**Mobil Alternative Energy Inc.**

P O BOX 17772
DENVER, COLORADO 80217

January 22, 1986



Mr. Felix R. Miera, Program Manager
Uranium Licensing Section
Radiation Protection Bureau
Environmental Improvement Division
P. O. Box 968
Santa Fe, New Mexico 87504

RESTORATION PROGRESS REPORT
CROWNPOINT SECTION 9 PILOT
IN SITU LEACH PLANT

Dear Mr. Miera:

The purpose of this letter is to provide the New Mexico Environmental Improvement Division and the Bureau of Land Management with an update on Mobil's restoration efforts at the Crownpoint Section 9 Pilot In Situ Leach Test Site.

Restoration Activities

Hydrogen Sulfide Injection: The procedure of injecting $H_2S$ into the wells which was begun May 1, 1984 and described in the 1984 Restoration Progress Report was continued in early 1985. The final $H_2S$ injection was completed March 18, 1985. The $H_2S$ treated wells continued to be sampled and monitored at intervals of once every two to four weeks. Produced waters were analyzed for pH, $U_3O_8$, and molybdenum.

After final $H_2S$ injection, the wells were allowed to sit inactive to allow time for the chemical reactions to occur and were periodically sampled. Of the 13 wells treated, the September 1985 laboratory analysis (Attachment 6) shows that molybdenum concentration has decreased in 10 wells and increased in 3 wells. The well field average for molybdenum has decreased from 7.7 mg/l in September 1984 and 10.4 mg/l in December 1984 to 4.8 mg/l in September 1985. Eight of the wells were below the NMWQCC standard for molybdenum in the September 1985 sampling compared to two wells below the standard in the September 1984 sampling.

Well Maintenance Program: A well maintenance program was begun in October 1985 with the approval of the State Engineer's Office. This program consisted of cleaning out the wells, and acidizing selected wells in preparation for the next phase of restoration. The selected wells were Numbers 211, 215, 216, 217, and 220. The acidizing work consisted of spotting a 15% hydrochloric acid solution in perforated zones of the selected wells to redevelop the perforations. After allowing sufficient time for redevelopment of the perforations, the acidic waters were removed from the wells. The static water level quickly returned to normal,

indicating successful redevelopment of the perforations. A pump test to help define the remainder of the restoration program is scheduled for early 1986.

Sample Analyses - Results to Date: Field assays of the production stream corresponding to cumulative gallons produced since October 1, 1980 are shown in Attachment 1. Attachments 2, 3, and 4 are graphic presentations of molybdenum data and the majority of the other data in Attachment 1. All six parameters of concern have shown very significant drops in concentration since the beginning of restoration efforts and several parameters continue to decrease in concentration as restoration efforts proceed. Reduction in parameter concentrations range from a high of 99.8% for uranium to 78% for bicarbonate (see Attachment 1).

With respect to trace metals and other minor constituents, the September 1985 analytical data (see Attachments 5 and 6) show the average concentration in the well field are below the New Mexico Standards (Section 3-103 NMWQCC Regulations) for all parameters except molybdenum. Molybdenum, which was approximately 80 mg/l at the start of restoration, has been reduced approximately 94%, based on the September 1985 sampling. Eight of the thirteen wells sampled were at or below the 1.0 mg/l standard compared to three at or below the standard in the September 1984 sampling.

Radiometric data (see Attachment 6) was also secured in the September 1985 sampling. The activity levels for these parameters have shown significant decreases since the beginning of restoration. The combined radium 226 and 228 concentration was at a 37.4 ± 2 pCi/l level, which is slightly above the September 1984 level and Section 3-103 NMWQCC Standards, but well within the naturally occurring range (0.0 ± 2.7 to 89.4 pCi/l) observed during baseline water quality sampling at the Section 9 Pilot Site location. Percent reductions in radiometric activity levels are shown in Attachment 7.

In summary, the data available at this time demonstrate that 25 of 27 pertinent parameters listed in Section 3-103 of the NMWQCC Regulations are less than levels specified in the Regulations. The radium 226 and 228 parameter is slightly above the standard, but consistent with baseline water quality values. Molybdenum concentration is also above the standard, but it has been reduced approximately 37% from the September 1984 value. This reduction in molybdenum concentration can be attributed to the utilization of $H_2S$ as a reductant and allowing time for the chemical reactions related to the use of $H_2S$ to occur. We feel we have been diligent in trying to reduce molybdenum concentrations and have shown marked improvement over previous results.

Individual Well Variations: As stated in previous reports, there have been variations in parameter concentrations in different wells, most

markedly with respect to molybdenum. In comparing the September 1984 sampling results with September 1985 sampling results, two wells show molybdenum increases with only one of any significance. The elevated level of molybdenum in several wells is believed to be related to both the amount of naturally occurring molybdenum in the formation at that particular location and the degree of sweep efficiency at that location during restoration efforts. However, wells have begun to show decreases in molybdenum levels due to the use of $H_2S$ as a reductant.

USGS Observation Well No. 9U-277: Clean up of Well No. 9U-277, related to molybdenum concentration, was completed since the last restoration progress report. Molybdenum levels decreased from 3.2 mg/l in December 1984 to less than 0.2 mg/l in June 1985 and have remained at this low level through November 1985.

Future Restoration Plans

Following the pump test of the well field previously mentioned, a ground water sweep restoration method is scheduled to be employed. It is Mobil's intention to continue restoration efforts based on ground water hydraulic principles rather than ground water chemistry due to the less than expected success of the $H_2S$ injection program.

We appreciate your cooperation throughout our restoration efforts and the granting of the necessary approvals that have allowed us to use a variety of restoration techniques in our effort to achieve complete restoration of the affected portion of the aquifer. We look forward to your continued cooperation.

If you have any questions, please contact me at (303) 293-6300.

Very truly yours,

J. F. Cullen
Engineering Manager

DGGANEY/jrh:212/c
Attachments

ATTACHMENT 1

PRODUCTION STREAM FIELD ASSAYS

| Cumulative Gallons Produced Since October 1, 1980 | $U_3O_8$ ppm | Ca ppm | $So_4$ ppm | $NCO_3$ ppm | Na ppm | Cl ppm |
|---|---|---|---|---|---|---|
| - | 145 | 320 | 1176 | 1005 | 1600 | 1671 |
| 374,762 | 142 | 326 | 1150 | 1023 | 1650 | 1671 |
| 736,639 | 132 | 317 | 1275 | 915 | 1620 | 1548 |
| 1,088,626 | 125 | 304 | 1175 | 874 | 1510 | 1656 |
| 1,373,375 | 103 | 280 | 1150 | 769 | 1850 | 1760 |
| 1,707,067 | 106 | 231 | 1100 | 800 | 1780 | 1795 |
| 2,075,608 | 97 | 276 | 1100 | 781 | 1510 | 1755 |
| 2,425,021 | 101 | 291 | 1050 | 737 | 1580 | 1728 |
| 2,721,818 | 89 | 282 | 1075 | 683 | 1640 | 1714 |
| 3,061,598 | 72 | 277 | 1150 | 683 | 1470 | 1678 |
| 3,446,723 | 72 | 306 | 975 | 698 | 1710 | 1860 |
| 3,791,287 | 62 | 310 | 925 | 612 | 1730 | 1800 |
| 4,117,896 | 58 | 282 | 975 | 585 | 1520 | 1787 |
| 5,007,311 | 48 | 228 | 977 | 622 | 1506 | 1639 |
| 5,384,309 | 42 | 235 | 902 | 617 | 1460 | 1405 |
| 5,757,729 | 40 | 193 | 866 | 649 | 1449 | 1213 |
| 6,126,444 | 34 | 157 | 787 | 634 | 1070 | 1010 |
| 6,362,630 | 32 | 156 | 775 | 610 | 1130 | 978 |
| 10,278,269 | 26 | 93 | 578 | 552 | 581 | 559 |
| 13,833,820 | 4 | 55 | 348 | 415 | 379 | 174 |
| 34,361,987 | 0.54 | 38 | 43 | 122 | 156 | 150 |
| 44,036,014 | 0.42 | 18 | 69 | 183 | 181 | 101 |
| 58,332,122 | 0.59 | 19 | 81 | 173 | 163 | 115 |
| 59,173,469 | 0.28 | 46 | 85 | 225 | 141 | 101 |
| % Reduction in Concentration | 99.8% | 86% | 93% | 78% | 92% | 94% |

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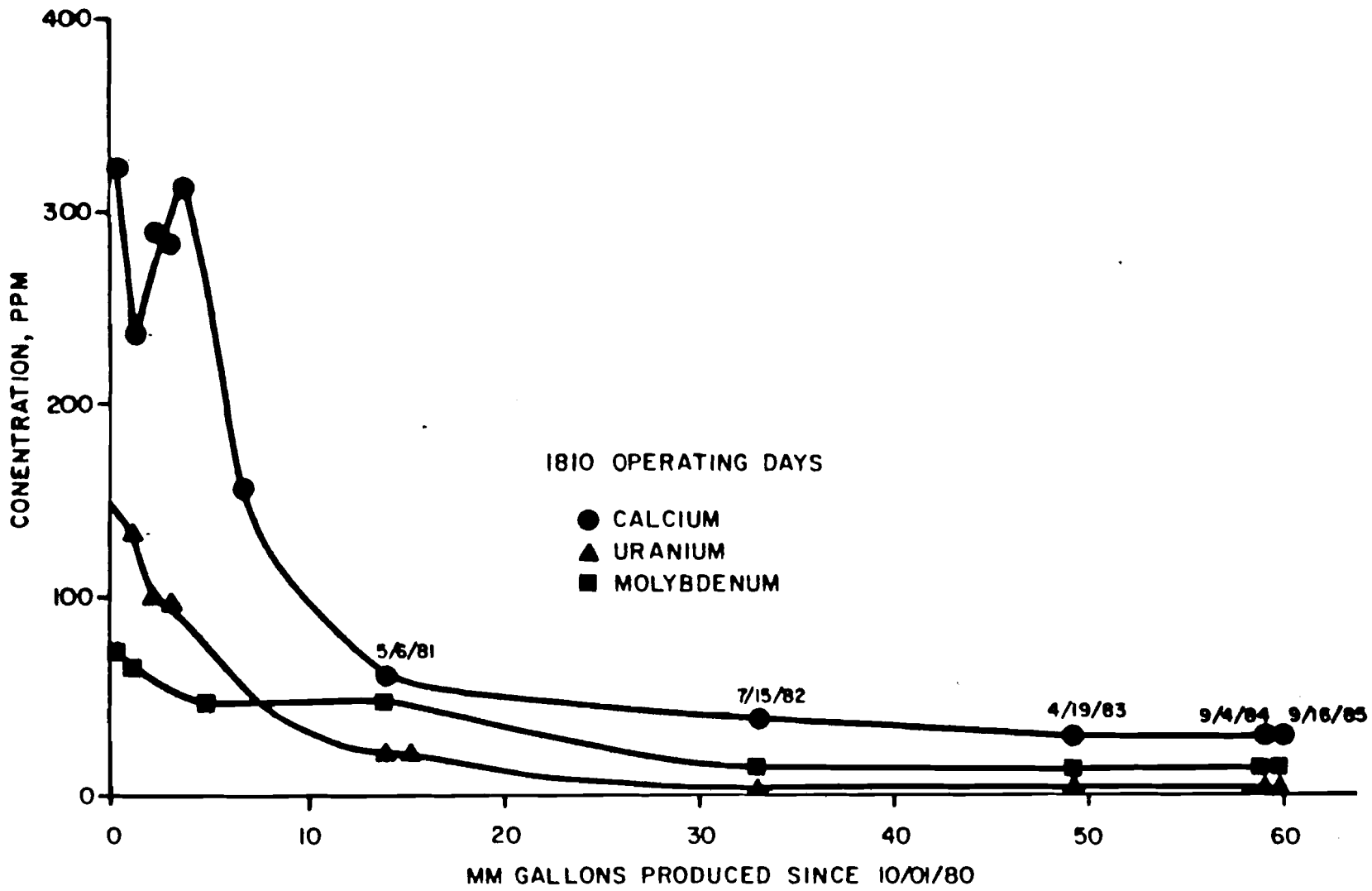
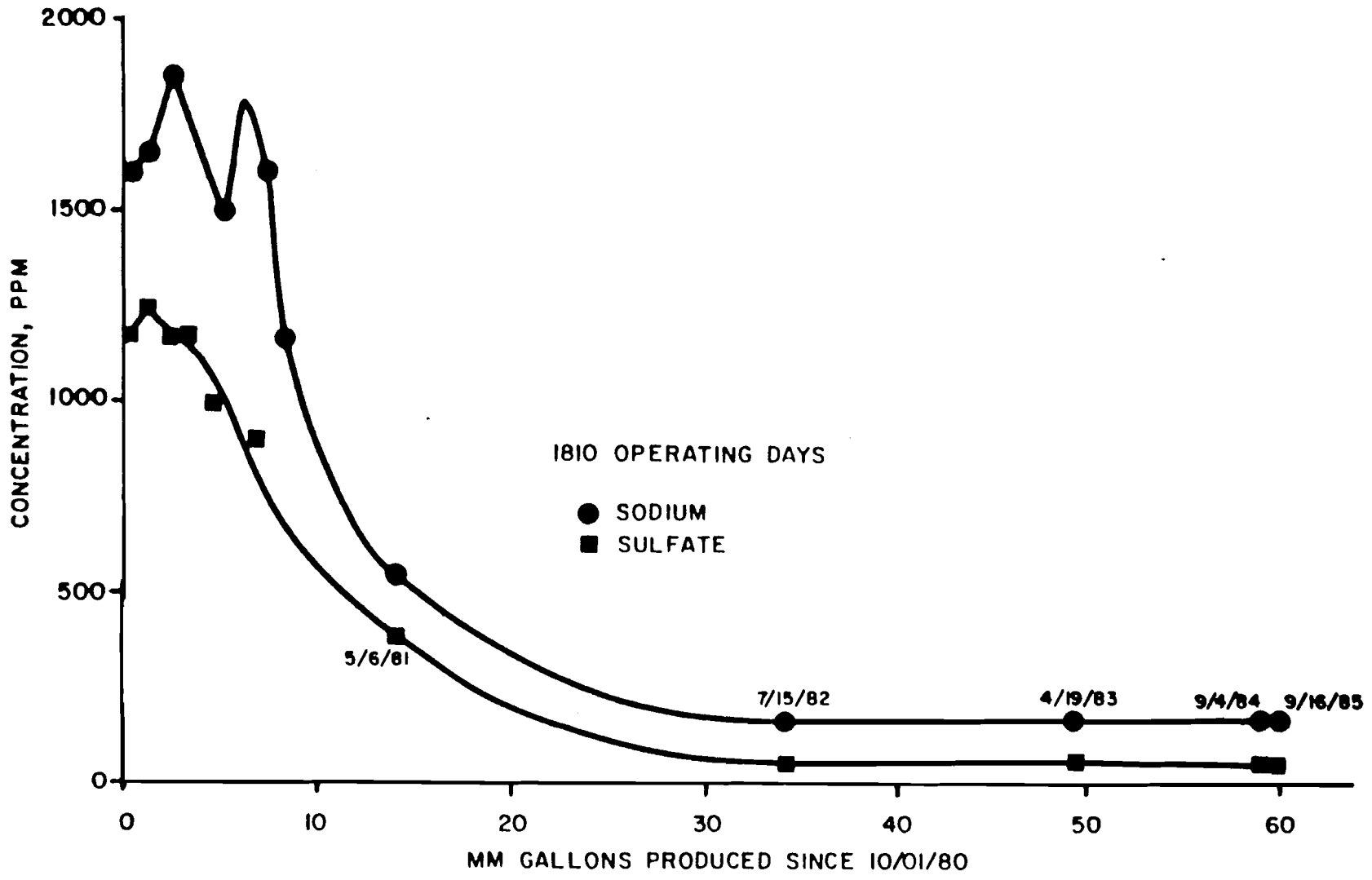
ATTACHMENT 2

# CALCIUM, URANIUM, MOLYBDENUM RESTORATION



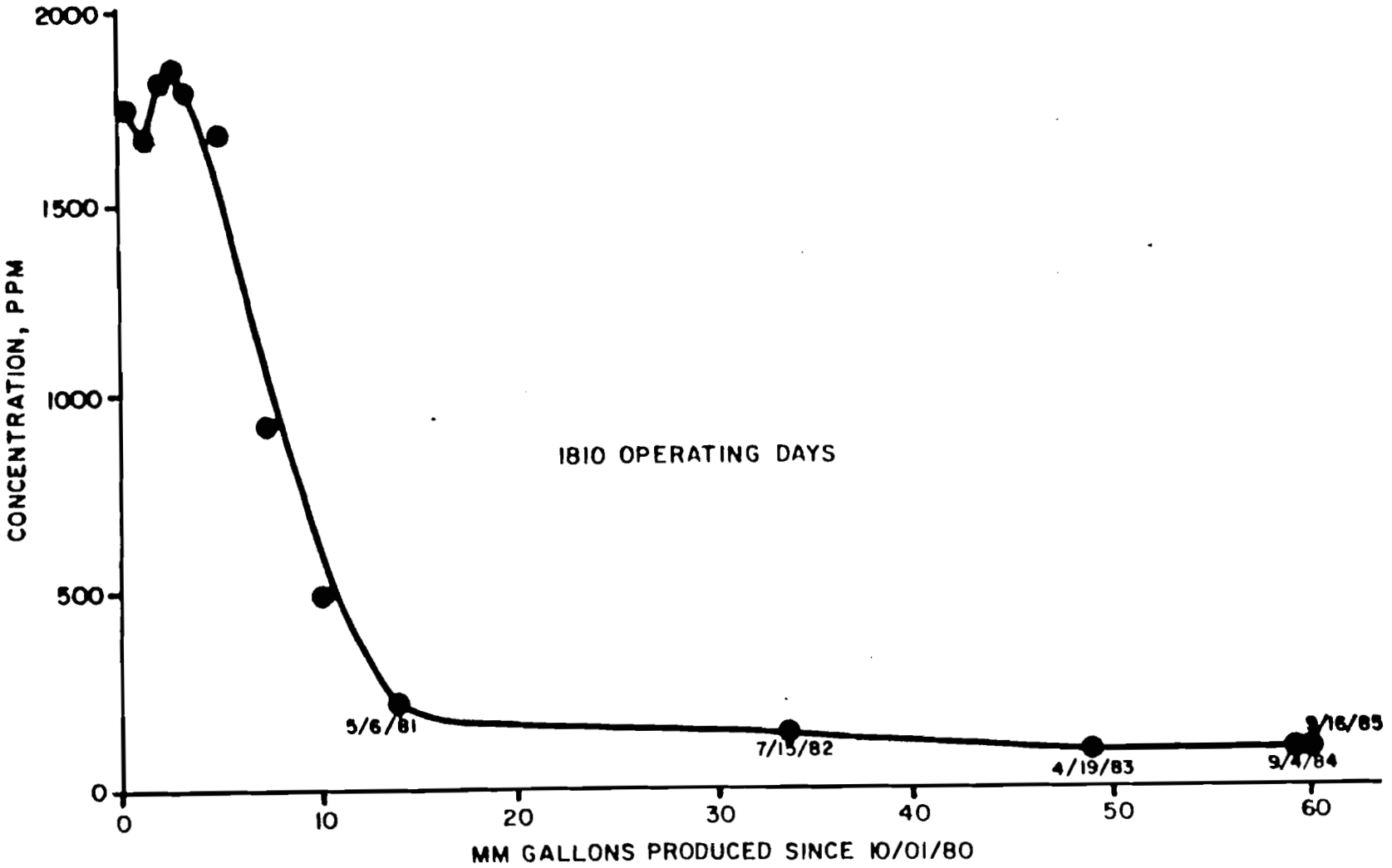
ATTACHMENT 3

# SODIUM, SULFATE RESTORATION



ATTACHMENT 4

# CHLORIDE RESTORATION



ATTACHMENT 5

Comparison of Parameter Concentrations for Production Stream Versus New Mexico Standards for Ground Water of 10,000 mg/1 TDS Concentration or Less

(Samples Taken September 4, 1984 and September 16, 1985)

| Parameter | New Mexico Standard (mg/1) | Production Stream 1433 Days of Operation Section 9 Pilot Leach (mg/1) | Production Stream 1810 Days of Operation Section 9 Pilot Leach (mg/1) |
|---|---|---|---|
| Aluminum | 5.0 | < 0.5 | < 0.5 |
| Arsenic | 0.1 | 0.057 | 0.032 |
| Barium | 1.0 | 0.26 | 0.22 |
| Boron | 0.75 | 0.1 | 0.22 |
| Cadmium | 0.01 | < 0.005 | < 0.007 |
| Chloride | 250.0 | 115.0 | 101.0 |
| Chromium | 0.05 | 0.007 | 0.011 |
| Cobalt | 0.05 | < 0.02 | 0.026 |
| Copper | 1.0 | < 0.005 | 0.012 |
| Cyanide | 0.2 | < 0.005 | < 0.007 |
| Fluoride | 1.6 | < 0.5 | < 0.5 |
| Iron | 1.0 | 0.06 | 0.37 |
| Lead | 0.05 | < 0.005 | < 0.006 |
| Manganese | 0.2 | 0.048 | 0.096 |
| Molybdenum | 1.0 | 7.65 | 4.80 |
| Mercury | 0.002 | < 0.0001 | < 0.0001 |
| Nickel | 0.2 | 0.02 | < 0.02 |
| Nitrate | 10.0 | 0.94 | < 0.05 |
| pH* | 6-9 | 8.4 | 8.2 |
| Phenols | 0.005 | < 0.002 | 0.004 |
| Radium-226 and -228 | 30.0 pCi/1 | 34.1 ±2 | 37.4 ±2 |
| Selenium | 0.05 | 0.017 | 0.032 |
| Silver | 0.05 | < 0.005 | < 0.006 |
| Sulfate | 600.0 | 81.5 | 85.0 |
| TDS | 1000.0 | 479.0 | 517.0 |
| Uranium | 5.0 | 0.59 | 0.28 |
| Zinc | 10.0 | 0.027 | 0.030 |

* Dimensionless (Units)

DGG12/85
jrh212

**Accu-Labs Research, Inc.**
11485 W. 48th Avenue Wheat Ridge, Colorado 80033
(303) 423-2766

November 4, 1985


Mr. Joe Sciba
Mobil Oil Corp.
P.O. Drawer F
Crownpoint, NM 87313

RE: 8752-20717-2
Date Samples Rec'd 9-30-85

REPORT OF ANALYSIS

| ALR Designation | 8752-20717-2-1 | 8752-20717-2-2 |
|---|---|---|
| Sponsor Designation | 208 | 210 |
| | 9-23-85 | 9-23-85 |
| Determination: mg/L | | |
| Arsenic, dissolved | 0.005 | 0.007 |
| Barium, dissolved | 0.4 | <0.2 |
| Cadmium, dissolved | <0.005 | <0.005 |
| Chromium, dissolved | <0.005 | <0.005 |
| Cyanide | <0.005 | <0.005 |
| Fluoride | <0.5 | <0.5 |
| Lead, dissolved | <0.005 | 0.007 |
| Mercury, total | <0.0001 | <0.0001 |
| Nitrate (as N) | <0.05 | <0.05 |
| Selenium, dissolved | <0.005 | <0.005 |
| Silver, dissolved | <0.005 | <0.005 |
| Chloride | 140 | 4 |
| Copper, dissolved | 0.005 | 0.008 |
| Iron, dissolved | 0.06 | 0.14 |
| Manganese, dissolved | 0.22 | 0.009 |
| Phenols | <0.002 | <0.002 |
| Sulfate (as $SO_4$) | 130 | 40 |
| TDS (at 180°C) | 760 | 270 |
| Zinc, dissolved | 0.019 | 0.043 |
| pH | 7.9 | 8.2 |
| Aluminum, dissolved | <0.5 | <0.5 |
| Boron | 0.2 | 0.2 |
| Cobalt, dissolved | <0.02 | <0.02 |
| Molybdenum, dissolved | 0.26 | 0.43 |
| Nickel, dissolved | <0.02 | 0.03 |
| Conductivity, µmhos/cm | 1400 | 490 |

**Accu-Labs Research, Inc.**

November 4, 1985
Page 2 of 2

Mr. Joe Sciba
Mobil Oil Corp.

RE: 8752-20717-2
Date Samples Rec'd 9-30-85

REPORT OF ANALYSIS

| ALR Designation | 8752-20717-2-1 | 8752-20717-2-2 |
|---|---|---|
| Sponsor Designation | 208 | 210 |
| | 9-23-85 | 9-23-85 |
| Determination: mg/L | | |
| Sodium, dissolved | 200 | 97 |
| Calcium, dissolved | 69 | 1.8 |
| Magnesium, dissolved | 2.5 | 0.06 |
| Potassium, dissolved | 1.8 | 0.4 |
| Carbonate (as $CO_3$) | <5 | <5 |
| Bicarbonate (as $HCO_3$) | 340 | 240 |
| Silica (as $SiO_2$) | 53 | 19 |

These samples are scheduled to be disposed of 30 days after the date of this report.

Mary Fabisiak for CC
Cathy Cairns
Water Laboratory
Supervisor

CC/dh dh

# Accu-Labs Research, Inc.
11485 W. 48th Avenue Wheat Ridge, Colorado 80033
(303) 423-2766


October 24, 1985


Mr. Joe Sciba
Mobil Oil Corp.
P.O. Drawer F
Crownpoint, NM 87313

RE: 8752-20647-11
Date Samples Rec'd 9-19-85

REPORT OF ANALYSIS

| ALR Designation | 8752-20647-11-1 | 8752-20647-11-2 | 8752-20647-11-3 | 8752-20647-11-4 | 8752-20647-11-5 |
|---|---|---|---|---|---|
| Sponsor Designation | 209 | 211 | 212 | 213 | 214 |
| | 9-16-85 | 9-16-85 | 9-16-85 | 9-16-85 | 9-16-85 |
| Determination: mg/L | | | | | |
| Arsenic, dissolved | 0.006 | 0.18 | 0.007 | <0.005 | 0.011 |
| Barium, dissolved | <0.2 | 0.2 | <0.2 | 0.2 | <0.2 |
| Cadmium, dissolved | <0.005 | 0.008 | <0.005 | 0.005 | <0.005 |
| Chromium, dissolved | 0.013 | 0.010 | 0.010 | 0.010 | 0.010 |
| Cyanide | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Fluoride | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Lead, dissolved | <0.005 | 0.005 | 0.009 | <0.005 | <0.005 |
| Mercury, total | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| Nitrate (as N) | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Selenium, dissolved | <0.005 | 0.15 | 0.018 | <0.005 | <0.005 |
| Silver, dissolved | <0.005 | 0.014 | <0.005 | <0.005 | 0.006 |
| Chloride | 88 | 190 | 4 | 70 | 87 |
| Copper, dissolved | 0.007 | 0.032 | 0.020 | 0.008 | 0.008 |
| Iron, dissolved | 0.07 | 1.6 | 0.12 | 0.11 | 0.63 |
| Manganese, dissolved | 0.14 | 0.36 | <0.005 | 0.063 | <0.005 |
| Phenols | <0.002 | 0.002 | 0.005 | <0.002 | 0.005 |
| Sulfate (as $SO_4$) | 87 | 130 | 51 | 120 | <5 |
| TDS (at 180°C) | 570 | 750 | 270 | 540 | 320 |

October 24, 1985


Mr. Joe Sciba
Mobil Oil Corp.

RE: 8752-20647-11
Date Samples Rec'd 9-19-85

REPORT OF ANALYSIS

| ALR Designation<br>Sponsor Designation<br>Determination: mg/L | 8752-20647-11-1<br>209<br>9-16-85 | 8752-20647-11-2<br>211<br>9-16-85 | 8752-20647-11-3<br>212<br>9-16-85 | 8752-20647-11-4<br>213<br>9-16-85 | 8752-20647-11-5<br>214<br>9-16-85 |
|---|---|---|---|---|---|
| Zinc, dissolved | 0.027 | 0.028 | 0.037 | 0.015 | 0.027 |
| pH | 8.4 | 7.9 | 8.7 | 8.0 | 10.3 |
| Aluminum, dissolved | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Boron | 0.2 | 0.2 | 0.3 | 0.2 | 0.3 |
| Cobalt, dissolved | 0.03 | 0.04 | 0.04 | <0.02 | 0.02 |
| Molybdenum, dissolved | 0.20 | 35 | 0.30 | 0.47 | 0.60 |
| Nickel, dissolved | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Conductivity, µmhos/cm | 940 | 1100 | 520 | 1200 | 1100 |
| Sodium, dissolved | 140 | 150 | 120 | 160 | 140 |
| Calcium, dissolved | 52 | 80 | 3.9 | 43 | 2.6 |
| Magnesium, dissolved | 0.82 | 3.2 | 0.23 | 0.75 | <0.05 |
| Potassium, dissolved | 1.2 | 1.5 | 1.1 | 1.2 | 0.8 |
| Carbonate (as $CO_3$) | 6 | <5 | 16 | <5 | 110 |
| Bicarbonate (as $HCO_3$) | 310 | 150 | 220 | 310 | <5 |
| Silica (as $SiO_2$) | 50 | 92 | 22 | 50 | 32 |

October 24, 1985


Mr. Joe Sciba
Mobil Oil Corp.

RE: 8752-20647-11
Date Samples Rec'd 9-19-85

REPORT OF ANALYSIS

| ALR Designation | 8752-20647-11-6 | 8752-20647-11-7 | 8752-20647-11-8 | 8752-20647-11-9 | 8752-20647-11-10 |
|---|---|---|---|---|---|
| Sponsor Designation | 215 | 216 | 217 | 218 | 219 |
| | 9-16-85 | 9-16-85 | 9-16-85 | 9-16-85 | 9-16-85 |
| Determination: mg/L | | | | | |
| Arsenic, dissolved | 0.074 | 0.025 | 0.059 | <0.005 | 0.006 |
| Barium, dissolved | <0.2 | <0.2 | 0.2 | 0.2 | <0.2 |
| Cadmium, dissolved | 0.009 | 0.008 | 0.014 | <0.005 | 0.011 |
| Chromium, dissolved | 0.010 | 0.010 | 0.015 | 0.010 | 0.020 |
| Cyanide | <0.005 | <0.005 | 0.061 | <0.005 | <0.005 |
| Fluoride | 0.6 | <0.5 | 0.5 | <0.5 | 0.5 |
| Lead, dissolved | <0.005 | <0.005 | <0.005 | <0.005 | 0.005 |
| Mercury, total | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| Nitrate (as N) | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Selenium, dissolved | 0.012 | 0.028 | 0.11 | 0.054 | <0.005 |
| Silver, dissolved | <0.005 | <0.005 | 0.005 | <0.005 | <0.005 |
| Chloride | 110 | 210 | 190 | 10 | 180 |
| Copper, dissolved | 0.010 | 0.009 | 0.031 | <0.005 | 0.006 |
| Iron, dissolved | 0.33 | 1.4 | 0.19 | 0.05 | 0.05 |
| Manganese, dissolved | 0.036 | 0.20 | 0.16 | 0.008 | 0.042 |
| Phenols | 0.002 | 0.016 | <0.002 | <0.002 | <0.002 |
| Sulfate (as $SO_4$) | 160 | 72 | 59 | 46 | 120 |
| TDS (at 180°C) | 660 | 640 | 620 | 270 | 700 |

October 24, 1985


Mr. Joe Sciba
Mobil Oil Corp.

RE: 8752-20647-11
Date Samples Rec'd 9-19-85

REPORT OF ANALYSIS

| ALR Designation | 8752-20647-11-6 | 8752-20647-11-7 | 8752-20647-11-8 | 8752-20647-11-9 | 8752-20647-11-10 |
|---|---|---|---|---|---|
| Sponsor Designation | 215 | 216 | 217 | 218 | 219 |
| | 9-16-85 | 9-16-85 | 9-16-85 | 9-16-85 | 9-16-85 |
| Determination: mg/L | | | | | |
| Zinc, dissolved | 0.032 | 0.043 | 0.032 | 0.029 | 0.032 |
| pH | 8.6 | 9.0 | 8.5 | 8.4 | 7.7 |
| Aluminum, dissolved | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Boron | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Cobalt, dissolved | 0.03 | <0.02 | <0.02 | <0.02 | 0.04 |
| Molybdenum, dissolved | 1.1 | 3.7 | 12 | 0.52 | 0.16 |
| Nickel, dissolved | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Conductivity, µmhos/cm | 1200 | 1000 | 1100 | 520 | 1100 |
| Sodium, dissolved | 130 | 180 | 130 | 110 | 140 |
| Calcium, dissolved | 86 | 56 | 92 | 5.5 | 100 |
| Magnesium, dissolved | 0.81 | 2.0 | 0.96 | 0.11 | 2.2 |
| Potassium, dissolved | 1.0 | 1.3 | 1.0 | 0.4 | 1.2 |
| Carbonate (as $CO_3$) | 12 | 12 | 10 | <5 | <5 |
| Bicarbonate (as $HCO_3$) | 220 | 170 | 250 | 250 | 240 |
| Silica (as $SiO_2$) | 59 | 71 | 210 | 18 | 140 |

October 24, 1985


Mr. Joe Sciba
Mobil Oil Corp.

RE: 8752-20647-11
Date Samples Rec'd 9-19-85

REPORT OF ANALYSIS

| | |
|---|---|
| ALR Designation | 8752-20647-11-11 |
| Sponsor Designation | 220 |
| | 9-16-85 |
| Determination: mg/L | |
| Arsenic, dissolved | 0.024 |
| Barium, dissolved | <0.2 |
| Cadmium, dissolved | <0.005 |
| Chromium, dissolved | 0.014 |
| Cyanide | <0.005 |
| Fluoride | <0.5 |
| Lead, dissolved | 0.017 |
| Mercury, total | 0.0001 |
| Nitrate (as N) | <0.05 |
| Selenium, dissolved | 0.009 |
| Silver, dissolved | <0.005 |
| Chloride | 31 |
| Copper, dissolved | <0.005 |
| Iron, dissolved | 0.08 |
| Manganese, dissolved | <0.005 |
| Phenols | 0.003 |
| Sulfate (as $SO_4$) | 89 |
| TDS (at 180°C) | 350 |

October 24, 1985


Mr. Joe Sciba
Mobil Oil Corp.

RE: 8752-20647-11
Date Samples Rec'd 9-19-85

REPORT OF ANALYSIS

| | |
|---|---|
| ALR Designation | 8752-20647-11-11 |
| Sponsor Designation | 220 |
| | 9-16-85 |
| Determination: mg/L | |
| Zinc, dissolved | 0.029 |
| pH | 8.2 |
| Aluminum, dissolved | <0.5 |
| Boron | 0.2 |
| Cobalt, dissolved | 0.02 |
| Molybdenum, dissolved | 7.7 |
| Nickel, dissolved | <0.02 |
| Conductivity, µmhos/cm | 640 |
| Sodium, dissolved | 140 |
| Calcium, dissolved | 6.7 |
| Magnesium, dissolved | 0.18 |
| Potassium, dissolved | 0.7 |
| Carbonate (as $CO_3$) | <5 |
| Bicarbonate (as $HCO_3$) | 220 |
| Silica (as $SiO_2$) | 25 |

These samples are scheduled to be disposed of 30 days after the date of this report.

