21-27-
15-187-20724

K & A
LABORATORIES

May 10, 1994

Amoco Production Company
1670 Broadway
Denver, Colorado 80202

Attention: Mr. Van Leighton

Re: Final Report
Standard Core Analysis and
Mercury Injection Capillary
Pressure Tests
Amoco Production Company
Well Federal Land Bank "C"
Lower Morrow Formation
Section 21-29S-39W
Stanton County, Kansas
K&A Job No. 94-6065-03

Gentlemen:

This report presents the final results of the standard core analysis and mercury injection capillary pressure tests performed on samples supplied from the referenced core material. A summary of these test results and the procedures used are presented below.

The standard core analysis test results are presented in tabular form on page 3. These results include air permeabilities, helium porosities, and grain densities. A crossplot of helium porosities versus air permeabilities has also been provided on page 4.

Mercury injection capillary pressure test results are presented on pages 5 through 18. These tests indicated endpoint mercury saturations (at a final injection pressure of 30,000 psia) which ranged from 81.5 to 94.6 percent pore volume and averaged 89.1 percent pore volume. In general, a good correlation was observed between endpoint saturations with air permeabilities and porosities. Test results, including individual pore throat-size histograms, are presented in tabular and graphical form.

The procedures used for these tests are as follows: upon sample arrival, each sample was cleaned with a 50:50 toluene/methanol azeotrope solvent using soxhlet-type extractors. All samples were then oven dried for 24 hours at a temperature of 220° Fahrenheit. After allowing the samples to cool in desiccators, an air permeability and helium porosity were measured for each sample.

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Air permeabilities were measured using steady-state flow techniques at a confining pressure of 400 psi. Helium porosities were measured at room conditions using a Boyles' Law double-celled helium porosimeter. Bulk volumes were measured using an Archimedes mercury immersion technique.

The samples selected for mercury injection tests were first trimmed to the test length of one inch and relabeled with the prefix "m". An air permeability and porosity were measured for each trimmed sample. Mercury was then injected into each sample using pressures that ranged from 1 to 30,000 psia. From the resulting data, capillary pressure relationships and pore throat-size distributions were computed. Test results are presented in tabular and graphical form.

The conditions, under which this report is presented, are described immediately following this report. We request that the report be used in its entirety if reproductions are to be made. Please contact us if you have any questions concerning these data, or if we may be of further service.

Respectfully Submitted,

K&A LABORATORIES

JMC/bw

K & A Laboratories

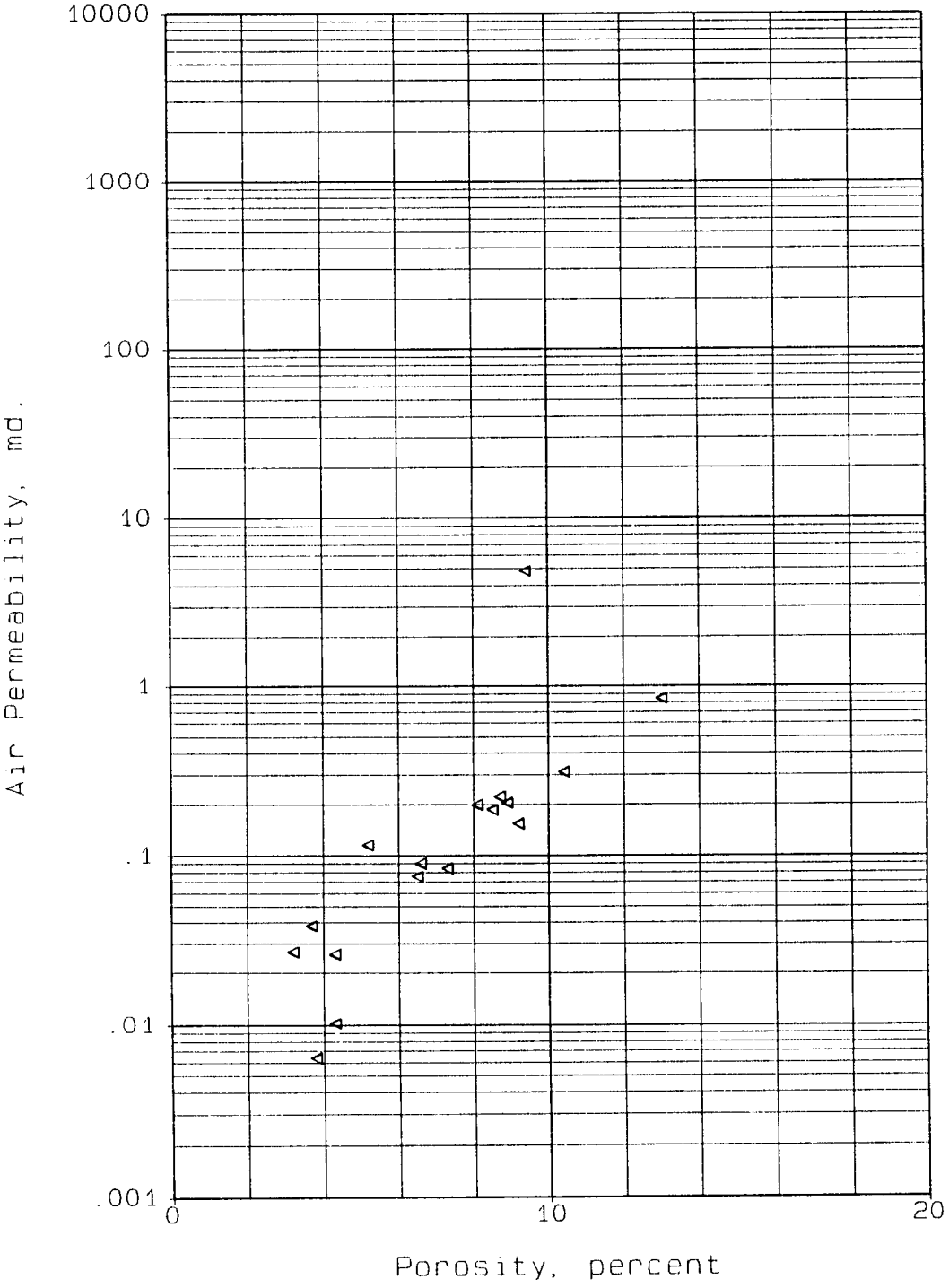
STANDARD CORE ANALYSIS SUMMARY

AMOCO PRODUCTION COMPANY
WELL FEDERAL LAND BANK "C"
LOWER MORROW FORMATION
SECTION 21-29S-39W
STANTON COUNTY, KANSAS

Sample Number	Depth, feet	Air Permeability, md	Porosity, percent	Grain Density, gm/cc
1	5,482	0.0267	3.2	2.71
2	5,484	0.0382	3.7	2.71
3	5,505	0.0901	6.6	2.69
4	5,506	0.0755	6.5	2.70
5	5,507	0.199	8.1	2.68
6	5,508	0.0844	7.3	2.69
7	5,509	0.186	8.5	2.69
8	5,510	0.0103	4.3	2.72
9	5,511	0.223	8.7	2.70
10	5,512	0.311	10.4	2.68
11	5,513	0.116	5.2	2.72
12	5,514	0.0259	4.3	2.71
13	5,515	0.205	8.9	2.71
14	5,516	0.844	13.0	2.68
15	5,517	0.154	9.2	2.69
16	5,518	4.86	9.4	2.67
17	5,519	0.00637	3.8	2.70

