystal layer with excellent inhibition of clay hydration and swelling effect, conducive to maintaining the stability of the wellbore, as an inhibition of drilling mud.

6) Mud Problems

- ✓ Lost Circulation
  This is an incident of loss of drilling mud due to caving, sloughing, too large fract, there is a cave that is in contact with the well. To overcome by injecting lost circulation material such as bentonite diesel oil plug, bentonite diesel oil cement plug, cement plug. There are also grasses, vetiver, rice stalks, sawdust, rice bran, bagasse, cantton, asbestos and mica.

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- ✓ Kick
  Kickis an event where formation fluid enters the borehole. Kicks usually occur due to insufficient mud density, too fast swabbing effect, use of the wet pull method which causes the height of the mud column to decrease which causes the bottom pressure of the hole by the mud to decrease, the lost effect can also reduce the height of the mud column in the well.
- ✓ Blowout
  blowoutis a wild burst caused by a kick that cannot be handled properly, the density of the mud is less so that the hydrostatic pressure is reduced and if this pressure is less than the formation pressure a blowout will occur. The handling method is to close the BOP and flow it through the choke manifold and inject new mud with a higher density through the kill sheet on the BOP.
- ✓ Pipe Sticking
  Pipe stickingis an incident where the drill pipe is stuck in the borehole. Usually occurs due to caving, sloughing, too thick mud cake, sticking in the wellbore that turns. If this problem occurs and cannot be resolved by backing off or disconnecting the pipe from the clamped pipe and drilling it is diverted to a different line.
- ✓ Caving
  Cavingis an incident where the wellbore collapses, especially in formations that have poor cementation, sandstone. Caving usually occurs due to the strong drill string friction, the mud cake is not strong, the mud is runny, the mud flow is too fast, the mud flow is turbulent, not laminar, so that sand can easily erode.
- ✓ Sloughing
  Sloughingis where the collapse of the drill hole in the shale formation is caused by runny mud, turbulent flow, too fast mud flow, usually this will cause pipe sticking because the debris will fall around the Bit.
- ✓ Problem Shale
  Shale problemis a problem in the drilling process caused by shale and clay. Shale problems occur due to the higher reactive levels of shale and clay and are easily hydrated by water, including by sloughing shale and swelling. Sloughing shale is a condition in which there is damage or collapse of the shale formation layer due to hydration by the drilling fluid, which then results in the collapse of the borehole wall in the shale formation layer. Swelling is the expansion of clay rocks due to the hydration process by the drilling fluid so that the liquid phase of the mud is absorbed into the clay layer and makes the clay expand.

7) Types of Mineral Clay

According to the Kummus classification of clay minerals are grouped into 3 groups. Several classifications of clay minerals are kaolinite, montmorillonite, illite[7]. The types of clay minerals are as follows:

