BACKGROUND GEOCHEMICAL CHARACTERIZATION REPORT

U.S. DEPARTMENT OF ENERGY

Rocky Flats Plant
Golden, Colorado

9 OCTOBER 1989

Rockwell International
Aerospace Operations
Rocky Flats Plant

Volume III - Appendices

DRAFT

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By
Date 4/21/92

ADMIN RECORD

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APPENDIX E

BOREHOLE GEOPHYSICS

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APPENDIX E

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APPENDIX E

BOREHOLE GEOPHYSICS

This appendix supplements section 3.2 Borehole Geophysics within the main report.

1.0 DATA ACQUISITION

Data was acquired in accordance with SOP 4.5, Borehole Geophysical Loggings (Rockwell International, 1989). Typically data acquisition has required six logging runs:

RUN 1:	Fluid temperature and fluid resistivity.
RUN 2:	SP, IP, 16 inch and 64 inch normal.
RUN 3:	Full wave form sonic.
RUN 4:	Guard Resistivity, Neutron Density, Natural Gamma Ray.
RUN 5:	Gamma-Gamma Density and Caliper.
RUN 6:	EM-39 Induction.

The combination of measuring devices are consistent (for example, fluid temperature and fluid resistivity are always run together) but the order the runs have varied in response to hold conditions. An additional run, a diplog, was made on 33-89BR. This sonde was run on a trial basis for this hole. To date the raw data for the diplog has not been processed. Because the diplog was run on an experimental basis at the request and cost of the logging company, COLOG, and because the results of that run are not to date interpretable, the diplog probe and logging results will not be discussed further in this report.

Data was acquired digitally by COLOG Inc., of Golden, Colorado under the oversight of a representative of EBASCO SERVICES INCORPORATED. Synopses of borehole

geophysical operations were prepared by EBASCO and are presented below by well. No synopsis is available for the first logging run on 37-89BR (28 April 1989), for wells 41-89BR and 43-89BR.

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EBASCO

March 7, 1989
RIGP-EDEN-89-048

Mr. Brent Lewis
Rockwell International
North American Space Operations
Rocky Flats Plant
P.O. Box 464
Golden, CO 80403

Subject: Geophysical Logging Oversight at 32-89 BR

Dear Brent:

On March 3, 1989, I oversaw borehole geophysical logging operations at borehole 32-89BR north of the Rocky Flats Plant. A synopsis of events were as follows:

Time	Event
0959	Arrived at site. Colog was completing fluid resistivity and temperature log.
1021	Started logging with SP, resistivity, and IP tools.
1106	Started logging with sonic tool.
1227	Started logging with gamma ray, neutron, and guard resistivity tools.
1318	Started logging with gamma-gamma density tool.
1431	Started logging with EM39 induction tool.
1515	Onsite logging operations completed.
1532	I departed site.

I went to Colog's office to get field plots of the logs and to review data.

Noted problems which will not effect data quality are:

1) A resistivity measurement of the drilling fluid was not possible due to the below freezing temperatures in the mud pit. This measurement would be helpful for calculating the formation porosities and permeabilities.

2) The EM39 borehole induction logger is still requiring careful attention during logging to get accurate depths. Overall, the EM data are about 2-3 feet off. Colog will be able to depth shift the data using the guard and 16" normal resistivity data as a reference. This should not effect overall data quality.

The geophysical logging operations went well despite the very cold temperatures, high winds, and ongoing snow storm. If you have any questions, feel free to contact me at 988-2202.

Sincerely yours,
EBASCO SERVICES INCORPORATED

Larry A. Irons

Larry A. Irons
Sr. Assoc. Geophysicist

LAI:an

cc: T. Greengard
M. Arndt
C. Davenport
J. Bergmann
H. Bienkowski
R. Crowder
T. Deignan
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Chron File

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EBASCO

RIGP-EDEN-023
February 22, 1989

Mr. Brent Lewis
Rockwell International
North American Space Operations
Rocky Flats Plant
P.O. Box 464
Golden, CO 80403

Subject: Geophysical Logging Oversight at 33-89BR

Dear Brent:

On February 16, 1989, I oversaw borehole geophysical logging operations at borehole 33-89BR north of the Rocky Flats Plant. A synopsis of events were as follows:

Time	Event
0934	Arrived at drill site
0951	It was decided to clear a blockage in hole at 109 feet by using the drill rig. Rig was froze up. Waiting on rig to become operational.
1133	Rig finished reaming out hole and pipe pulled.
1149	Logging operations started with temperature and fluid resistivity tools.
1218	SP, resistivity and IP tools lowered down hole.
1255	Sonic probe lowered down hole.
1329	Alternate sonic probe lowered down hole.
1446	Neutron, guard resistivity, and gamma ray tools lowered down hole.
1535	Gamma-gamma density and caliper probe lowered down hole.
1620	Pipmeter probe lowered down hole.
1731	EM39 induction tool lowered down hole.
1815	Logging operations completed.
1824	Colog is packing up, I departed site.