AIR PERMEABILITY VS. POROSITY CROSSPLOT

AMOCO PRODUCTION COMPANY
WELL FEDERAL LAND BANK "C"
LOWER MORROW FORMATION
SECTION 21-29S-39W
STANTON COUNTY, KANSAS



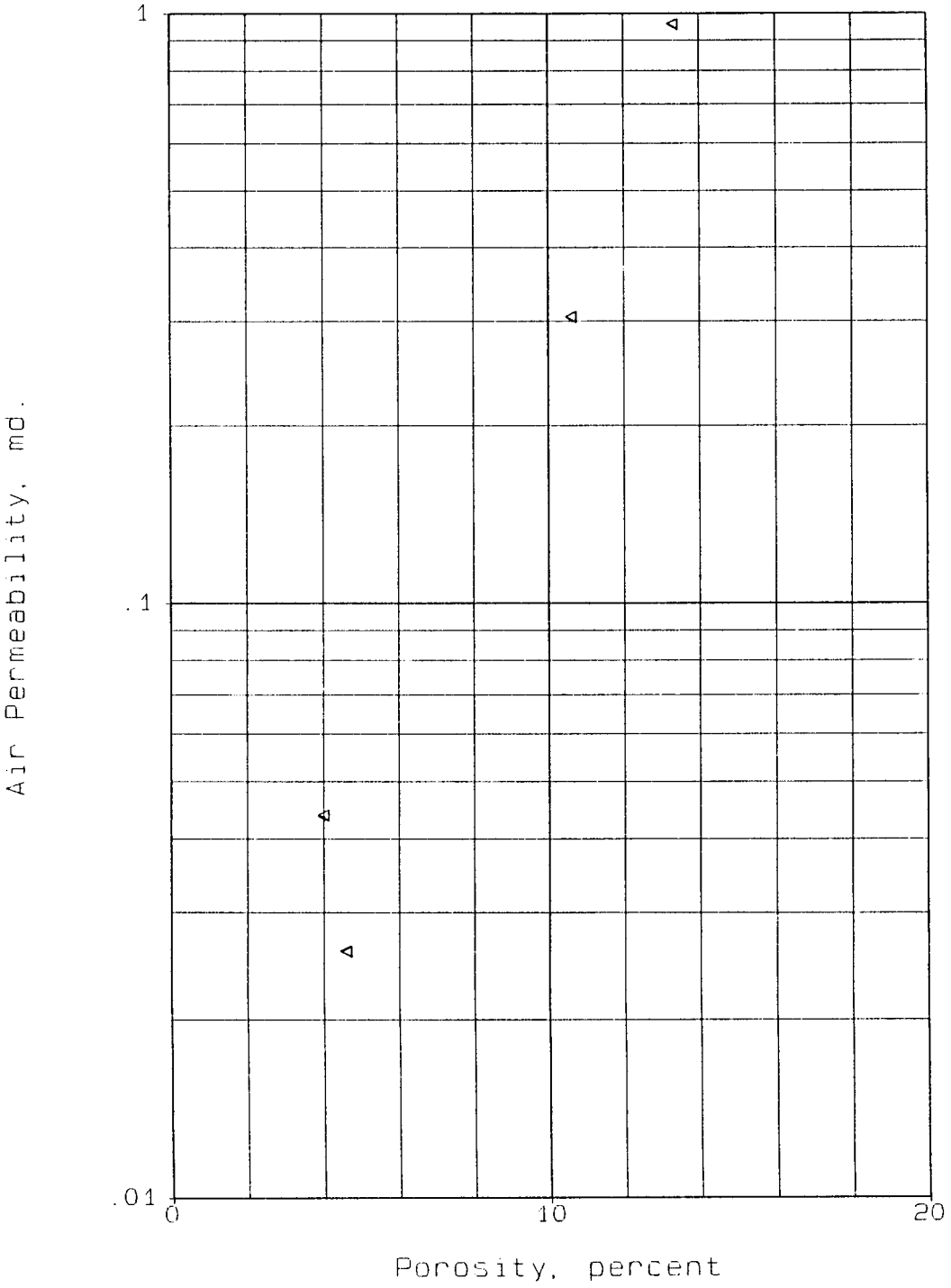
SUMMARY OF HIGH PRESSURE MERCURY INJECTION TEST RESULTS

AMOCO PRODUCTION COMPANY
WELL FEDERAL LAND BANK "C"
LOWER MORROW FORMATION
SECTION 21-29S-39W
STANTON COUNTY, KANSAS

Sample Number	Depth, feet	Porosity, percent	Air Permeability, md.	Endpoint Mercury Saturation at 30,000 psia (%PV)
2M	5484	4.0	0.0438	86.6
10M	5512	10.6	0.305	93.6
12M	5514	4.6	0.0258	81.5
14M	5516	13.3	0.959	94.6