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- ✓ Kaolinite Kaolinite is also called two-layer clay with a plate structure consisting of one tetrahedral plate and one octahedral plate. The bond between the crystals/plates (hydrogen bonds) is very weak and the absorption of H2O molecules is very small, which prevents expansion of the particles because water cannot penetrate the coating. Therefore kaolinite does not swell under the forming conditions. Grouped kaolin particles are usually in the form of books. The shape of the particles is more regular (square). The space formed between two lattices in one crystal is called the ground plane. The hydroxyl (OH) side of the aluminum oxide octahedron (gibbsite) and the oxygen side of the silicon dioxide tetrahedral bond between the two lattices of a single crystal. Hydrogen bonds are strong enough to cause swelling (edema).
- ✓ Montmorillonite Montmorillonite has a 3-layer sheet structure (alumina octahedron in the middle and 2 silica tetrahedra on the outside) and adjacent oxygen atoms bonded together. If some or all of the Al3 elements are replaced by Fe2 or Mg2 and Si4Al3, the surface of the montmorillonite particles becomes negatively charged. This negative charge is usually replaced by bonds (chemical bonds) with Ca2 and/or Mg2, H, K, Na ions. Weak (physical) joints between layers (crystals) facilitate entry and absorption of water molecules into the gaps of layers/crystals. This is actually due to the tendency for cations (Ca2, Na, etc.) to hydrate (i.e. bind to H2O molecules).
- ✓ Illit
  IlliteThey are also called triple clays, such as montmorillonite, because they have the same sheet structure (i.e. two tetrahedral silica sheets and one octahedral sheet), but the difference is that the surface of the crystal unit binds potassium (K) cations and is relatively fixed. Although K can attract H2O molecules due to the strong bonds between crystal units, the uptake of H2O molecules is very limited and does not lead to significant development of illite particles. This type of clay has more dispersive properties when exposed to water at greater depths.
- ✓ Attapulgite
  Attapulgiteis a combination of smectite and palygorskite. The palygorskite component is a form of acicular hair-like crystals that do not swell or expand. Attapulgite, unlike some bentonites (sodium-rich montmorillonite), will form a gel structure in the brines used in drilling muds and is used exclusively in drills contaminated with brine. Palygorskite particles can be thought of as charged particles with zones of positive and negative charges. This alternating charge enables them to form gel suspensions in salt and fresh water.

8) Shale Stability

The KCl polymer polyamine mud system is a mud formulated with the concept of total inhibitor, unlike conventional water base mud systems, this chemical additive is explicitly designed in the formulation to achieve the specified drilling characteristics. The main features of the KCl polymer polyamine slurry system include high shale stability, clay and cutting inhibitors, increased rate of penetration (ROP), minimized bit balling and accretion, can reduce torque and drag, and are environmentally friendly. The development of drilling industry

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activities, regulations regarding drilling waste disposal or known as drilling waste disposal have been implemented throughout the world, especially mud waste.

✓ Potassium chloride (KCL)

Potassium chloride(KCl) also has the ability to prevent clay from swelling. The inhibition capacity of KCl depends on its concentration, which is regulated according to the properties of the oil shale. The addition of KCl in water dissociates into K and Cl ions. During the stabilization of oil shale minerals, Na ions are replaced by K ions, which is often called ion exchanger. Making K ions bind much more strongly than Na ions. K ions have an atomic radius that can seal the oil shale microstructure thereby preventing water from entering the microstructure, reducing the hydration of the oil shale and Cl- balancing the formation salinity.

✓ Polyamine

According to Lestari polyamine is a water-soluble shale inhibitor, able to separate amino groups at intervals between clay layers and attach themselves to crystalline layers, providing excellent clay hydration and swelling control, to help maintain wellbore stability and retain drilling mud. . . The properties of polyamines are: mud shale suppression, expansion, good dispersion performance, low volume, recyclability, long-term action, good compatibility with drilling fluid systems, environmental friendliness. The KCl-polyamine sludge system supports K and NH4 values as shale inhibitors. The role of polyamines in the KCl-polyamine-polyamine mud supports the performance of K and NH4 ions with a shale surface protection system with an ion bond layer, clay suppression and hydration of the shale walls.

✓ Partially-Hydrolozed Polyacrylamide(PHPA)

The PHPA component is formed by polymerizing acrylonitrile to form polyacrylonitrile, which is then partially hydrolyzed to release acrylamide and acrylic acid groups, known as PHPA, along the polymer chain, as well as elongating clay, flocculants and encapsulated colloids. PHPA is used to encapsulate chips and stabilize flakes. PHPA also functions as a viscosity increaser, friction reducer, flocculating agent, and fluid loss control agent.

✓ Glycol

Provides anti-flake properties through chemisorption. water-soluble glycol is added to the slurry to increase the pressing properties. Glycol is added as a liquid and usually maintained as a proportion of the liquid phase (2-5% of the total volume of the slurry). Every major drilling fluid supplier sells a variety of glycols which are simply added as additives to polymer-based inhibitor mud systems such as KCl.