Mary Labisiak for cc
Cathy Cairns
Water Laboratory
Supervisor

CC/dh dh
cc: John Kauffman

**Accu-Labs Research, Inc.**
11485 W. 48th Avenue Wheat Ridge, Colorado 80033
(303) 423-2766

November 5, 1985
Page 1 of 1

Mr. Joe Sciba
Mobil Oil Corp.
P.O. Drawer F
Crownpoint, NM 87313

RE: 8752-20717-2
Date Samples Rec'd 9-30-85

REPORT OF ANALYSIS

| ALR Designation<br>Sponsor Designation | 8752-20717-2-1<br>208<br>9-23-85 | 8752-20717-2-2<br>210<br>9-23-85 |
|---|---|---|
| Determination: pCi/L | | |
| Uranium (as U), dissolved, mg/L | 0.12 | 0.10 |
| Radium-226, dissolved, ± counting error* | 90 ± 4 | 1.7 ± 0.8 |
| Radium-228, dissolved, ± counting error* | 0.4 ± 1.7 | 1.4 ± 1.5 |
| Combined Ra-226 and Ra-228, ± counting error* | 90 ± 4 | 3.1 ± 1.7 |
| Gross Alpha, dissolved, ± counting error* | 250 ± 30 | 150 ± 20 |
| Gross Beta, dissolved, ± counting error* | 84 ± 8 | 39 ± 4 |
| Lead-210, dissolved, ± counting error* | 17 ± 2 | 9 ± 2 |
| Thorium-230, dissolved, ± counting error* | 0.0 ± 0.1 | 0.1 ± 0.1 |

*Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96σ.
These samples are scheduled to be disposed of 45 days after the date of this report.

Bud Summers
Radiochemistry
Supervisor

BS/dh dh

# Accu-Labs Research, Inc.
11485 W. 48th Avenue Wheat Ridge, Colorado 80033
(303) 423-2766


October 25, 1985


Mr. Joe Sciba
Mobil Oil Corp.
P.O. Drawer F
Crownpoint, NM 87313

RE: 8752-20647-11
Date Samples Rec'd 9-19-85

REPORT OF ANALYSIS

| ALR Designation | 8752-20647-11-1 | 8752-20647-11-2 | 8752-20647-11-3 | 8752-20647-11-4 | 8752-20647-11-5 |
|---|---|---|---|---|---|
| Sponsor Designation | 209 | 211 | 212 | 213 | 214 |
| | 9-16-85 | 9-16-85 | 9-16-85 | 9-16-85 | 9-16-85 |
| Determination: pCi/L | | | | | |
| Uranium (as U), dissolved, mg/L | 0.18 | 0.36 | 0.55 | 0.36 | 0.044 |
| Combined Ra-226 and Ra-228, ± counting error* | 55 ± 3 | 87 ± 12 | 4.5 ± 1.2 | 32 ± 2 | 1.8 ± 1.1 |
| Radium-226, dissolved, ± counting error* | 54 ± 3 | 85 ± 12 | 3.6 ± 0.8 | 32 ± 2 | 1.2 ± 0.5 |
| Radium-228, dissolved, ± counting error* | 1.0 ± 0.9 | 1.7 ± 1.2 | 0.9 ± 0.9 | 0.5 ± 0.8 | 0.6 ± 1.0 |
| Gross Alpha, dissolved, ± counting error* | 350 ± 30 | 770 ± 40 | 770 ± 30 | 540 ± 30 | 68 ± 10 |
| Gross Beta, dissolved, ± counting error* | 130 ± 10 | 250 ± 10 | 160 ± 10 | 130 ± 10 | 20 ± 4 |
| Lead-210, dissolved, ± counting error* | 27 ± 4 | 38 ± 4 | -0.5 ± 2.8 | 0.9 ± 3.0 | 0.7 ± 2.5 |
| Thorium-230, dissolved, ± counting error* | -0.3 ± 0.4 | 0.0 ± 0.1 | 0.1 ± 0.1 | 0.0 ± 0.1 | 0.0 ± 0.1 |

October 25, 1985


Mr. Joe Sciba
Mobil Oil Corp.

RE: 8752-20647-11
Date Samples Rec'd 9-19-85

REPORT OF ANALYSIS

| ALR Designation<br>Sponsor Designation | 8752-20647-11-6<br>215<br>9-16-85 | 8752-20647-11-7<br>216<br>9-16-85 | 8752-20647-11-8<br>217<br>9-16-85 | 8752-20647-11-9<br>218<br>9-16-85 | 8752-20647-11-10<br>219<br>9-16-85 |
|---|---|---|---|---|---|
| Determination: pCi/L | | | | | |
| Uranium (as U), dissolved, mg/L | 0.57 | 0.36 | 0.20 | 0.33 | 0.29 |
| Combined Ra-226 and Ra-228, ± counting error* | 68 ± 3 | 26 ± 9 | 58 ± 4 | 5.5 ± 1.3 | 38 ± 3 |
| Radium-226, dissolved, ± counting error* | 66 ± 3 | 26 ± 9 | 56 ± 4 | 5.4 ± 1.0 | 38 ± 3 |
| Radium-228, dissolved, ± counting error* | 1.9 ± 0.8 | -0.1 ± 1.0 | 1.8 ± 1.0 | 0.1 ± 0.8 | 0.1 ± 0.8 |
| Gross Alpha, dissolved, ± counting error* | 740 ± 40 | 530 ± 30 | 490 ± 30 | 450 ± 20 | 350 ± 30 |
| Gross Beta, dissolved, ± counting error* | 260 ± 10 | 130 ± 10 | 130 ± 10 | 100 ± 10 | 100 ± 10 |
| Lead-210, dissolved, ± counting error* | 20 ± 4 | 9.6 ± 3.2 | 4.3 ± 3.2 | 16 ± 3 | 12 ± 4 |
| Thorium-230, dissolved, ± counting error* | 0.3 ± 0.1 | 0.0 ± 0.1 | 0.1 ± 0.1 | 0.9 ± 0.3 | 0.4 ± 0.2 |

Mr. Joe Sciba
Mobil Oil Corp.

RE: 8752-20647-11
Date Samples Rec'd 9-19-85

REPORT OF ANALYSIS

| | |
|---|---|
| ALR Designation | 8752-20647-11-11 |
| Sponsor Designation | 220 |
| | 9-16-85 |
| Determination: pCi/L | |
| Uranium (as U), dissolved, mg/L | 0.20 |
| Combined Ra-226 and Ra-228, ± counting error* | 17 ± 2 |
| Radium-226, dissolved, ± counting error* | 16 ± 2 |
| Radium-228, dissolved, ± counting error* | 0.9 ± 0.9 |
| Gross Alpha, dissolved, ± counting error* | 600 ± 30 |
| Gross Beta, dissolved, ± counting error* | 250 ± 10 |
| Lead-210, dissolved, ± counting error* | 140 ± 10 |
| Thorium-230, dissolved, ± counting error* | 20 ± 2 |

*Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96σ.
These samples are scheduled to be disposed of 45 days after the date of this report.

Bud Summers
Radiochemistry
Supervisor

BS/dh dh
cc: John Kauffman

ATTACHMENT 7

PRODUCTION STREAM SAMPLES - RADIOMETRICS

| Date Sampled | Gross Alpha pCi/l | Gross Beta pCi/l | Ra-226 Dissolved pCi/l | Ra-228 Dissolved pCi/l |
|---|---|---|---|---|
| 10/08/80 | 88,000 ± 700 | 57,200 ± 1,300 | 200 ± 30 | 5.8 ± 1.5 |
| 10/28/80 | 52,500 ± 800 | 31,800 ± 500 | 49 ± 7 | 0.5 ± 1.4 |
| 11/18/80 | 48,700 ± 1,000 | 31,100 ± 300 | 140 ± 10 | 1.8 ± 0.8 |
| 12/03/80 | 39,100 ± 900 | 32,100 ± 600 | 68 ± 12 | 1.2 ± 1.0 |
| 01/29/81 | 8,700 ± 200 | 4,200 ± 100 | 52 ± 7 | 2.1 ± 1.4 |
| 02/04/81 | 7,800 ± 200 | 2,700 ± 100 | 38 ± 6 | 0.5 ± 3.8 |
| 05/06/81 | 5,300 ± 100 | 1,300 ± 100 | 46 ± 6 | 0.7 ± 1.4 |
| 07/15/82 | 386 ± 30 | 149 ± 10 | 26 ± 3 | 0.7 ± 1.4 |
| 09/04/84 | 510 ± 30 | 120 ± 10 | 34 ± 3 | 0.4 ± 0.7 |
| 09/16/85 | 470 ± 30 | 140 ± 10 | 37 ± 4 | 0.9 ± 1.0 |
| % Reduction in Activity Level | 99% | 99% | 82% | 84% |

DGG 12/85
jrh:212

40-8911





# Mobil Mining And Minerals Company

P.O. BOX 17027
DENVER, COLORADO 80217

A DIVISION OF
MOBIL OIL CORPORATION

November 14, 1986



Mr. Gary Konwinski
Project Manager
U. S. Nuclear Regulatory Commission
Region IV
P. O. Box 25325
Denver, Colorado 80225

MOBIL PILOT IN-SITU LEACH
URANIUM PROJECT, CROWNPOINT, NM

Dear Mr. Konwinski:

In accordance with the provisions and stipulations to the Interim Mining and Reclamation Plan for the Pilot testing of in-situ uranium leaching near Crownpoint, New Mexico, please be advised that Mobil herein declares that restoration of the mining zone is complete. All water quality parameters are returned to a level consistent with the prescribed restoration standards.

As support for our restoration declaration, attached are:

- Current water quality based on samples taken during September, 1986 (Attachment 1).
- Historical annual water quality prior to development (Attachment 2) and through production and restoration (Attachment 3).
- A production and restoration history of the project (Attachment 4).

To demonstrate the completeness of restoration, Mobil proposes to enter a nine (9) month "stability period". During this period samples will be taken monthly in accordance with Appendix "A".

Mobil proposes to begin the "stability period" during November, 1986. Please contact me if you need any additional information and to select a mutually agreeable ~~date to obtain~~ the initial samples.

Very truly yours,

J. F. Cullen
Manager Technical Services



JFC:sdm:29

cc: Kevin Lambert
John Andrews

87-111

# Mobil Mining And Minerals Company

P.O. BOX [illegible]
DENVER COLORADO [illegible]

A DIVISION OF
MOBIL OIL CORPORATION

November 14, 1986

Mr. Kevin Lambert
Environmental Improvement Division
Grandwater and Hazardous Waste Bureau
P. O.. Box 968, Crcwn Building
Santa Fe, New Mexico 87504-0968

MOBIL PILOT IN-SITU LEACH
URANIUM PROJECT, CROWNPOINT, NM

Dear Mr. Lambert:

In accordance with the provisions and stipulations to the Interim Mining and Reclamation Plan for the Pilot testing of in-situ uranium leaching near Crownpoint, New Mexico, please be advised that Mobil herein declares that restoration of the mining zone is complete. All water quality parameters are returned to a level consistent with the prescribed restoration standards.

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To demonstrate the completeness of restoration, Mobil proposes to enter a nine (9) month "stability period". During this period samples will be taken monthly in accordance with Appendix "A".

Mobil proposes to begin the "stability period" during November, 1986. Please contact me if you need any additional information.

Very truly yours,

J. F. Cullen
Manager Technical Services

JFC:sdm.28

cc: Gary Konwinski
John Andrews

# Mobil Mining And Minerals Company

P.O. BOX [illegible]
DENVER, COLORADO [illegible]

A DIVISION OF
MOBIL OIL CORPORATION

November 14, 1986

Mr. John M. Andrews, Jr.
U. S. Department Interior
Geological Survey Conservation Div.
P. O. Box 26124
Albuquerque, NM 87125

MOBIL PILOT IN-SITU LEACH
URANIUM PROJECT, CROWNPOINT, NM

Dear Mr. Andrews:

In accordance with the provisions and stipulations to the Interim Mining and Reclamation Plan for the Pilot testing of in-situ uranium leaching near Crownpoint, New Mexico, please be advised that Mobil herein declares that restoration of the mining zone is complete. All water quality parameters are returned to a level consistent with the prescribed restoration standards.

As support for our restoration declaration, attached are:

- Current water quality based on samples taken during September, 1986 (Attachment 1).
- Historical annual water quality prior to development (Attachment 2) and through production and restoration (Attachment 3).
- A production and restoration history of the project (Attachment 4).

To demonstrate the completeness of restoration, Mobil proposes to enter a nine (9) month "stability period". During this period samples will be taken monthly in accordance with Appendix "A".

Mobil proposes to begin the "stability period" during November, 1986. Please contact me if you need any additional information.

Very truly yours,

J. F. Cullen
Manager Technical Services

JFC:sdm:30

cc: Kevin Lambert
Gary Konwinski

ATTACHMENT 1

Current Water Quality - Crownpoint Section 9 Wellfield
September 1986

| Chemical Constituent | New Mexico Standard mg/liter | Restoration Standard mg/liter | 1986 Average mg/liter |
|---|---|---|---|
| Aluminum, dissolved | 5.0 | 5.0 | 0.808 |
| Arsenic | 0.1 | 0.1 | 0.014 |
| Barium | 1.0 | 1.0 | 0.277 |
| Boron | 0.75 | 0.75 | 0.238 |
| Cadmium | 0.01 | 0.036 | 0.006 |
| Chloride | 250.0 | 250.0 | 54.538 |
| Chromium | 0.05 | 0.074 | 0.005 |
| Cobalt, dissolved | 0.05 | 0.05 | 0.021 |
| Copper, dissolved | 1.0 | 1.0 | 0.008 |
| Cyanide | 0.2 | 0.780 | <0.005 |
| Fluoride | 1.6 | 1.6 | <0.5 |
| Iron, dissolved | 1.0 | 5.50 | 0.146 |
| Lead, dissolved | 0.05 | 0.063 | 0.016 |
| Manganese, dissolved | 0.2 | 0.456 | 0.035 |
| Molybdenum, dissolved | 1.0 | 1.0 | 1.118 |
| Mercury, total | 0.002 | 0.002 | 0.0003 |
| Nickel, dissolved | 0.2 | 0.2 | 0.022 |
| Nitrate (as N) | 10.0 | 10.0 | 0.556 |
| PH | 6 to 9 | 6 to 9 | 9.062 |
| Phenols | 0.005 | 0.047 | 0.008 |
| Combined Ra-226 & 228 | 30.0 | 97.2 | 59.939 |
| Selenium, dissolved | 0.05 | 0.05 | 0.006 |
| Silver, dissolved | 0.05 | 0.05 | <0.005 |
| Sulfate (as S04) | 600.0 | 600.0 | 47.615 |
| TDS (at 180 C) | 1000.0 | 1000.0 | 356.154 |
| Uranium (as U) | 5.0 | 5.0 | 0.319 |
| Zinc, dissolved | 10.0 | 10.0 | 0.039 |

gjl15

**Accu-Labs Research, Inc.**
11485 W. 48th Avenue Wheat Ridge, Colorado 80033
(303) 423-2766

October 24, 1986


Mr. Joe Sciba
Mobil Oil Corporation
P.O. Drawer F
Crownpoint, NM 87313

RE: 8752-22793-8
Date Samples Rec'd 9-25-86

REPORT OF ANALYSIS

| ALR Designation<br>Sponsor Designation<br>Determination: mg/L | 8752-22793-8-1<br>208<br>9-22-86 | 8752-22793-8-2<br>209<br>9-22-86 | 8752-22793-8-3<br>210<br>9-22-86 | 8752-22793-8-4<br>211<br>9-22-86 | 8752-22793-8-5<br>212<br>9-22-86 |
|---|---|---|---|---|---|
| Arsenic, dissolved | <0.005 | 0.007 | 0.009 | 0.025 | 0.005 |
| Barium, dissolved | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 |
| Cadmium, dissolved | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Chromium, dissolved | 0.007 | <0.005 | <0.005 | <0.005 | <0.005 |
| Cyanide | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Fluoride | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Lead, dissolved | 0.011 | 0.10 | <0.005 | <0.005 | 0.005 |
| Mercury, total | 0.0002 | 0.0015 | 0.0002 | 0.0002 | <0.0001 |
| Nitrate (as N) | 0.14 | <0.05 | <0.05 | 0.07 | 0.09 |
| Selenium, dissolved | 0.008 | 0.011 | <0.005 | <0.005 | 0.005 |
| Silver, dissolved | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Chloride | 29 | 35 | 26 | 110 | 12 |
| Copper, dissolved | 0.01 | 0.042 | 0.005 | <0.005 | <0.005 |
| Iron, dissolved | 0.10 | 0.26 | 0.02 | <0.02 | <0.02 |
| Manganese, dissolved | 0.015 | 0.029 | 0.020 | 0.16 | 0.010 |
| Phenols | 0.016 | 0.005 | 0.004 | 0.018 | 0.008 |
| Sulfate (as $SO_4$) | 44 | 70 | 31 | 44 | 51 |
| TDS (at 180°C) | 310 | 360 | 280 | 420 | 300 |

Mr. Joe Sciba
Mobil Oil Corporation

RE: 8752-22793-8
Date Samples Rec'd 9-25-86

REPORT OF ANALYSIS

| ALR Designation | 8752-22793-8-1 | 8752-22793-8-2 | 8752-22793-8-3 | 8752-22793-8-4 | 8752-22793-8-5 |
|---|---|---|---|---|---|
| Sponsor Designation | 208 | 209 | 210 | 211 | 212 |
| | 9-22-86 | 9-22-86 | 9-22-86 | 9-22-86 | 9-22-86 |
| Determination: mg/L | | | | | |
| Zinc, dissolved | 0.038 | 0.21 | 0.012 | 0.011 | 0.013 |
| pH | 9.1 | 8.7 | 9.1 | 8.7 | 10 |
| Aluminum, dissolved | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Boron | 0.1 | 0.1 | 0.2 | 0.6 | 0.5 |
| Cobalt, dissolved | 0.02 | 0.02 | 0.03 | <0.02 | <0.02 |
| Molybdenum, dissolved | 1.4 | 2.7 | 0.67 | 1.5 | 0.56 |
| Nickel, dissolved | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Conductivity, µmhos/cm | 550 | 610 | 520 | 770 | 560 |
| Sodium, dissolved | 120 | 120 | 110 | 120 | 110 |
| Calcium, dissolved | 6.3 | 5.7 | 2.5 | 26 | 3.0 |
| Magnesium, dissolved | 0.12 | 0.17 | 0.09 | 0.81 | <0.05 |
| Potassium, dissolved | 0.9 | 0.8 | 0.7 | 1.4 | 1.3 |
| Carbonate (as $CO_3$) | 6 | 12 | 18 | 12 | 87 |
| Bicarbonate (as $HCO_3$) | 210 | 190 | 200 | 170 | 86 |
| Silica (as $SiO_2$) | 28 | 29 | 14 | 22 | 27 |

Mr. Joe Sciba
Mobil Oil Corporation

RE: 8752-22793-8
Date Samples Rec'd 9-25-86

REPORT OF ANALYSIS

| ALR Designation | 8752-22793-8-6 | 8752-22793-8-7 | 8752-22793-8-8 |
|---|---|---|---|
| Sponsor Designation | 215 | 216 | 220 |
| | 9-22-86 | 9-22-86 | 9-22-86 |
| Determination: mg/L | | | |
| Arsenic, dissolved | 0.040 | 0.030 | 0.028 |
| Barium, dissolved | 0.3 | 0.4 | <0.2 |
| Cadmium, dissolved | <0.005 | 0.006 | <0.005 |
| Chromium, dissolved | <0.005 | <0.005 | <0.005 |
| Cyanide | <0.005 | <0.005 | <0.005 |
| Fluoride | <0.5 | <0.5 | <0.5 |
| Lead, dissolved | 0.005 | <0.005 | <0.005 |
| Mercury, total | <0.0001 | <0.0001 | <0.0001 |
| Nitrate (as N) | 0.62 | 4.0 | <0.05 |
| Selenium, dissolved | <0.005 | <0.005 | <0.005 |
| Silver, dissolved | <0.005 | <0.005 | <0.005 |
| Chloride | 78 | 88 | 61 |
| Copper, dissolved | 0.005 | <0.005 | <0.005 |
| Iron, dissolved | 0.10 | <0.02 | 0.02 |
| Manganese, dissolved | 0.048 | 0.035 | 0.026 |
| Phenols | 0.005 | 0.015 | 0.006 |
| Sulfate (as $SO_4$) | 46 | 45 | 48 |
| TDS (at 180°C) | 370 | 380 | 260 |

Mr. Joe Sciba
Mobil Oil Corporation

RE: 8752-22793-8
Date Samples Rec'd 9-25-86

REPORT OF ANALYSIS

| ALR Designation | 8752-22793-8-6 | 8752-22793-8-7 | 8752-22793-8-8 |
|---|---|---|---|
| Sponsor Designation | 215 | 216 | 220 |
| Determination: mg/L | 9-22-86 | 9-22-86 | 9-22-86 |
| Zinc, dissolved | 0.016 | 0.013 | 0.013 |
| pH | 9.1 | 8.0 | 8.7 |
| Aluminum, dissolved | <0.5 | <0.5 | <0.5 |
| Boron | 0.2 | 0.2 | 0.1 |
| Cobalt, dissolved | <0.02 | <0.02 | <0.02 |
| Molybdenum, dissolved | 1.4 | 0.59 | 0.55 |
| Nickel, dissolved | 0.02 | 0.04 | <0.02 |
| Conductivity, µmhos/cm | 630 | 680 | 530 |
| Sodium, dissolved | 100 | 100 | 92 |
| Calcium, dissolved | 21 | 23 | 11 |
| Magnesium, dissolved | 0.44 | 0.37 | 0.31 |
| Potassium, dissolved | 1.2 | 2.8 | 0.7 |
| Carbonate (as $CO_3$) | 18 | <5 | 12 |
| Bicarbonate (as $HCO_3$) | 140 | 160 | 140 |
| Silica (as $SiO_2$) | 28 | 23 | 16 |

These samples are scheduled to be discarded 30 days after the date of this report.

Cathy Cairns Shugarts
Cathy Cairns Shugarts
Water Laboratory
Supervisor

CCS/dh

# Accu-Labs Research, Inc.
11485 W. 48th Avenue Wheat Ridge, Colorado 80033
(303) 423-2766


October 24, 1986


Mr. Joe Sciba
Mobil Oil Corporation
P.O. Drawer F
Crownpoint, NM 87313

RE: 8752-22863-5
Date Samples Rec'd 10-6-86

REPORT OF ANALYSIS

| ALR Designation | 8752-22863-5-1 | 8752-22863-5-2 | 8752-22863-5-3 | 8752-22863-5-4 | 8752-22863-5-5 |
|---|---|---|---|---|---|
| Sponsor Designation | 213 | 214 | 217 | 218 | 219 |
| | 9-30-86 | 9-30-86 | 9-30-86 | 9-30-86 | 9-30-86 |
| Determination: mg/L | | | | | |
| Aluminum, dissolved | <0.5 | <0.5 | <0.5 | <0.5 | 4.5 |
| Arsenic, dissolved | <0.005 | <0.005 | <0.005 | 0.015 | 0.008 |
| Barium, dissolved | <0.2 | <0.2 | <0.2 | <0.2 | 0.9 |
| Bicarbonate (as $HCO_3$) | 170 | 160 | 93 | 180 | 190 |
| Boron | 0.2 | 0.2 | 0.2 | 0.3 | 0.2 |
| Cadmium, dissolved | 0.009 | <0.005 | 0.006 | 0.007 | <0.005 |
| Calcium, dissolved | 5.7 | 2.4 | 8.5 | 2.2 | 18 |
| Carbonate (as $CO_3$) | 18 | 31 | 37 | 25 | 18 |
| Chloride | 40 | 38 | 88 | 25 | 79 |
| Chromium, dissolved | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Cobalt, dissolved | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Conductivity, µmhos/cm | 550 | 590 | 610 | 520 | 800 |
| Copper, dissolved | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Cyanide | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Fluoride | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Iron, dissolved | 0.12 | 0.07 | 0.03 | <0.02 | 1.1 |
| Lead, dissolved | <0.005 | <0.005 | <0.005 | <0.005 | 0.043 |
| Magnesium, dissolved | 0.11 | <0.05 | 0.14 | 0.06 | 0.47 |

Mr. Joe Sciba
Mobil Oil Corporation

RE: 8752-22863-5
Date Samples Rec'd 10-6-86

REPORT OF ANALYSIS

| ALR Designation | 8752-22863-5-1 | 8752-22863-5-2 | 8752-22863-5-3 | 8752-22863-5-4 | 8752-22863-5-5 |
|---|---|---|---|---|---|
| Sponsor Designation | 213 9-30-86 | 214 9-30-86 | 217 9-30-86 | 218 9-30-86 | 219 9-30-86 |
| Determination: mg/L | | | | | |
| Manganese, dissolved | 0.016 | <0.005 | <0.005 | <0.005 | 0.076 |
| Mercury, total | 0.0002 | <0.0001 | <0.0001 | <0.0001 | 0.0012 |
| Molybdenum, total | 0.98 | 0.67 | 1.1 | 0.92 | 1.5 |
| Nickel, total | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Nitrate/Nitrite (as N) | 0.86 | <0.05 | 1.1 | <0.05 | 0.10 |
| pH | 9.1 | 9.8 | 9.6 | 9.1 | 8.8 |
| Phenols | <0.002 | <0.002 | 0.010 | 0.003 | 0.007 |
| Potassium, dissolved | 0.7 | 0.8 | 0.7 | 0.4 | 0.9 |
| Selenium, dissolved | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Silica (as $SiO_2$) | 22 | 19 | 25 | 18 | 38 |
| Silver, dissolved | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Sodium, dissolved | 110 | 140 | 110 | 120 | 140 |
| TDS (at 180°C) | 320 | 350 | 360 | 340 | 580 |
| Sulfate (as $SO_4$) | 33 | 55 | 19 | 33 | 100 |
| Zinc, dissolved | 0.015 | 0.013 | 0.012 | 0.017 | 0.13 |

These samples are scheduled to be discarded 30 days after the date of this report.

Cathy Cairns Shugarts
Cathy Cairns Shugarts
Water Laboratory
Supervisor

CCS/dh

Accu-Labs Research, Inc.
11485 W. 48th Avenue Wheat Ridge, Colorado 80033
(303) 423-2766

October 3, 1986

Mr. Joe Sciba
Mobil Oil Corporation
P.O. Drawer F
Crownpoint, NM 87313

RE: 8752-22831-3
Date Samples Rec'd 10-1-86

REPORT OF ANALYSIS

| ALR Designation<br>Sponsor Designation | 8752-22831-3-1<br>Well 214<br>9-30-86 | 8752-22831-3-2<br>Well 218<br>9-29-86 | 8752-22831-3-3<br>Well 219<br>9-30-86 |
|---|---|---|---|
| Determination: pCi/L | | | |
| Radon-222,<br>± counting error* | 10 ± 5 | 11 ± 6 | 120 ± 10 |

*Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96σ.
These samples are scheduled to be disposed of 45 days after the date of this report.

Bud Summers
Radiochemistry
Supervisor

BS/dh

# Accu-Labs Research, Inc.
11485 W. 48th Avenue Wheat Ridge, Colorado 80033
(303) 423-2766


September 29, 1986


Mr. Joe Sciba
Mobil Oil Corporation
P.O. Drawer F
Crownpoint, NM 87313

RE: 8752-22783-5
Date Samples Rec'd 9-24-86

REPORT OF ANALYSIS

| ALR Designation<br>Sponsor Designation | 8752-22783-5-1<br>Well 213<br>9-23-86 | 8752-22783-5-2<br>Well 215<br>9-22-86 | 8752-22783-5-3<br>Well 216<br>9-22-86 | 8752-22783-5-4<br>Well 217<br>9-22-86 | 8752-22783-5-5<br>Well 220<br>9-22-86 |
|---|---|---|---|---|---|
| Determination: pCi/L | | | | | |
| Radon-222,<br>± counting error | 410 ± 20 | 1400 ± 100 | 850 ± 30 | 1700 ± 100 | 62 ± 9 |

*Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96σ.
These samples are scheduled to be disposed of 45 days after the date of this report.

Bud Summers
Radiochemistry Supervisor

BS/ch

# Accu-Labs Research, Inc.
11485 W. 48th Avenue Wheat Ridge, Colorado 80033
(303) 423-2766


September 22, 1986
Page 1 of 1

Mr. Joe Sciba
Mobil Oil Corporation
P.O. Drawer F
Crownpoint, NM 87313

RE: 8752-22757-2
Date Samples Rec'd 9-19-86

REPORT OF ANALYSIS

| | | |
|---|---|---|
| ALR Designation | 8752-22757-2-1 | 8752-22757-2-2 |
| Sponsor Designation | No. 211 | No. 212 |
| | 9-18-86 | 9-18-86 |
| Determination: pCi/L | | |
| Radon-222, ± counting error* | 28 ± 6 | 10 ± 5 |

*Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96σ.
These samples are scheduled to be disposed of 45 days after the date of this report.

Bud Summers
Radiochemistry
Supervisor

BS/dh

YEARLY 1986 SEPT.

# Accu-Labs Research, Inc.

11485 W. 48th Avenue Wheat Ridge, Colorado 80033
(303) 423-2766

September 22, 1986


Mr. Joe Sciba
Mobil Oil Corporation
P.O. Drawer F
Crownpoint, NM 87313

RE: 8752-22748-3
Date Samples Rec'd 9-18-86

REPORT OF ANALYSIS

| ALR Designation<br>Sponsor Designation | 8752-22748-3-1<br>Well 208 | 8752-22748-3-2<br>Well 209 | 8752-22748-3-3<br>Well 210 |
|---|---|---|---|
| Determination: pCi/L | | | |
| Radon-222,<br>± counting error* | 440 ± 30 | 13,000 ± 1000 | 140 ± 20 |

*Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96σ.
These samples are scheduled to be disposed of 45 days after the date of this report.

Bud Summers
Radiochemistry
Supervisor

BS/dh
dh

# Accu-Labs Research, Inc.
11485 W. 48th Avenue Wheat Ridge, Colorado 80033
(303) 423-2766


November 13, 1986


Mr. Joe Sciba
Mobil Oil Corporation
P.O. Drawer F
Crownpoint, NM 87313

RE: 8752-22793-8
Date Samples Rec'd 9-25-86

REPORT OF ANALYSIS

| ALR Designation<br>Sponsor Designation<br><br>Determination: pCi/L | 8752-22793-8-1<br>208<br>9-22-86 | 8752-22793-8-2<br>209<br>9-22-86 | 8752-22793-8-3<br>210<br>9-22-86 | 8752-22793-8-4<br>211<br>9-22-86 | 8752-22793-8-5<br>212<br>9-22-86 |
|---|---|---|---|---|---|
| Gross Alpha, dissolved, ± counting error* | 310 ± 20 | 2200 ± 100 | 49 ± 8 | 84 ± 12 | 28 ± 7 |
| Gross Beta, dissolved, ± counting error* | 140 ± 10 | 1000 ± 100 | 10 ± 5 | 16 ± 10 | 17 ± 5 |
| Lead-210, dissolved, ± counting error* | 47 ± 3 | 770 ± 10 | 3.1 ± 1.6 | 2.4 ± 1.6 | -0.2 ± 1.5 |
| Radium-226, dissolved, ± counting error* | 11 ± 2 | 120 ± 10 | 4.3 ± 1.2 | 34 ± 3 | 0.6 ± 0.4 |
| Radium-228, dissolved, ± counting error* | 0.9 ± 0.9 | 0.0 ± 1.4 | -0.3 ± 0.8 | 0.2 ± 1.1 | 0.3 ± 1.0 |
| Combined Radium-226 and Radium-228, ± counting error* | 12 ± 2 | 120 ± 10 | 4.0 ± 1.4 | 34 ± 3 | 0.9 ± 1.1 |
| Thorium-230, ± counting error* | 5.9 ± 1.4 | 72 ± 2 | 0.0 ± 0.1 | 0.0 ± 0.1 | 0.2 ± 0.2 |
| Uranium (as U), dissolved, mg/L | 0.28 | 0.68 | 0.034 | 0.037 | 0.033 |

Mr. Joe Sciba
Mobil Oil Corporation

RE: 8752-22793-8
Date Samples Rec'd 9-25-86

REPORT OF ANALYSIS

| ALR Designation<br>Sponsor Designation<br>Determination: pCi/L | 8752-22793-8-6<br>215<br>9-22-86 | 8752-22793-8-7<br>216<br>9-22-86 | 8752-22793-8-8<br>220<br>9-22-86 |
|---|---|---|---|
| Gross Alpha, dissolved, ± counting error* | 700 ± 30 | 160 ± 20 | 210 ± 20 |
| Gross Beta, dissolved, ± counting error* | 260 ± 10 | 53 ± 7 | 34 ± 6 |
| Lead-210, dissolved, ± counting error* | 30 ± 2 | 11 ± 2 | 2.0 ± 1.5 |
| Radium-226, dissolved, ± counting error* | 58 ± 3 | 47 ± 4 | 26 ± 3 |
| Radium-228, dissolved, ± counting error* | 1.3 ± 0.8 | 1.1 ± 0.9 | 0.3 ± 0.9 |
| Combined Radium-226 and Radium-228, ± counting error* | 59 ± 3 | 48 ± 4 | 26 ± 3 |
| Thorium-230, ± counting error* | 46 ± 2 | 1.4 ± 0.4 | 0.4 ± 0.2 |
| Uranium (as U), dissolved, mg/L | 0.80 | 0.16 | 0.26 |

*Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96σ.
These samples are scheduled to be discarded 45 days after the date of this report.

Bud Summers
Radiochemistry
Supervisor

BS/dh
cc: Jerry Lyons, Mobil

# Accu-Labs Research, Inc.
11485 W. 48th Avenue Wheat Ridge, Colorado 80033
(303) 423-2766


November 14, 1986


Mr. Joe Sciba
Mobil Oil Corporation
P.O. Drawer F
Crownpoint, NM 87313

RE: 8752-22863-5
Date Samples Rec'd 10-6-86

PARTIAL REPORT — REPORT OF ANALYSIS

| ALR Designation<br>Sponsor Designation<br>Determination: pCi/L | 8752-22863-5-1<br>213<br>9-30-86 | 8752-22863-5-2<br>214<br>9-30-86 | 8752-22863-5-3<br>217<br>9-30-86 | 8752-22863-5-4<br>218<br>9-30-86 | 8752-22863-5-5<br>219<br>9-30-86 |
|---|---|---|---|---|---|
| Radium-226, dissolved, ± counting error* | 11 ± 2 | 4.4 ± 1.3 | 7.1 ± 1.6 | 2.2 ± 1.0 | 450 ± 10 |
| Radium-228, dissolved, ± counting error* | 0.5 ± 0.9 | 0.0 ± 0.7 | -0.3 ± 0.6 | -0.1 ± 0.8 | 3.6 ± 1.1 |
| Combined Radium-226 and Radium-228, ± counting error* | 12 ± 2 | 4.4 ± 1.5 | 6.8 ± 1.7 | 2.1 ± 1.3 | 450 ± 10 |
| Uranium (as U), dissolved, mg/L | 0.21 | 0.047 | 0.11 | 0.19 | 1.3 |

Bud Summers
Radiochemistry
Supervisor

BS/dh

OFFICIAL FILE COPY

AUTH. _____ CALL UP _____

☐ TEMP ☐ FILE CAPTION _____

ATTACHMENT 2
Baseline Water Quality
Data, Crownpoint, Section 9

File 1.A.1.2.1

November 10, 1980

Mr. Gerald W. Stewart
Environmental Program Manager
Uranium Licensing Section
Radiation Protection Bureau
P. O. Box 968
Santa Fe, New Mexico 87503

Pilot In Situ Test
Crownpoint, Section 9
Radioactive Material License
NM-MOB-UL-02
Baseline and Restoration Data

Dear Mr. Stewart:

Please find enclosed the final compilation and calculation of baseline and restoration values for all of the ground water sampling and analyses completed prior to initiating injection of leaching fluids at the Crownpoint, Section 9 Pilot In Situ Uranium Test Project. These data are submitted in compliance with Radioactive Material License NM-MOB-UL-02.