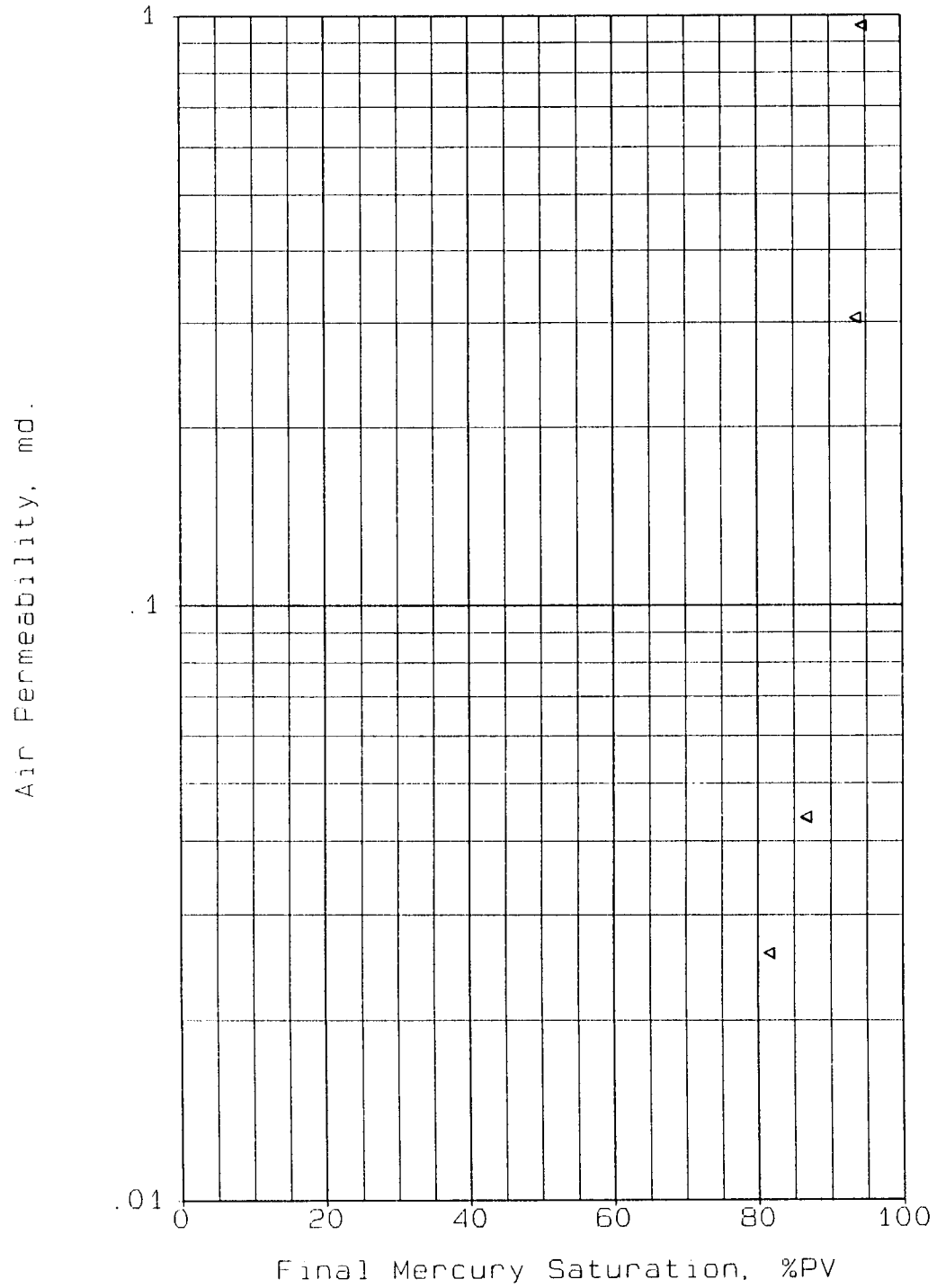
AIR PERMEABILITY VS. POROSITY CROSSPLOT

AMOCO PRODUCTION COMPANY
WELL FEDERAL LAND BANK "C"
LOWER MORROW FORMATION
SECTION 21-29S-39W
STANTON COUNTY, KANSAS



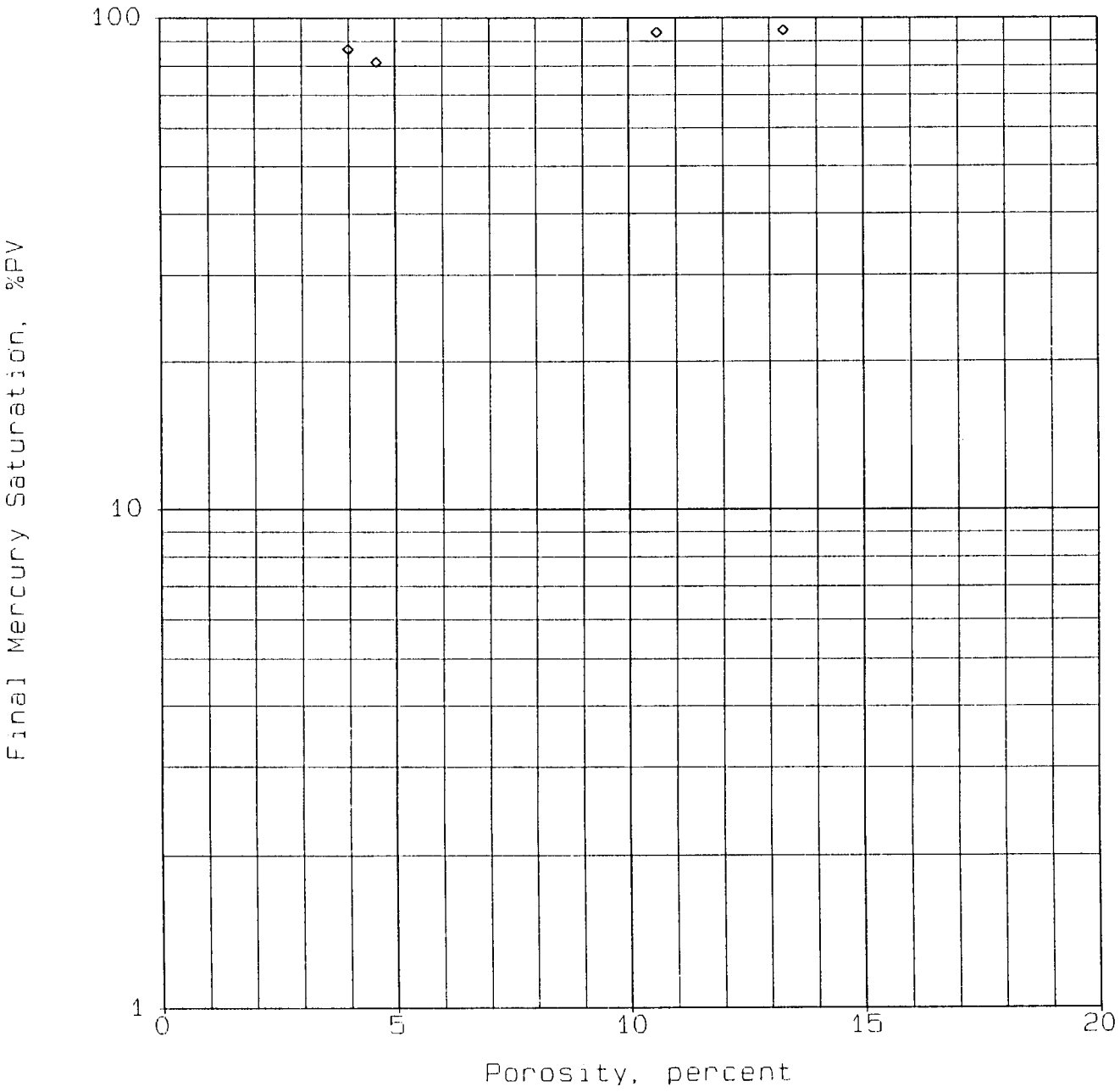
FINAL MERCURY SATURATION VS. AIR PERMEABILITY RESULTS

AMOCO PRODUCTION COMPANY
WELL FEDERAL LAND BANK "C"
LOWER MORROW FORMATION
SECTION 21-29S-39W
STANTON COUNTY, KANSAS



POROSITY VS. FINAL MERCURY SATURATION RESULTS

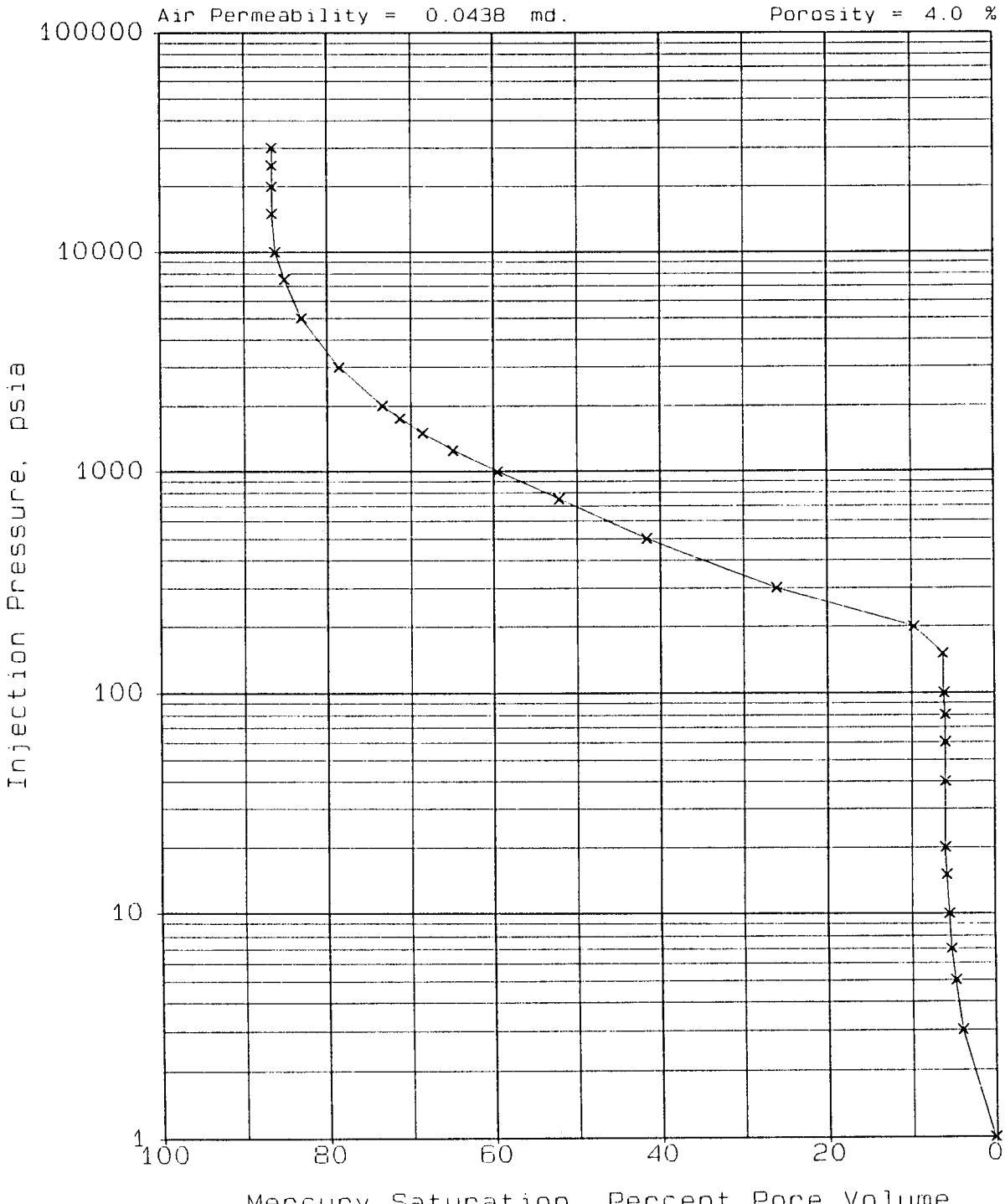
AMOCO PRODUCTION COMPANY
