Nonombre Atoka-Morrow Unit
Description and Geologic Justification

Yates Petroleum Corporation is requesting the formation of the Nonombre State Unit to support the drilling of the 2 Dome-Nonombre "AWZ" State, a 13,300' exploratory well, to test the Atoka-Morrow formation located in the NW/4 of Section 31 Township 13 South Range 34 East, in Lea County, New Mexico. The unit will include the following lands as shown on figure 1: sections 29, 30, 31, & 32 T13S R34E. The primary objective of the proposed well will be gas productive Atoka-Morrow sandstones at depths between 12,100 feet and 13,200 feet measured depth.

Nine wells have been drilled in the unit area (see figure 1). The initial well in the area was the 1 State C in 1965 which opened the Nonombre Pennsylvanian Field producing from a depth of 10344-10360. The 1 State D, 2 State D, and 3 State D wells were drilled 1965-66 and then subsequently recompleted to various zones with the latest recompletion work being done on the 3 State D well in 1990 when it was renamed the 1 Ranger "AHJ" State. All of the reported production from these wells is from the Upper Pennsylvanian carbonate reservoirs (Cisco-Canyon age), except for a small amount of Atoka production from the 3 State D well (renamed the State FO) from 1981-1985.

Three new wells have recently been started by Yates in the proposed unit area, the 2 Dome-Nonombre "AWZ", the 1 Troy "AWY" State, and the 1 Cocono "AVY" State. Yates plans to drill the 2 Dome-Nonombre "AWZ" well to a TD of 13,300' to test the Atoka-Morrow formation. If this well is successful Yates plans to drill the other two wells to a similar depth.

Three deep wells have already been drilled in the unit area and penetrated the Atoka-Morrow formation. Two of these have been completed in the Atoka-Morrow section, but none have been economic producers. The State "D" #3 was drilled by Midwest Oil Co. in 1966 in NW/4 sec. 32 to test the Devonian Formation at 14,438. A drill stem test was taken across the Atoka-Morrow interval from 12406-440 and tested at 250 mcfd. 5 ½" casing was run to 13010' and the well was perforated and produced oil from the Pennsylvanian section from 10459-489'. In 1980 the well was re-entered by Amoco, re-named the 3 State "FO", and re-completed in the Atoka-Morrow sands from 12,230-565, opening the Nonombre Atoka Field. The recompletion scout ticket indicates a CAOF of 6458 mcfd and an IP of 1630 mcfd. Production history data, however, indicate the well produced at an initial rate of about 900 mcfd and declined rapidly to about 150 mcfd in the first year. This well ultimately produced 194 mmcf and the Atoka-Morrow zone was abandoned in 1985 after dropping below 25 mcfd. This is the only well that reports production from the Atoka-Morrow zone in the Nonombre Field.

In 1981 the Dome-Nonombre "31" State 1 was drilled in NE/4 sec. 31 by Viking Petroleum to a TD of 13,174 in the Morrow, and 5 ½" casing was run to 13,142'. Several Atoka-Morrow sands were perforated from 12,236 – 12,416. No stimulation treatment or production is reported from the well. Also in 1981, the State "LP" 1 was drilled in the SE/4 sec. 32 by Amoco Production Co. to a TD of 13,200'in the Morrow, and 5 ½" casing was run to 11,360. No tests were reported in the Atoka-Morrow section in this well.

The increase of activity in the area in 1980-81 was prompted by Amoco's initial success in the re-completion of the 3 State "FO" well and by high gas prices. Ultimately the 3 State "FO" was a disappointment as it declined quite rapidly and the amount of gas produced would not justify drilling additional wells. Although the logs on the Dome-Nonombre "31" State 1 well look quite promising the well was not produced and one can only speculate why more effort was not made to produce the well. Perhaps the collapse of gas prices and the general industry down turn that occurred in 1981 had some influence on the operator's decisions regarding the completion of the well.

Yates is currently interested in the Nonombre Unit area due to the high gas prices and the resulting improved economics of drilling for the Atoka-Morrow. Yates also believes that completion technologies have improved since 1981 and that it may be possible to achieve better production rates and higher

ultimate recovery than was realized in the 3 State "FO" well. A commercial discovery in Yates initial well could lead to the drilling of several offset wells to develop the proposed unit area and surrounding leases. For additional discussion of the production history of the 3 State "FO" well and Yates' reservoir engineering analysis of the Nonombre Unit area's potential please see the attached internal company memo from Dave Boneau (reservoir engineer) to Reed Meek (geologist).