As can be seen in reviewing the data, wells 202 through 225 were sampled from five to six times for baseline determination while wells 276 through 280 were sampled three times for baseline determination. The mean, mean plus three standard deviations, maximum value, applicable New Mexico Water Quality Control Commission Standards, and restoration values are tabulated for each parameter for each well or group of wells in accordance with the USGS stipulations. The average value (baseline value) for each parameter for all wells is reported for both the Westwater Canyon and Dakota Aquifers.

If you have any questions, please contact me at (303) 572-2585 or W. A. Steingraber at (303) 572-5764.

Sincerely,

G. A. Cresswell
Hydrological & Environmental
Affairs Manager-Uranium

MAS:gh
Enclosures

OFFICIAL FILE COPY

AUTH. _____ CALL UP _____

☐ TEMP ☐ FILE CAPTION _____

File 1.A.1.2.1

November 10, 1980

Ms. Maxine S. Goad
Program Manager
Ground Water Section
Water Pollution Control Bureau
P. O. Box 968
Santa Fe, New Mexico 87503

Pilot In Situ Test
Crownpoint, Section 9
Discharge Plan DP-26
Baseline and Restoration Data

Dear Ms. Goad:

Please find enclosed the final compilation and calculation of baseline and restoration values for all of the ground water sampling and analyses completed prior to initiating injection of leaching fluids at the Crownpoint, Section 9 Pilot In Situ Uranium Test Project. These data are submitted in compliance with Discharge Plan DP-26.

As can be seen in reviewing the data, wells 202 through 225 were sampled from five to six times for baseline determination while wells 276 through 280 were sampled three times for baseline determination. The mean, mean plus three standard deviations, maximum value, applicable New Mexico Water Quality Control Commission Standards, and restoration values are tabulated for each parameter for each well or group of wells in accordance with the USGS stipulations. The average value (baseline value) for each parameter for all wells is reported for both the Westwater Canyon and Dakota Aquifers.

If you have any questions, please contact me at (303) 572-2585 or W. A. Steingraber at (303) 572-5764.

Sincerely,

G. A. Cresswell
Hydrological & Environmental
Affairs Manager-Uranium

WAS:gh
Enclosures

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

ALUMINUM
mg/l

| WELL NUMBER | AVERAGE | MEAN | MEAN + 3σ | MAXIMUM VALUE | NMWQCC STANDARD | RESTORATION VALUE |
|---|---|---|---|---|---|---|
| 208 | 0.2 | 0.2 | 1.3 | 1.6 | 5.0 | 5.0 |
| 209 | 0.1 | | | | | |
| 210 | 0.3 | | | | | |
| 211 | 0.1 | | | | | |
| 212 | 0.1 | | | | | |
| 213 | 0.2 | | | | | |
| 214 | 0.3 | | | | | |
| 215 | 0.2 | | | | | |
| 216 | 0.4 | | | | | |
| 217 | 0.1 | | | | | |
| 218 | 0.2 | | | | | |
| 219 | 0.1 | | | | | |
| 220 | 0.5 | | | | | |
| 202 | 0.1 | | | | 5.0 | 5.0 |
| 221 | 0.3 | | | | 5.0 | 5.0 |
| 222 | 0.2 | | | | 5.0 | 5.0 |
| 223 | <0.1 | | | | 5.0 | 5.0 |
| 224 | 0.6 | | | | 5.0 | 5.0 |
| 225 | 0.1 | | | | 5.0 | 5.0 |
| 207 | 0.3 | | | | 5.0 | 5.0 |
| 277 | <0.5 | <0.5 | <0.5 | <0.5 | 5.0 | 5.0 |
| 278 | <0.5 | | | | | |
| 279 | <0.5 | | | | | |
| 280 | <0.5 | | | | | |
| 276-A | <0.5 | | | | 5.0 | 5.0 |
| 276-B | <0.5 | | | | 5.0 | 5.0 |

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

ARSENIC
mg/l

| WELL NUMBER | AVERAGE | MEAN | MEAN + 3σ | MAXIMUM VALUE | NMWQCC STANDARD | RESTORATION VALUE |
|---|---|---|---|---|---|---|
| 208 | 0.002 | 0.004 | 0.025 | 0.04 | 0.100 | 0.10 |
| 209 | 0.003 | | | | | |
| 210 | 0.017 | | | | | |
| 211 | 0.003 | | | | | |
| 212 | 0.002 | | | | | |
| 213 | 0.003 | | | | | |
| 214 | 0.003 | | | | | |
| 215 | 0.002 | | | | | |
| 216 | 0.003 | | | | | |
| 217 | 0.005 | | | | | |
| 218 | 0.003 | | | | | |
| 219 | 0.002 | | | | | |
| 220 | 0.004 | | | | | |
| 202 | 0.003 | | | | 0.100 | 0.100 |
| 221 | 0.003 | | | | 0.100 | 0.100 |
| 222 | 0.002 | | | | 0.100 | 0.1 |
| 223 | 0.003 | | | | 0.100 | 0.100 |
| 224 | 0.002 | | | | 0.100 | 0.100 |
| 225 | 0.003 | | | | 0.100 | 0.100 |
| 207 | 0.002 | | | | 0.100 | 0.100 |
| 277 | 0.008 | 0.005 | 0.015 | 0.01 | 0.100 | 0.100 |
| 278 | 0.003 | | | | | |
| 279 | 0.005 | | | | | |
| 280 | 0.003 | | | | | |
| 276-A | 0.002 | | | | 0.100 | 0.100 |
| 276-B | 0.006 | | | | 0.100 | 0.100 |

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

BARIUM
mg/l

| WELL NUMBER | AVERAGE | MEAN | MEAN + 3 $\sigma$ | MAXIMUM VALUE | NMWQCC STANDARD | RESTORATION VALUE |
|---|---|---|---|---|---|---|
| 208 | 0.1 | 0.2 | 0.7 | 0.6 | 1.0 | 1.0 |
| 209 | 0.2 | | | | | |
| 210 | 0.1 | | | | | |
| 211 | 0.3 | | | | | |
| 212 | 0.2 | | | | | |
| 213 | 0.2 | | | | | |
| 214 | 0.1 | | | | | |
| 215 | 0.1 | | | | | |
| 216 | 0.1 | | | | | |
| 217 | 0.2 | | | | | |
| 218 | 0.2 | | | | | |
| 219 | 0.1 | | | | | |
| 220 | 0.1 | | | | | |
| 202 | 0.2 | | | | 1.0 | 1.0 |
| 221 | <0.1 | | | | 1.0 | 1.0 |
| 222 | 0.1 | | | | 1.0 | 1.0 |
| 223 | 0.1 | | | | 1.0 | 1.0 |
| 224 | 0.1 | | | | 1.0 | 1.0 |
| 225 | 0.1 | | | | 1.0 | 1.0 |
| 207 | <0.1 | | | | 1.0 | 1.0 |
| 277 | <0.1 | <0.1 | 0.1 | 0.1 | 1.0 | 1.0 |
| 278 | 0.1 | | | | | |
| 279 | <0.1 | | | | | |
| 280 | <0.1 | | | | | |
| 276-A | 0.1 | | | | 1.0 | 1.0 |
| 276-B | <0.1 | | | | 1.0 | 1.0 |

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

BORON
mg/l

| WELL NUMBER | AVERAGE | MEAN | MEAN + 3σ | MAXIMUM VALUE | NMWQCC STANDARD | RESTORATION VALUE |
|---|---|---|---|---|---|---|
| 208 | 0.1 | 0.1 | 0.5 | 0.4 | 0.75 | 0.75 |
| 209 | 0.1 | | | | | |
| 210 | 0.1 | | | | | |
| 211 | 0.1 | | | | | |
| 212 | 0.1 | | | | | |
| 213 | 0.1 | | | | | |
| 214 | 0.1 | | | | | |
| 215 | 0.1 | | | | | |
| 216 | 0.2 | | | | | |
| 217 | 0.1 | | | | | |
| 218 | 0.1 | | | | | |
| 219 | 0.2 | | | | | |
| 220 | 0.1 | | | | | |
| 202 | 0.2 | | | | 0.75 | 0.75 |
| 221 | 0.2 | | | | 0.75 | 0.75 |
| 222 | 0.2 | | | | 0.75 | 0.75 |
| 223 | 0.1 | | | | 0.75 | 0.75 |
| 224 | 0.1 | | | | 0.75 | 0.75 |
| 225 | 0.1 | | | | 0.75 | 0.75 |
| 207 | 0.3 | | | | 0.75 | 0.75 |
| 277 | 0.1 | 0.1 | 0.1 | 0.1 | 0.75 | 0.75 |
| 278 | 0.1 | | | | | |
| 279 | 0.1 | | | | | |
| 280 | 0.1 | | | | | |
| 276-A | 0.1 | | | | 0.75 | 0.75 |
| 276-B | 0.1 | | | | 0.75 | 0.75 |

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

CADMIUM
mg/l

| WELL NUMBER | AVERAGE | MEAN | MEAN + 3σ | MAXIMUM VALUE | NMWQCC STANDARD | RESTORATION VALUE |
|---|---|---|---|---|---|---|
| 208 | <0.001 | 0.007 | 0.036 | 0.03 | 0.01 | 0.036 |
| 209 | <0.001 | | | | | |
| 210 | 0.005 | | | | | |
| 211 | 0.009 | | | | | |
| 212 | 0.004 | | | | | |
| 213 | 0.007 | | | | | |
| 214 | 0.008 | | | | | |
| 215 | 0.007 | | | | | |
| 216 | 0.011 | | | | | |
| 217 | 0.009 | | | | | |
| 218 | 0.007 | | | | | |
| 219 | 0.011 | | | | | |
| 220 | 0.004 | | | | | |
| 202 | 0.001 | | | | 0.01 | 0.010 |
| 221 | 0.011 | | | | 0.01 | 0.011 |
| 222 | 0.007 | | | | 0.01 | 0.010 |
| 223 | 0.011 | | | | 0.01 | 0.011 |
| 224 | 0.005 | | | | 0.01 | 0.010 |
| 225 | <0.001 | | | | 0.01 | 0.010 |
| | | | | | | 0.010 |
| 207 | 0.001 | | | | 0.01 | |
| 277 | <0.01 | <0.01 | <0.01 | <0.01 | 0.01 | 0.01 |
| 278 | <0.01 | | | | | |
| 279 | <0.01 | | | | | |
| 280 | <0.01 | | | | | |
| 276-A | <0.01 | | | | 0.01 | 0.010 |
| 276-B | <0.01 | | | | 0.01 | 0.010 |

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

CHLORIDE
mg/l

| WELL NUMBER | AVERAGE | MEAN | MEAN + 3σ | MAXIMUM VALUE | NMWQCC STANDARD | RESTORATION VALUE |
|---|---|---|---|---|---|---|
| 208 | 37.2 | 25.3 | 99.8 | 146.0 | 250 | 250.0 |
| 209 | 19.8 | | | | | |
| 210 | 28.0 | | | | | |
| 211 | 31.2 | | | | | |
| 212 | 8.8 | | | | | |
| 213 | 13.9 | | | | | |
| 214 | 20.4 | | | | | |
| 215 | 37.8 | | | | | |
| 216 | 10.2 | | | | | |
| 217 | 47.0 | | | | | |
| 218 | 15.5 | | | | | |
| 219 | 21.0 | | | | | |
| 220 | 30.1 | | | | | |
| 202 | 9.4 | | | | 250 | 250.0 |
| 221 | 8.5 | | | | 250 | 250.0 |
| 222 | 5.6 | | | | 250 | 250.0 |
| 223 | 5.8 | | | | 250 | 250.0 |
| 224 | 26.3 | | | | 250 | 250.0 |
| 225 | 9.2 | | | | 250 | 250.0 |
| 207 | 30.0 | | | | 250 | 250.0 |
| 277 | 6.0 | 7.3 | 11.1 | 9.0 | 250 | 250.0 |
| 278 | 7.0 | | | | | |
| 279 | 7.0 | | | | | |
| 280 | 9.0 | | | | | |
| 276-A | 6.0 | | | | 250 | 250.0 |
| 276-B | 95.3 | | | | 250 | 250.0 |

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

CHROMIUM
mg/l

| WELL NUMBER | AVERAGE | MEAN | MEAN + 3σ | MAXIMUM VALUE | NMWQCC STANDARD | RESTORATION VALUE |
|---|---|---|---|---|---|---|
| 208 | 0.002 | 0.005 | 0.074 | 0.190 | 0.05 | 0.074 |
| 209 | 0.002 | | | | | |
| 210 | 0.002 | | | | | |
| 211 | 0.002 | | | | | |
| 212 | 0.003 | | | | | |
| 213 | 0.003 | | | | | |
| 214 | 0.001 | | | | | |
| 215 | 0.004 | | | | | |
| 216 | 0.002 | | | | | |
| 217 | 0.002 | | | | | |
| 218 | 0.032 | | | | | |
| 219 | 0.002 | | | | | |
| 220 | 0.002 | | | | | |
| 202 | 0.003 | | | | 0.05 | 0.050 |
| 221 | 0.013 | | | | 0.05 | 0.050 |
| 222 | 0.007 | | | | 0.05 | 0.050 |
| 223 | 0.003 | | | | 0.05 | 0.050 |
| 224 | 0.002 | | | | 0.05 | 0.050 |
| 225 | 0.002 | | | | 0.05 | 0.050 |
| 207 | 0.003 | | | | 0.05 | 0.050 |
| 277 | <0.05 | <0.05 | <0.05 | < 0.05 | 0.05 | 0.050 |
| 278 | <0.05 | | | | | |
| 279 | <0.05 | | | | | |
| 280 | <0.05 | | | | | |
| 276-A | <0.05 | | | | 0.05 | 0.050 |
| 276-B | <0.05 | | | | 0.05 | 0.050 |

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

COBALT
mg/l

| WELL NUMBER | AVERAGE | MEAN | MEAN + 3σ | MAXIMUM VALUE | NMWQCC STANDARD | RESTORATION VALUE |
|---|---|---|---|---|---|---|
| 208 | <0.05 | <0.05 | <0.05 | 0.06 | 0.05 | 0.05 |
| 209 | <0.05 | | | | | |
| 210 | <0.05 | | | | | |
| 211 | <0.05 | | | | | |
| 212 | <0.05 | | | | | |
| 213 | <0.05 | | | | | |
| 214 | <0.05 | | | | | |
| 215 | <0.05 | | | | | |
| 216 | <0.05 | | | | | |
| 217 | <0.05 | | | | | |
| 218 | <0.05 | | | | | |
| 219 | <0.05 | | | | | |
| 220 | <0.05 | | | | | |
| 202 | <0.05 | | | | 0.05 | 0.05 |
| 221 | <0.05 | | | | 0.05 | 0.05 |
| 222 | <0.05 | | | | 0.05 | 0.05 |
| 223 | <0.05 | | | | 0.05 | 0.05 |
| 224 | <0.05 | | | | 0.05 | 0.05 |
| 225 | <0.05 | | | | 0.05 | 0.05 |
| 207 | <0.05 | | | | 0.05 | 0.05 |
| 277 | <0.06 | <0.06 | <0.06 | 0.08 | 0.05 | 0.05 |
| 278 | <0.06 | | | | | |
| 279 | <0.06 | | | | | |
| 280 | <0.06 | | | | | |
| 276-A | <0.06 | | | | 0.05 | 0.06 |
| 276-B | <0.06 | | | | 0.05 | 0.06 |

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

COPPER
mg/l

| WELL NUMBER | AVERAGE | MEAN | MEAN + 3$\sigma$ | MAXIMUM VALUE | NMWQCC STANDARD | RESTORATION VALUE |
|---|---|---|---|---|---|---|
| 208 | 0.010 | 0.003 | 0.029 | 0.07 | 1.0 | 1.000 |
| 209 | <0.001 | | | | | |
| 210 | 0.005 | | | | | |
| 211 | <0.05 | | | | | |
| 212 | <0.05 | | | | | |
| 213 | 0.002 | | | | | |
| 214 | 0.001 | | | | | |
| 215 | 0.019 | | | | | |
| 216 | <0.05 | | | | | |
| 217 | <0.001 | | | | | |
| 218 | 0.001 | | | | | |
| 219 | 0.013 | | | | | |
| 220 | 0.002 | | | | | |
| 202 | 0.001 | | | | 1.0 | 1.000 |
| 221 | 0.029 | | | | 1.0 | 1.000 |
| 222 | 0.010 | | | | 1.0 | 1.000 |
| 223 | 0.015 | | | | 1.0 | 1.000 |
| 224 | 0.030 | | | | 1.0 | 1.000 |
| 225 | 0.025 | | | | 1.0 | 1.000 |
| 207 | 0.005 | | | | 1.0 | 1.000 |
| 277 | 0.04 | 0.040 | 0.058 | 0.05 | 1.0 | 1.000 |
| 278 | 0.04 | | | | | |
| 279 | 0.04 | | | | | |
| 280 | 0.04 | | | | | |
| 276-A | 0.04 | | | | 1.0 | 1.000 |
| 276-B | 0.04 | | | | 1.0 | 1.000 |

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

CYANIDE
mg/l

| WELL NUMBER | AVERAGE | MEAN | MEAN + 3σ | MAXIMUM VALUE | NMWQCC STANDARD | RESTORATION VALUE |
|---|---|---|---|---|---|---|
| 208 | 0.083 | 0.097 | 0.780 | 1.4 | 0.2 | 0.780 |
| 209 | 0.100 | | | | | |
| 210 | 0.050 | | | | | |
| 211 | 0.200 | | | | | |
| 212 | 0.175 | | | | | |
| 213 | 0.150 | | | | | |
| 214 | 0.050 | | | | | |
| 215 | 0.133 | | | | | |
| 216 | 0.020 | | | | | |
| 217 | 0.120 | | | | | |
| 218 | 0.050 | | | | | |
| 219 | 0.180 | | | | | |
| 220 | 0.067 | | | | | |
| 202 | 0.020 | | | | 0.2 | 0.200 |
| 221 | 0.017 | | | | 0.2 | 0.200 |
| 222 | 0.017 | | | | 0.2 | 0.200 |
| 223 | 0.380 | | | | 0.2 | 0.380 |
| 224 | 0.017 | | | | 0.2 | 0.200 |
| 225 | 0.200 | | | | 0.2 | 0.200 |
| 207 | 0.050 | | | | 0.2 | 0.200 |
| 277 | <0.005 | <0.005 | <0.005 | <0.005 | 0.2 | 0.200 |
| 278 | <0.005 | | | | | |
| 279 | <0.005 | | | | | |
| 280 | <0.005 | | | | | |
| 276-A | <0.005 | | | | 0.2 | 0.200 |
| 276-B | <0.008 | | | | 0.2 | 0.200 |

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

IRON
mg/l

| WELL NUMBER | AVERAGE | MEAN | MEAN + 3σ | MAXIMUM VALUE | NMWQCC STANDARD | RESTORATION VALUE |
|---|---|---|---|---|---|---|
| 208 | 1.29 | 0.64 | 5.50 | 8.50 | 1.00 | 5.50 |
| 209 | 0.18 | | | | | |
| 210 | 1.88 | | | | | |
| 211 | 0.06 | | | | | |
| 212 | 0.08 | | | | | |
| 213 | 0.41 | | | | | |
| 214 | 0.43 | | | | | |
| 215 | 0.83 | | | | | |
| 216 | 0.34 | | | | | |
| 217 | 0.08 | | | | | |
| 218 | 0.59 | | | | | |
| 219 | 0.19 | | | | | |
| 220 | 1.46 | | | | | |
| 202 | 2.05 | | | | 1.00 | 2.05 |
| 221 | 0.14 | | | | 1.00 | 1.00 |
| 222 | 0.24 | | | | 1.00 | 1.00 |
| 223 | 0.42 | | | | 1.00 | 1.00 |
| 224 | 2.46 | | | | 1.00 | 2.46 |
| 225 | 0.19 | | | | 1.00 | 1.00 |
| 207 | 2.20 | | | | 1.00 | 2.20 |
| 277 | 0.08 | 0.16 | 0.51 | 0.38 | 1.00 | 1.00 |
| 278 | 0.35 | | | | | |
| 279 | 0.15 | | | | | |
| 280 | 0.09 | | | | | |
| 276-A | 0.06 | | | | 1.00 | 1.00 |
| 276-B | 0.04 | | | | 1.00 | 1.00 |

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

LEAD
mg/l

| WELL NUMBER | AVERAGE | MEAN | MEAN + 3σ | MAXIMUM VALUE | NMWQCC STANDARD | RESTORATION VALUE |
|---|---|---|---|---|---|---|
| 208 | 0.001 | 0.003 | 0.063 | 0.170 | 0.05 | 0.063 |
| 209 | 0.004 | | | | | |
| 210 | 0.002 | | | | | |
| 211 | < 0.001 | | | | | |
| 212 | 0.006 | | | | | |
| 213 | 0.001 | | | | | |
| 214 | 0.001 | | | | | |
| 215 | 0.001 | | | | | |
| 216 | 0.001 | | | | | |
| 217 | 0.001 | | | | | |
| 218 | 0.029 | | | | | |
| 219 | 0.001 | | | | | |
| 220 | 0.001 | | | | | |
| 202 | 0.001 | | | | 0.05 | 0.050 |
| 221 | 0.007 | | | | 0.05 | 0.050 |
| 222 | 0.001 | | | | 0.05 | 0.050 |
| 223 | 0.002 | | | | 0.05 | 0.050 |
| 224 | 0.001 | | | | 0.05 | 0.050 |
| 225 | 0.001 | | | | 0.05 | 0.050 |
| 207 | 0.003 | | | | 0.05 | |
| 277 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | 0.05 | 0.050 |
| 278 | < 0.01 | | | | | |
| 279 | < 0.01 | | | | | |
| 280 | < 0.01 | | | | | |
| 276-A | < 0.01 | | | | 0.05 | 0.050 |
| 276-B | < 0.01 | | | | 0.05 | 0.050 |

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

MANGANESE
mg/l

| WELL NUMBER | AVERAGE | MEAN | MEAN + 3σ | MAXIMUM VALUE | NMWQCC STANDARD | RESTORATION VALUE |
|---|---|---|---|---|---|---|
| 208 | 0.181 | 0.066 | 0.456 | 0.94 | 0.2 | 0.456 |
| 209 | 0.062 | | | | | |
| 210 | 0.108 | | | | | |
| 211 | 0.052 | | | | | |
| 212 | 0.009 | | | | | |
| 213 | 0.044 | | | | | |
| 214 | 0.041 | | | | | |
| 215 | 0.150 | | | | | |
| 216 | 0.018 | | | | | |
| 217 | 0.022 | | | | | |
| 218 | 0.069 | | | | | |
| 219 | 0.050 | | | | | |
| 220 | 0.031 | | | | | |
| 202 | 0.096 | | | | 0.2 | 0.20 |
| 221 | 0.027 | | | | 0.2 | 0.20 |
| 222 | 0.016 | | | | 0.2 | 0.20 |
| 223 | 0.010 | | | | 0.2 | 0.20 |
| 224 | 0.050 | | | | 0.2 | 0.20 |
| 225 | 0.006 | | | | 0.2 | 0.20 |
| 207 | 0.121 | | | | 0.2 | 0.20 |
| 277 | <0.01 | <0.01 | 0.013 | 0.02 | 0.2 | 0.20 |
| 278 | <0.01 | | | | | |
| 279 | <0.01 | | | | | |
| 280 | 0.01 | | | | | |
| 276-A | <0.01 | | | | 0.2 | 0.20 |
| 276-B | 0.19 | | | | 0.2 | 0.20 |

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

MOLYBDENUM
mg/l

| WELL NUMBER | AVERAGE | MEAN | MEAN + 3σ | MAXIMUM VALUE | NMWQCC STANDARD | RESTORATION VALUE |
|---|---|---|---|---|---|---|
| 208 | 0.291 | 0.238 | 0.661 | 2.3 | 1.0 | 1.0 |
| 209 | 0.078 | | | | | |
| 210 | 0.582 | | | | | |
| 211 | 0.020 | | | | | |
| 212 | 0.165 | | | | | |
| 213 | 0.209 | | | | | |
| 214 | 0.044 | | | | | |
| 215 | 0.077 | | | | | |
| 216 | 0.078 | | | | | |
| 217 | 0.066 | | | | | |
| 218 | 0.486 | | | | | |
| 219 | 0.673 | | | | | |
| 220 | 0.272 | | | | | |
| 202 | 0.099 | | | | 1.0 | 1.0 |
| 221 | 0.012 | | | | 1.0 | 1.0 |
| 222 | 0.011 | | | | 1.0 | 1.0 |
| 223 | 0.052 | | | | 1.0 | 1.0 |
| 224 | 0.010 | | | | 1.0 | 1.0 |
| 225 | 0.329 | | | | 1.0 | 1.0 |
| 207 | 0.003 | | | | 1.0 | 1.0 |
| 277 | 0.042 | 0.033 | 0.042 | 0.046 | 1.0 | 1.0 |
| 278 | 0.033 | | | | | |
| 279 | 0.036 | | | | | |
| 280 | 0.021 | | | | | |
| 276-A | 0.020 | | | | 1.0 | 1.0 |
| 276-B | 0.007 | | | | 1.0 | 1.0 |

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

TOTAL MERCURY
mg/l

| WELL NUMBER | AVERAGE | MEAN | MEAN + 3σ | MAXIMUM VALUE | NMWQCC STANDARD | RESTORATION VALUE |
|---|---|---|---|---|---|---|
| 208 | 0.00087 | 0.00053 | 0.00194 | 0.0055 | 0.002 | 0.0020 |
| 209 | 0.00040 | | | | | |
| 210 | 0.00094 | | | | | |
| 211 | 0.00018 | | | | | |
| 212 | 0.00013 | | | | | |
| 213 | 0.00088 | | | | | |
| 214 | 0.00080 | | | | | |
| 215 | 0.00042 | | | | | |
| 216 | <0.00004 | | | | | |
| 217 | 0.00008 | | | | | |
| 218 | 0.00008 | | | | | |
| 219 | 0.00024 | | | | | |
| 220 | 0.00080 | | | | | |
| 202 | 0.0010 | | | | 0.002 | 0.0020 |
| 221 | 0.00083 | | | | 0.002 | 0.0020 |
| 222 | 0.00010 | | | | 0.002 | 0.0020 |
| 223 | 0.00002 | | | | 0.002 | 0.0020 |
| 224 | <0.00004 | | | | 0.002 | 0.0020 |
| 225 | <0.00004 | | | | 0.002 | 0.0020 |
| 207 | <0.00004 | | | | 0.002 | <0.0020 |
| 277 | <0.00003 | <0.00003 | <0.00003 | <0.00003 | 0.002 | 0.0020 |
| 278 | <0.00003 | | | | | |
| 279 | <0.00003 | | | | | |
| 280 | <0.00003 | | | | | |
| 276-A | <0.00003 | | | | 0.002 | 0.0020 |
| 276-B | <0.00004 | | | | 0.002 | 0.0020 |

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

NICKEL
mg/l

| WELL NUMBER | AVERAGE | MEAN | MEAN + 3σ | MAXIMUM VALUE | NMWQCC STANDARD | RESTORATION VALUE |
|---|---|---|---|---|---|---|
| 208 | 0.01 | 0.02 | 0.11 | 0.10 | 0.2 | 0.20 |
| 209 | 0.02 | | | | | |
| 210 | 0.02 | | | | | |
| 211 | 0.03 | | | | | |
| 212 | 0.02 | | | | | |
| 213 | 0.02 | | | | | |
| 214 | 0.02 | | | | | |
| 215 | 0.02 | | | | | |
| 216 | 0.03 | | | | | |
| 217 | 0.04 | | | | | |
| 218 | 0.02 | | | | | |
| 219 | 0.03 | | | | | |
| 220 | 0.03 | | | | | |
| 202 | 0.01 | | | | 0.2 | 0.20 |
| 221 | 0.02 | | | | 0.2 | 0.20 |
| 222 | 0.03 | | | | 0.2 | 0.20 |
| 223 | 0.03 | | | | 0.2 | 0.20 |
| 224 | 0.03 | | | | 0.2 | 0.20 |
| 225 | 0.03 | | | | 0.2 | 0.20 |
| 207 | 0.02 | | | | 0.2 | 0.20 |
| 277 | 0.03 | 0.02 | 0.08 | 0.06 | 0.2 | 0.20 |
| 278 | 0.04 | | | | | |
| 279 | <0.02 | | | | | |
| 280 | <0.02 | | | | | |
| 276-A | 0.03 | | | | 0.2 | 0.20 |
| 276-B | <0.02 | | | | 0.2 | 0.20 |

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

NITRATE (asN)
mg/l

| WELL NUMBER | AVERAGE | MEAN | MEAN + 3σ | MAXIMUM VALUE | NMWQCC STANDARD | RESTORATION VALUE |
|---|---|---|---|---|---|---|
| 208 | 0.08 | 0.08 | 0.69 | 1.9 | 10.0 | 10.0 |
| 209 | 0.08 | | | | | |
| 210 | 0.12 | | | | | |
| 211 | 0.08 | | | | | |
| 212 | 0.22 | | | | | |
| 213 | 0.08 | | | | | |
| 214 | <0.10 | | | | | |
| 215 | 0.10 | | | | | |
| 216 | 0.09 | | | | | |
| 217 | 0.04 | | | | | |
| 218 | 0.07 | | | | | |
| 219 | 0.11 | | | | | |
| 220 | 0.05 | | | | | |
| 202 | 0.08 | | | | 10.0 | 10.0 |
| 221 | 0.07 | | | | 10.0 | 10.0 |
| 222 | 0.07 | | | | 10.0 | 10.0 |
| 223 | 0.04 | | | | 10.0 | 10.0 |
| 224 | 0.32 | | | | 10.0 | 10.0 |
| 225 | 0.12 | | | | 10.0 | 10.0 |
| 207 | 0.08 | | | | 10.0 | 10.0 |
| 277 | <0.04 | 0.05 | 0.23 | 0.15 | 10.0 | 10.0 |
| 278 | <0.04 | | | | | |
| 279 | 0.08 | | | | | |
| 280 | 0.14 | | | | | |
| 276-A | <0.04 | | | | 10.0 | 10.0 |
| 276-B | <0.05 | | | | 10.0 | 10.0 |

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

pH

| WELL NUMBER | AVERAGE | MEAN | MEAN + 3σ | MAXIMUM VALUE | NMWQCC STANDARD | RESTORATION VALUE |
|---|---|---|---|---|---|---|
| 208 | 7.9 | 7.4 | N/A | 9.1 | 6 to 9 | 6 to 9 |
| 209 | 7.4 | | | | | |
| 210 | 7.3 | | | | | |
| 211 | 7.8 | | | | | |
| 212 | 8.0 | | | | | |
| 213 | 7.4 | | | | | |
| 214 | 7.4 | | | | | |
| 215 | 7.2 | | | | | |
| 216 | 7.8 | | | | | |
| 217 | 8.3 | | | | | |
| 218 | 7.4 | | | | | |
| 219 | 7.3 | | | | | |
| 220 | 7.8 | | | | | |
| 202 | 7.6 | | | | 6 to 9 | 6 to 9 |
| 221 | 7.9 | | | | 6 to 9 | 6 to 9 |
| 222 | 7.9 | | | | 6 to 9 | 6 to 9 |
| 223 | 7.8 | | | | 6 to 9 | 6 to 9 |
| 224 | 7.5 | | | | 6 to 9 | 6 to 9 |
| 225 | 7.6 | | | | 6 to 9 | 6 to 9 |
| 207 | 7.2 | | | | 6 to 9 | 6 to 9 |
| 277 | 8.9 | 8.2 | N/A | 9.2 | 6 to 9 | 6 to 9 |
| 278 | 8.7 | | | | | |
| 279 | 8.6 | | | | | |
| 280 | 9.0 | | | | | |
| 276-A | 8.8 | | | | 6 to 9 | 6 to 9 |
| 276-B | 7.6 | | | | 6 to 9 | 6 to 9 |

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

PHENOLS
mg/l

| WELL NUMBER | AVERAGE | MEAN | MEAN + 3σ | MAXIMUM VALUE | NMWQCC STANDARD | RESTORATION VALUE |
|---|---|---|---|---|---|---|
| 208 | 0.004 | 0.011 | 0.047 | 0.066 | 0.005 | 0.047 |
| 209 | 0.010 | | | | | |
| 210 | 0.010 | | | | | |
| 211 | 0.020 | | | | | |
| 212 | 0.023 | | | | | |
| 213 | 0.012 | | | | | |
| 214 | 0.008 | | | | | |
| 215 | 0.011 | | | | | |
| 216 | 0.011 | | | | | |
| 217 | 0.016 | | | | | |
| 218 | 0.004 | | | | | |
| 219 | 0.012 | | | | | |
| 220 | 0.009 | | | | | |
| 202 | 0.010 | | | | 0.005 | 0.010 |
| 221 | 0.004 | | | | 0.005 | 0.005 |
| 222 | 0.009 | | | | 0.005 | 0.009 |
| 223 | 0.015 | | | | 0.005 | 0.015 |
| 224 | 0.009 | | | | 0.005 | 0.009 |
| 225 | 0.020 | | | | 0.005 | 0.020 |
| 207 | 0.004 | | | | 0.005 | 0.005 |
| 277 | 0.003 | 0.004 | 0.008 | 0.007 | 0.005 | 0.008 |
| 278 | 0.004 | | | | | |
| 279 | 0.005 | | | | | |
| 280 | 0.003 | | | | | |
| 276-A | 0.003 | | | | 0.005 | 0.005 |
| 276-B | 0.009 | | | | 0.005 | 0.009 |

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

COMBINED DISSOLVED
RADIUM 226 & RADIUM 228 pCi/l

| WELL NUMBER | AVERAGE | MEAN | MEAN + 3σ | MAXIMUM VALUE | NMWQCC STANDARD | RESTORATION VALUE |
|---|---|---|---|---|---|---|
| 208 | <32.3 | <21.6 | <97.2 | 89.4±3.0 | 30.0 | 97.2 |
| 209 | <48.2 | | | | | |
| 210 | 4.5 | | | | | |
| 211 | <43.8 | | | | | |
| 212 | <6.9 | | | | | |
| 213 | <4.2 | | | | | |
| 214 | <11.6 | | | | | |
| 215 | <58.4 | | | | | |
| 216 | 3.8 | | | | | |
| 217 | <6.6 | | | | | |
| 218 | <12.3 | | | | | |
| 219 | <29.0 | | | | | |
| 220 | <23.7 | | | | | |
| 202 | <1 | | | | 30.0 | 30.0 |
| 221 | <2.2 | | | | 30.0 | 30.0 |
| 222 | <1 | | | | 30.0 | 30.0 |
| 223 | <1 | | | | 30.0 | 30.0 |
| 224 | <1.1 | | | | 30.0 | 30.0 |
| 225 | <8.3 | | | | 30.0 | 30.0 |
| 207 | <1.1 | | | | 30.0 | 30.0 |
| 277 | 5.1 | 2.4 | 8.3 | 7.2±5.8 | 30.0 | 30.0 |
| 278 | 1.6 | | | | | |
| 279 | 0.5 | | | | | |
| 280 | 2.5 | | | | | |
| 276-A | 0.6 | | | | 30.0 | 30.0 |
| 276-B | 2.4 | | | | 30.0 | 30.0 |