WELL FEDERAL LAND BANK "C"
LOWER MORROW FORMATION
SECTION 21-29S-39W
STANTON COUNTY, KANSAS



HIGH PRESSURE MERCURY INJECTION TEST RESULTS

AMOCO PRODUCTION COMPANY
WELL FEDERAL LAND BANK "C"
LOWER MORROW FORMATION
SECTION 21-29S-39W
STANTON COUNTY, KANSAS

Sample Number: 2M



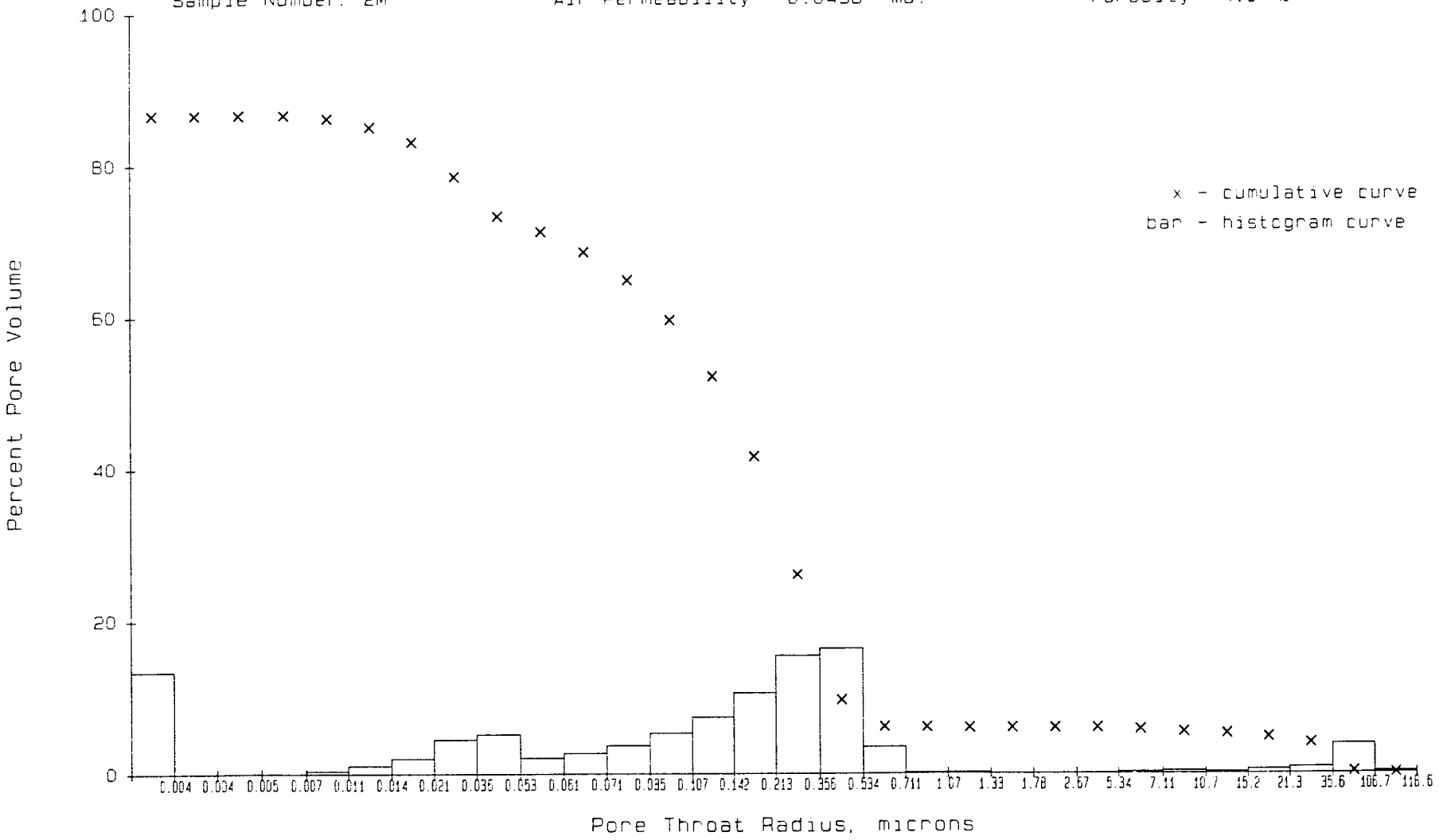
COMPOSITE PORE SIZE DISTRIBUTION RESULTS

AMOCO PRODUCTION COMPANY
WELL FEDERAL LAND BANK "C"
LOWER MORROW FORMATION
SECTION 21-29S-39W
STANTON COUNTY, KANSAS

Sample Number: 2M

Air Permeability = 0.0438 md.

