**Workover Operations**

NOTE : The following procedures and calculations are more commonly used in

workover operations, but at times they are used in drilling

operations.

**Bullheading**

Bullheading is a term used to describe killing the well by forcing formation fluids back into the formation by pumping kill weight fluid down the tubing and in some cases down the casing.

The bullheading method killing a well is primarily used in the following situations :

a. Tubing in the well with a packer set. No communication exists between

tubing and annulus.

b. Tubing in the well, influx in the annulus, and for some reason, cannot

circulate through the tubing.

c. No tubing in the well. Influx in the casing. Bullheading is simplest,

fastest, and safest method to use to kill the well.

NOTE : Tubing could be well off bottom also.

d. In drilling operations, bullheading has been used successfully in areas

where hydrogen sulfide is a possibility.

Example calculations involved in bullheading operations :

Using the information given below, the necessary calculations will be performed to kill the well by bullheading. The example calculations will pertain to “a” above :

DATA : Depth of perforations = 6480 ft  
 Fracture gradient = 0.862 psi/ft  
 Formation pressure gradient = 0.401 psi/ft  
 Tubing hydrostatic pressure (THP) = 326 psi  
 Shut-in tubing pressure = 2000 psi  
 Tubing = 2-7/8 in. — 6.5 lb/ft  
 Tubing capacity = 0.00579 bbl/ft  
 Tubing internal yield pressure = 7260 psi  
 Kill fluid density = 8.4 ppg

NOTE : Determine the best pump rate to use. The pump rate must exceed the

rate of gas bubble migration up the tubing. The rate of gas bubble

migration (ft/hr)in a shut-in well can be determined by the

following formula :

Solution :

Calculate the maximum allowable tubing (surface) pressure (MATP) for formation fracture :

1. MATP (initial) with influx in the tubing

5260 psi

1. MATP (final) with kill fluid in tubing

**Determine tubing capacity :**

*Tubing capacity (bbl) = tubing length (ft) x tubing capacity (bbl/ft)*

= 6480 ft x 0.00579 bbl/ft

= 37.5 bbl

**Lubricate and Bleed**

The lubricate and bleed method involves alternately pumping a kill fluid into the tubing or into the casing if there is no tubing in the well, allowing the kill fluid to fall, then bleeding off a volume of gas until kill fluid reaches the choke. As each volume of kill fluid is pumped into the tubing, the SITP should decrease by a calculated value until the well is eventually killed.

This method is often used for two reasons ;

1. Shut-in pressures approach the rated working pressure of the wellhead or

tubing and dynamic pumping pressure may exceed the limits, as in the

case of bullheading.

2. Either to completely kill the well or lower the SITP to a value where

other kill methods can be safely employed without exceeding rated

limits.

This method can also be applied when the wellbore or perforations are plugged, rendering bullheading useless. In this case, the well can be killed without necessitating the use of tubing or snubbing small diameter tubing.

Users should be aware that the lubricate and bleed method is often a very time consuming process, whereas another method may kill the well more quickly.

The following is an example of a typical lubricate and bleed kill procedure.

Sample Case :

A workover is planned for a well where the SITP approaches the working pressure of the wellhead equipment. To minimize the possibility of equipment failure, the lubricate and bleed method will be used to reduce the SITP to a level at which bullheading can be safely conducted. The data below will be used to describe this procedur :

TVD = 6500 ft  
Depth of perforations = 6450 ft   
SITP = 283O psi  
Tubing = 2-7/8 In. — 6.5 lb/ft - N-8O  
Tubing capacity = 0.00579 bbl/ft  
 172.76 ft/bbl  
Tubing internal yield = 10,570 psi  
Wellhead working pressure = 3000 psi  
Kill fluid density = 9.0 ppg

Calculations

Calculate the expected pressure reduction for each band of kill fluid pumped :

psi/bbl = tubing capacity (ft/bbl) x 0.052 x kill weight fluid (ppg)

= l72.76 ft/bbl x 0.052 x 9.0 ppg

= 80.85

For each one barrel pumped, the SITP will be reduced by 80.85 psi.

Calculate tubing capacity (bbl) to the perforations :

bbl = tubing capacity(bbl/ft) x depth to perforations (ft)

= 0.00579 bbl/ft x 6450 ft

= 37.3 bbl

Procedure :

1. Rig up all surface equipment including pumps and gas flare lines.  
2. Record SITP and SICP.

3. Open the choke to allow gas to escape from the well and momentarily

reduce the SITP.  
4. Close the choke and pump in 9.0 ppg brine until the tubing pressure

reaches 2830 psi.   
5. Wait for a period of time to allow the brine to fall in the tubing. This

period will range from 1/4 to 1 hour depending on gas density, pressure,

and tubing size.  
6. Open the choke and bleed gas until 9.0 brine begins to escape.  
7. Close the choke and pump in 9.0 ppg brine water.  
8. Continue the process until a low level, safe working pressure is

attained.

A certain amount of time is required for the kill fluid to fall down the tubing after the pumping stops. The actual waiting time is not to allow fluid to fall, but rather, for gas to migrate up through the kill fluid. Gas migrates at rates of 1000 to 2000 ft/hr. Therefore considerable time is required for fluid to fall or migrate to 6500 ft. Therefore, after pumping, it is important to wait several minutes before bleeding gas to prevent bleeding off kill fluid through the choke.