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

SELENIUM
mg/l

| WELL NUMBER | AVERAGE | MEAN | MEAN + 3σ | MAXIMUM VALUE | NMWQCC STANDARD | RESTORATION VALUE |
|---|---|---|---|---|---|---|
| 208 | <0.01 | <0.01 | <0.01 | 0.01 | 0.05 | 0.05 |
| 209 | <0.01 | | | | | |
| 210 | <0.01 | | | | | |
| 211 | <0.01 | | | | | |
| 212 | <0.01 | | | | | |
| 213 | <0.01 | | | | | |
| 214 | <0.01 | | | | | |
| 215 | <0.01 | | | | | |
| 216 | <0.01 | | | | | |
| 217 | <0.01 | | | | | |
| 218 | <0.01 | | | | | |
| 219 | <0.01 | | | | | |
| 220 | <0.01 | | | | | |
| 202 | <0.01 | | | | 0.05 | 0.05 |
| 221 | <0.01 | | | | 0.05 | 0.05 |
| 222 | <0.01 | | | | 0.05 | 0.05 |
| 223 | <0.01 | | | | 0.05 | 0.05 |
| 224 | <0.01 | | | | 0.05 | 0.05 |
| 225 | <0.01 | | | | 0.05 | 0.05 |
| 207 | <0.01 | | | | 0.05 | 0.05 |
| 277 | 0.014 | 0.015 | 0.025 | 0.022 | 0.05 | 0.05 |
| 278 | 0.013 | | | | | |
| 279 | 0.019 | | | | | |
| 280 | 0.014 | | | | | |
| 276-A | 0.016 | | | | 0.05 | 0.05 |
| 276-B | 0.005 | | | | 0.05 | 0.05 |

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

SILVER
mg/l

| WELL NUMBER | AVERAGE | MEAN | MEAN + 3σ | MAXIMUM VALUE | NMWQCC STANDARD | RESTORATION VALUE |
|---|---|---|---|---|---|---|
| 208 | <0.01 | <0.01 | <0.01 | 0.02 | 0.05 | 0.05 |
| 209 | <0.01 | | | | | |
| 210 | <0.01 | | | | | |
| 211 | <0.01 | | | | | |
| 212 | <0.01 | | | | | |
| 213 | <0.01 | | | | | |
| 214 | <0.01 | | | | | |
| 215 | <0.01 | | | | | |
| 216 | <0.01 | | | | | |
| 217 | <0.01 | | | | | |
| 218 | <0.01 | | | | | |
| 219 | <0.01 | | | | | |
| 220 | <0.01 | | | | | |
| 202 | <0.01 | | | | 0.05 | 0.05 |
| 221 | <0.01 | | | | 0.05 | 0.05 |
| 222 | <0.01 | | | | 0.05 | 0.05 |
| 223 | <0.01 | | | | 0.05 | 0.05 |
| 224 | <0.01 | | | | 0.05 | 0.05 |
| 225 | <0.01 | | | | 0.05 | 0.05 |
| 207 | <0.01 | | | | 0.05 | 0.05 |
| 277 | <0.005 | <0.005 | <0.005 | <0.005 | 0.05 | <0.005 |
| 278 | <0.005 | | | | 0.05 | 0.05 |
| 279 | <0.005 | | | | 0.05 | 0.05 |
| 280 | <0.005 | | | | 0.05 | 0.05 |
| 276-A | <0.005 | | | | 0.05 | 0.05 |
| 276-B | <0.005 | | | | 0.05 | 0.05 |

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

SULFATE
mg/l

| WELL NUMBER | AVERAGE | MEAN | MEAN + 3σ | MAXIMUM VALUE | NMWQCC STANDARD | RESTORATION VALUE |
|---|---|---|---|---|---|---|
| 208 | 52 | 40 | 138 | 158 | 600 | 600 |
| 209 | 16 | | | | | |
| 210 | 59 | | | | | |
| 211 | 30 | | | | | |
| 212 | 22 | | | | | |
| 213 | 61 | | | | | |
| 214 | 66 | | | | | |
| 215 | 30 | | | | | |
| 216 | 24 | | | | | |
| 217 | 23 | | | | | |
| 218 | 51 | | | | | |
| 219 | 18 | | | | | |
| 220 | 50 | | | | | |
| 202 | 51 | | | | 600 | 600 |
| 221 | 40 | | | | 600 | 600 |
| 222 | 37 | | | | 600 | 600 |
| 223 | 33 | | | | 600 | 600 |
| 224 | 36 | | | | 600 | 600 |
| 225 | 28 | | | | 600 | 600 |
| 207 | 217 | | | | 600 | 600 |
| 277 | 32 | 30 | 43 | 37 | 600 | 600 |
| 278 | 26 | | | | | |
| 279 | 32 | | | | | |
| 280 | 31 | | | | | |
| 276-A | 36 | | | | 600 | 600 |
| 276-B | 111 | | | | 600 | 600 |

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

TOTAL DISSOLVED SOLIDS
mg/l

| WELL NUMBER | AVERAGE | MEAN | MEAN + 3σ | MAXIMUM VALUE | NMWQCC STANDARD | RESTORATION VALUE |
|---|---|---|---|---|---|---|
| 208 | 390 | 373 | 589 | 701 | 1,000 | 1,000 |
| 209 | 355 | | | | | |
| 210 | 388 | | | | | |
| 211 | 366 | | | | | |
| 212 | 325 | | | | | |
| 213 | 390 | | | | | |
| 214 | 443 | | | | | |
| 215 | 383 | | | | | |
| 216 | 316 | | | | | |
| 217 | 386 | | | | | |
| 218 | 376 | | | | | |
| 219 | 370 | | | | | |
| 220 | 338 | | | | | |
| 202 | 412 | | | | 1,000 | 1,000 |
| 221 | 331 | | | | 1,000 | 1,000 |
| 222 | 315 | | | | 1,000 | 1,000 |
| 223 | 309 | | | | 1,000 | 1,000 |
| 224 | 326 | | | | 1,000 | 1,000 |
| 225 | 331 | | | | 1,000 | 1,000 |
| 207 | 601 | | | | 1,000 | 1,000 |
| 277 | 322 | 318 | 340 | 325 | 1,000 | 1,000 |
| 278 | 317 | | | | | |
| 279 | 308 | | | | | |
| 280 | 323 | | | | | |
| 276-A | 342 | | | | 1,000 | 1,000 |
| 276-B | 558 | | | | 1,000 | 1,000 |

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

TOTAL URANIUM
mg/l

| WELL NUMBER | AVERAGE | MEAN | MEAN + 3σ | MAXIMUM VALUE | NMWQCC STANDARD | RESTORATION VALUE |
|---|---|---|---|---|---|---|
| 208 | 0.023 | 0.013 | 0.062 | 0.082 | 5 | 5.0 |
| 209 | 0.006 | | | | | |
| 210 | 0.014 | | | | | |
| 211 | 0.007 | | | | | |
| 212 | 0.010 | | | | | |
| 213 | 0.008 | | | | | |
| 214 | 0.007 | | | | | |
| 215 | 0.014 | | | | | |
| 216 | 0.008 | | | | | |
| 217 | 0.005 | | | | | |
| 218 | 0.009 | | | | | |
| 219 | 0.010 | | | | | |
| 220 | 0.043 | | | | | |
| 202 | 0.002 | | | | 5 | 5.0 |
| 221 | 0.005 | | | | 5 | 5.0 |
| 222 | 0.008 | | | | 5 | 5.0 |
| 223 | 0.006 | | | | 5 | 5.0 |
| 224 | 0.007 | | | | 5 | 5.0 |
| 225 | 0.012 | | | | 5 | 5.0 |
| 207 | 0.007 | | | | 5 | 5.0 |
| 277 | <0.002 | <0.002 | <0.002 | 0.003 | 5 | 5.0 |
| 278 | <0.002 | | | | | |
| 279 | <0.002 | | | | | |
| 280 | <0.002 | | | | | |
| 276-A | <0.002 | | | | 5 | 5.0 |
| 276-B | 0.002 | | | | 5 | 5.0 |

MOBIL OIL CORPORATION
PILOT IN SITU LEACH TEST SITE
SECTION 9 T17N, R13W
McKINLEY COUNTY, NEW MEXICO

BASELINE GROUNDWATER DATA

ZINC
mg/l

| WELL NUMBER | AVERAGE | MEAN | MEAN + 3σ | MAXIMUM VALUE | NMWQCC STANDARD | RESTORATION VALUE |
|---|---|---|---|---|---|---|
| 208 | <0.01 | 0.01 | 0.19 | 0.51 | 10.0 | 10.0 |
| 209 | <0.01 | | | | | |
| 210 | 0.01 | | | | | |
| 211 | <0.01 | | | | | |
| 212 | 0.01 | | | | | |
| 213 | <0.01 | | | | | |
| 214 | <0.01 | | | | | |
| 215 | 0.01 | | | | | |
| 216 | 0.01 | | | | | |
| 217 | 0.01 | | | | | |
| 218 | <0.01 | | | | | |
| 219 | 0.12 | | | | | |
| 220 | 0.01 | | | | | |
| 202 | 0.01 | | | | 10.0 | 10.0 |
| 221 | 0.01 | | | | 10.0 | 10.0 |
| 222 | 0.01 | | | | 10.0 | 10.0 |
| 223 | <0.01 | | | | 10.0 | 10.0 |
| 224 | 0.02 | | | | 10.0 | 10.0 |
| 225 | <0.01 | | | | 10.0 | 10.0 |
| 207 | 0.02 | | | | 10.0 | 10.0 |
| 277 | 0.03 | 0.03 | 0.05 | 0.03 | 10.0 | 10.0 |
| 278 | 0.02 | | | | | |
| 279 | 0.02 | | | | | |
| 280 | 0.03 | | | | | |
| 276-A | 0.04 | | | | 10.0 | 10.0 |
| 276-B | 0.03 | | | | 10.0 | 10.0 |

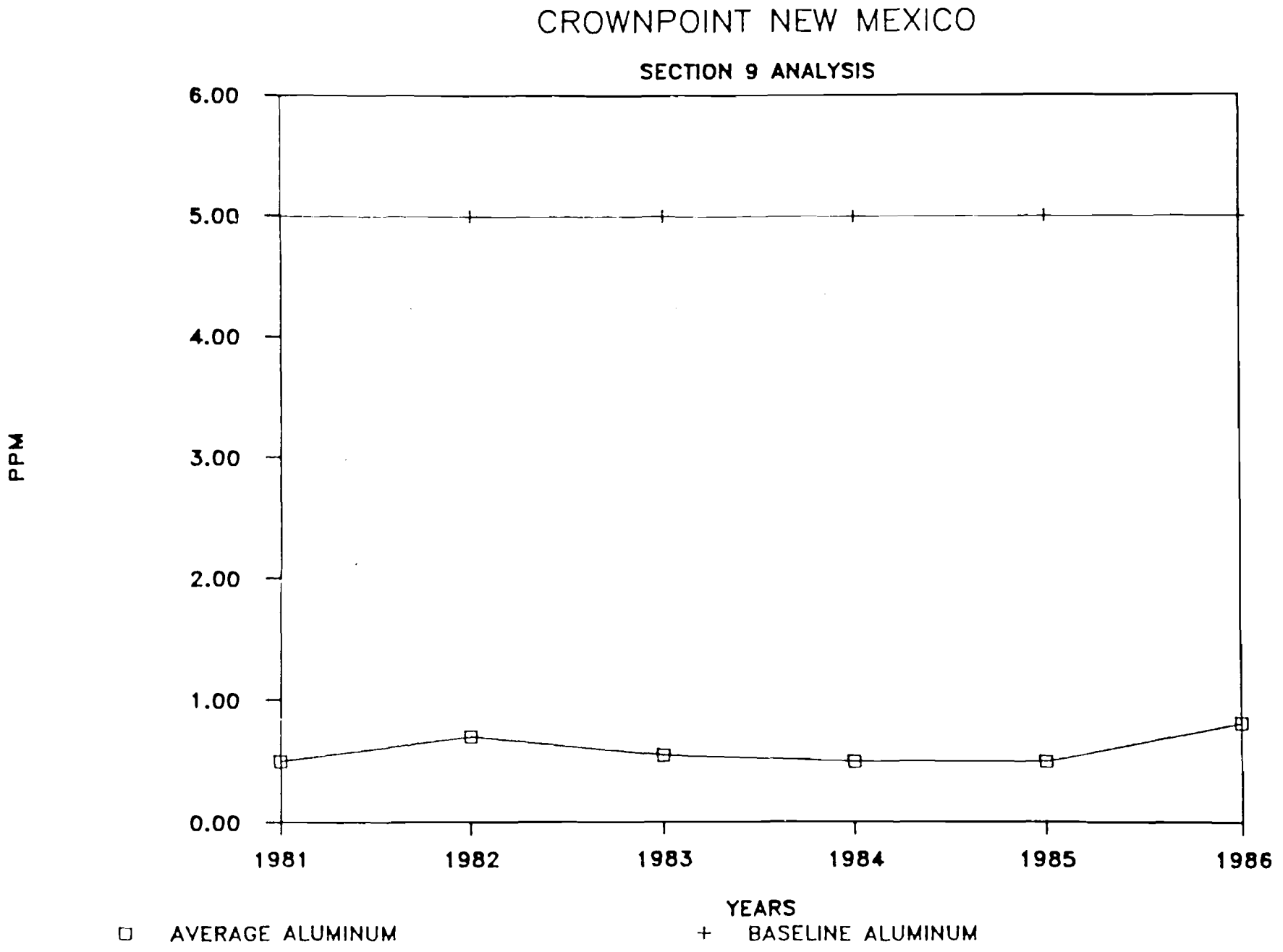
ATTACHMENT 3

HISTORICAL ANNUAL WATER QUALITY
CROWNPOINT SECTION 9 WELLFIELD

| Chemical Constituent | New Mexico Standard mg/liter | Restoration Standard mg/liter | 1981 Average of Values | 1982 Average of Values | 1983 Average of Values | 1984 Average of Values | 1985 Average of Values | 1986 Average of Values |
|---|---|---|---|---|---|---|---|---|
| Aluminum, dissolved | 5.0 | 5.0 | 0.500 | 0.700 | 0.550 | 0.500 | 0.500 | 0.808 |
| Arsenic | 0.1 | 0.1 | 0.086 | 0.073 | 0.069 | 0.057 | 0.032 | 0.014 |
| Barium | 1.0 | 1.0 | 0.227 | 0.200 | 0.325 | 0.262 | 0.215 | 0.277 |
| Boron | 0.75 | 0.75 | 0.191 | 0.155 | 0.088 | 0.108 | 0.215 | 0.238 |
| Cadmium | 0.01 | 0.036 | 0.005 | 0.005 | 0.005 | 0.005 | 0.007 | 0.006 |
| Chloride | 250.0 | 250.0 | 127.273 | 156.000 | 372.500 | 115.5 | 111.5 | 54.538 |
| Chromium | 0.05 | 0.074 | 0.004 | 0.005 | 0.005 | 0.007 | 0.011 | 0.005 |
| Cobalt, dissolved | 0.05 | 0.05 | 0.016 | 0.020 | 0.020 | 0.020 | 0.026 | 0.021 |
| Copper, dissolved | 1.0 | 1.0 | 0.007 | 0.005 | 0.005 | 0.005 | 0.012 | 0.008 |
| Cyanide | 0.2 | 0.780 | 0.005 | 0.005 | 0.005 | 0.005 | 0.009 | <0.005 |
| Fluoride | 1.6 | 1.6 | 0.336 | 0.309 | 0.413 | 0.500 | 0.508 | <0.5 |
| Iron, dissolved | 1.0 | 5.50 | 0.130 | 0.018 | 0.015 | 0.065 | 0.372 | 0.146 |
| Lead, dissolved | 0.05 | 0.063 | 0.005 | 0.022 | 0.009 | 0.005 | 0.006 | 0.016 |
| Manganese, dissolved | 0.2 | 0.456 | 0.217 | 0.053 | 0.142 | 0.048 | 0.096 | 0.035 |
| Molybdenum, dissolved | 1.0 | 1.0 | 27.667 | 9.076 | 13.250 | 8.231 | 4.803 | 1.118 |
| Mercury, total | 0.002 | 0.002 | 0.0002 | 0.0019 | 0.0001 | 0.0001 | 0.0001 | 0.0003 |
| Nickel, dissolved | 0.2 | 0.2 | 0.030 | 0.020 | 0.070 | 0.021 | 0.021 | 0.022 |
| Nitrate (as N) | 10.0 | 10.0 | 0.050 | 0.075 | 0.050 | 0.941 | 0.050 | 0.556 |
| PH | 6 to 9 | 6 to 9 | 6.665 | 8.402 | * | 8.438 | 8.446 | 9.062 |
| Phenols | 0.005 | 0.047 | 0.005 | 0.012 | 0.003 | 0.002 | 0.004 | 0.008 |
| Combined Ra-226 & 228 | 30.0 | 97.2 | * | 30.525 | * | 22.077 | 48.677 | 59.939 |
| Selenium, dissolved | 0.05 | 0.05 | 0.017 | 0.149 | 0.067 | 0.017 | 0.032 | 0.006 |
| Silver, dissolved | 0.05 | 0.05 | 0.007 | 0.005 | 0.005 | 0.005 | 0.006 | <0.005 |
| Sulfate (as SO4) | 600.0 | 600.0 | 131.091 | 44.182 | 46.500 | 81.538 | 80.846 | 47.615 |
| TDS (at 180 C) | 1000.0 | 1000.0 | 623.182 | 529.727 | 785.000 | 479.231 | 556.923 | 356.154 |
| Uranium (as U) | 5.0 | 5.0 | * | 0.166 | 0.370 | 0.590 | 0.303 | 0.319 |
| Zinc, dissolved | 10.0 | 10.0 | 0.014 | 0.031 | 0.014 | 0.027 | 0.027 | 0.039 |

NOTE:
* Data not available.