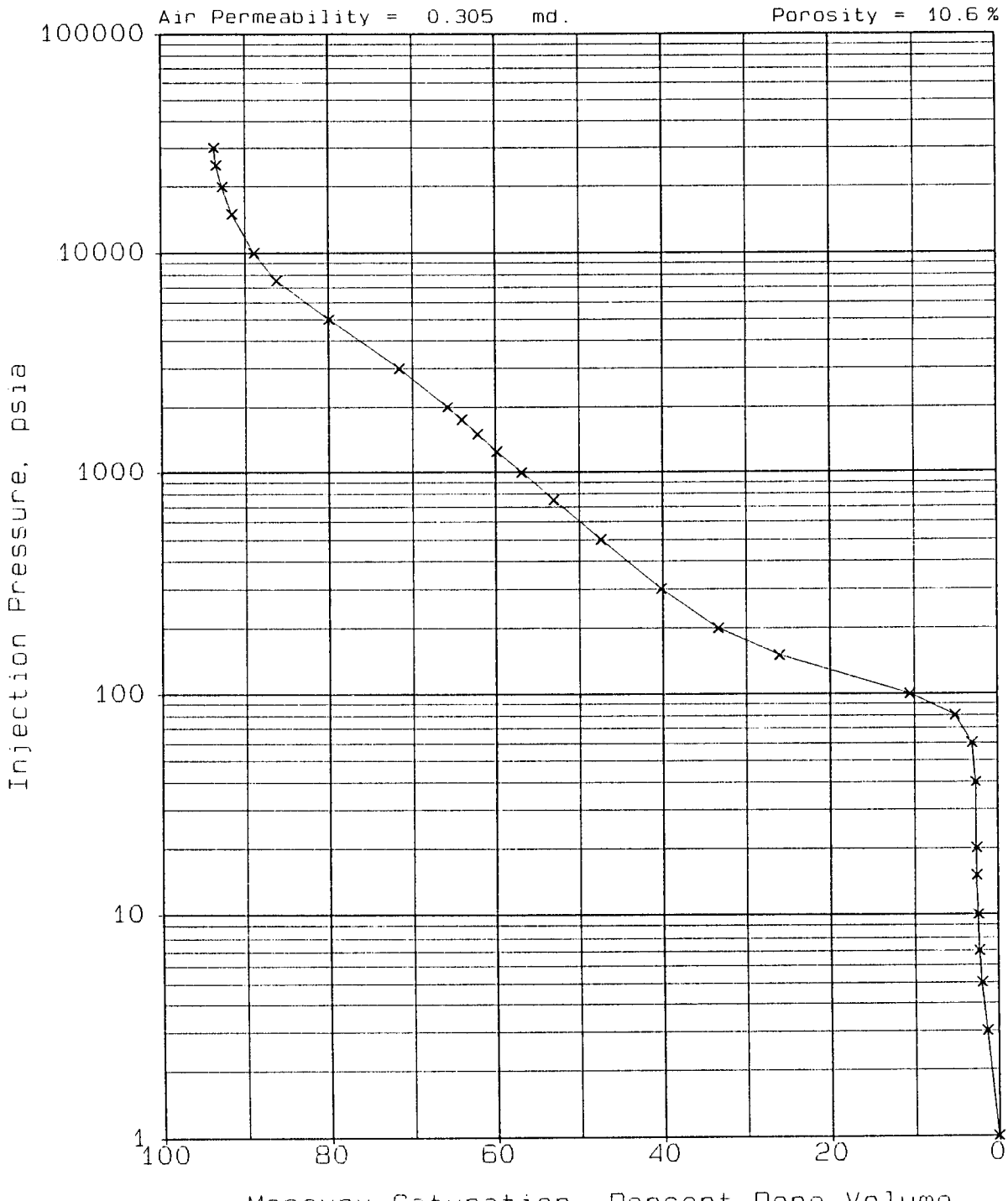
Porosity = 4.0 %



HIGH PRESSURE MERCURY INJECTION TEST RESULTS

AMOCO PRODUCTION COMPANY
WELL FEDERAL LAND BANK "C"
LOWER MORROW FORMATION
SECTION 21-29S-39W
STANTON COUNTY, KANSAS

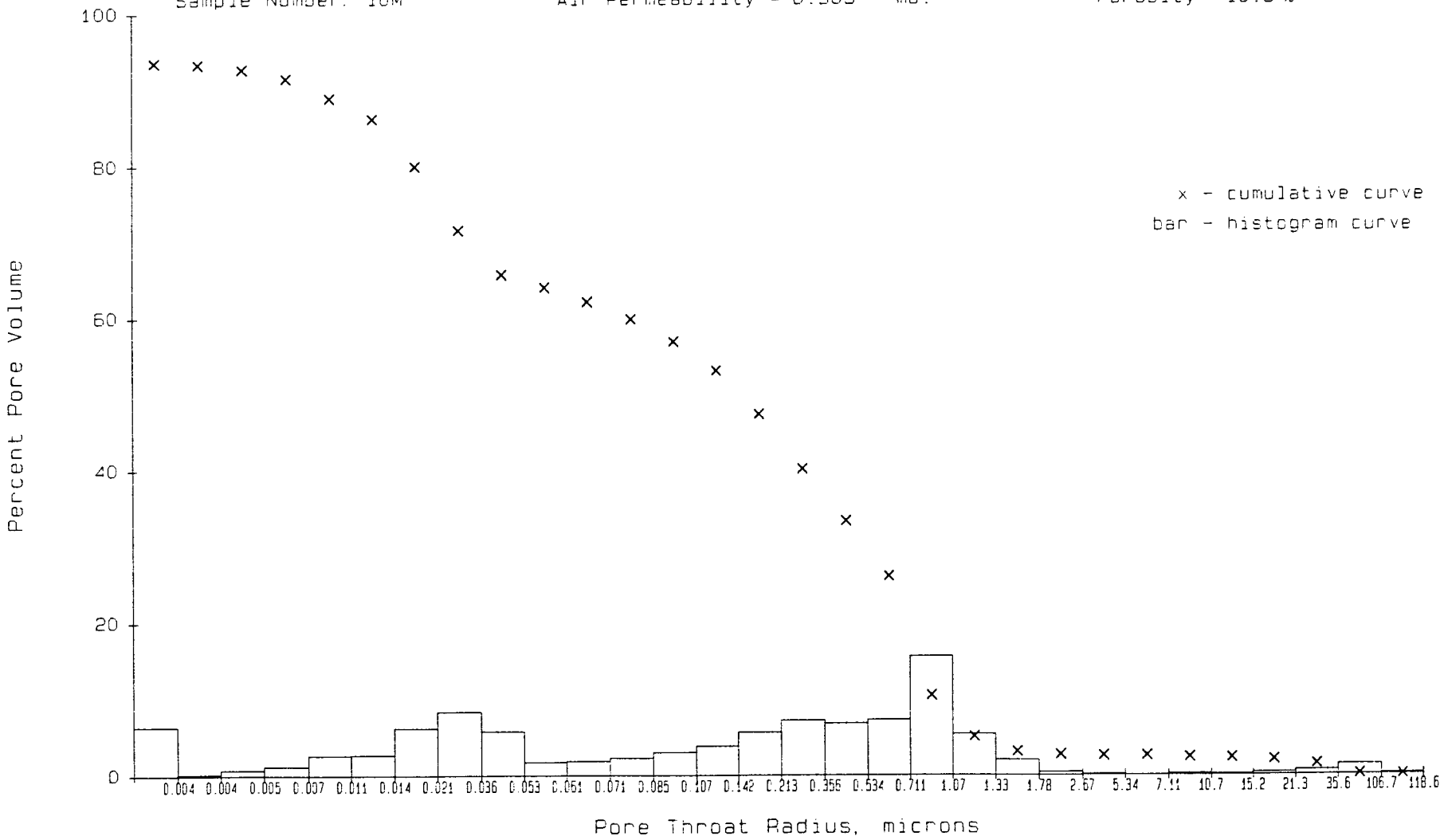
Sample Number: 10M