2. RESEARCH METHOD

The research method used is to collect data, study the literature and analyze the data. The available data are materials and equipment data. After collecting and analyzing the data, then manufacture and test the sludge to get the data.

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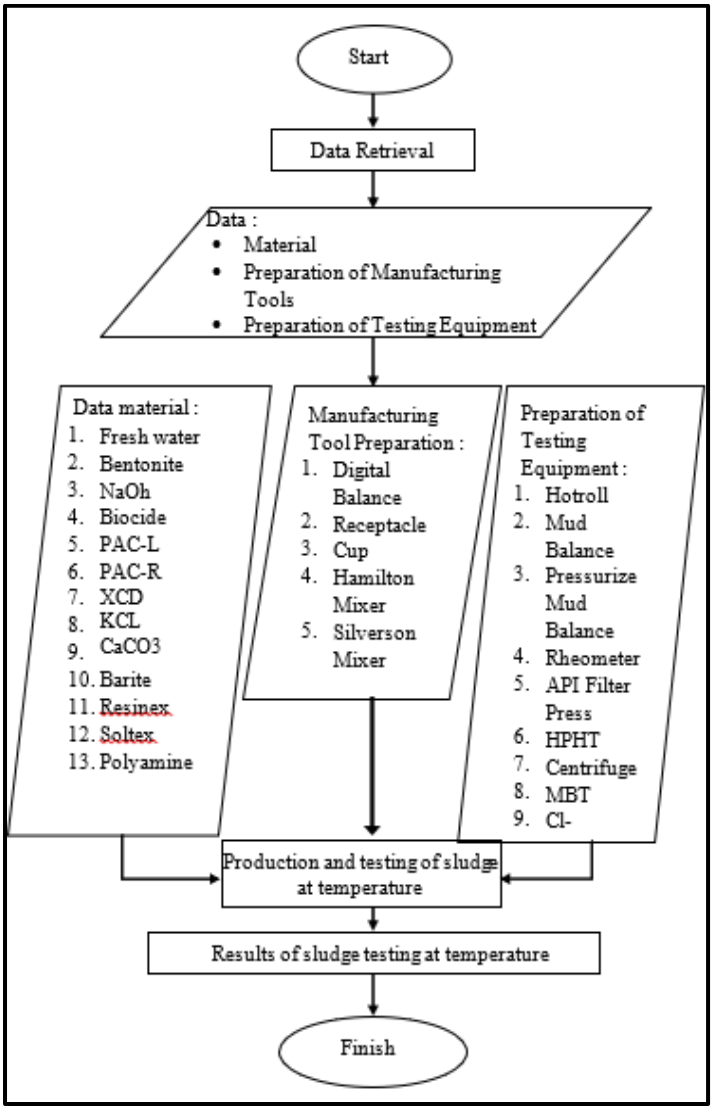

Figure 1. Flow diagram
(Source : Personal Documentation)

3. RESULT AND DISCUSSION

In this final project, the scope of the problems that occur in8-1/2" route at a depth of 900 m (total depth) we use KCL Polymer Polyamine mud because at this depth, in addition to the very high temperature, there are shale problems in formations such as swelling clay and sloughing shale. To overcome this we need to design KCL Polymer Polyamine mud because this mud is very effective.

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a. Data

The data provided is as follows:

Table 1. HPWBM Sludge Material Data

MIXING PROCEDURE				
Total Volume Built	350 mL			
Material	conc (ppb)	SG (g/ml)	Volume (ml)	Weight (gram)
Fresh Water		1,00	247,65	247,65
BIOCIDE	0,25	1,05	0,24	0,25
Caustic Soda	0,90	2,13	0,42	0,90
BENTONITE	1,25	2,50	0,50	1,25
PAC-LV	0,75	1,50	0,50	0,75
STARCH	3,75	1,50	2,50	3,75
SOLTEX	6,00	1,54	3,90	6,00
CALCIUM CARBONATE MEDIUM (CaCO3 Medium)	10,00	2,60	3,85	10,00
BARITE	286,00	4,20	68,10	286,00
XANTHAN GUM BIOPOLYMER/ XCD POLYMER	1,50	1,60	0,94	1,50
KCL 97%	32,00	1,98	16,16	32,00
POLYAMINE	5,93	1,13	5,25	5,93