gjl16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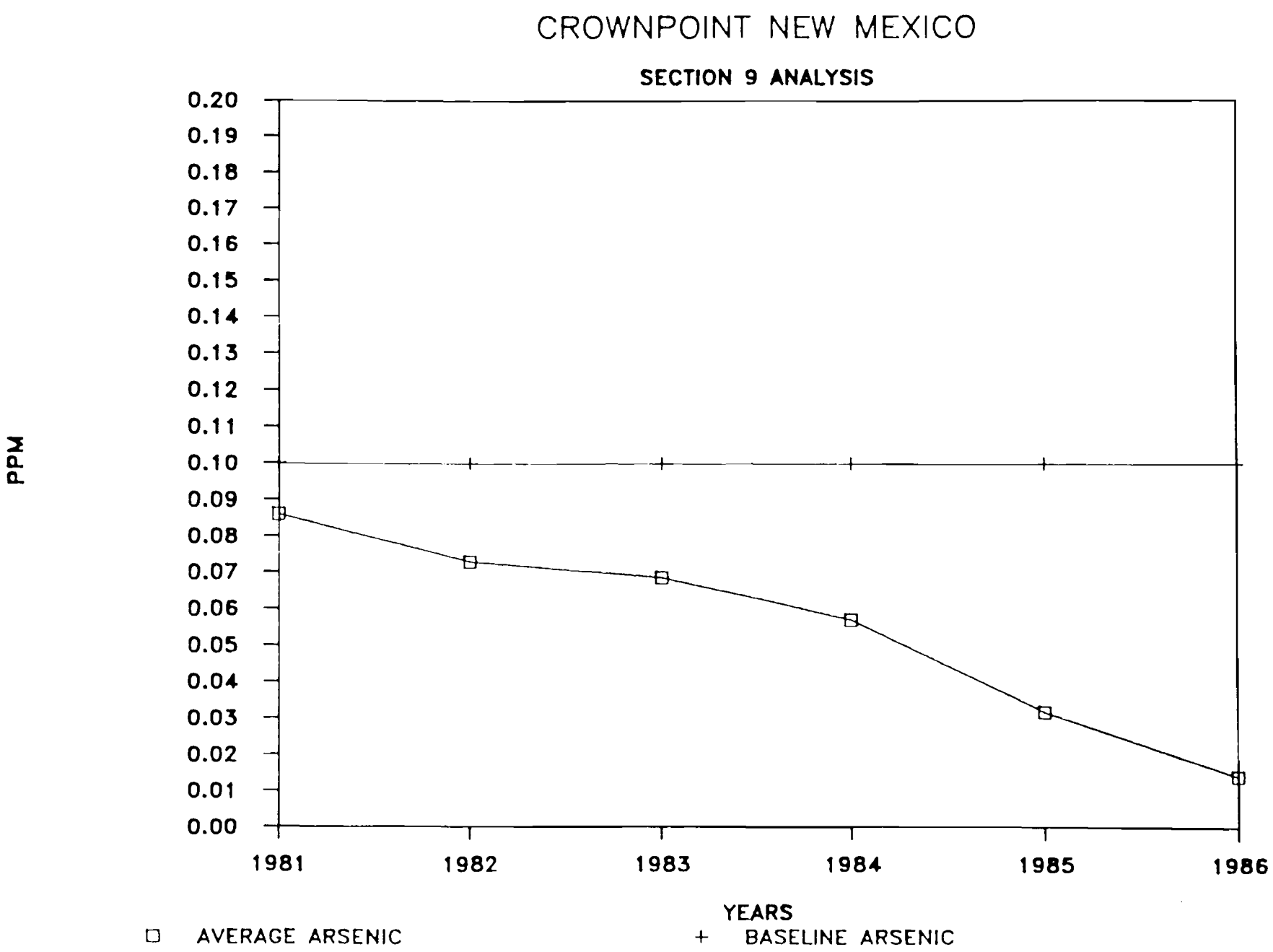
5.00
4.00
3.00
2.00
1.00
0.00
PPM
1981
1982
1983
1984
1985
1986
YEARS
AVERAGE ALUMINUM
BASELINE ALUMINUM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0.15
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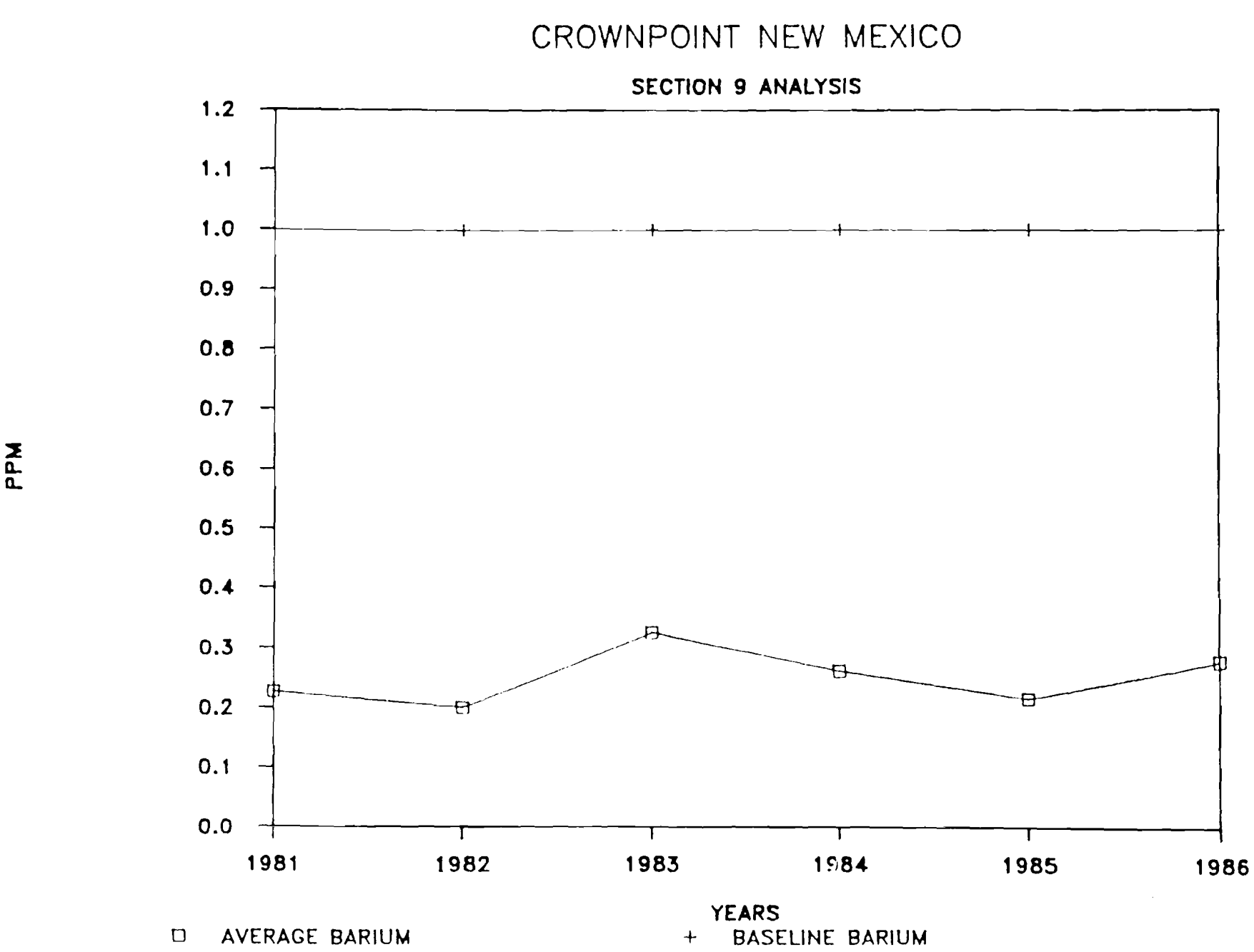
0.13
0.12
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
1981
1982
1983
1984
1985
1986
YEARS
AVERAGE ARSENIC
BASELINE ARSENIC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1.0
0.9
0.8
0.7
0.6
0.5
0.4
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0.1
0.0
1981
1982
1983
1984
1985
1986
YEARS
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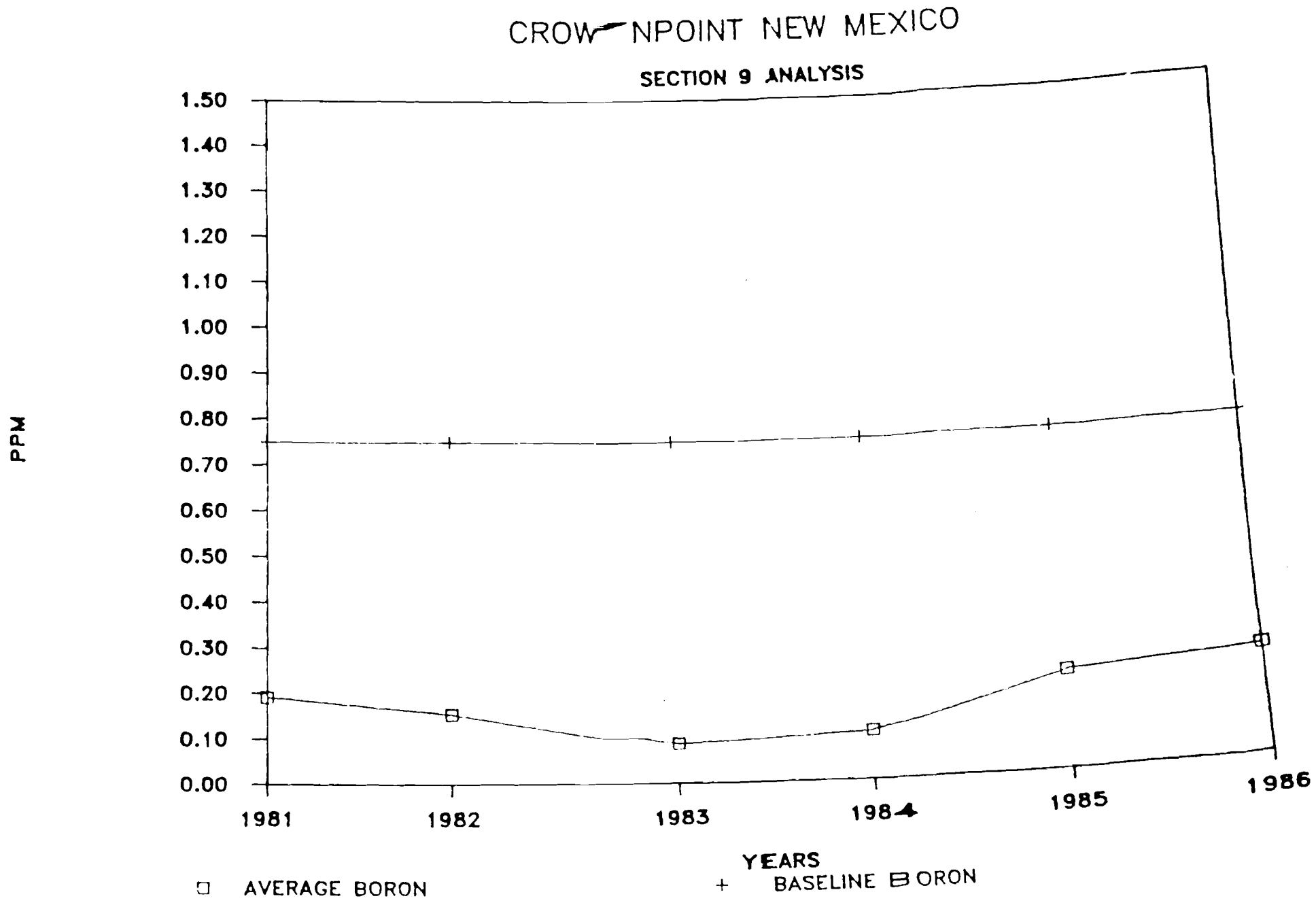
BASELINE BARIUM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0.70
0.60
0.50
0.40
0.30
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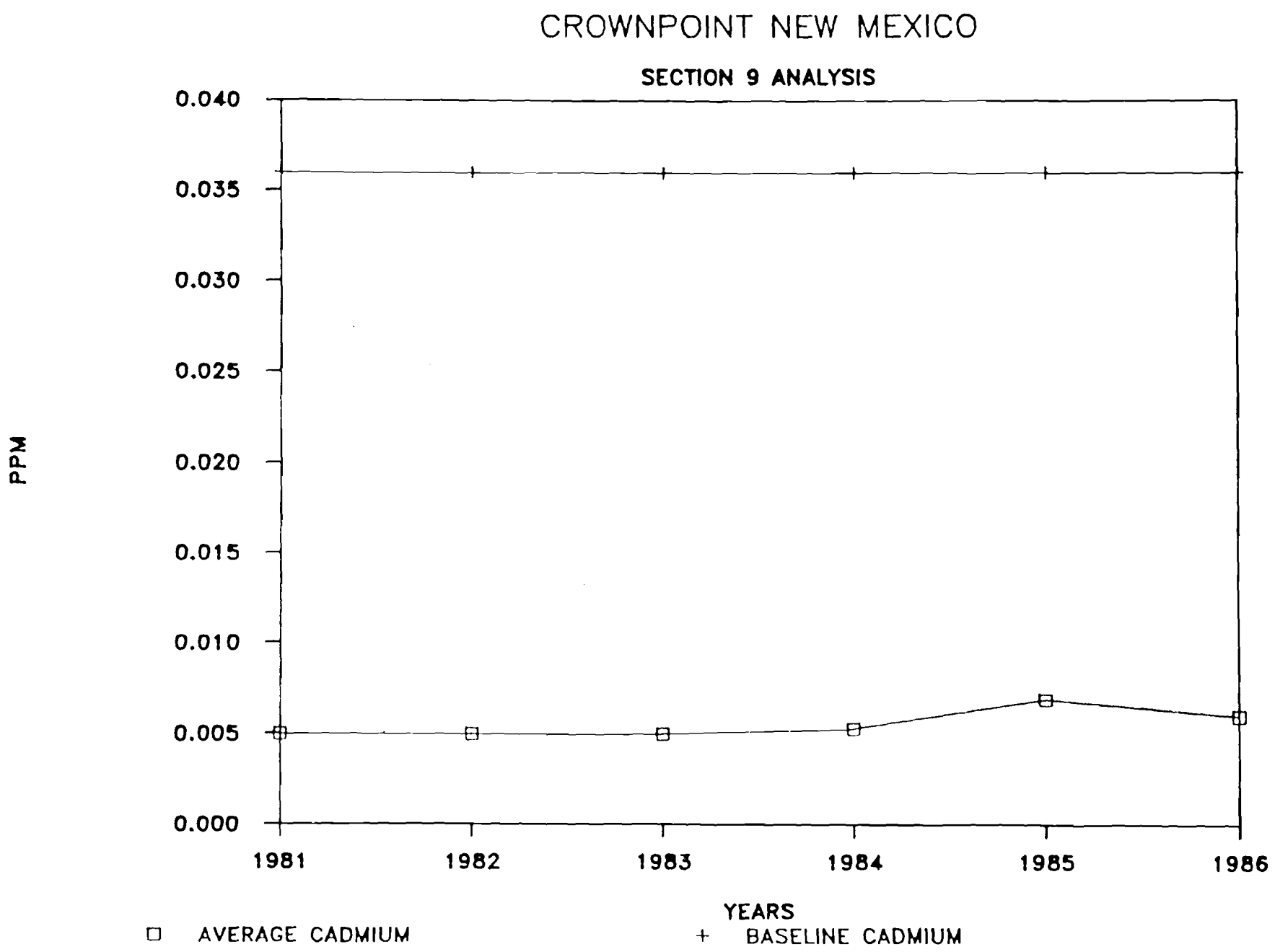
0.00
PPM
1981
1982
1983
1984
1985
1986
YEARS
AVERAGE BORON
BASELINE BORON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PPM
1981
1982
1983
1984
1985
1986
YEARS
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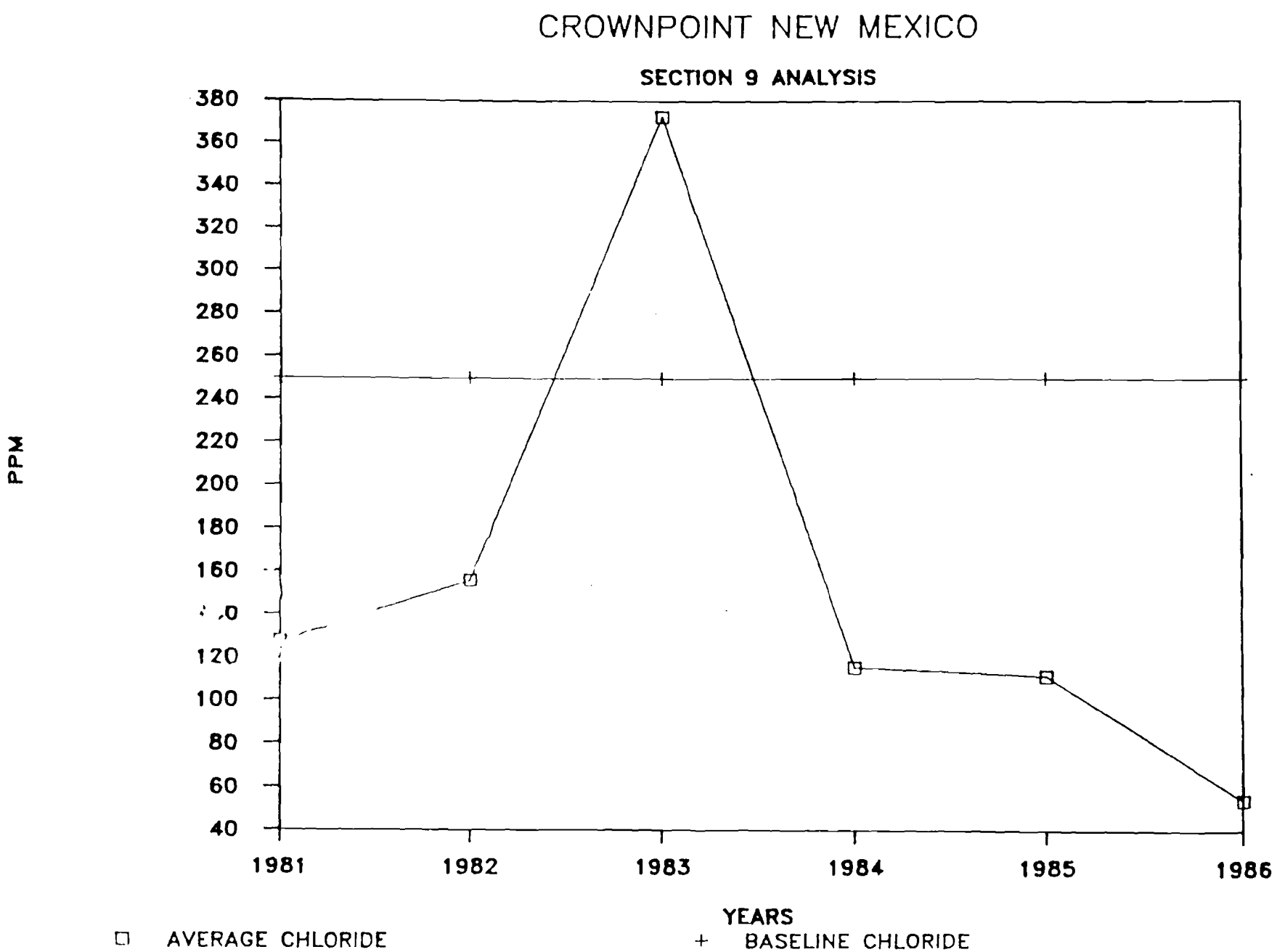
BASELINE CADMIUM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300
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260
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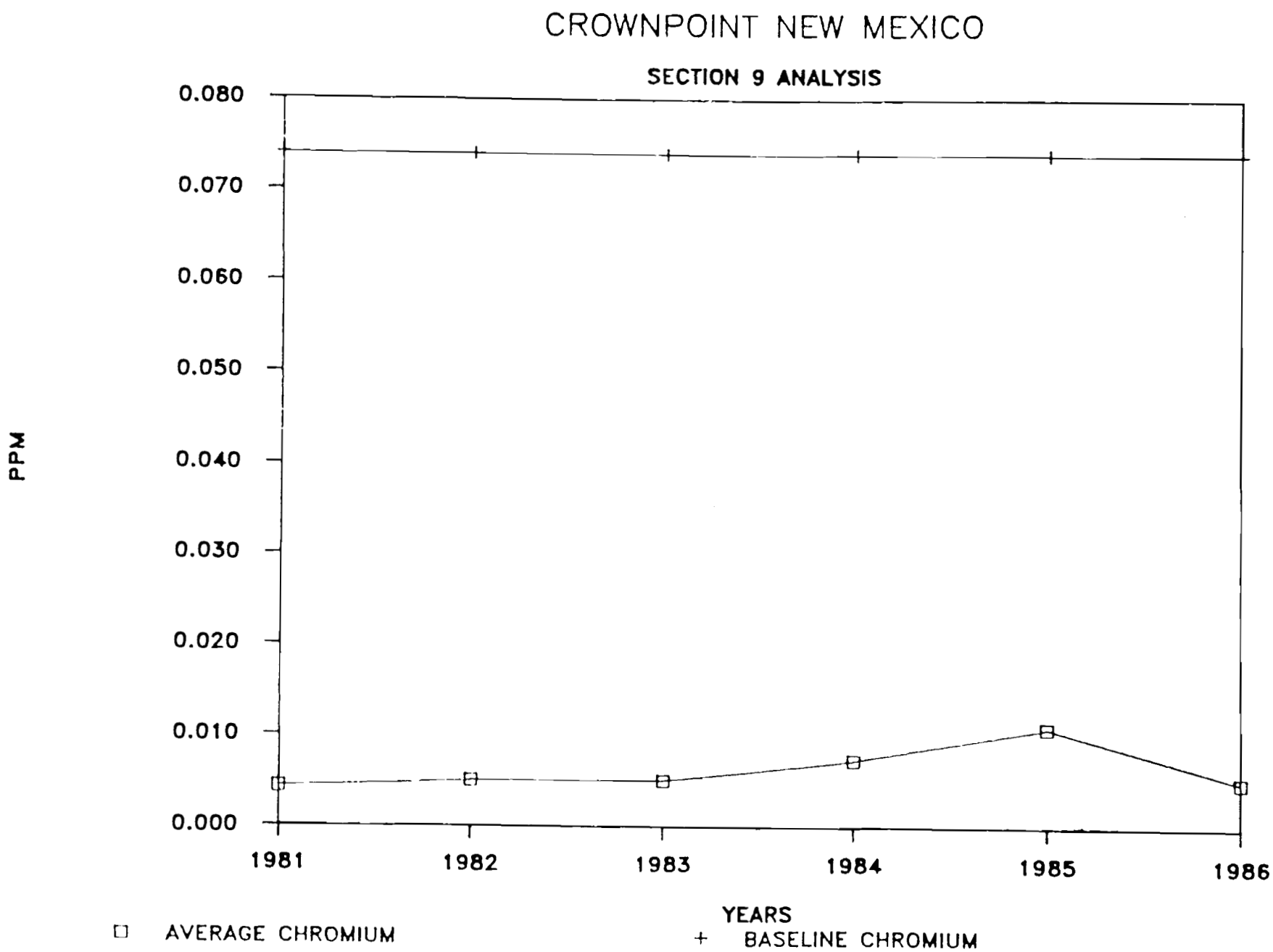
220
200
180
160
120
100
80
60
40
PPM
1981
1982
1983
1984
1985
1986
YEARS
AVERAGE CHLORIDE
BASELINE CHLORIDE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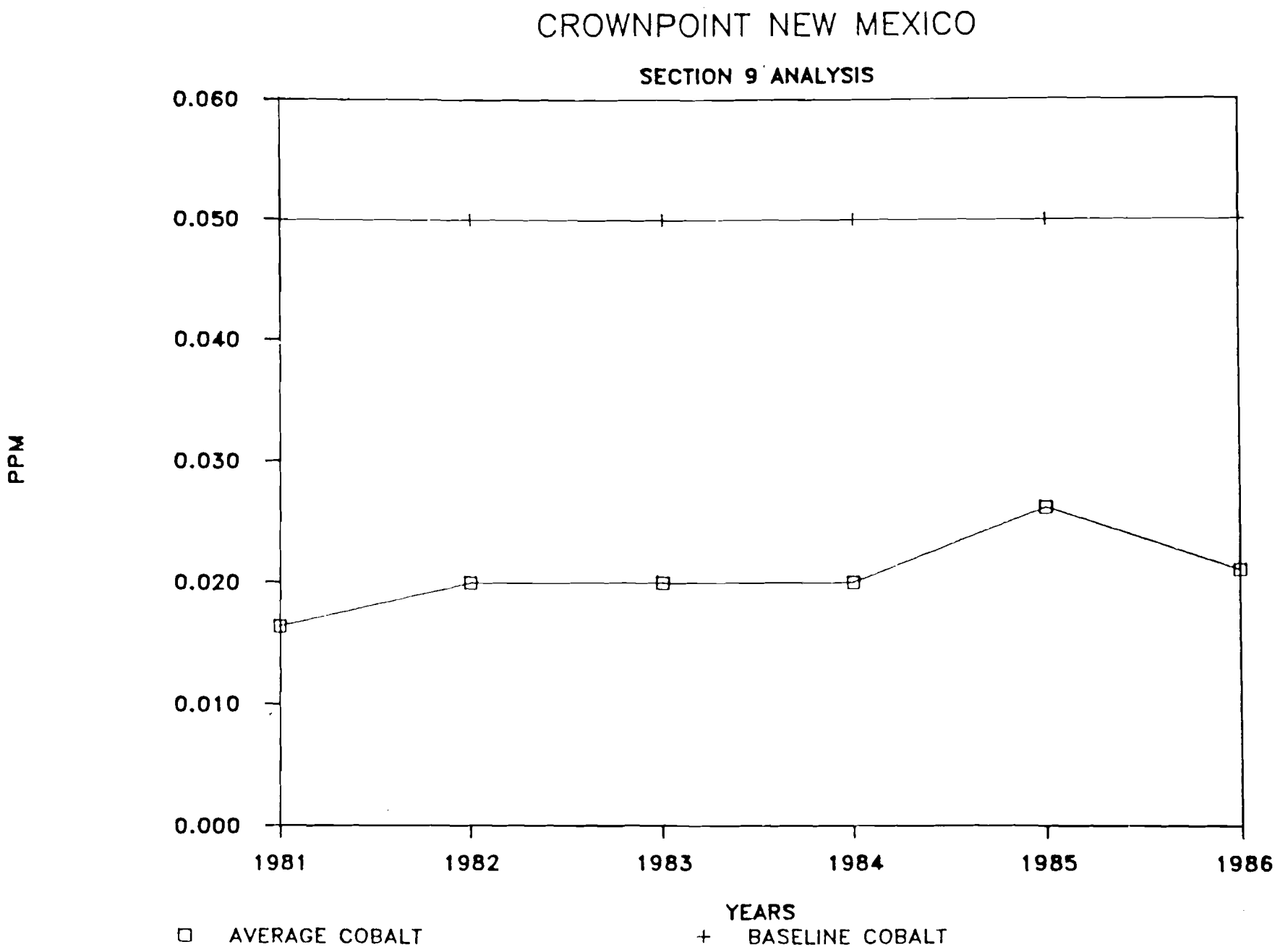
PPM
1981
1982
1983
1984
1985
1986
YEARS
AVERAGE CHROMIUM
BASELINE CHROMIUM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PPM
1981
1982
1983
1984
1985
1986
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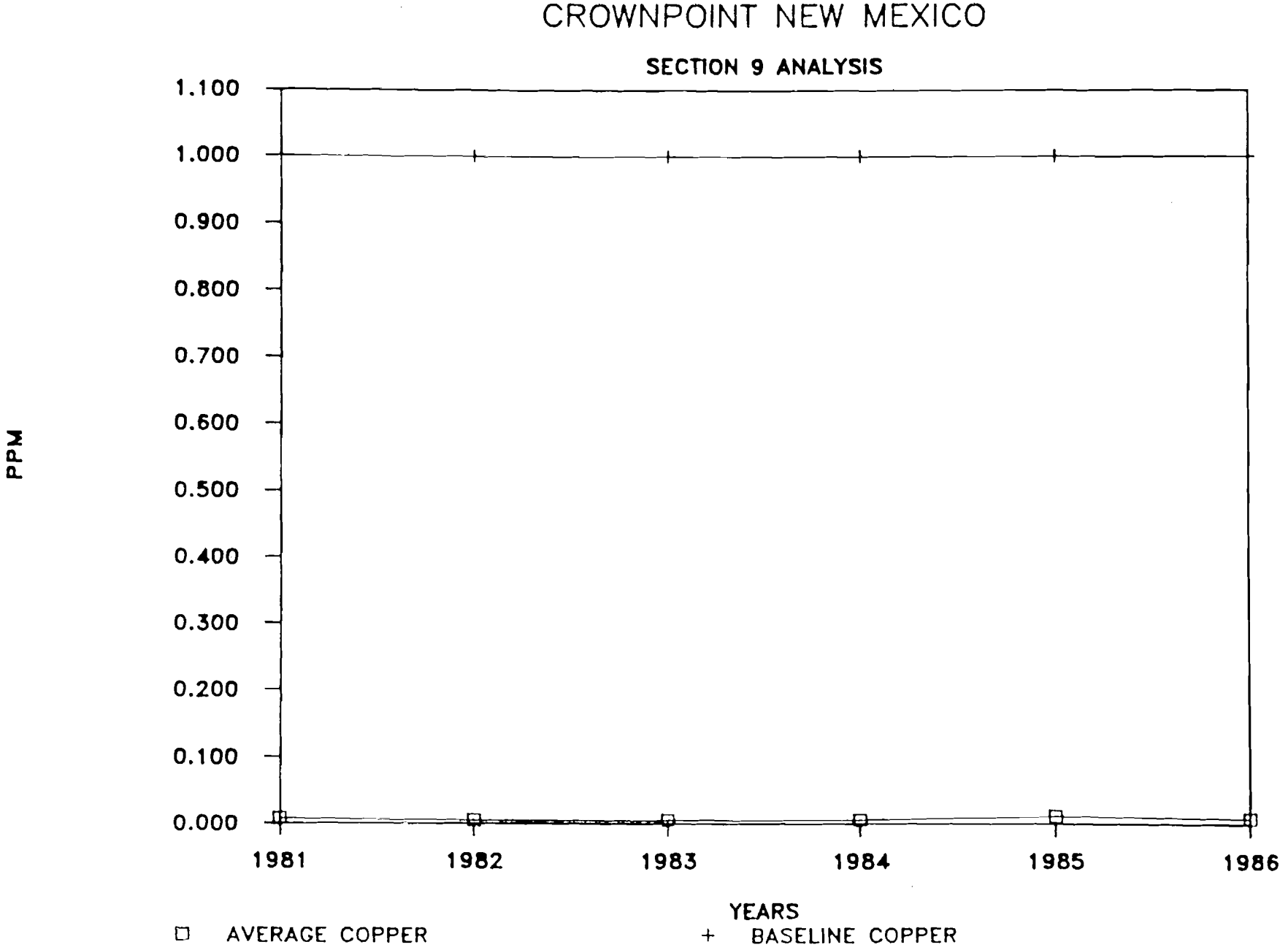
AVERAGE COBALT
BASELINE COBALT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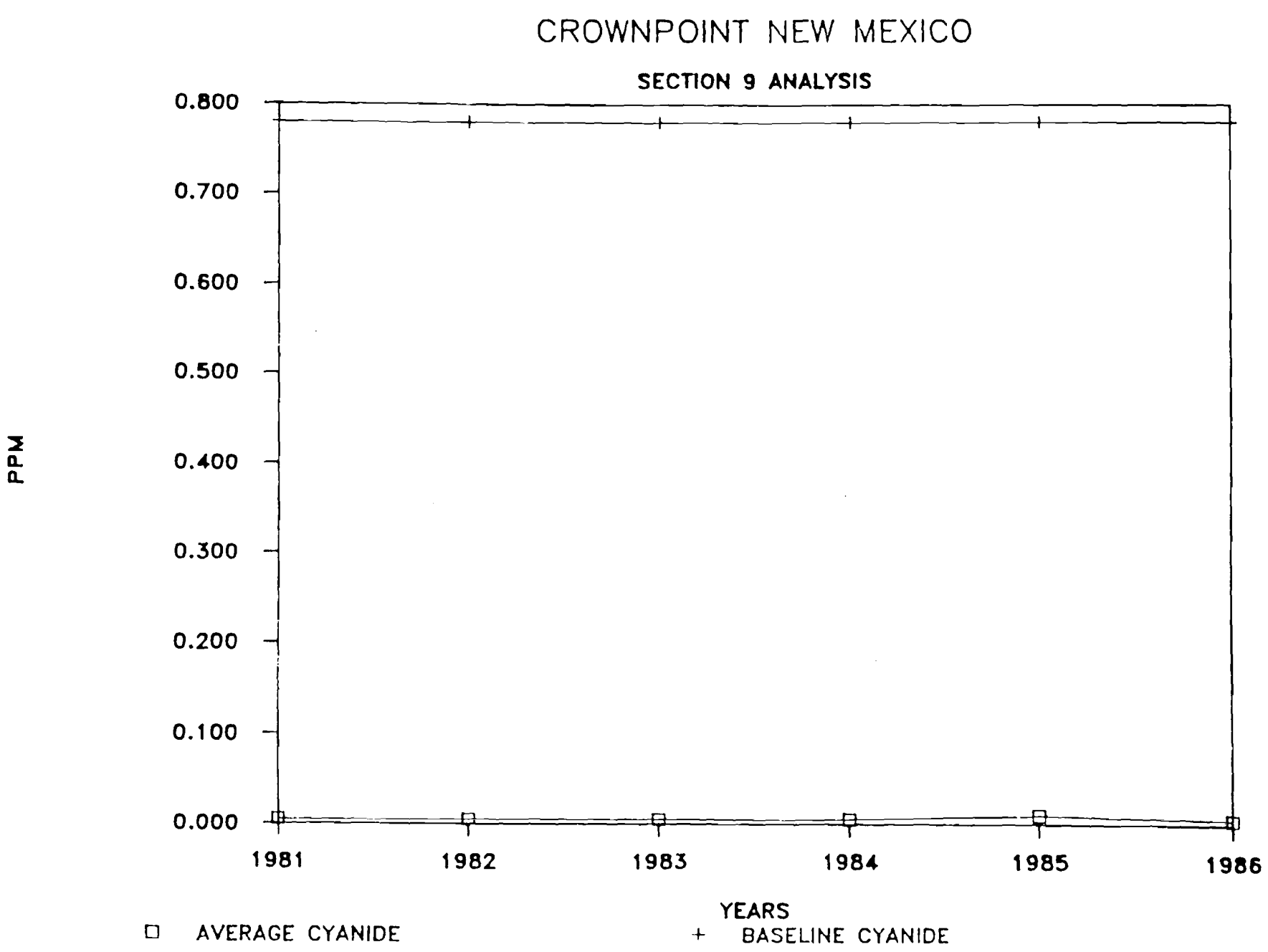
PPM
1981
1982
1983
1984
1985
1986
YEARS
AVERAGE COPPER
BASELINE COPPER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PPM
1981
1982
1983
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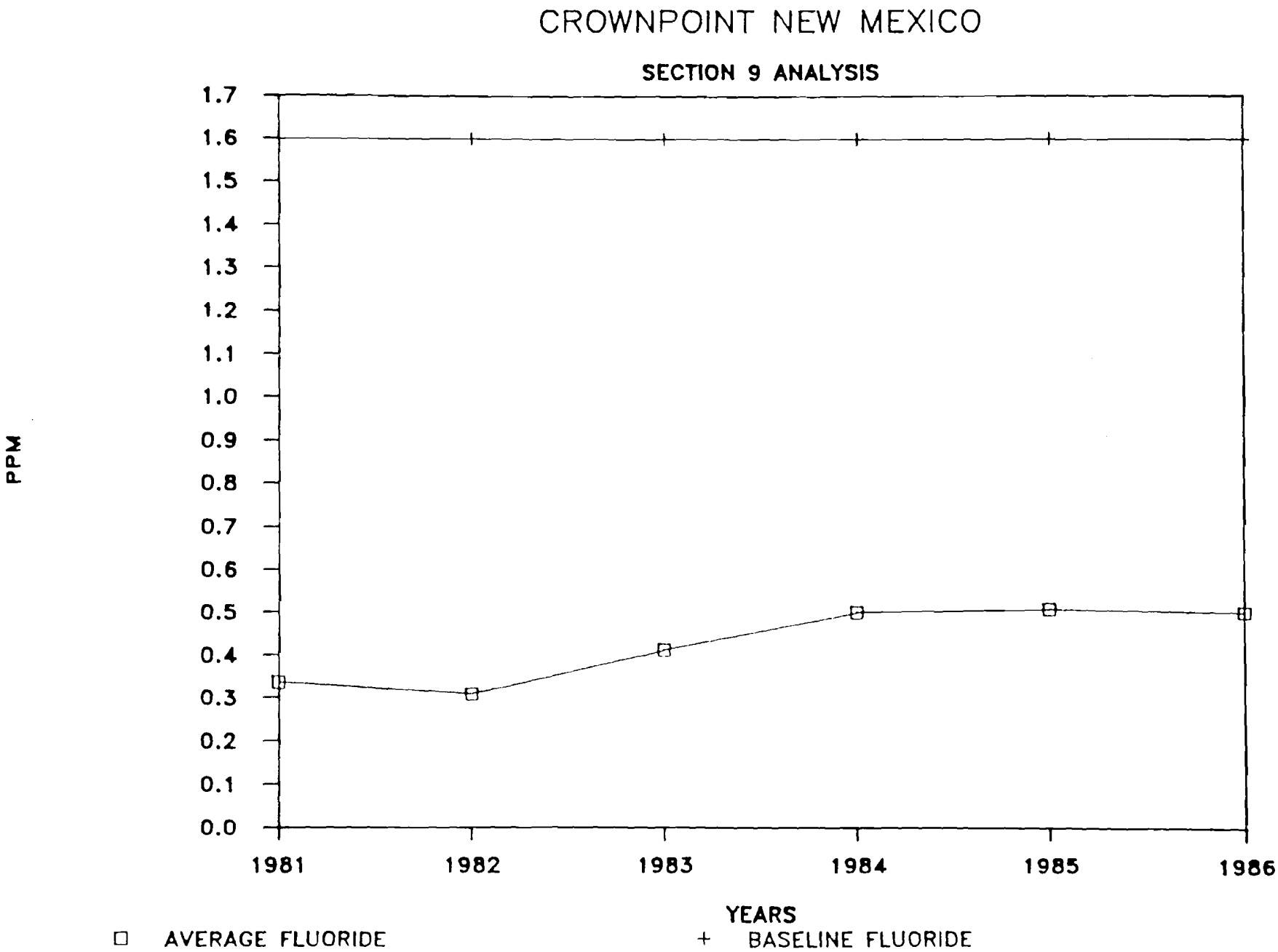
1985
1986
YEARS
AVERAGE CYANIDE
BASELINE CYANIDE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0.7
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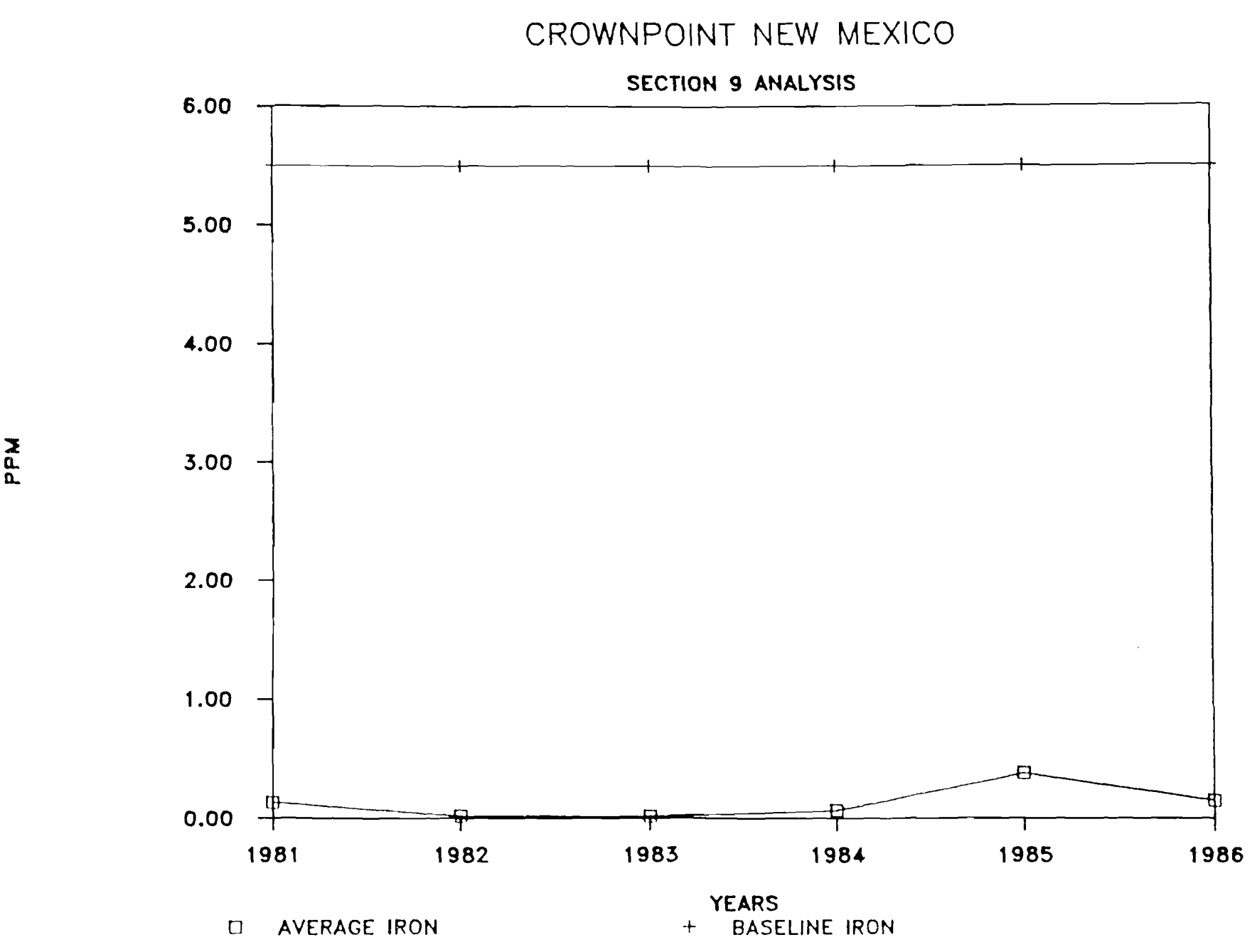
YEARS
AVERAGE FLUORIDE
BASELINE FLUORIDE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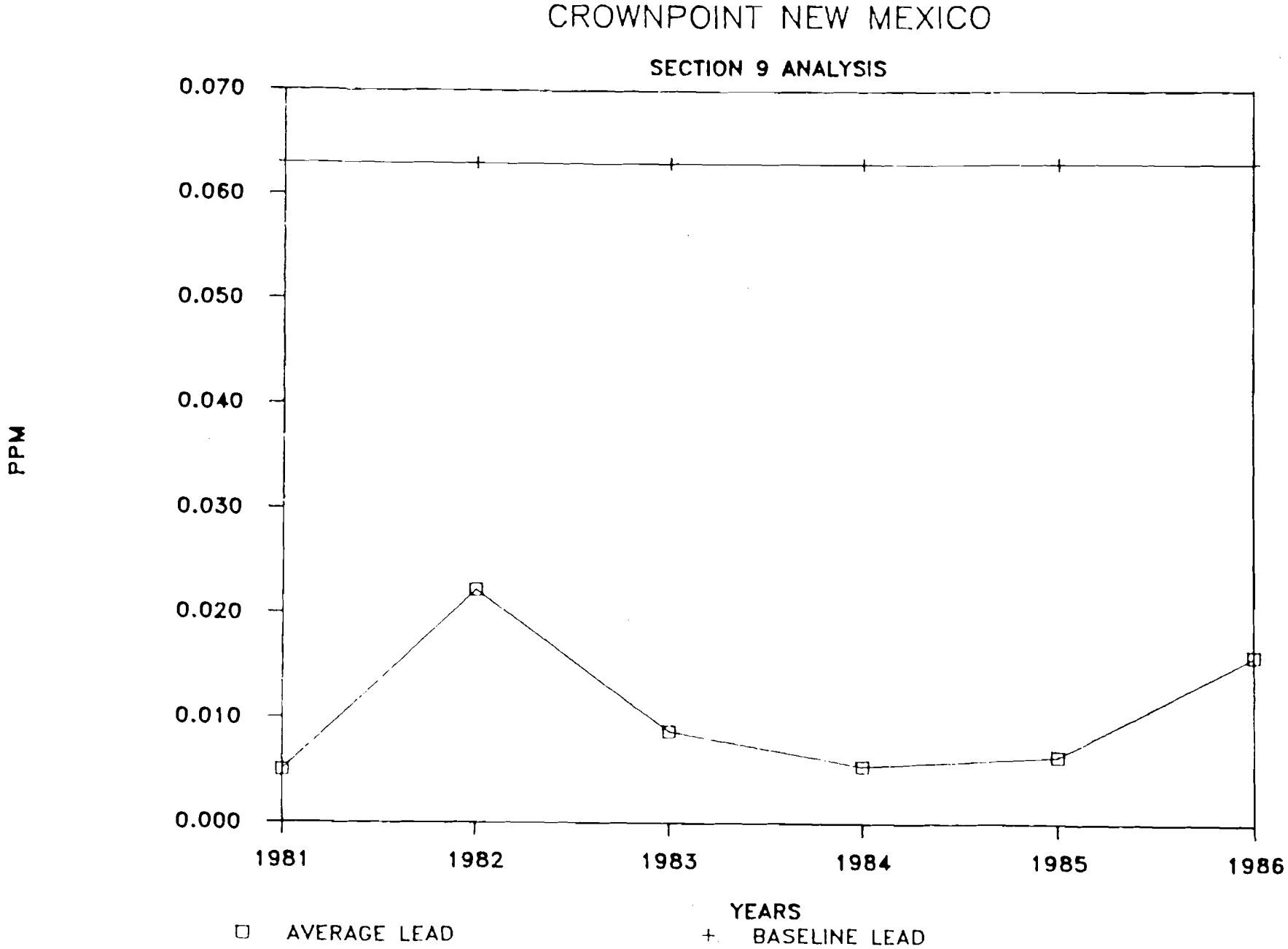