COMPOSITE PORE SIZE DISTRIBUTION RESULTS

AMOCO PRODUCTION COMPANY
WELL FEDERAL LAND BANK "C"
LOWER MORROW FORMATION
SECTION 21-29S-39W
STANTON COUNTY, KANSAS

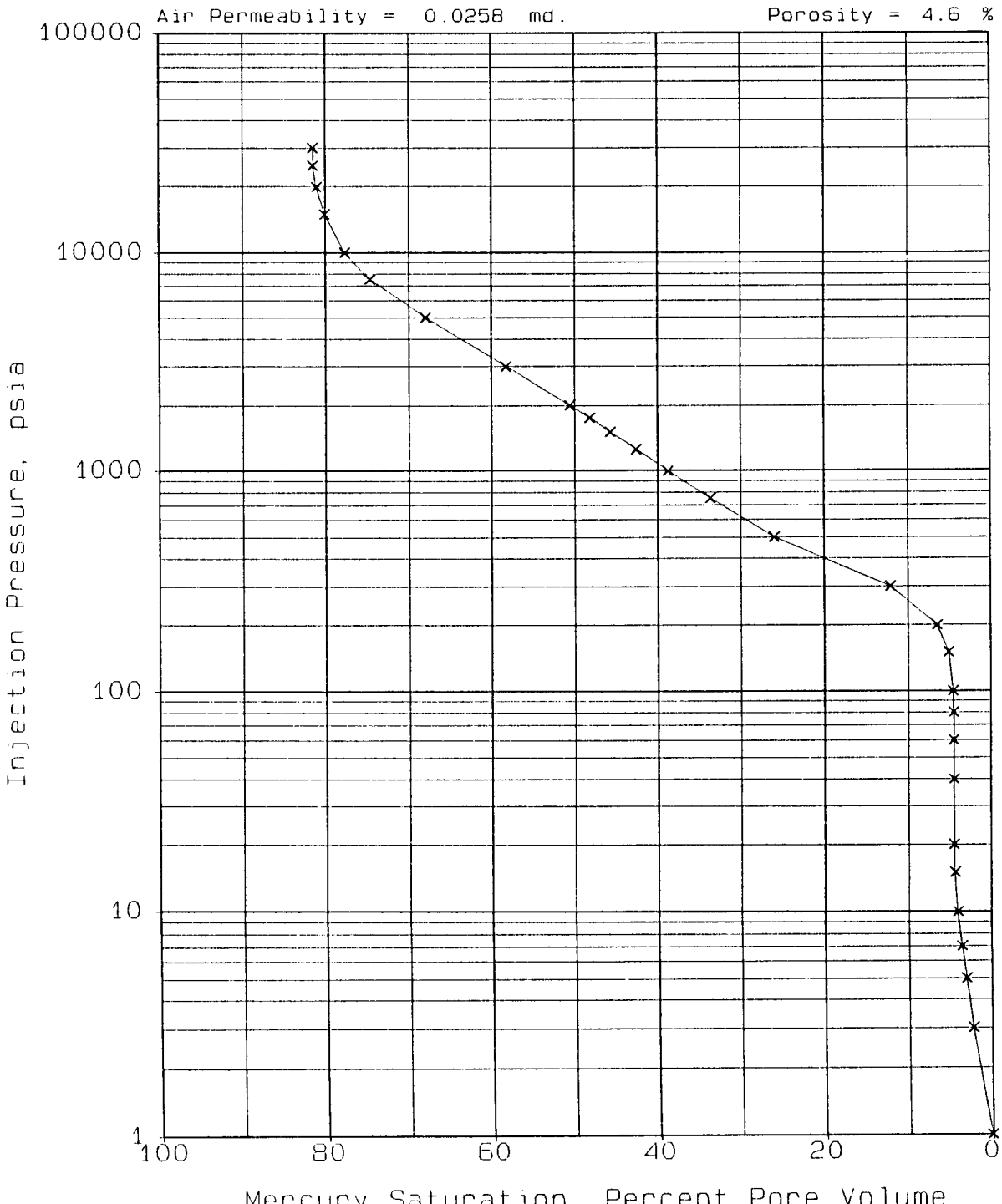
Sample Number: 10M Air Permeability = 0.305 md. Porosity = 10.6 %