Figure 2 is a structural cross section (A-A') showing the Atoka-Morrow section in the three deep wells in the proposed unit area, and a fourth well located west of the unit. There are multiple thin sand intervals throughout the Atoka and Morrow Formations, which are considered prospective as gas reservoirs. The structure map (figure 3) on the top of the Mississippian illustrates the interpretation that the proposed unit area lies to the east of a large fault. This fault was apparently active before, during, and after Atoka-Morrow deposition because there is a thicker section on the down thrown (east) side of the fault, and the current structural position offsets the Atoka-Morrow section by 800-1000 feet. The Atoka-Morrow interval isopach map (figure 4) indicates the thickening of the interval on the east side of the fault. The Atoka-Morrow net sand isopach map (figure 5) indicates the highest thickness of potential gas reservoir is in the area adjacent to the fault on the down thrown (east) side where the overall section is thickest.

Based on the net sand isopach map along with reservoir pressure data Yates Petroleum Corporation estimates that there is about 32 billion cubic feet of gas in place in the Atoka-Morrow formation within the proposed Nonombre State Unit area. The best hope of capturing this potential resource is through drilling a new well and using modern stimulation methods to maximize the production rate and ultimate recovery of the gas.

April 5, 2001

To: Reed Meek

From: Dave Boneau Dave Boneau

Subject: Proposed Nonombre Unit

This note explains two items that support the possibility of commercial production from the Atoka-Morrow interval in the proposed Yates Nonombre Unit in Sections 29 to 32 of Township 13S-34E, Lea County, New Mexico.

First, gas in-place in the Atoka-Morrow can be expected to be about four Bcf per 320-acre spacing unit.

Second, the Amoco FO #3 produced 197 MMcf from the Atoka-Morrow without fracture stimulation. I believe a modern well in the same setting will produce approximately one Bcf after fracture stimulation.

Gas In Place

The Amoco FO #3 is located 1980 N and 1980 W of Section 32-13S-34E. The well was drilled by Midwest Oil in 1967 as a Devonian test to total depth of 14,500 feet. In 1980, Amoco completed the well as an Atoka-Morrow producer in April of 1981. The well produced 197 MMcf between 1981 and 1985. The productive zones in the Atoka-Morrow are tabulated below:

Interval	Feet of Pay	Porosity	Porosity-Feet
12230-12237	7 ft	0.10	0.70
12426-12439	13 ft	0.05	0.65
12556-12565	9 ft	0.07	0.63
	29 ft	0.07	1.98

The reservoir has initial pressure of 4700 psi at 190 degrees F. The gas has gravity of 0.65 so that Pc = 674 psi and Tc = 372 degrees R.

Then, Pr = 4700/674 = 6.97
Tr = (190 + 460)/372 = 1.75 and z = 0.97.

Now, Bg = 35.35*P/(z*T)
Bg = 35.35*4700/(0.97*650) = 264 SCF per cubic foot

The point is to calculate original gas in place in a 320-acre spacing unit.

OGIP = 43560*A*h*phi*Sg*Bg
OGIP = 43560*320*(1.98)*0.6*264 where phi*h = 1.98 and Sg is about 0.6
OGIP = 4.37 Bcf

Thus, there is sufficient gas in place to support commercial production.

Performance of Amoco FO #3 well

The attachment shows the production history of the Amoco FO #3 well from 1981 to 1985. The actual production started at about 900 Mcf/D, but production fell rapidly and total production from the well was less than 200 MMcf. The completion report for the well says that the Atoka-Morrow was stimulated with a small acid treatment. Today, we would stimulate the well much more effectively via fracture treatment. At a minimum, the fracture treatment would slow the decline in production. Many Atoka-Morrow wells in southeast New Mexico decline about 30 percent per year. A well starting at 900 Mcf/D and declining 30 percent per year has ultimate reserves of about 875 MMcf.

Actually, the fracture treatment could easily increase the initial rate by a factor near two. Thus, initial rate could be, say, 1500 Mcf/D. Then, a 30 to 35 percent decline rate will result in reserves of about 1.3 Bcf.

Thus, a modern stimulated well could easily have reserves of 0.9 to 1.3 Bcf. And there is plenty of gas (4.4 Bcf) available to be recovered in a 320-acre spacing unit. At current gas prices, a well with ultimate reserves of 1 Bcf can be economic at these depths; and Yates hopes to develop the Atoka-Morrow potential of the Nonombre Unit. From an engineering point of view, there is clearly Atoka-Morrow potential at the proposed Yates Nonombre Unit.

Copy: Pinson McWhorter
Gail Brown

Lease Name: STATE FO
County, State: LEA, NM
Operator: AMOCO PRODUCTION COMPANY
Field: NONOMBRE
Reservoir: ATOKA MORROW
Location: 32 13S 34E SE NW