1982
1983
1984
1985
1986
YEARS
AVERAGE IRON
BASELINE IRON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YEARS
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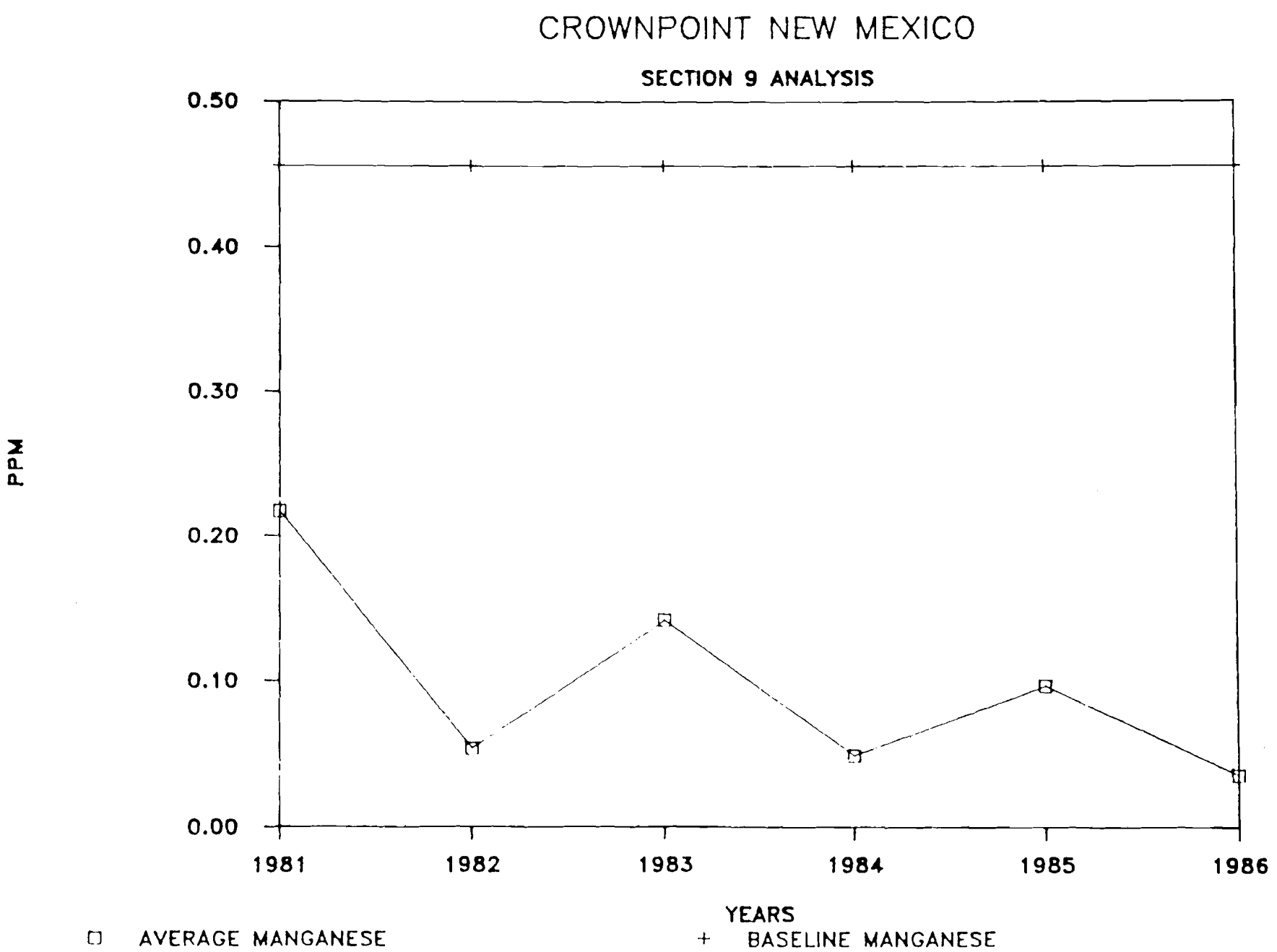
BASELINE LEAD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PPM
1981
1982
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1986
YEARS
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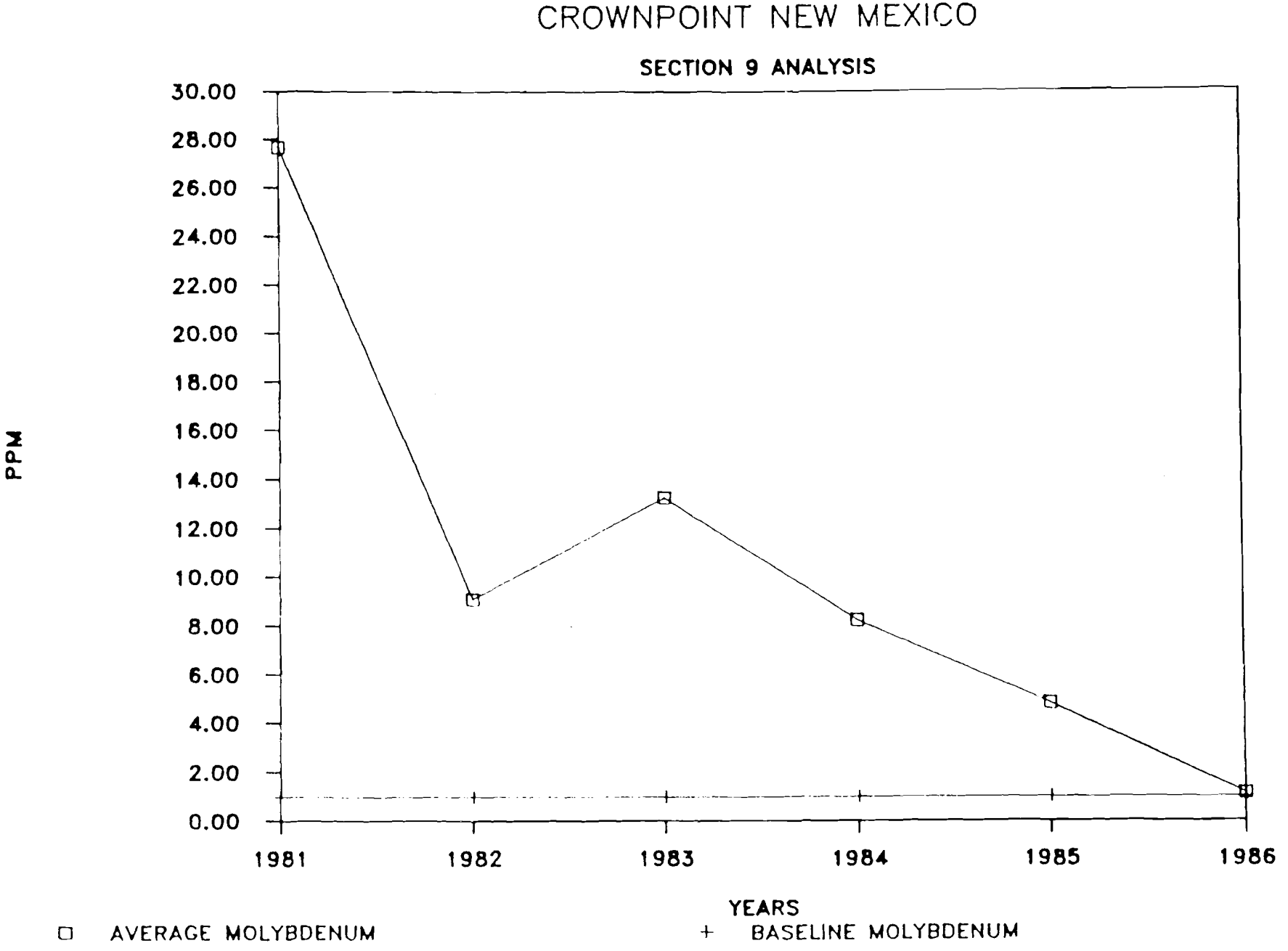
BASELINE MANGANESE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12.00
10.00
8.00
6.00
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1981
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1983
1984
1985
1986
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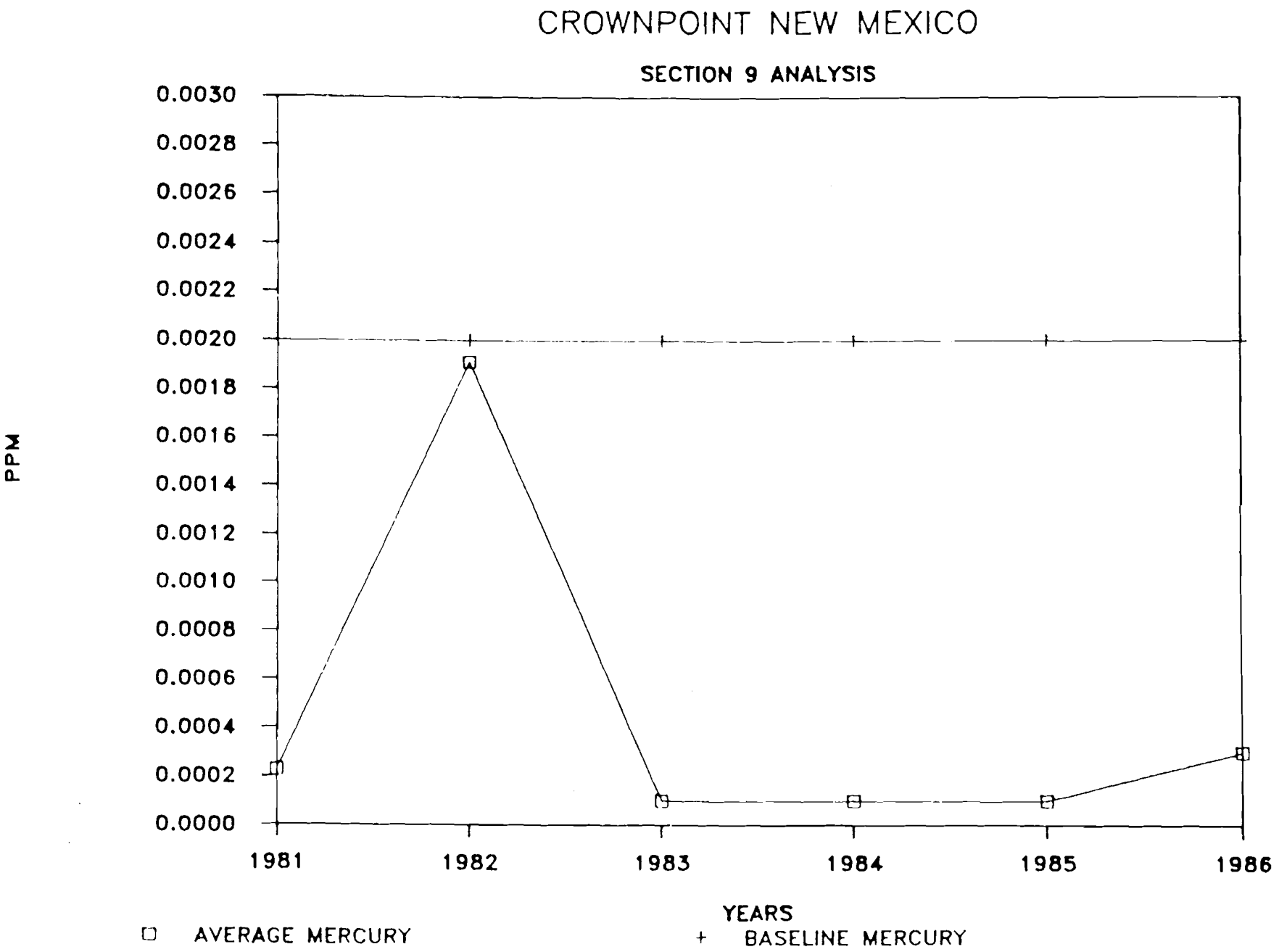
BASELINE MOLYBDENUM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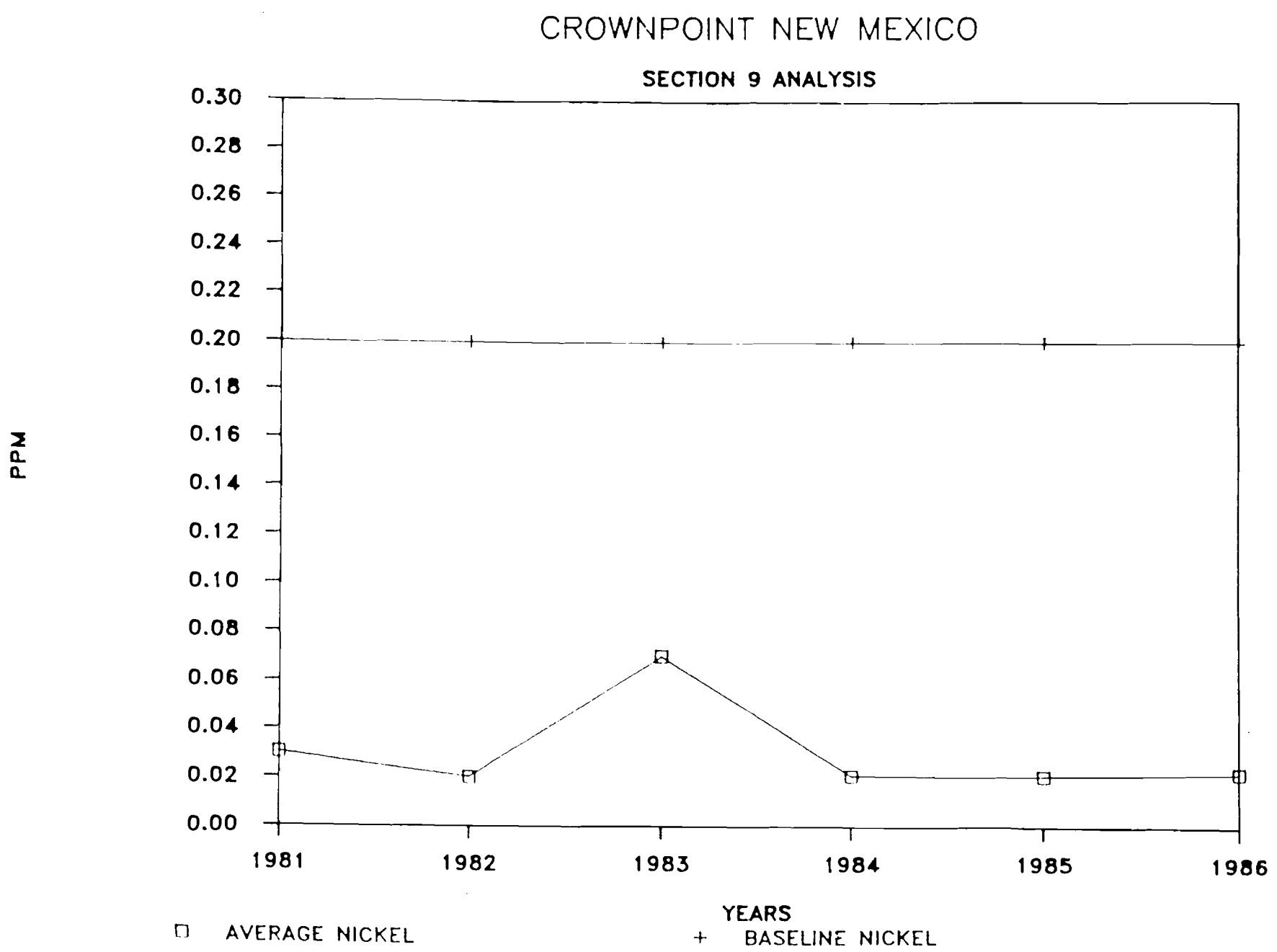
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1984
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1986
YEARS
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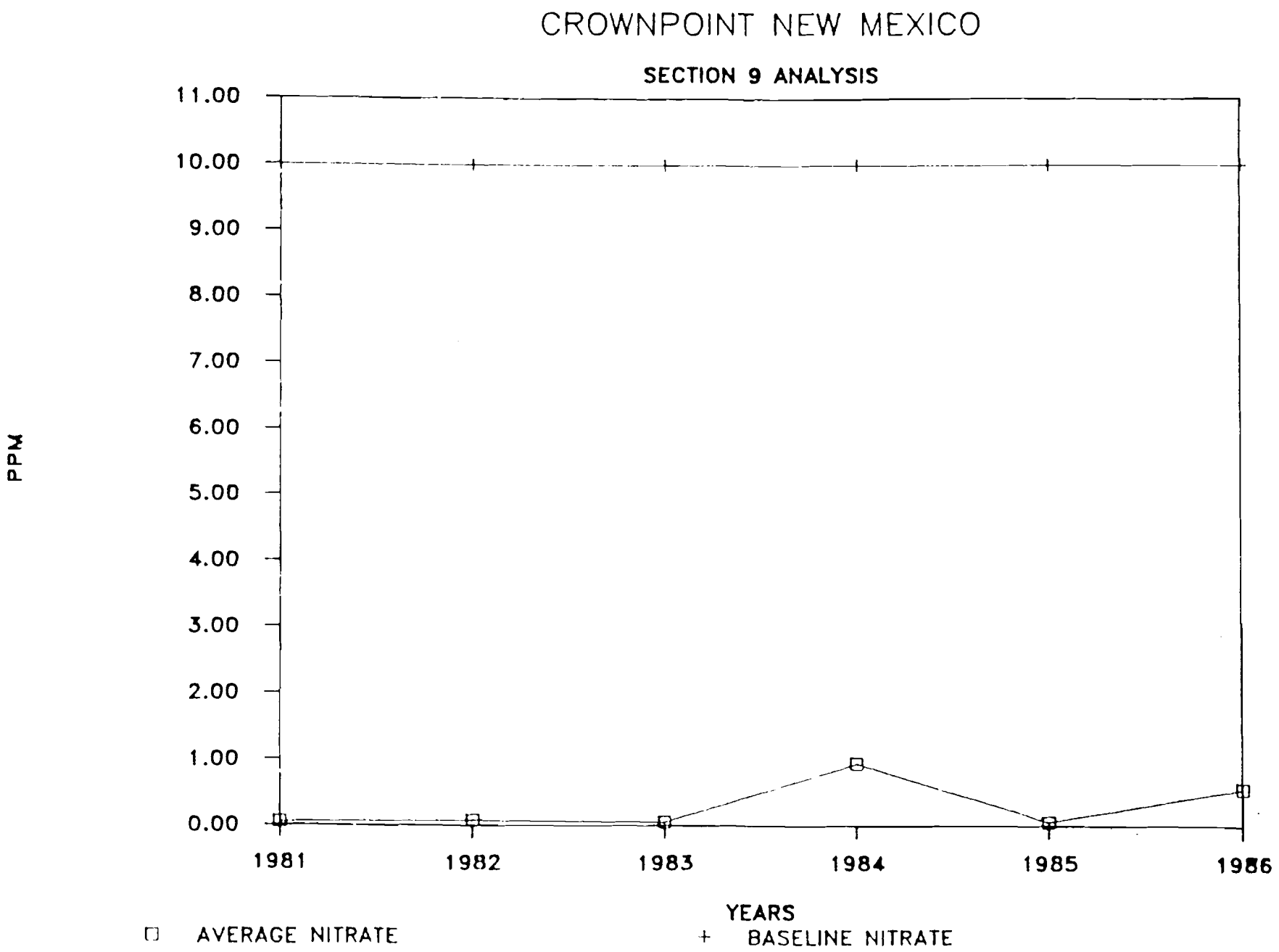
BASELINE NICKEL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PPM
1981
1982
1983
1984
1985
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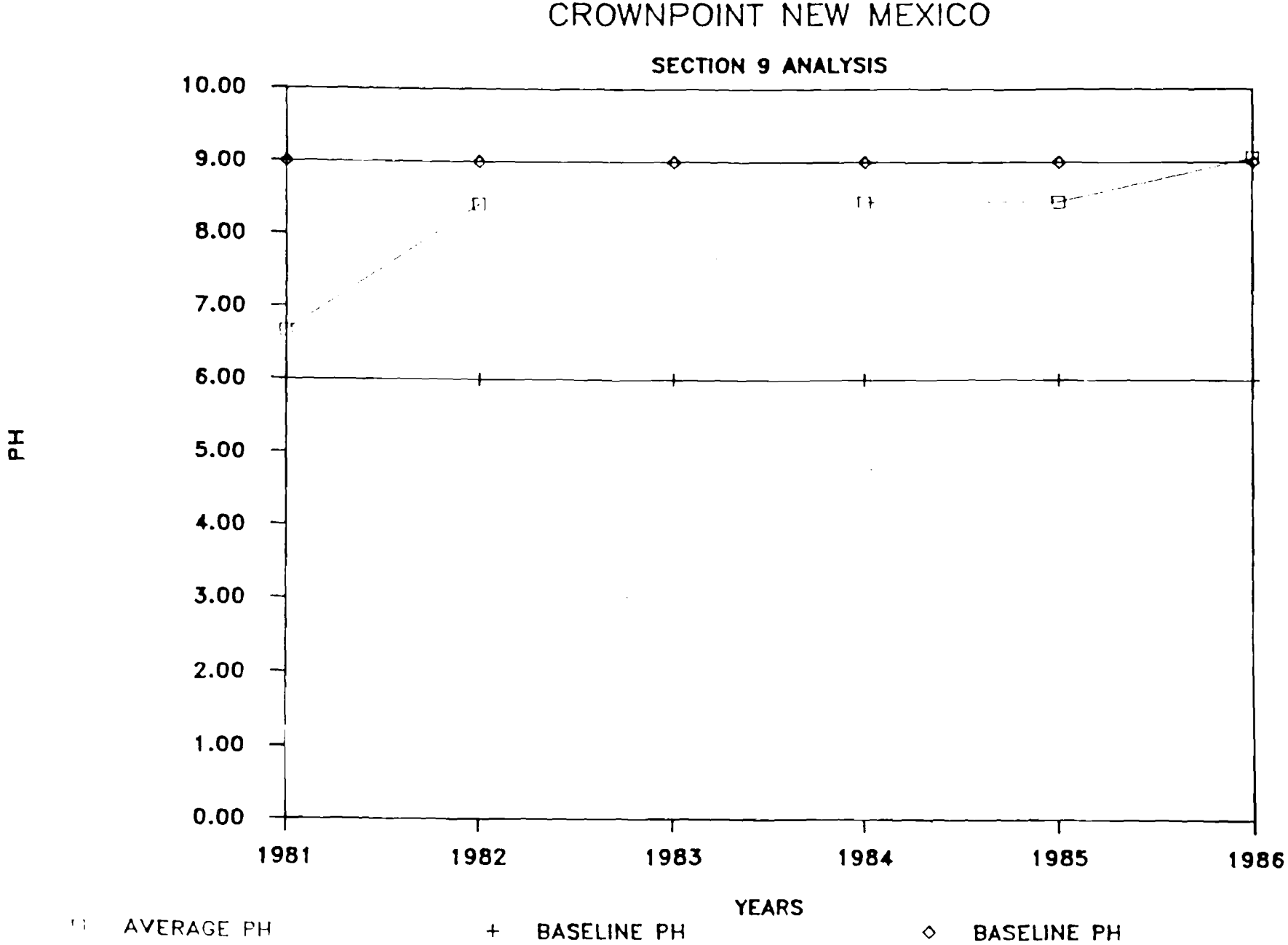
YEARS
AVERAGE NITRATE
BASELINE NITRATE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4.00
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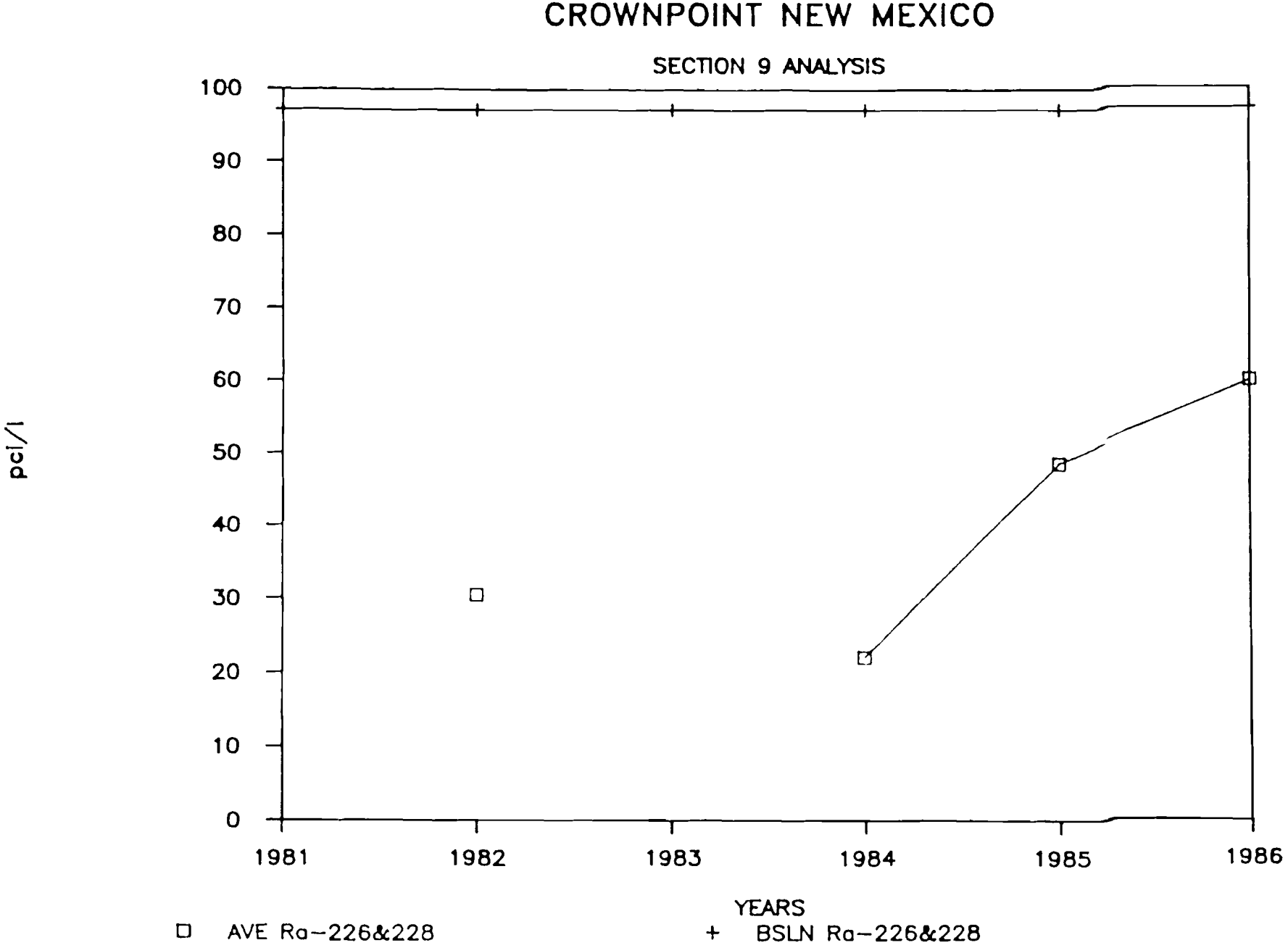
PH
1981
1982
1983
1984
1985
1986
YEARS
AVERAGE PH
BASELINE PH
BASELINE PH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pci/l
100
90
80
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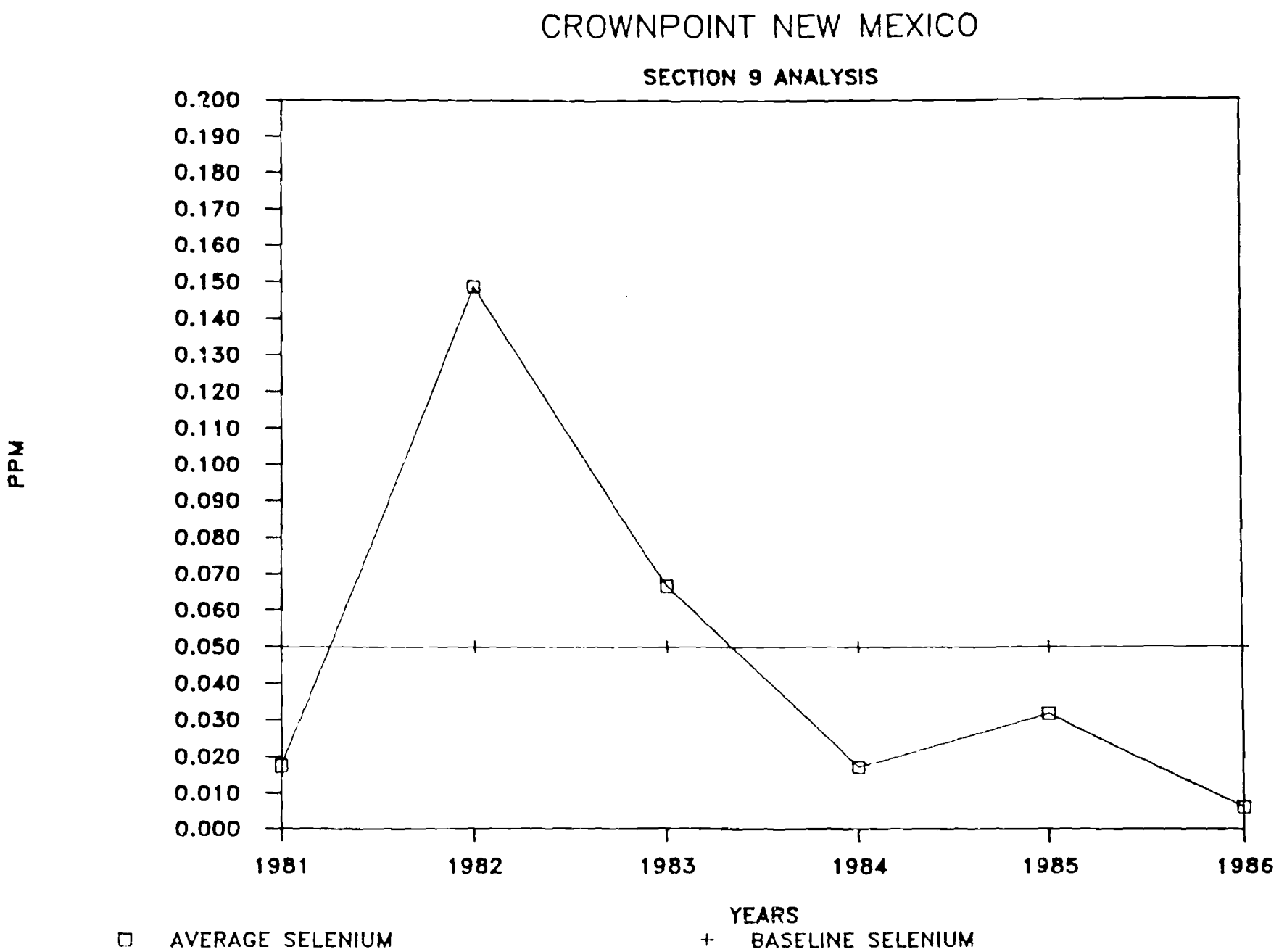
20
10
0
1981
1982
1983
1984
1985
1986
YEARS
AVE Ra-226&228
BSLN Ra-226&228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0.120
0.110
0.100
0.090
0.080
0.070
0.060
0.050
0.040
0.030
0.020
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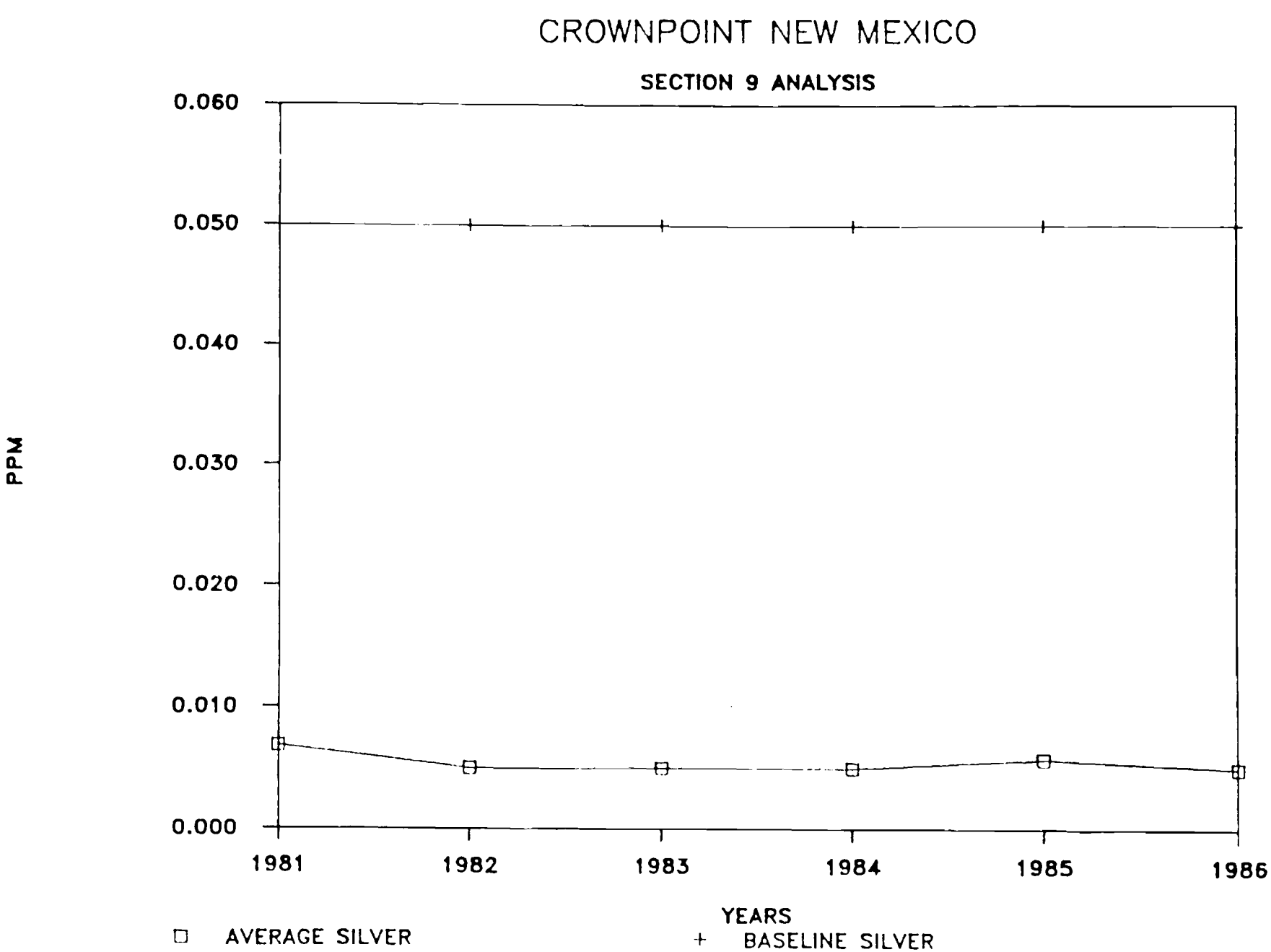
0.000
1981
1982
1983
1984
1985
1986
YEARS
AVERAGE SELENIUM
BASELINE SELENIUM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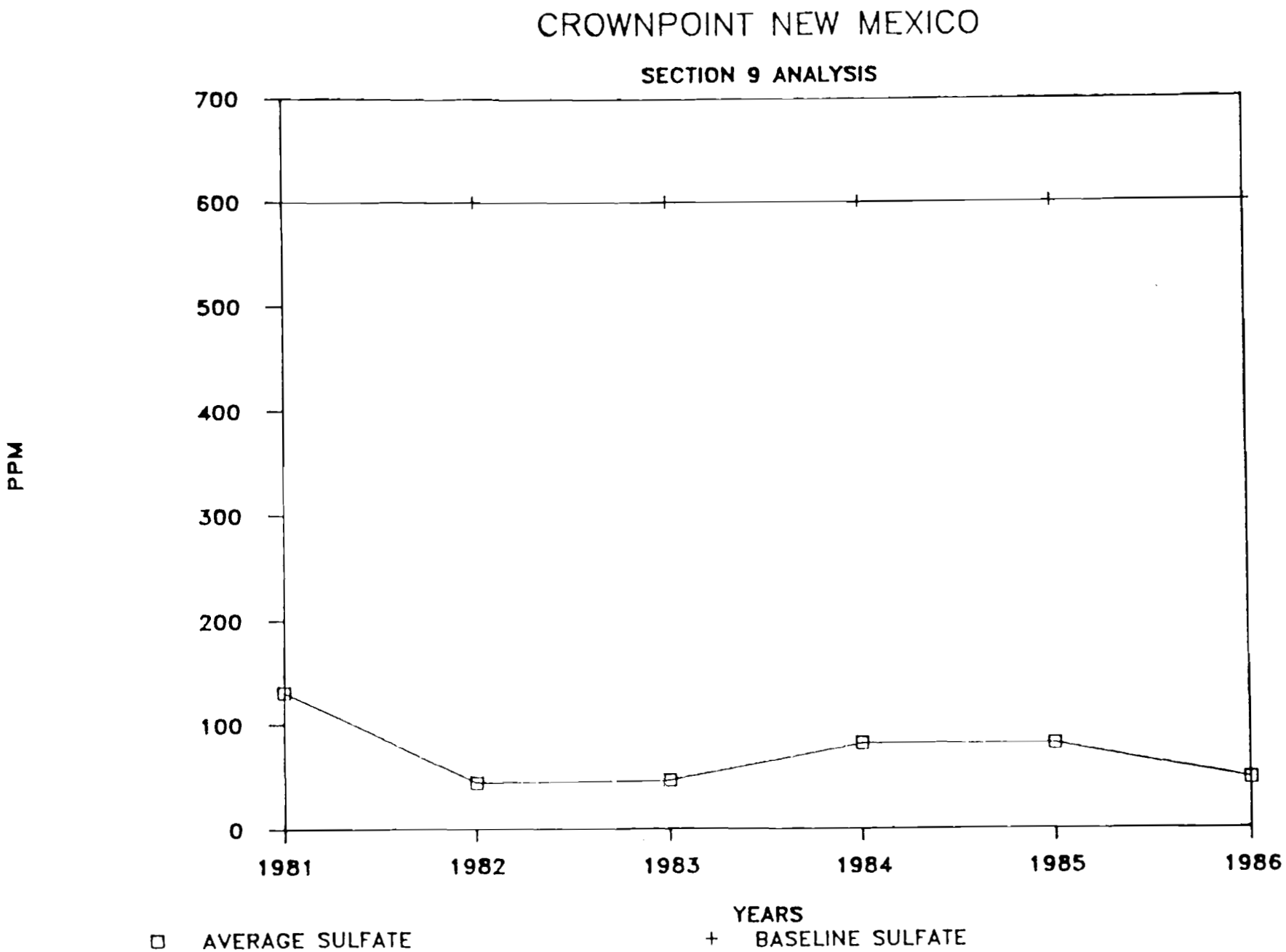
0.050
0.040
0.030
0.020
0.010
0.000
PPM
1981
1982
1983
1984
1985
1986
YEARS
AVERAGE SILVER
BASELINE SILVER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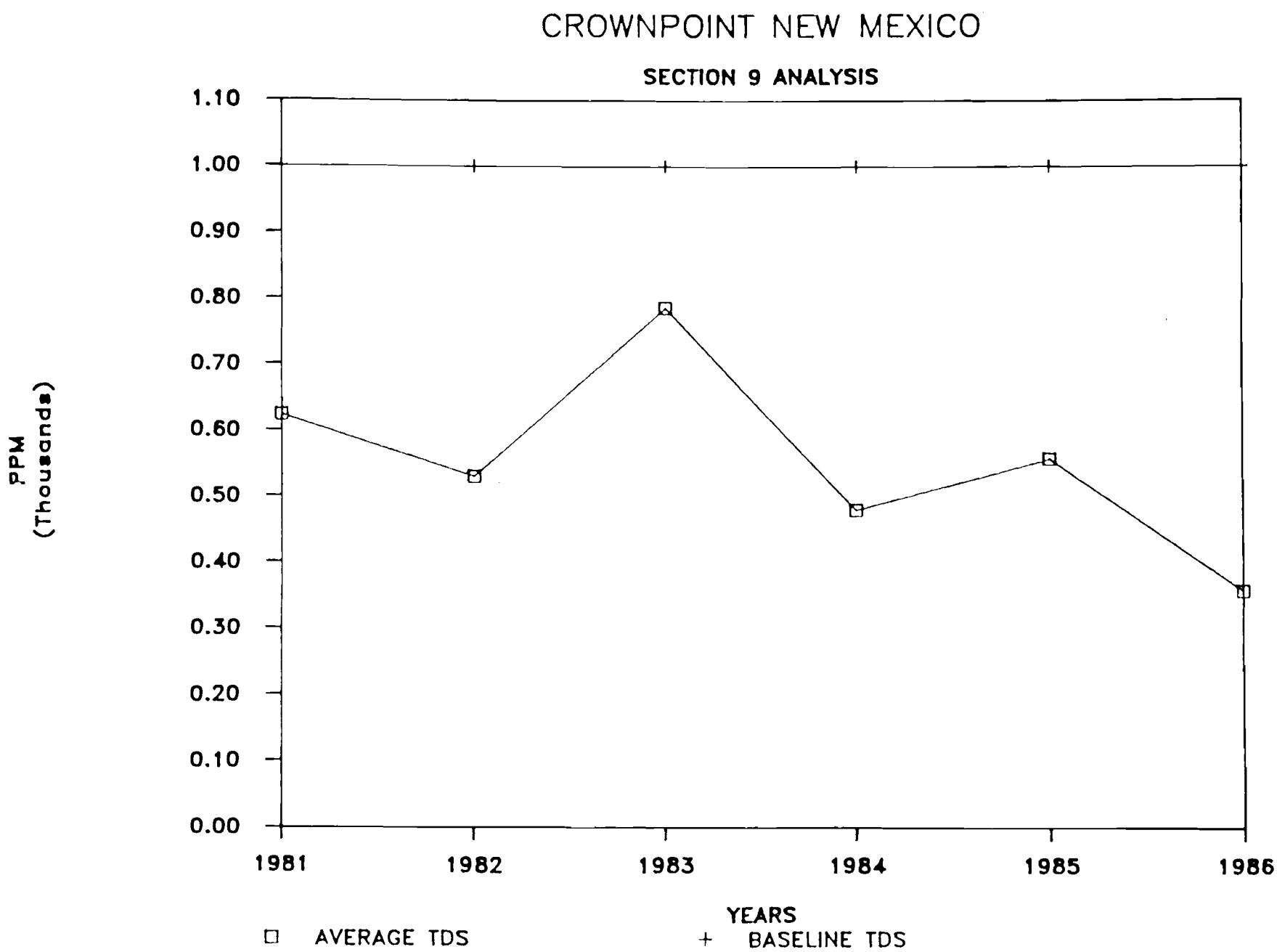
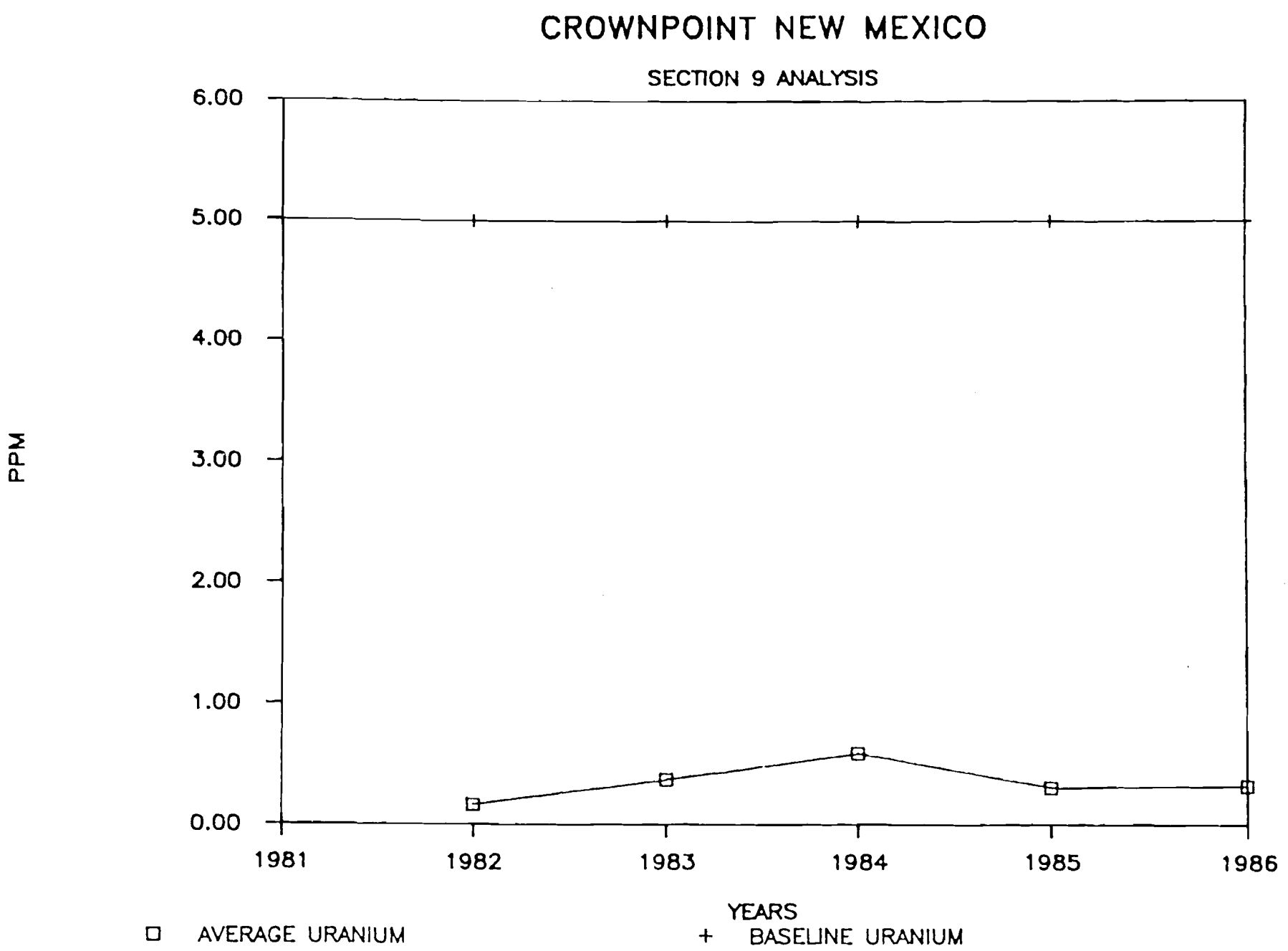
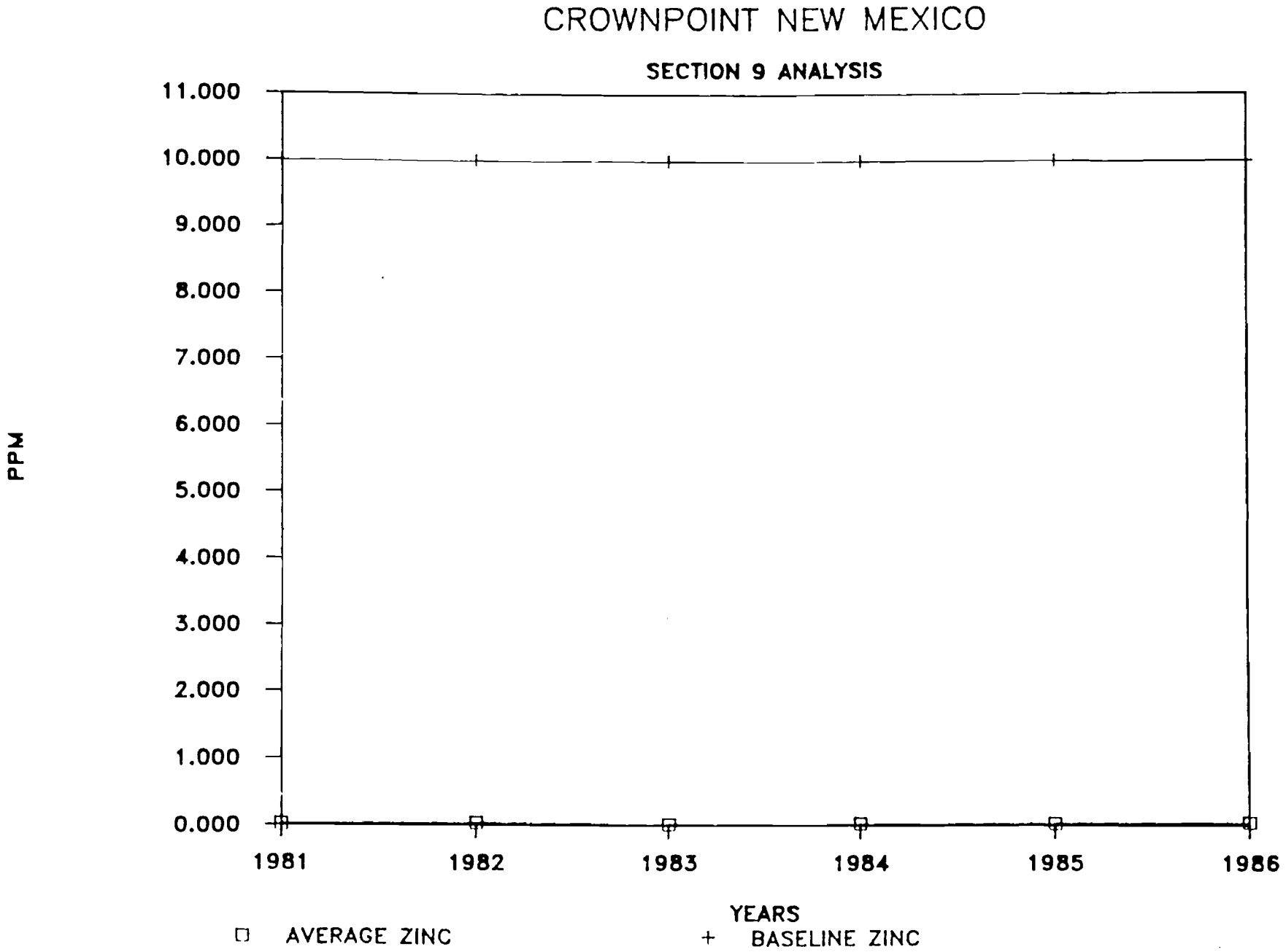
200
100
0
PPM
1981
1982
1983
1984
1985
1986
YEARS
AVERAGE SULFATE
BASELINE SULFATE