HIGH PRESSURE MERCURY INJECTION TEST RESULTS

AMOCO PRODUCTION COMPANY
WELL FEDERAL LAND BANK "C"
LOWER MORROW FORMATION
SECTION 21-29S-39W
STANTON COUNTY, KANSAS

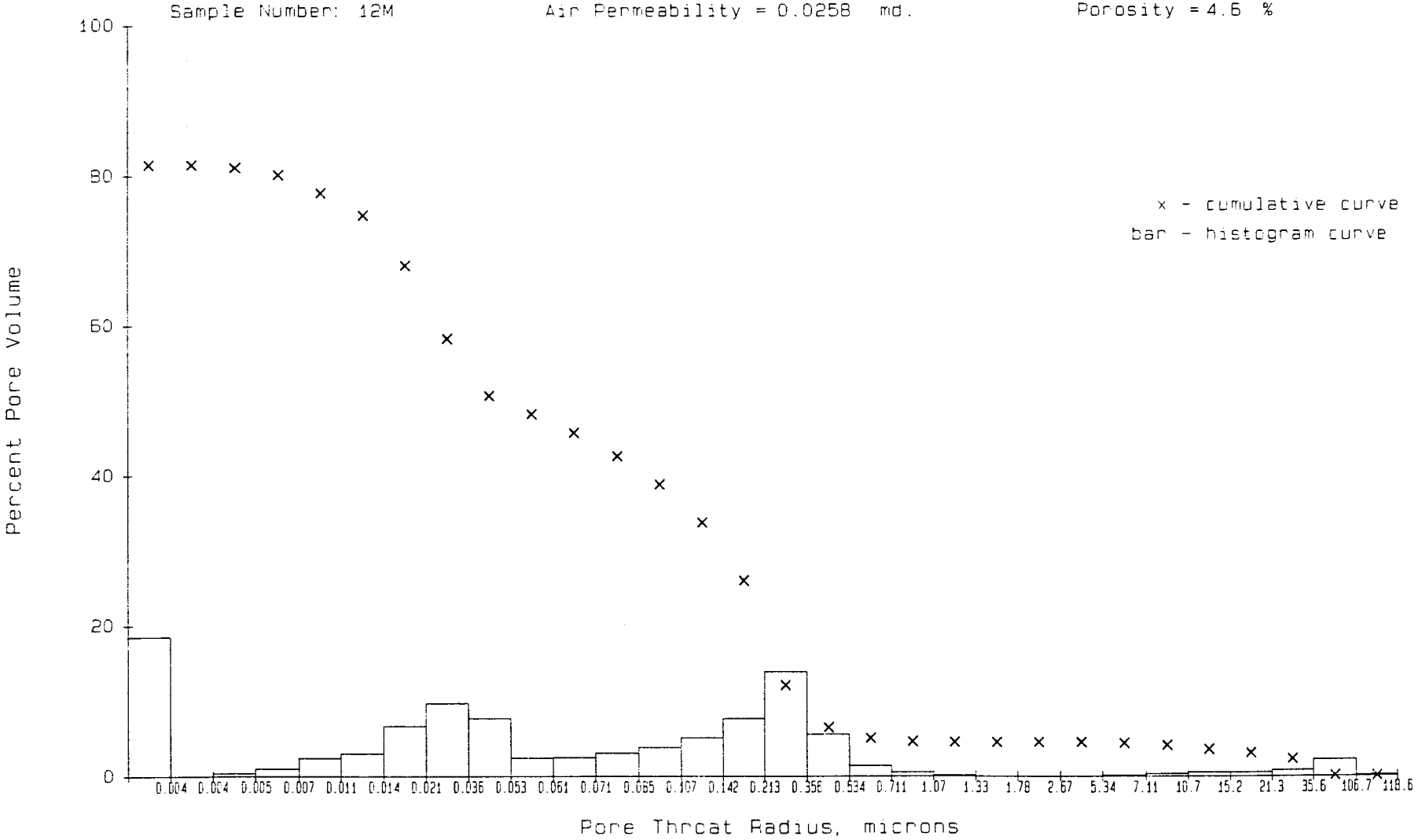
Sample Number: 12M



COMPOSITE PORE SIZE DISTRIBUTION RESULTS

AMOCO PRODUCTION COMPANY
WELL FEDERAL LAND BANK "C"
LOWER MORROW FORMATION
SECTION 21-29S-39W
STANTON COUNTY, KANSAS

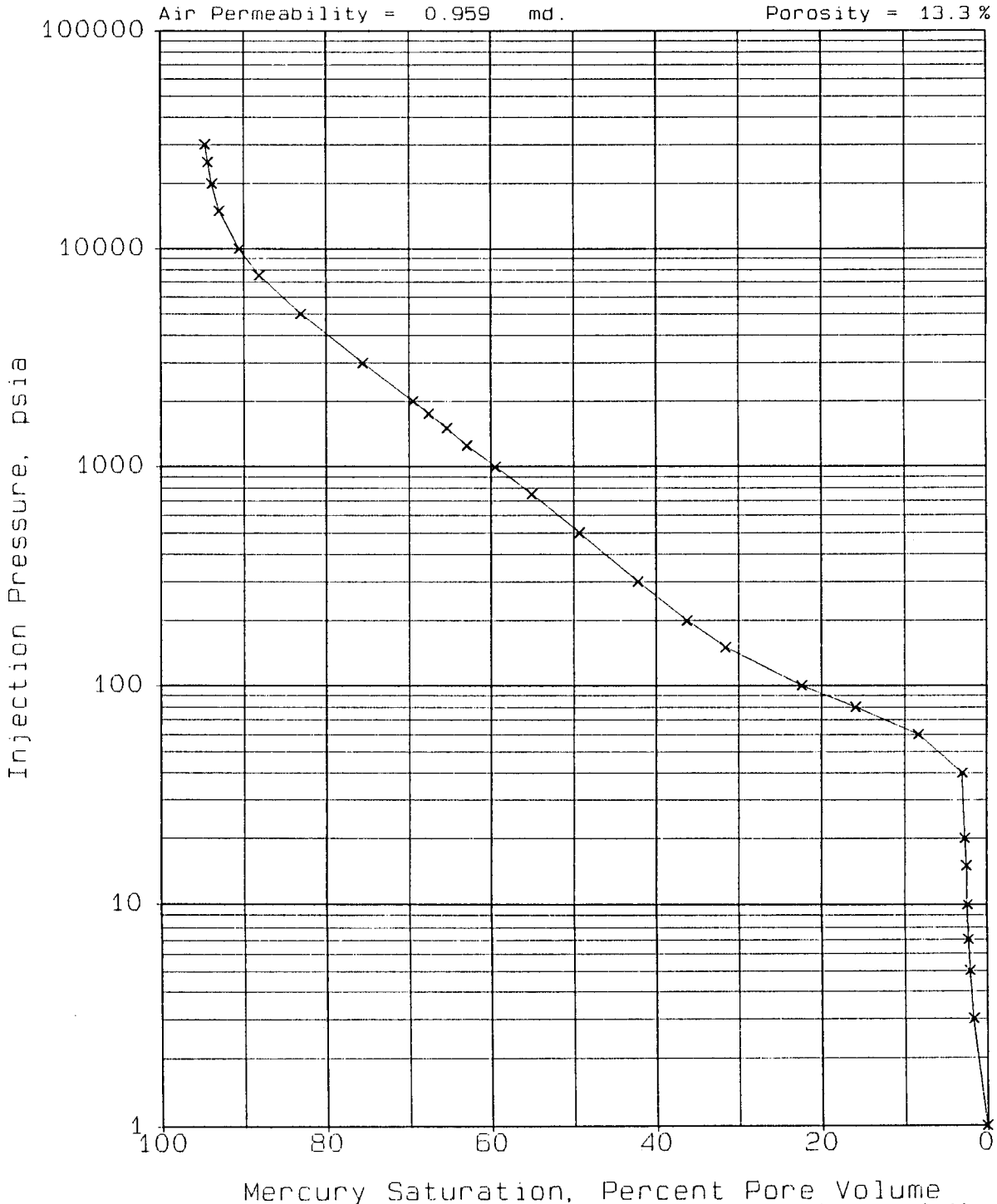
Sample Number: 12M Air Permeability = 0.0258 md. Porosity = 4.6 %



