WELL FILE

PETRO-TECH PERUANA S.A.

## *INTEROFFICE MEMO*

EEM-158-96

TO: John Meyers

FROM: Marco A. Raez

SUBJECT: **PVT ANALYSES**

DATE: May 23, 1996

According to our memo EEM/RMG-123-96 (96.04.12), we are recommending to take PVT analyses in the following wells:

- PN9-22 (Mogollon)
- LO16-14 (Upper Basal Salina)
- LO7-20R (Mogollon)

In case that Well LO11-23 were already producing by the date programmed for these analyses, it could be used instead of Well LO7-20R.

Attached please find a summary of considerations that should be taken for a successful completion of sampling for PVT analysis.

Marco A. Raez

HCH/mts
Att.

cc: A. Agurto
Well Files

## SUMMARY

## SURFACE SAMPLING FOR PVT ANALYSIS

A brief summary of the more important points that must be considered in the technique of surface sampling for PVT analysis follows:

1. Well Stabilization

   The well should be stabilized for one or two days with all separator controls and metering equipment functioning as for the taking of samples. A reasonably slow rate of production should be set, but sufficient so that the well maintains steady flow as indicated by the behavior of the tubing head pressure and by the "differential" pen on the orifice meter.

2. Subsurface and Well-Head Data

   In order that the laboratory and field data may be correlated, bottomhole static and flowing pressures and temperatures should be recorded. Tubing head pressure data are useful in well performance studies but are not required for PVT studies. Measurement of the reservoir temperature to the nearest degree (°F) is essential to the laboratory analysis.

   To achieve such accuracy may require a number of temperature measurements being made if the ordinary maximum-indicating thermometers are employed.

3. Separator-Tank Flash Equilibrium Data

   It is desirable to record all pressures and temperatures that bear on the flash-separation equilibrium. Better than normal field equipment is usually desirable for controlling the separator pressure and dumping mechanism. A sensitive back-pressure regulator to control separator pressures within ± ½ psig is preferred. The dump valve or liquid level controller should be sensitively adjusted, or manually controlled if necessary, in order that the fluctuations in liquid level will not seriously disrupt either the constancy of the separator pressure or the accuracy of crude oil production gauges. Thermometers should be positioned so as to obtain as nearly as possible the flash temperature of the gas-liquid surface in the separator and the temperature of the inflow stream at the stock tank. The pressure on the stock tank should also be noted.

4. Accuracy in Fluid Volume Measurements

The assumption is made that the gas is measured by orifice meter and crude oil by tank gauging. Other metering methods are acceptable if they can achieve accuracy of at least ± 1%.

In order to measure accurately the gas stream leaving the separator, observations must be made of the temperature and gravity of the gas at the meter run, as well as the atmospheric or barometric pressure. The orifice plates must be of standard dimensions and clean, the internal diameter of the flow line know, the orifice meter "zeroed" and "proved" before the test, and the differential pressure recorded on a sufficiently large scale (by selecting a proper orifice size) to offer "one percent accuracy".

The orifice size should be sufficiently small so as to affect at least a ten-inch differential (head of water) reading. Accurate measurement of the liquid production in the stock tank will require temperature and gravity measurements and perhaps centrifuging to determine the BS&W percentage. To achieve the desired accuracy in stock tank liquid measurements --within one percent-- will require gauging to the nearest one-quarter of an inch in two feet of production. All field measurements will be directed to defining the ratio of separator gas to stock tank crude oil at standard conditions of 60°F and one atmosphere. Subsequently, it will be the responsibility of the laboratory to define accurately the ratio of separator gas to separator liquid, allowing for the liquid shrinkage between the separator and the stock tank.

5. Technique of Taking Samples

The separator oil sample must be taken upstream from the dump valve, preferably by displacing water from the oil sampling cylinder. About two quarts of separator oil are desired. After this amount of water has been displaced from the sampling cylinder (maintained at separator pressure), the sampler is disconnected from the separator and a small amount of water drained from the bottom to provide a gas-phase cushion (to allow for thermal expansion during shipment). The amount of gas sample required will be directly proportional to the production gas-oil ration and inversely proportional to the pressure of the separator from which the gas samples are taken[*].

These samples are taken upstream from the back-pressure regulator, concurrently with the taking of the oil samples. To aid in purging extraneous gas or air from the gas cylinders, it is helpful to have them evacuated beforehand. However, commencing with atmospheric pressure in a gas cylinder, the number of times (n) necessary to fill and empty this container from a separator operating at p (atmosphere), in order to reduce the content of original gases to less than

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[*] i.e. with GOR 1000 cu. ft./bbl. and separator pressure (or gas sample pressure) 30 psig, 6 cu. ft. of gas container space would be filled for recombination with 2 quarts oil.

½ percent is found in the expression: $(1/p)n < .005$. The samples of oil and gas should be "tagged" fro identification in the laboratory, and if the final pressures on these cylinders are noted before they leave the field, the laboratory personnel will be enabled to determine whether leakage might have occurred during shipment.

The laboratory will corroborate the reported gas gravity and, in accordance with their measurement, recalculate the gas volume rate. Therefore, it is necessary that they be provided with all data pertaining to the gas measurement in the field.

24/ar/96