CROWNPOINT NEW MEXICO
SECTION 9 ANALYSIS
PPM
(Thousands)
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1981
1982
1983
1984
1985
1986
YEARS
AVERAGE TDS
BASELINE TDS


CROWNPOINT NEW MEXICO
SECTION 9 ANALYSIS
6.00
5.00
4.00
3.00
2.00
1.00
0.00
PPM
1981
1982
1983
1984
1985
1986
YEARS
AVERAGE URANIUM
BASELINE URANIUM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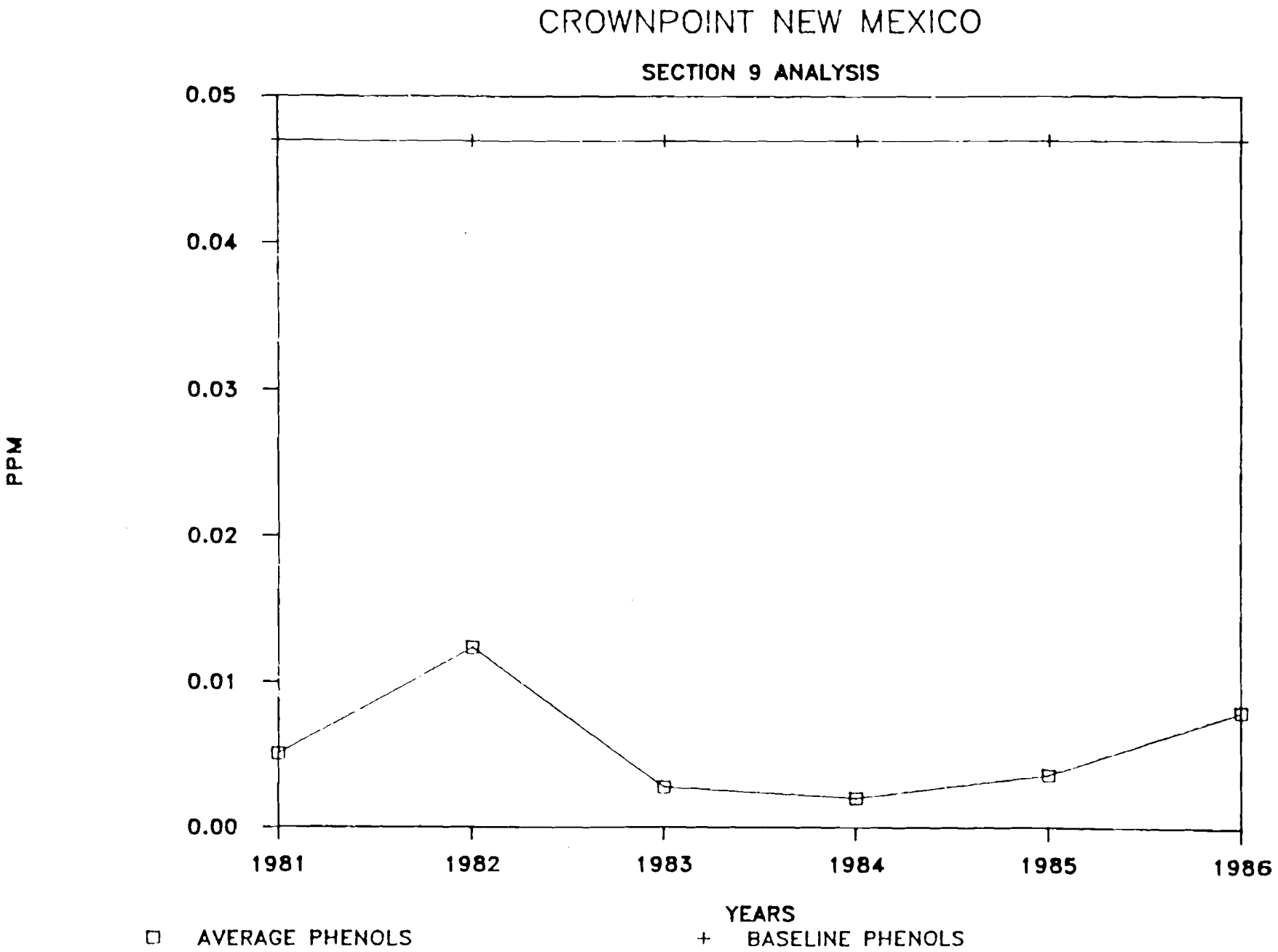
SECTION 9 ANALYSIS
11.000
10.000
9.000
8.000
7.000
6.000
5.000
4.000
3.000
2.000
1.000
0.000
PPM
1981
1982
1983
1984
1985
1986
YEARS
AVERAGE ZINC
BASELINE ZINC


CROWNPOINT NEW MEXICO
SECTION 9 ANALYSIS
0.05
0.04
0.03
0.02
0.01
0.00
PPM
1981
1982
1983
1984
1985
1986
YEARS
AVERAGE PHENOLS
BASELINE PHENOLS

ATTACHMENT 4

PRODUCTION HISTORY
CROWNPOINT SECTION 9
IN-SITU LEACH PILOT PLANT
NOVEMBER 6, 1979 TO OCTOBER 1, 1980

The injection of chemicals began on November 6, 1979 and utilized a 2 gram per liter (g/L) $NaHCO_3$ solution. This was followed on November 9 by injection with 2g/L $H_2O_2$ and 2g/L $NaHCO_3$. The injection rate was 73 gpm and the production rate was 75 gpm. The 2gpm bleed was pumped to a disposal pond. The use of the small bleed conserved water and helped eliminate excursions caused by over injection. These injection and production rates decreased to approximately 55 gpm over the life of the pilot test.

The first chemical break through in a production well was seen on November 15. Uranium break through occurred in a production well on November 16 and the production stream in all four production wells contained uranium by early December.

The production of uranium started slowly, but over 3 months gradually reached 100 ppm. By May 1980 the level of uranium in the production stream exceeded 100 ppm and remained at this level for the rest of the leaching phase of the test.

Molybdenum levels in the production stream reached 100 ppm almost immediately, rapidly escalated to 200 ppm and remained higher than the uranium concentration until May, 1980. Molybdenum concentrations after May remained slightly lower than uranium concentrations for the balance of the leaching phase. Figure 1 shows uranium and molybdenum levels as a function of time throughout the leaching phase of the pilot test.

Uranium in the leachate was removed by an ion exchange unit and the "barren" solution was reinjected into the well field after chemicals were added to regenerate the desired leachate formulation. Figure 2 is a process flow sheet for the in-situ leach plant. Details on the actual processing of uranium bearing leachate can be found in:

> Vogt, T.C., Strom, E.T., Venuto, P.B., Winget, J.E., and Scoggins, M.W., "Insitu Leaching of Crownpoint, New Mexico Uranium One Part 6, The Section 9 Pilot Test", Journal of Petroleum Technology, December 1984, pp 2243-2254.

During the early portion of the leaching phase, uranium loading on the ion exchange (IX) resins was poor. The resin beads appeared to be loaded with as much molybdenum as uranium. Eventually a process was evolved to strip molybdenum from the IX resin selectively and remove it from the circuit. As molybdenum was gradually removed from the production stream, uranium loading on the IX beads improved.

The leaching phase of the Pilot Test continued until October 1, 1980, at which time the introduction of chemicals to the leachate ceased. It was

estimated that approximately 15% of the uranium in the pilot area was recovered during the leaching phase.

FIGURE 1

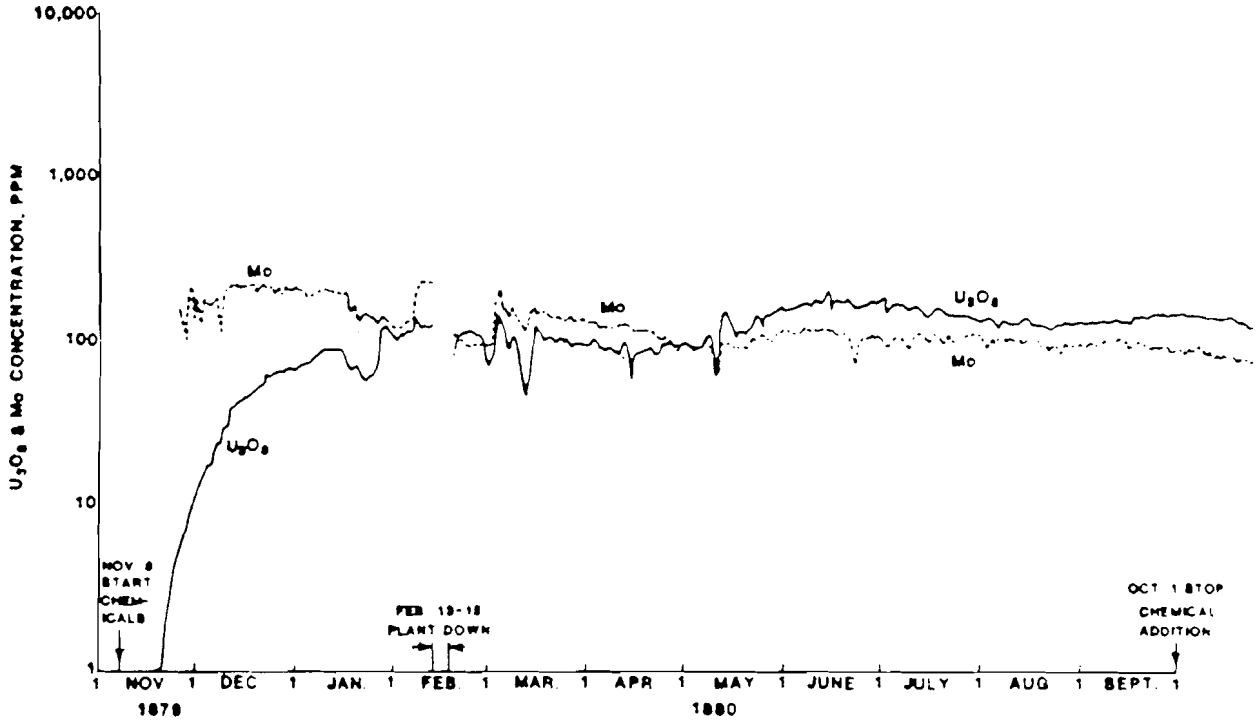



Fig. 7—Uranium and molybdenum levels in the production stream at the Crownpoint Section 9 pilot test

FIGURE 2

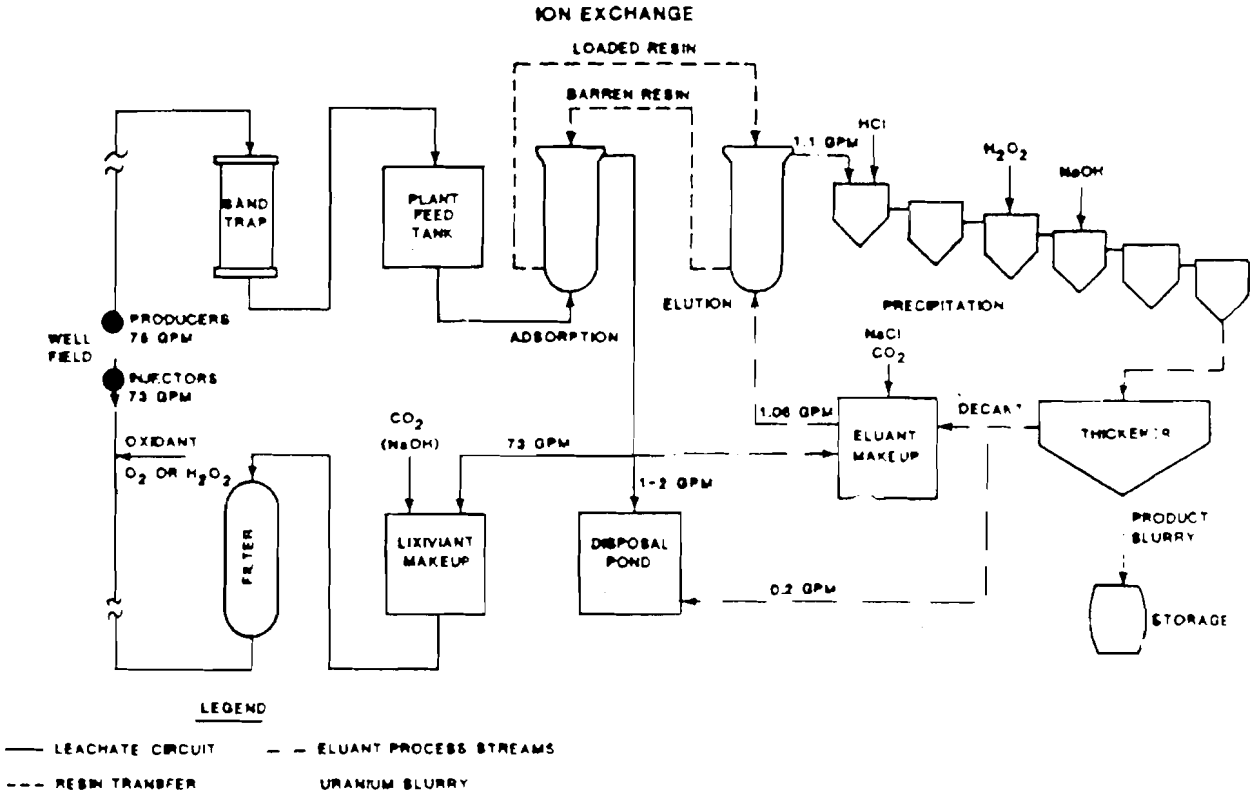



Fig. 6—Process flowsheet for in-situ pilot plant.

ATTACHMENT 4

RESTORATION HISTORY

CROWNPOINT SECTION 9

IN-SITU LEACH PILOT PLANT

OCTOBER 1980 TO OCTOBER 1986

Stage 1 Leaching Stopped, Normal Well Field Operation Continued (October 1, 1980 to December 1st week).

Injection of lixiviant chemicals was stopped on October 1, 1980. Normal operation of the well field continued, however, (to remove uranium and molybdenum from the leachate) at a flow rate of about 40 gpm.

Uranium was removed by the ion exchange columns. Molybdenum was removed by the molybdenum strip circuit incorporated in the surface plant. Waste waters were routed to the evaporation ponds and barren lixiviant (no chemicals added) was circulated back to the well field.

During this two month period, significant reduction in concentrations of calcium, sodium, sulfates, bicarbonate, molybdenum, uranium, and radionuclide activities were measured in the leachate (i.e., water removed from the well field for treatment).

Stage 2 Water Softening Treatment (December 1st Week to December 24, 1980)

A lime water softener was brought on stream during the first week of December 1980. The softener was used to reduce temporary hardness and alkalinity from the barren lixiviant prior to injection into the well field. This "pretreatment" was necessary for successful operation of a reverse osmosis unit planned for installation.

Lime slurry generated by the water softener was shipped to Kerr-McGee for disposal in an approved tailings impoundment. Waste waters generated by the water softener were routed to the evaporation ponds for disposal. During this three week period concentrations of major ions in the leachate remained fairly stable with no significant reduction in concentrations noted.

Stage 3 Ground Water Sweep (December 24 to 30, 1980)

A high rate ground water sweep (approximately 260 gpm) was initiated on December 24, 1980. Water was simply pumped from the well field and routed to a surge pond. Pumping was stopped on December 30, 1980 when the pond capacity was 80% consumed by the discharge.

Approximately 2.2 MM gallons of water was pumped from the well field and routed directly to the waste evaporation ponds.

During this six day sweep significant reduction in concentrations of calcium, sodium, sulfates, chlorides, and uranium was observed.

Stage 4 Pond Water Treatment (December 30, 1980 to late January 1981)

While waiting for the Reverse Osmosis (R. O.) unit to be brought on stream for the well field, water was pumped from the pond to the water softener and back to the pond to reduce temporary hardness and alkalinity.

During this three to four week period no restoration activity in the well field was conducted.

Stage 5 R. O. Treatment and Ground Water Sweep (Late January 1981 to July 1981)

The reverse osmosis (R.O.) unit was installed and put into operation in late January 1981. Water was withdrawn from the well field at approximately 70 gpm and processed through the water softener to reduce temporary hardness and alkalinity. From the softener the water was passed through the R.O. unit to reduce the concentration of other dissolved constituents.

During this five plus month period, a significant reduction in concentrations of calcium, sodium, sulfates, chlorides, bicarbonate, uranium, and radionuclide activity was observed in the water produced from the well field. Only a small reduction in the molybdenum concentration was recorded.

Stage 6 Lime Treatment and Ground Water sweep (July 1981 to May 1982)

In July, lime (calcium hydroxide) was added to the R.O. permeate to reduce dissolved molybdenum in the leach pattern.

Experiments at Mobil's Field Research Laboratory (FRL) in Dallas had indicated that an increase in pH and an increase in calcium would be beneficial in reducing the levels of dissolved molybdenum.

Prior to addition of lime in the R.O. permeate, molybdenum levels in the well field has leveled off at approximately 32 mg/l. Major cations and anions continued to decline slowly in concentration. By adding lime to the system, the molybdenum levels decreased steadily to 9.7 mg/l (average for the well field). A significant reduction in concentrations of calcium, sodium, sulfates, chlorides, bicarbonates, uranium, and radionuclide activity during the ten plus month period also occurred.

Stage 7 Ion Exchange and "Clean Water" Sweep (May 1982 to November 8, 1982)

Use of the R. O. unit and the addition of lime to the well field was halted in May 1982. At that point a "clean water" sweep was initiated. All water from the well field was routed to the ion exchange columns for removal of molybdenum and uranium.

The waste fluid from the ion exchange columns was routed to the evaporation ponds for disposal. The clean water produced was recirculated back to the well field to continue the sweep. A small bleed of ground water was maintained during the sweep operation.

Major cations and anions continued to decline slowly in concentration such that all were below required restoration levels. Molybdenum concentrations continued to decline slowly.

Stage 8 Sodium Sulfide Treatment and Ground Water Sweep (November 8, 1982 to April 15, 1983)

On November 8, 1982 sodium sulfide (a reducing agent) was added to the clean water produced from the ion exchange columns to eliminate dissolved oxygen introduced into the system due to contact with the atmosphere in the surface process plant. By creating a reducing environment in the well field, dissolved molybdenum concentrations would drop along with other heavy metals such as selenium. Sodium sulfide injection was terminated on April 15, 1983 after approximately 9 MM gallons of water were circulated through the well field.

No significant change in major water quality parameters, including molybdenum, occurred during this six month period.

Stage 9 Sit and Soak Period (August 15 to July 14, 1983)

Beginning April 15, 1983 the well field was allowed to "sit and soak" with just a minimum (1 gpm) bleed for approximately three months. All bleed water was routed to the evaporation ponds for disposal.

Analysis of the bleed water at the beginning and end of the sit and soak stage showed no change in major parameters including molybdenum.

Stage 10 Ground Water Sweep (July 14, 1983 to January 13, 1984)

From July 14 to August 3, 1983 a brief ground water sweep was conducted in the well field. Approximately 1 MM gallons of water were pumped from the well field and discharged directly into the evaporation ponds for disposal during this three week period.

From August 10, 1983 to November 9, 1983 a minimum bleed (1 gpm) was maintained on the well field. Use of the low flow rate was necessary until an amended water appropriation application (submitted to the State Engineer) was approved. The 1 GPM bleed was routed to the evaporation ponds for disposal.

After receipt of the amended water appropriation at the end of October 1983, production flow was increased to 40 gpm on November 9, 1983. No water was injected back into the formation, but was routed to the evaporation ponds for disposal.

On December 16, 1983 production flow was decreased from 40 gpm to 20 gpm because the evaporation ponds were approaching full capacity. All flow was stopped on January 13, 1984.

During this five month sweep period no significant change in molybdenum concentrations were observed. Concentrations of sodium and chloride did drop significantly.

Stage 11 R.O. Treatment and Ground Water Sweep (January 18 to May 1, 1984)

On January 18, 1984 a reverse osmosis (R. O.) unit was brought on line to reduce dissolved constituents. Water was pumped from the well field at about 34 gpm and routed to the R.O. Unit for treatment. R. O. Permeate was injected back into the well field at a rate of 25gpm. R. O. reject (approximately 9 gpm) was routed to the third evaporation pond for disposal.

During the three plus month period concentrations of chloride and molybdenum decreased slightly.

Stage 12 Hydrogen Sulfide Injection (May 1, 1984 to March 18, 1985)

On May 1, 1984 Hydrogen sulfide ($H_2S$) was injected into the wellfield to test the effectiveness of the chemical as a reductant (i.e., to lower the pH of the ground water in the well field, maintain the aquifer redox potential in a reduced state similar to preleaching conditions, and reduce the concentration of dissolved molybdenum and other heavy metals).

Tests were conducted by pumping ground water at a rate of approximately 20 gpm from one well, adding 400 mg/l $H_2S$, and injecting the treated water into another well (13 total). The total volume of water injected into each well treated was approximately 40 M gallons. The $H_2S$ treated wells were sampled and monitored at an interval of once every two to four weeks. Samples were analyzed for pH, uranium, and molybdenum.

Water samples collected and analyzed during this period showed mixed results for molybdenum. Of the 13 wells, molybdenum concentrations dropped in six wells, rose in four wells, and stayed approximately the same in three wells.

Stage 13 Sit and Soak Period (March 18, 1985 to April 15, 1986)

Following $H_2S$ treatment/injection the well field was allowed to "sit and soak" to allow sufficient time for dissolved molybdenum to react with $H_2S$ to form $MoS_2$ (solid). During this period water samples were collected from the well field periodically and analyzed.

Of the 13 wells treated with $H_2S$, the September 1985 laboratory analysis showed molybdenum concentration decreased in ten wells and increased in three wells. The well field average concentration for molybdenum had decreased from 7.7 mg/l in September 1984 and 10.4 mg/l in December 1984 to 4.8 mg/l in September 1985. By September 1985, eight of the wells were below NMWQCC 1.0 mg/l standard for molybdenum.

Also, during this period beginning in October 1985 a well maintenance program was conducted in the well field with the approval of the State Engineer's Office. Five wells were selected for maintenance which included cleaning and acidizing to improve well performance. The well maintenance program ended in December 1985.

Stage 14 Ground Water Circulation (April 15, 1986 - May 20, 1986)

To insure that a well was properly cleaned and insure that residual well bore material was not contaminating the samples, the wells were pumped to the pond. After pumping each well, water from within the wellfield was pumped in a closed circuit into each well to insure uniform mixing of reduced fluids throughout the wellfield.

Stage 15 Sit and Soak (Static Condition) May 20, 1986 - Present

In preparation for declaring restoration, the wellfield has remained idle except for routine water quality sampling as required under the terms and conditions of the permits.

MOBIL PILOT INSITU LEACH

URANIUM PROJECT

CROWNPOINT, NEW MEXICO

# APPENDIX A

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SAMPLING PROCEDURE

The following procedure is utilized in obtaining samples of water from the wells in the Section 9 wellfield. The well field is shown on Exhibit 1.

1. A packer and sampling apparatus is lowered down the well to a point where the bottom of the packer is even with the top of the perforations. The sampling device, a pneumatic displacement pump, is attached 2.0 feet below the bottom of the packer so the pump lies adjacent to perforations in the well casing. The placement of the packer and pump is diagrammed on Exhibit 2. The packer is inflated by nitrogen gas to a pressure that is 40 to 50 pounds greater than the hydrostatic pressure at that depth in the well.

2. The pump, also operated by nitrogen gas, then evacuates two casing volumes of water occupying the perforated interval of the well at a rate of 0.10 pgm. This volume of water varies from 29 to 57 gallons depending upon the size of the casing and the extent of the perforated interval. This water is evacuated in order to allow fresh formation water to displace the stagnant water in the well bore prior to sampling. Exhibit 3 is a tabulation of the wells, their inside diameters, and the volume of stagnant water to be evacuated prior to the taking of the sample.

   The sampling device is a pneumatic displacement pump manufactured by Baski Water Instruments, Inc. of Denver, Colorado. The operation of this pump is described on Exhibit 4.

3. Following evacuation of two casing volumes of stagnant water, a three gallon sample is taken. This sample is treated for use in the various analyses as described below.

   A. 1 Liter non-filtered, untreated.

   B. 1 Liter filtered through a 0.45 micron filter and preserved with 6 NaOH tablets.

   C. 1 Liter filtered as above and preserved with 2mls of $H_2SO_4$ or 5mls $CuSO_4$. This sample stored in glass container.