HIGH PRESSURE MERCURY INJECTION TEST RESULTS

AMOCO PRODUCTION COMPANY
WELL FEDERAL LAND BANK "C"
LOWER MORROW FORMATION
SECTION 21-29S-39W
STANTON COUNTY, KANSAS

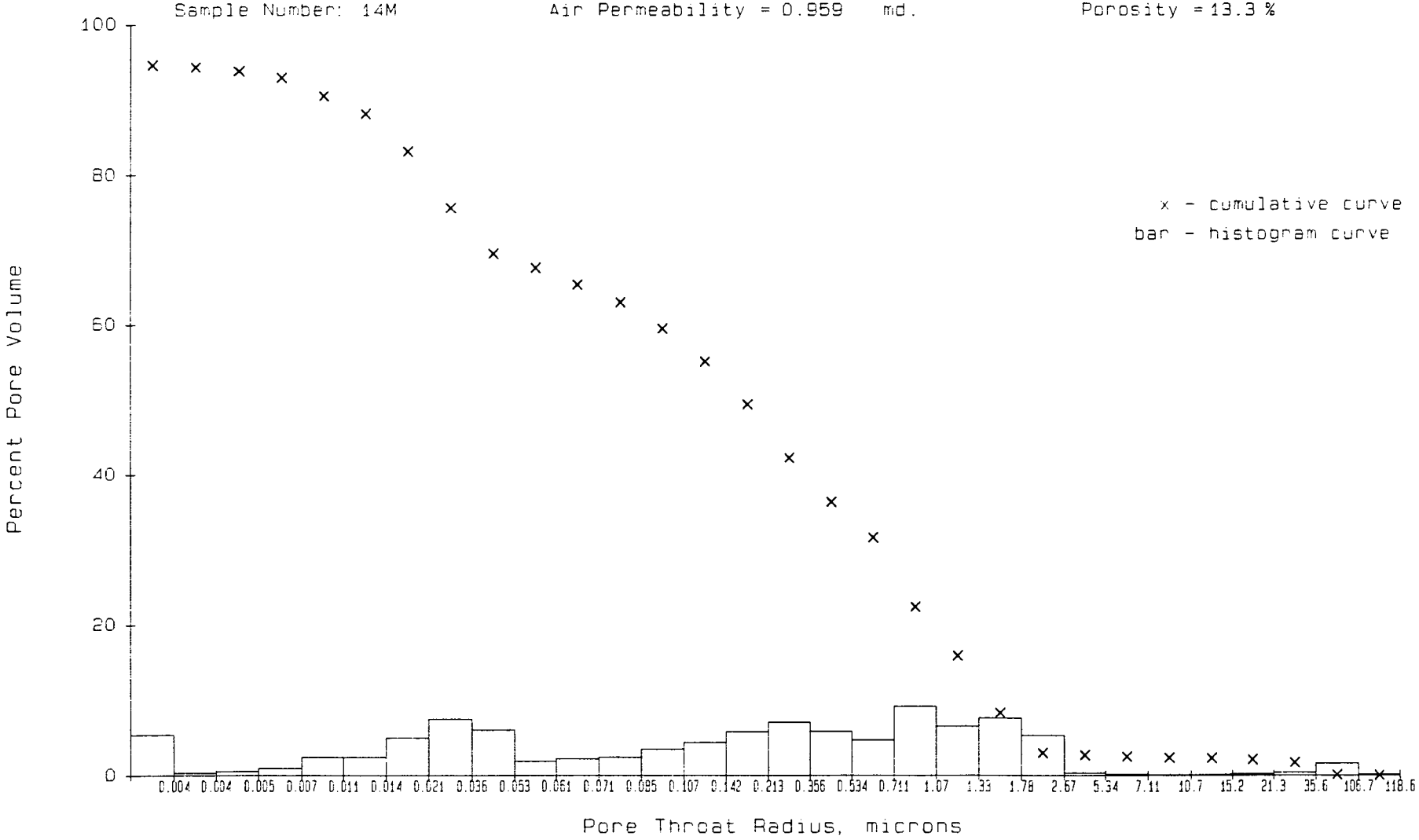
Sample Number: 14M



COMPOSITE PORE SIZE DISTRIBUTION RESULTS

AMOCO PRODUCTION COMPANY
WELL FEDERAL LAND BANK "C"
LOWER MORROW FORMATION
SECTION 21-29S-39W
STANTON COUNTY, KANSAS

Sample Number: 14M Air Permeability = 0.959 md. Porosity = 13.3 %



HIGH PRESSURE MERCURY INJECTION TEST RESULTS

AMOCO PRODUCTION COMPANY
WELL FEDERAL LAND BANK "C"
LOWER MORROW FORMATION
SECTION 21-29S-39W
STANTON COUNTY, KANSAS

Sample Number:	2M	10M	12M
Depth, feet:	5484	5512	5514
Air Permeability, md.:	0.0438	0.305	0.0258
Porosity, percent:	4.0	10.6	4.6

Injection Pressure (psia)	Mercury Saturation (%PV)	Mercury Saturation (%PV)	Mercury Saturation (%PV)
0	0.0	0.0	0.0
1	0.2	0.1	0.1
3	4.0	1.4	2.3
5	4.8	2.0	3.1
7	5.3	2.3	3.6
10	5.5	2.4	4.1
15	5.8	2.6	4.4
20	6.0	2.6	4.5
40	6.0	2.7	4.5
60	6.0	3.1	4.5
80	6.0	5.1	4.5
100	6.1	10.5	4.6
150	6.2	26.1	5.1
200	9.7	33.4	6.5
300	26.1	40.2	12.1
500	41.6	47.4	26.0
750	52.2	53.1	33.7
1000	59.6	56.9	38.8
1250	64.9	59.9	42.6
1500	68.6	62.2	45.7
1750	71.3	64.1	48.2
2000	73.4	65.8	50.6
3000	78.6	71.6	58.3
5000	83.1	80.0	68.0
7500	85.1	86.2	74.7
10000	86.2	88.9	77.7
15000	86.6	91.5	80.1
20000	86.6	92.7	81.1
25000	86.6	93.4	81.5
30000	86.6	93.6	81.5

HIGH PRESSURE MERCURY INJECTION TEST RESULTS

AMOCO PRODUCTION COMPANY
WELL FEDERAL LAND BANK "C"
LOWER MORROW FORMATION
SECTION 21-29S-39W
STANTON COUNTY, KANSAS

Sample Number:	14M
Depth, feet:	5516
Air Permeability, md.:	0.959
Porosity, percent:	13.3

Injection Pressure (psia)	Mercury Saturation (%PV)
0	0.0
1	0.1
3	1.7
5	2.1
7	2.3
10	2.4
15	2.5
20	2.7
40	3.0
60	8.3
80	15.9
100	22.4
150	31.6
200	36.3
300	42.2
500	49.3
750	55.1
1000	59.5
1250	63.0
1500	65.4
1750	67.6
2000	69.5
3000	75.6
5000	83.1
7500	88.1
10000	90.5
15000	92.9
20000	93.8
25000	94.3
30000	94.6

CONDITIONS AND QUALIFICATIONS

K&A Laboratories will endeavor to provide accurate and reliable laboratory measurements of the cores provided by the client. The results of any core analysis are necessarily affected by the condition in which the core is received and the selection of the samples to be analyzed. In the absence of direction by the client, K&A Laboratories will utilize its best geological and engineering judgment in selecting the samples to be analyzed. It should be recognized that most cores do not have uniform properties and that selection of truly representative samples is rarely possible. Unless otherwise directed, the samples will normally be selected from the highest quality segments. Thus, use of the properties measured in this report in reservoir calculations could result in an overestimation in reservoir volume and/or deliverability. K&A Laboratories assumes no responsibility nor offers any guarantee of the productivity or performance of any oil or gas well or hydrocarbon recovery process based upon the data presented in this report.