After knowing the materials and composition to be used, the next step is making sludge. The procedure to be carried out is as follows:

Table 2. Mud Mixxing Procedure

MIXING PROCEDURE									
Total Volume Built	350 mL					Mix order	Time (min)	Mix Speed
Material	conc (ppb)	SG (g/ml)	Volume (ml)	Weight (gram)					
Fresh Water		1,00	247,65	247,65					
BIOCIDE	0,25	1,05	0,24	0,25			1	1	Low
Caustic Soda	0,90	2,13	0,42	0,90			2	1	Low
BENTONITE	1,25	2,50	0,50	1,25			3	5	Low
PAC-LV	0,75	1,50	0,50	0,75			4	3	Low
STARCH	3,75	1,50	2,50	3,75			5	3	Low
SOLTEX	6,00	1,54	3,90	6,00			6	3	Low
CALCIUM CARBONATE MEDIUM (CaCO3 Medium)	10,00	2,60	3,85	10,00			8	3	Low
BARITE	286,00	4,20	68,10	286,00			9	4	Low
XANTHAN GUM BIOPOLYMER/ XCD POLYMER	1,50	1,60	0,94	1,50			10	10	Low
KCL 97%	32,00	1,98	16,16	32,00			12	2	Low
POLYAMINE	5,93	1,13	5,25	5,93			13	3	Low

b. Discussion

Based on the results of the sludge testing that has been carried out, the results are as follows:

Table 3. Sludge Test Results Specifications

MUD PROPERTIES	SPEC	ORIGINAL			
		INITIAL	AHR 200° F	AHR 250° F	AHR 300° F
Mud Weight	1,40 - 1,90	1,70	1,70	1,70	1,70
600 rpm		105	100	96	89
300 rpm		74	69	65	60
200 rpm		62	58	55	52
100 rpm		46	41	39	37
6 rpm		18	13	12	11
3 rpm		14	10	9	8
PV	≤ 50	31	31	31	29
YP	30 – 50	43	38	34	31
LSYRP	6 – 10	10	7	6	5
Gel Strenght 10"	10 – 20	16	12	10	9
Gel Strenght 10'	14 – 38	32	17	15	13
Filtrate API (100 psi)	≤ 5	3,0	2,6	2,8	3,0
pH	9,5 – 11,0	10,78	10,59	10,34	10,23
MBT	≤ 10,0	2,5	2,5	2,5	2,5
K +	≥ 30,000	1,6 ml = 38,589	1,5ml = 36,216	1,4ml = 33,843	1,3ml = 31,470
Solid	≤ 30	24%	24%	24%	24%

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4. CONCLUSION

Based on the results of the discussion conducted several conclusions can be drawn, including:

a. Making KCL Polymer Polyamine mud requires additives to condition the physical and chemical properties of the mud when exposed to high temperatures, namely: NaOH, Biocide, PAC-LV, PAC-R, XCD-Polymer, KCL, CaCO3, XCD-Polymer, KCL, Resinex, Soltex, Polyamine.
b. Based on the results of KCL polymer mud testing with temperature. When the mud is exposed to its rheology temperature it will decrease, but not too much because the mud has a material that is able to hold the mud when exposed to high temperatures, namely soltex, besides that polyamine also affects the resistance of the mud when exposed to high temperatures.
c. temperatureeffect on the rheology of the KCl polymer polyamine mud, this can be seen when the mud is tested at a temperature of 200°F – 300°F, especially the gel strength which is out of the desired range at a temperature of 300°F.

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