   D. 1 Liter filtered as above and preserved with 5mls conc $HHNO_3$.

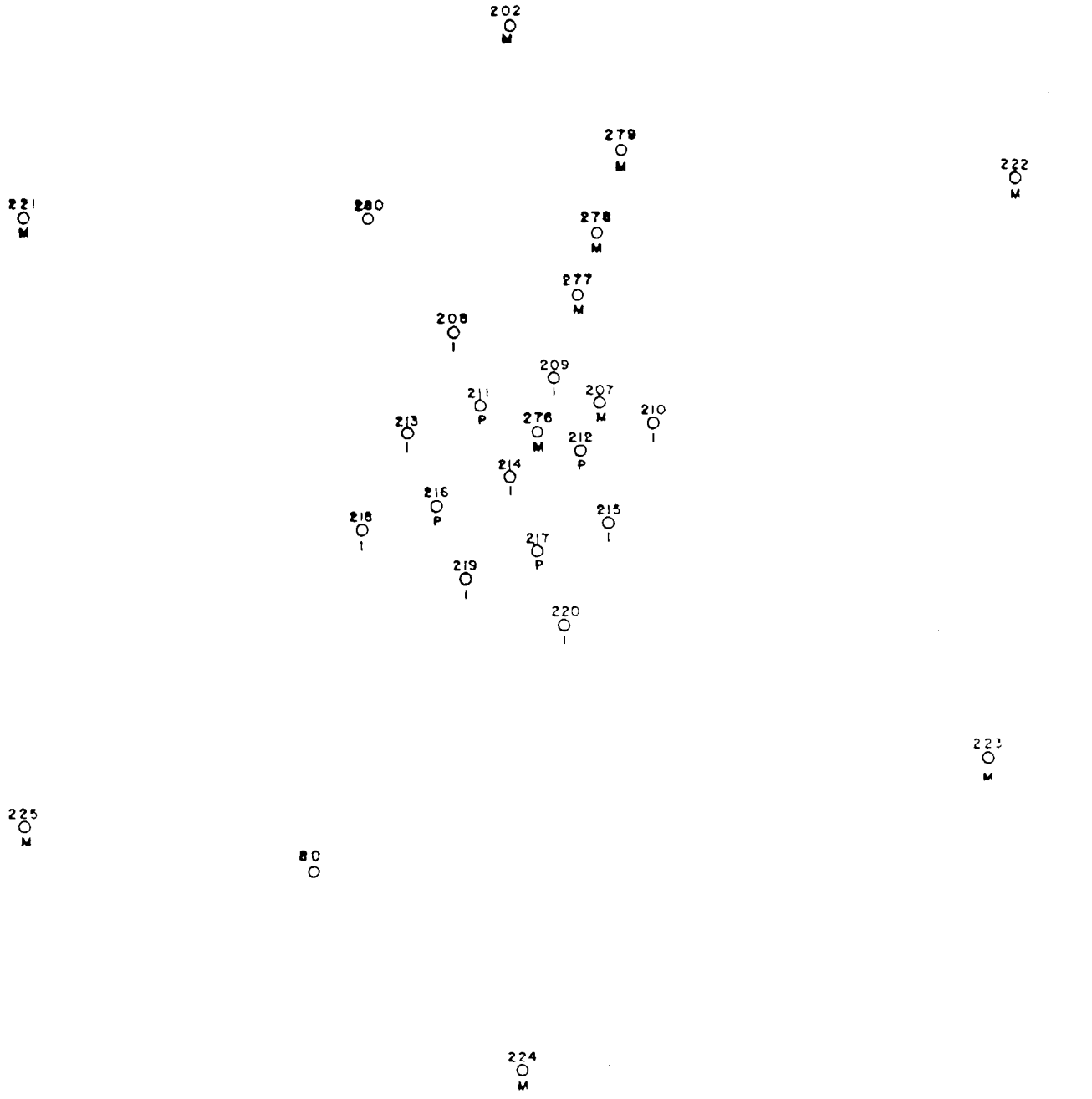
   E. 1 Liter filtered as above and preserved with 2mls conc. $H_2SO_4$.

   F. 0.5 Liter non-filtered and preserved with 2.5 mls conc. $HNO_3$.

   G. 1 Gallon filtered as above and preserved with 20mls conc $HNO_3$.

   Radon 222 is sampled in the field by attaching tubing to a sample port and filling a vacuum blood sample tube by inserting an injection needle through the vacuum tube seal. The radon sample is shipped to the lab the following morning by air express. Samples A, B, and C are shipped cold in an ice chest while the rest are shipped at room temperature.

EXHIBIT 1




LEGEND

ALL WELLS HAVE PREFIX "9U"

I = INJECTION WELL

P = PRODUCING WELL

M = MONITOR WELL

0 100 200

SCALE IN FEET

N

CROWNPOINT PROJECT

McKINLEY CO., NEW MEXICO

SECTION 9 WELLFIELD

EXHIBIT 2

TYPICAL INSTALLATION FOR WATER SAMPLING

SECTION 9 WELLFIELD

CROWNPOINT PROJECT

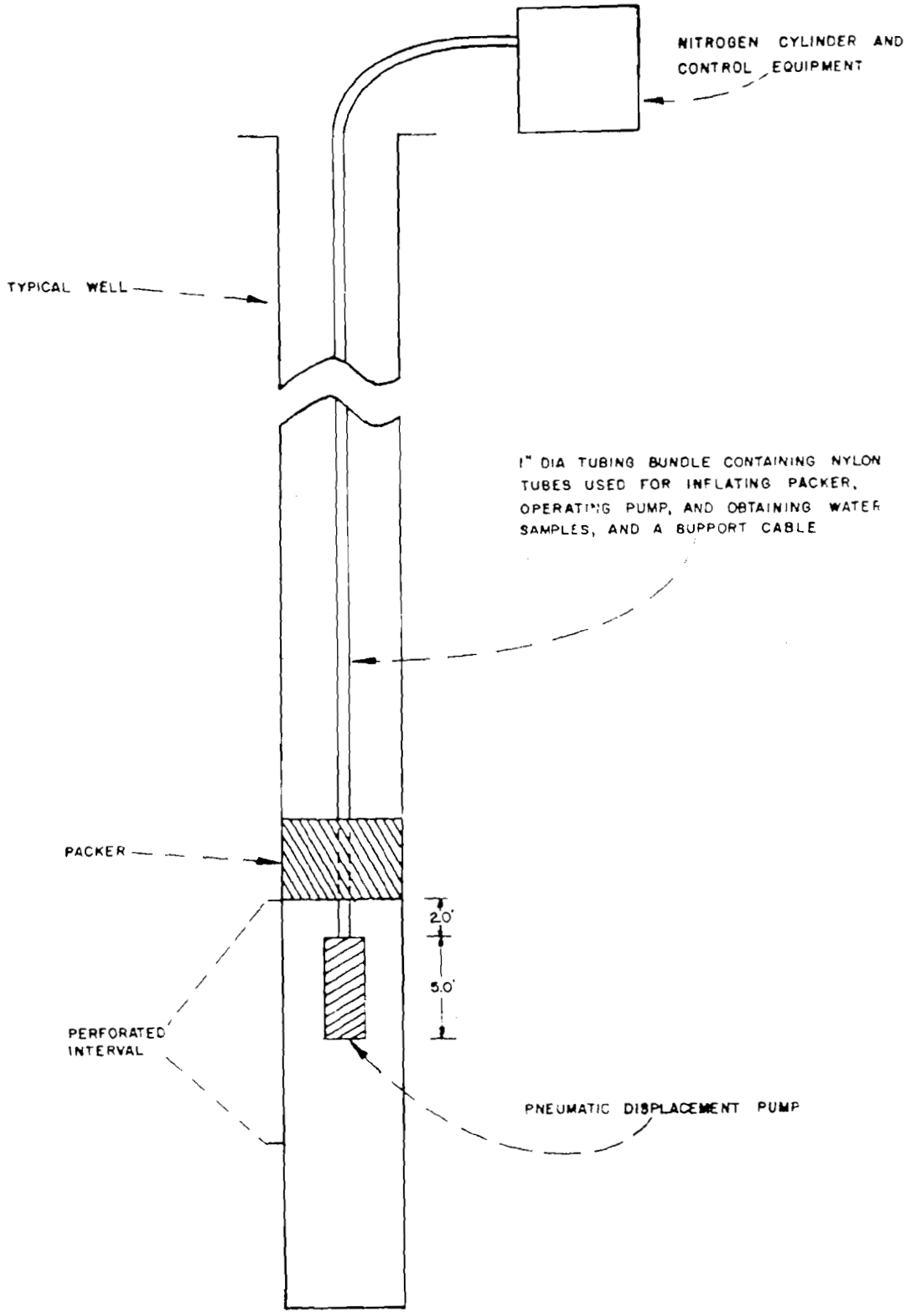


EXHIBIT 3

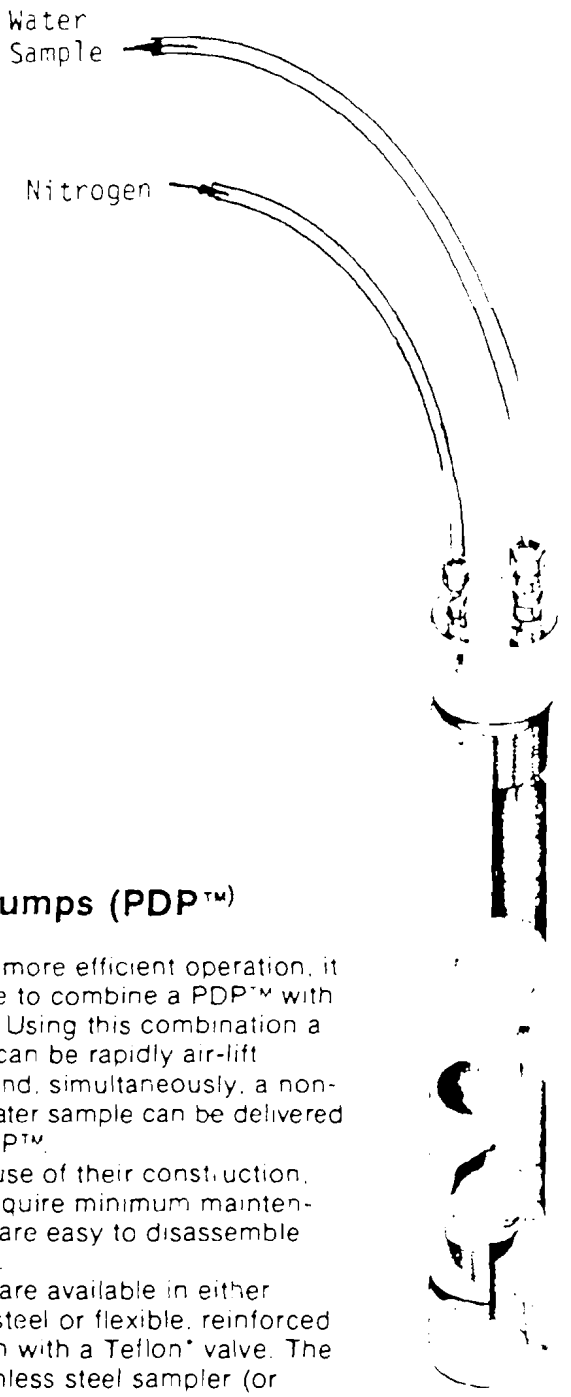
WELL PARAMETERS

SECTION 9 WELLFIELD

CROWNPOINT PROJECT

| WELL 17-13-9U | CASING I.D. IN INCHES | PERFORATED INTERVAL, FT. | PACKER PLACEMENT, FT. | TWO CASING VOLUMES, GAL |
|---|---|---|---|---|
| 208 | 5.0 | 1952-1980 | 1952 | 57 |
| 209 | 5.0 | 1953-1979 | 1953 | 53 |
| 210 | 5.0 | 1954-1982 | 1954 | 57 |
| 211 | 5.0 | 1954-1971 | 1954 | 35 |
| 212 | 5.0 | 1955-1977 | 1955 | 45 |
| 213 | 5.0 | 1946-1974 | 1946 | 57 |
| 214 | 6.0 | 1957-1967 | 1957 | 29 |
| 215 | 5.0 | 1966-1988 | 1966 | 45 |
| 216 | 5.0 | 1956-1978 | 1956 | 45 |
| 217 | 5.0 | 1956-1981 | 1956 | 51 |
| 218 | 5.0 | 1952-1978 | 1952 | 53 |
| 219 | 5.0 | 1952-1976 | 1952 | 49 |
| 220 | 5.0 | 1968-1994 | 1968 | 53 |

EXHIBIT 4




## Pneumatic Displacement Pumps (PDP™)

Pneumatic displacement pumps (PDP™) are used for obtaining non-aerated water samples from boreholes. The PDP™ is lowered to the desired depth, and compressed nitrogen gas is fed into it, forcing (or displacing) a sample of water to the ground surface. The nitrogen pressure is then released and the PDP™ fills up with water, thus ready to begin another cycle.

A battery operated timed nitrogen controller (TNC™) can automatically cycle the pneumatic displacement pump. In this fashion an unmanned well can be pumped out at a controlled rate.

If samples must be obtained more than twice a year, it might prove more economical to have a permanent installation. A screen can be attached to the bottom end of the PDP™ to prevent plugging should it be desirable or necessary to bury it in the ground.

For a more efficient operation, it is possible to combine a PDP™ with air-lifting. Using this combination a borehole can be rapidly air-lift pumped and, simultaneously, a non-aerated water sample can be delivered by the PDP™.

Because of their construction, PDP™ require minimum maintenance and are easy to disassemble and clean.

They are available in either stainless steel or flexible, reinforced vinyl, each with a Teflon* valve. The rigid, stainless steel sampler (or PDP) normally comes in five-foot sections, while the flexible, vinyl sampler is available in any length.

As a rule, stainless steel is utilized for depths to 1,000 feet. On special order, however, a PDP™ of stainless steel can be supplied for depths of up to 5,000 feet. Vinyl is limited to depths of 300 feet.

*DuPont

EXHIBIT 5

CROWNPOINT SECTION 9

WELLFIELD SAMPLING SCHEDULE

| WELL NO | NOV. 1986 | DEC. 1986 | JAN. 1987 | FEB. | MAR. | APR. | MAY | JUNE | JULY |
|---|---|---|---|---|---|---|---|---|---|
| 208 | X | Y | | | X | Y | | | X |
| 209 | X | | | Y | X | Y | | | X |
| 210 | X | | | Y | X | Y | | | X |
| 211 | X | | Y | | X | | Y | | X |
| 212 | X | | Y | | X | | Y | | X |
| 213 | X | Y | | | X | | | Y | X |
| 214 | X | Y | | | X | Y | | | X |
| 215 | X | | Y | | X | | | Y | X |
| 216 | X | | Y | | X | | Y | | X |
| 217 | X | | Y | | X | | Y | | X |
| 218 | X | Y | | | X | | | Y | X |
| 219 | X | | | Y | X | | Y | | X |
| 220 | X | | | Y | X | | | Y | X |

X: Full Analysis of stability period parameters (quadrimonthly).

Y: Full analysis of stability period parameters (monthly).

EXHIBIT 6

List of Water Quality Parameters to be Detected

Crownpoint Section 9 Wellfield

Restoration Sample Parameters

A. Quadrimonthly parameters, mg/L

| | |
|---|---|
| Aluminum, dissolved | Maganese (dissolved) |
| Arsenic | Molybdenum (dissolved) |
| Barium | Mercury (dissolved |
| Boron | Nickel (total) |
| Cadmium | Nitrate (as N) |
| Choride | pH |
| Chromium | Phenols |
| Cobalt (dissolved) | Combined Radium 226&228 (pci/L) |
| Copper (dissolved) | Selenium (dissolved) |
| Cyanide | Silver (dissolved) |
| Fluoride | Sulfate (as SO4) |
| Iron (dissolved) | TDS (at 180 degrees F) |
| Lead (dissolved) | Uranium (as U) |

B. Monthly parameters, mg/L

| | |
|---|---|
| Chloride | Combined Ra 226&228 (pci/L) |
| Manganese | Selenium |
| Molybdenum | Sulfate |
| Phenols | TDS |

## LABORATORY IDENTIFICATION AND ANALYTICAL METHODS

### Laboratory Identification and Certification

Mobil proposes to utilize the same laboratory which has historically analyzed our samples. Accu-Labs Research, Inc., located in Wheat Ridge, Colorado, is certified by the United States Environmental Protection Agency and the Colorado Department of Health. See Exhibits 7 and 8 for certification letters.

### Analytical Methods

The analytical methods utilized by Accu-Labs Research, Inc for Mobil's samples are outlined in Exhibit 9. Please note that the nominal detection limits for each water quality parameter are shown in the Methods Summary Section of Exhibit 9.

EXHIBIT 7

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VIII
ONE DENVER PLACE — 999 18TH STREET — SUITE 1300
DENVER, COLORADO 80202-2413



JUL 28 1986

Ref: 8HWM-RP

Mr. William R. Gilgren
Accu-Labs Research, Inc.
11485 W. 48th Ave.
Wheatridge, CO 80033

Dear Mr. Gilgren:

Attached is a copy of Robert Tauer's report of his on-site evaluation of your laboratory. The purpose for the visit was to determine if your laboratory should continue to be certified under the Safe Drinking Water Act.

Based on the recommendations in the report I am granting certification to Accu-Labs Research, Inc., for the analysis of gross alpha, gross beta, Radium 226, Radium 228, Uranium, and Tritium in drinking water. The certification will remain in effect for three years. Continued satisfactory performance on EPA/Las Vegas check samples is required.

If you have any further questions concerning the certification or the report, please contact Robert Tauer at (303) 236-5083.

Sincerely yours,

James B. Lehr

James B. Lehr, Director
Environmental Services Division

Attachment

cc: Juanita Hillman
8-ES

EXHIBIT 8

# COLORADO DEPARTMENT OF HEALTH

Richard D. Lamm
Governor

Thomas M. Vernon, M.D.
Executive Director

RECEIVED

MAR 24 1986

WHEATRIDGE

MARCH 19, 1986

WILLIAM GILGREN, PRESIDENT
ACCU-LABS RESEARCH, INC.
11485 W. 48TH AVENUE
WHEAT RIDGE, COLORADO 80033

CERTIFICATION STATUS OF ACCU-LABS RESEARCH, INC.

Based on a review of Performance Evaluation WS017, Accu-Labs Research, Inc. is CERTIFIED for the inorganic parameters and total trihalomethane analyses. The certification for Pesticide/Herbicide analyses is downgraded to PROVISIONALLY CERTIFIED.

Anne M. Wolfgang

ANNE M. WOLFGANG
QUALITY ASSURANCE COORDINATOR

AMW/mak

EXHIBIT 9

SUMMARY OF ANALYTICAL METHODS UTILIZED BY ACCU-LABS RESEARCH, INC.

Total Uranium; Water:

An aliquot of the sample is pipetted onto a NaF-LiF pellet and fused. The pellet is exposed to ultraviolet light and the fluorescence is measured. The intensity of the fluorescence is directly proportional to the uranium concentration.

Reference: No. 1, 3, 4, 7, 8, 9

Total Uranium; Solids:

An aliquot of sample was digested with nitric, sulfuric, perchloric, and hydrofluoric acid and evaporated to dryness. The residue was dissolved in dilute nitric acid and extracted with ethyl acetate. A very small aliquot of the organic layer was pipetted onto a NaF-LiF pellet and fused using a Geoco fusion burner. The pellet was exposed to ultraviolet light and the flourescence measured using a fluorometer.

Reference: No. 4

Radium-226; Water:

Radium in the sample is concentrated and coprecipitated with Barium Sulfate. The precipitate is either gross alpha counted to determine the total Radium-226 alpha activity or is redissolved into a basic EDTA solution. The solution is placed in a sealed bubbler and stored for ingrowth of Rn-222. After ingrowth, the gas is purged into a Lucas cell and counted for its alpha activity.

Reference: No. 1, 2, 3, 5, 7, 8, 9

Radium-226; Solids:

An aliquot of the sample is fused with sodium peroxide and dissolved completely in dilute HCl. Radium-226 in the sample is concentrated and separated by coprecipitation with barium sulfate. The precipitate is either gross alpha counted to determine the Radium-226 activity or dissolved into a basic EDTA solution, placed in a sealed bubbler and stored for ingrowth of Rn-222. After ingrowth, the gas is purged into a scintillation cell. When the Rn-222 daughters are in equilibrium with the parent, the scintillation cell is counted for alpha activity.

Reference: No. 1, 2, 3, 5

Gross Alpha/Beta; Water:

An aliquot of the sample, containing up to 120 mg dissolved solids, was acidified and brought to dryness. The residue was transferred to a stainless steel planchet and counted for its Gross Alpha and Gross Beta activity. The final reported result was corrected for self absorption and backscatter.

Reference: No. 1, 2, 3, 4, 6, 7, 8, 9

Lead-210; Water and Solids:

The sample is digested with acid, redissolved in dilute HCl and run through an anion exchange column to separate out the Lead-210. Following separation, the Lead-210 is precipitated out as lead chromate. After decay of the Lead-210 to Bismuth-210, a gross beta count is taken.

Reference: No. 6, 9

Thorium-230; Water and Solids:

The sample is digested with acid, redissolved in 8N Nitric acid. Thorium is then separated by anion exchange followed by a gross alpha count. The total thorium alpha activity is reported at Th-230.

Reference: No. 7

Radium-228; Water and Solids:

All radium is separated from the sample as a $BaSO_4$ precipitate. Ac-228 is allowed to ingrow. After ingrowth, Ac-228 is co-precipitated with Yttrium as the oxalate and gross beta counted.

Reference: No. 1, 2, 3, 8

NOTE: The referenced methodology does allow Accu-Labs Research, Inc. to meet NRC Guideline 4.14 Lower Level of Detection, provided the client submits sufficient volume of sample when requesting the analyses.

METHOD REFERENCES UTILIZED BY ACCU-LABS RESEARCH, INC.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5. Misaqi, Fazlelleh L., Monitoring Radon-222 Content of Mine Waters Informational Report 1026, U.S. Department of Interior, Mining Enforcement and Safety Administration, Denver, Colorado, 1975.

6. "Radioassay Procedures for Environmental Samples", 1967, USDHEW, Section 7.2.3.

7. "Handbook of Analytical Procedures", USAEC, Grand Junction Lab, 1970, page 196.

8. "Prescribed Procedures for Measurement of Radioactivity in Drinking Water", EPA-600/4-80-032, August 1980, Environmental Monitoring and Support Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio 45268.

9. "Methods for Determination of Radioactive Substances in Water and Fluvial Sediments", U.S.G.S. Book 5, Chapter A5, 1977.

10. "Acid Dissolution Method for the Analysis of Plutonium in Soil", EPA-600/7-79-081, March 1979, U.S. EPA Environmental Monitoring and Support Laboratory, Las Vegas, Nevada, 1979.

11. "Procedures for the Isolation of Alpha Spectrometrically Pure Plutonium, Uranium and Americium", by E.H. Essington and B.J. Drennon, Los Alamos National Lab, private communication.

12. "Isolation of Americium from Urine Samples", Rocky Flats Plant, Health Safety and Environmental Laboratories, Laboratory Procedure, HS and EL-7, revised 1/21/83.

## METHODS SUMMARY

| PARAMETER | REFERENCE NO. | EPA METHOD NO. | NOMINAL DETECTION LIMIT |
|---|---|---|---|
| Color (Colorimetric-Platinum-Cobalt) | 1, 2 | 110.2 | 2 color units |
| Conductance (Specific conductance, mhos at 25°C) | 1, 2, 3 | 120.1 | 2 mhos/cm |
| Hardness, total (mg/L as $CaCO_3$) (titrimetric, EDTA) | 1, 2, 3 | 130.2 | 2 mg/L |
| pH (Electrometric) | 1, 2, 3 | 150.1 | 0.1 units |
| Residue, Filterable (TDS, Gravimetric, Dried 180°C) | 1, 2 | 160.1 | 5 mg/L |
| Residue, Unfilterable (TSS, Gravimetric, Dried 105°C) | 1 | 160.2 | 5 mg/L |
| Residue, Total (TS, Gravimetric, Dried at 103-105°C) | 1, 2 | 160.3 | 5 mg/L |
| Residue, Volatile (TV, Gravimetric, Ignition at 550°C) | 1, 2 | 160.4 | 5 mg/L |
| Settleable Matter (Volumetric, Imhoff Cone) | 1, 2 | 160.5 | 0.1 ml/L/hr |
| Temperature (Thermometric) | 1, 2 | 170.1 | |
| Turbidity (Nephelometric) | 1, 2, 3 | 180.1 | 1 NTU |
| Aluminum (Atomic Absorption direct aspiration) | 1, 2, 4 | 202.1 | 0.5 mg/L |
| Aluminum (Atomic Absorption furnace technique) | 1, 2, 4, 5 | 202.2 | 0.05 mg/L |
| Antimony (Atomic Absorption direct aspiration) | 1, 2, 4 | 204.1 | 0.5 mg/L |

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| PARAMETER | REFERENCE NO. | EPA METHOD NO. | NOMINAL DETECTION LIMIT |
|---|---|---|---|
| Antimony (Atomic Absorption furnace technique) | 1, 2, 4, 5 | 204.2 | 0.005 mg/L |
| Arsenic (Atomic Absorption furnace technique) | 1, 2, 4, 5 | 206.2 | 0.005 mg/L |
| Barium (Atomic Absorption direct aspiration) | 1, 2, 4 | 208.1 | 0.2 mg/L |
| Beryllium (Atomic Absorption direct aspiration) | 1, 2, 4 | 210.1 | 0.005 mg/L |
| Beryllium (Atomic Absorption furnace technique) | 1, 2, 4, 5 | 210.2 | 0.001 mg/L |
| Bismuth (Atomic Absorption direct aspiration) | 4 | | 0.2 mg/L |
| Boron (Colorimetric, curcumin) | 1, 2 | 212.3 | 0.1 mg/L |
| Cadmium (Atomic Absorption direct aspiration) | 1, 2, 4 | 213.1 | 0.005 mg/L |
| Cadmium (Atomic Absorption furnace technique) | 1, 2, 4, 5 | 213.2 | 0.0005 mg/L |
| Calcium (Atomic Absorption direct aspiration) | 1, 2, 4 | 215.1 | 0.1 mg/L |
| Chromium (Atomic Absorption direct aspiration) | 1, 2, 4 | 218.1 | 0.005 mg/L |
| Chromium (Atomic Absorption furnace technique) | 1, 2, 4, 5 | 218.2 | 0.005 mg/L |
| Chromium, hexavalent (Colorimetric diphenylcarbazide) | 1, 2 | 218.4 | 0.02 mg/L |
| Cobalt (Atomic Absorption direct aspiration) | 1, 2, 4 | 219.1 | 0.02 mg/L |
| Cobalt (Atomic Absorption furnace technique) | 1, 2, 4, 5 | 219.2 | 0.005 mg/L |

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| PARAMETER | REFERENCE NO. | EPA METHOD NO. | NOMINAL DETECTION LIMIT |
|---|---|---|---|
| Copper (Atomic Absorption direct aspiration) | 1, 2, 4 | 220.1 | 0.005 mg/L |
| Copper (Atomic Absorption furnace technique) | 1, 2, 4, 5 | 220.2 | 0.001 mg/L |
| Germanium (Atomic Absorption direct aspiration) | 4 | | 0.5 mg/L |
| Gold (Atomic Absorption direct aspiration) | 1, 2, 4 | 231.1 | 0.5 mg/L |
| Iron (Atomic Absorption direct aspiration) | 1, 2, 4 | 236.1 | 0.01 mg/L |
| Iron (Atomic Absorption furnace technique) | 1, 2, 4, 5 | 236.2 | 0.005 mg/L |
| Lead (Atomic Absorption direct aspiratin) | 1, 2, 4 | 239.1 | 0.1 mg/L |
| Lead (Atomic Absorption furnace technique) | 1, 2, 4, 5 | 239.2 | 0.005 mg/L |
| Lithium (Atomic Absorption direct aspiration) | 4 | | 0.001 mg/L |
| Magnesium (Atomic Absorption direct aspiration) | 1, 2, 4 | 242.1 | 0.05 mg/L |
| Manganese (Atomic Absorption direct aspiration) | 1, 2, 4 | 243.1 | 0.005 mg/L |
| Manganese (Atomic Absorption furnace technique) | 1, 2, 4, 5 | 243.2 | 0.0005 mg/L |
| Mercury (Manual Cold Vapor technique) | 1, 2 | 245.1 | 0.0001 mg/L |
| Molybdenum (Atomic Absorption furnace technique) | 1, 2, 4, 5 | 246.2 | 0.005 mg/L |
| Nickel (Atomic Absorption direct aspiration) | 1, 2, 4 | 249.1 | 0.02 mg/L |

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| PARAMETER | REFERENCE NO. | EPA METHOD NO. | NOMINAL DETECTION LIMIT |
|---|---|---|---|
| Nickel (Atomic Absorption furnace technique) | 1, 2, 4, 5 | 249.2 | 0.005 mg/L |
| Palladium (Atomic Absorption direct aspiration) | 1, 4 | 253.2 | 0.005 mg/L |
| Platinum (Atomic Absorption furnace technique) | 1, 4 | 255.2 | 0.05 mg/L |
| Potassium (Atomic Absorption direct aspiration) | 1, 2, 4, 5 | 258.1 | 0.1 mg/L |
| Selenium (Atomic Absorption furnace technique) | 1, 2, 4, 5 | 270.2 | 0.005 mg/L |
| Silver (Atomic Absorption direct aspiration) | 1, 2, 4 | 272.1 | 0.005 mg/L |
| Silver (Atomic Absorption furnace technique) | 1, 2, 4, 5 | 272.2 | 0.001 mg/L |
| Sodium (Atomic Absorption direct aspiration) | 1, 2, 4 | 273.1 | 0.1 mg/L |
| Tin (Atomic Absorption direct aspiration) | 1, 4 | 282.1 | 1.0 mg/L |
| Tin (Atomic Absorption furnace technique) | 1, 4 | 282.2 | 0.005 mg/L |
| Thallium (Atomic Absorption direct aspiration) | 1, 2, 4 | 279.1 | 0.5 mg/L |
| Thallium (Atomic Absorption furnace technique) | 1, 2, 4, 5 | 279.2 | 0.005 mg/L |
| Vanadium (Atomic Absorption direct aspiration) | 1, 2, 4 | 286.1 | 0.5 mg/L |
| Vanadium (Atomic Absorption furnace technique) | 1, 2, 4, 5 | 286.2 | 0.005 mg/L |
| Zinc (Atomic Absorption direct aspiration) | 1, 2, 4 | 289.1 | 0.005 mg/L |

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| PARAMETER | REFERENCE NO. | EPA METHOD NO. | NOMINAL DETECTION LIMIT |
|---|---|---|---|
| Zinc (Atomic Absorption furnace technique) | 1, 2, 4, 5 | 289.2 | 0.001 mg/L |
| Nitrogen, Kjeldahl, total (Digestion, Colorimetric Phenate) | 1, 2 | 351.1 | 1 mg/L |
| Nitrogen, Kjeldahl, total (Digestion, Ion Selective Electrode) | 1, 2 | 351.4 | 1 mg/L |
| Nitrate-Nitrite (Colorimetric, Automated, Cadmium Reduction) | 1, 3, 7 | 353.2 | 0.05 mg/L |
| Nitrite (Colorimetric, Automated) | 1, 3, 7 | 353.2 | 0.05 mg/L |
| Phosphorus - All Forms (Colorimetric, Ascorbic Acid, Single Reagent) | 1, 2, 3, | 365.2 | 0.02 mg/L |
| Silica, dissolved (Colorimetric) | 1, 2, 3 | 370.1 | 2 mg/L |
| Sulfate (Colorimetric, Automated, Methylthymol Blue, AAII) | 1, 2, 8 | 375.2 | 3 mg/L |
| Sulfate (Gravimetric) | 1, 2, 3 | 375.3 | 5 mg/L |
| Sulfide (Titrimetric Iodine) | 1, 2 | 376.1 | 1 mg/L |
| Biological Oxygen Demand (Oxygen Depletion 5 Day 20°C) | 1, 2 | 405.1 | 2 mg/L |
| Chemical Oxygen Demand (Titrimetric, Low Level) | 1, 2, 3 | 410.2 | 2 mg/L |
| Oil and Grease, total-recoverable (Gravimetric, Separatory Funnel Extraction) | 1, 2 | 413.1 | 1 mg/L |

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| PARAMETER | REFERENCE NO. | EPA METHOD NO. | NOMINAL DETECTION LIMIT |
|---|---|---|---|
| Organic Carbon, total (Combustion or Oxidation IR Detection) | 1, 2, 3 | 415.1 | 1 mg/L |
| Phenolics, total-recoverable (Spectrophotometric, Manual 4-APP with Distillation) | 1, 2, 3 | 420.1 | 0.002 mg/L |
| Acidity (Titrimetric) | 1, 2, 3 | 305.1 | 5 mg/L |
| Alkalinity (Titrimetric pH 4.5) | 1, 2, 3 | 310.1 | 5 mg/L |
| Chloride (Colorimetric, Automated, Ferricyanide AA11) | 1, 2, 6 | 325.2 | 3 mg/L |
| Chloride (Titrimetric, Mercuric Nitrate) | 1, 2, 3 | 325.3 | 3 mg/L |
| Cyanide, total (Spectrophotometric) | 1, 2, 3 | 335.2 | 0.005 mg/L |
| Fluoride (Potentiometric, Ion Selective Electrode) | 1, 2, 3 | 340.2 | 0.5 mg/L |
| Iodide (Titrimetric) | 1, 3 | 345.1 | 2 mg/L |
| Nitrogen, Ammonia (Colorimetric Automated Phenate) | 1, 2 | 350.1 | 0.2 mg/L |
| Nitrogen, Ammonia (Potentrometric, Ion Selective Electrode) | 1, 2 | 350.3 | 0.2 mg/L |
| Inorganic Carbon, total (Coulometric) | 9 | | 1 mg/L |
| Surfactants (MBAS) | 2 | 425.1 | 0.025 mg/L |
| Thiosulfate (Titration) | 10 | | 1 mg/L |

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| PARAMETER | REFERENCE NO. | EPA METHOD NO. | NOMINAL DETECTION LIMIT |
|---|---|---|---|
| Pesticides: | 11 | 608 | |
| Lindane | | | 0.004 mg/L |
| Endrin | | | 0.0002 mg/L |
| Methoxychlor | | | 0.1 mg/L |
| Toxaphene | | | 0.005 mg/L |
| Herbicides: | 12 | | |
| 2,4-D | | | 0.1 mg/L |
| 2,4,5-TP (Silvex) | | | 0.01 mg/L |
| Trihalomethanes | 11, 13 | 601, 501.2 | 0.01 mg/L |
| PCB's | 11 | 608 | 0.001 mg/L |
| Total Organic Halogens | 14 | 450.1 | 0.005 mg/L |

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2. "Standard Methods for the Examination of Water and Wastewater", 14th Edition, 1975.

3. Annual Book of ASTM Standards, Part 31, "Water", 1976.

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6. Technicon Autoanalyzer, Industrial Method No. 99-70W, Technicon Industrial Systems, September, 1973.

7. Technicon Autoanalyzer, Industrial Method No. 100-70W, "Nitrate and Nitrite in Wastewater".

8. Technicon Autoanalyzer, Industrial Method No. 118-71/W, "Sulfate in Water and Wastewater".

9. Procedure developed at Huffman Laboratories referred to as "Carbonate Carbon" or "Mineral Carbon".

10. "The Encyclopedia of Industrial Chemical Analysis", Volume 18, Page 432, 1973.

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12. "Methods for Organochlorine Pesticides and Chlorophenoxy Acid Herbicides in Drinking Water and Raw Source Water", US EPA 1981 (EPA 600/4-81-053).

13. "The Analysis of Trihalomethanes in Drinking Water by Liquid/Liquid Extraction", US EPA 1979.

14. "Total Organic Halide", US EPA [illegible] (EPA 600/4-81-056).

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## OTHER ACTIVITIES

As part, of Mobil's permit, routine water sampling and analysis of all monitor wells has been required. Recognizing that the purpose of the "Stability Period" is to determine water quality in a static, or natural, condition, and the pumping of these monitor wells creates an unnatural condition, Mobil proposes to discontinue all routine monitor well sampling. Instead, effective November 15, 1986, Mobil will conduct routine water sampling and analysis of monitor wells on the second, fourth, and eighth month of the program.

During the Stability Period, Mobil will suspend all activities which could impact the water quality of the reservoir. All operational activities pertaining to the Westwater Formation in the wellfield will be limited to the sampling described in this document.