Noted problems which will probably not effect data quality are:

1) The 36" sonic probe did not record sufficient quality data for the automatic event picking algorithm. Colog switched to the alternate 48" probe which solved the problem.
2) The digital depth recorder on the Mount Sopris System was incorrect by 0.2 to 0.3 feet consistently in the same direction after logging. This should not affect data quality.
3) The EM39 borehole induction logger is more difficult to set up. A tripod with a depth meter must be set up over the hole. This requires moving the drill rig off of the hole. The depth meter wheel on the tripod was not rotating properly initially. This was corrected by a Colog person pulling on the downgoing cable. The log depth was incorrect by 0.7 feet after logging. This should not affect data quality, but EM logging should be monitored closely to prevent degradation in data quality.

4) SP and 64" normal resistivity logs have spiked events at certain depth intervals. Bob Crowder of Colog offered that this may be caused by a combination of fluid resistivity and rugosity in the hole. I need more time to review data to evaluate effect on overall data quality and origin of the problem.

The geophysical logging operations went well owing to Colog's experience and commitment to acquire quality data. If you have any questions, feel free to contact me at 988-2202.

Sincerely yours,
EBASCO SERVICES INCORPORATED

Larry A. Irons
Sr. Assoc. Geophysicist

cc: Tom Greengard
Mike Arndt
Clark Davenport
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Henry Bienkowski
Robert Crowder
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RIGP-EDEN-89-068
March 21, 1989

Mr. Brent Lewis
Rockwell International
North American Space Operations
Rocky Flats Plant
Bldg. 250
P.O. Box 464
Goldern, CO 80403

Subject: Geophysical Logging Oversight at 34-89BR

Dear Brent:

On March 13, 1989, I oversaw borehole geophysical logging operations at borehole 34-89BR north of the Rocky Flats Plant. A synopsis of events were as follows:

TIME	EVENT
0830	Arrived at drill site.
0840	Drillers reaming hole and pulling pipe.
0922	Logging operations started with temperature and fluid resistivity tools.
0949	SP, resistivity, and IP tools lowered down hole.
1040	Sonic probe lowered down hole.
1140	Neutron, guard resistivity, and gamma ray tools lowered down hole.
1200	Loose connection on probe hinders quality data acquisition.
1250	Section on probe replaced with BPF section and reassembled
1305	BPF section alleviates problem; neutron, guard resistivity, and gamma ray tools lowered down hole.
1332	Gamma - gamma density and caliper probe lowered down hole.
1426	EM 39 induction tool lowered down hole.
1500	COLOG leaving; I departed site.

Comments:

1) The digital depth recorder on the Mount Sopris System was incorrect by 0.1 to 0.3 feet consistently in the same direction after logging. This should not adversely effect data quality.

2) EM39 borehole induction log depth was incorrect by 1.6 feet. Data were shifted by COLOG to alleviate the problem, and the data exhibits good correlation with the resistivity tools.

3) The gamma/guard resistivity/neutron tool contained a loose pin connection in the tool housing, which caused gamma count readings to be unreasonably high. The problem was corrected by replacing a section of the probe with a section from a different probe. High quality data was acquired after the tool was fixed.

4) Log responses exhibit characteristics of a "sandy" interval from approximately 125 - 135 feet. Another sandy interval occurs just below casing; however, certain log responses are affected by casing, and care should be taken when quantitatively interpreting certain log data near or in casing. Notice the mudcake buildup in the 127 - 132 feet interval on the caliper log. This implies the adjacent sandy interval exhibits relatively good permeability.

Sincerely yours,

EBASCO SERVICES INCORPORATED

Timothy M. Deignan

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EBASCO

RIGP-EDEN-89-106
April 6, 1989

Mr. Brent Lewis
Rockwell International
North American Space Operations
Rocky Flats Plant
Bldg. 250
P.O. Box 464
Golden, CO 80403

Subject: Geophysical Logging Oversight at 35-89BR

Dear Brent:

On April 4, 1989, I oversaw borehole geophysical logging operations at borehole 35-89BR north of the Rocky Flats Plant. A synopsis of events were as follows:

TIME	EVENT
0815	Arrived at drill site
0848	Drillers finished pulling pipe.
0859	Temperature and fluid resistivity probe lowered down hole.
0942	SP, IP, and resistivity tools lowered down hole.
1101	Sonic probe lowered down hole.
1220	Neutron, guard resistivity, and gamma ray tools lowered down hole.
1316	Gamma-gamma density and caliper probe lowered down hole.
1410	EM 39 induction tool lowered down hole.
1505	I departed site.

Comments:

1) The digital depth recorder on the Mount Sopris System was incorrect by 0.1 to 0.4 feet consistently in the same direction after logging. This should not adversely effect data quality.

2) EM 39 borehole induction log depth was incorrect by 0.1 feet. The data were depth - shifted by COLOG, and a close correlation exists between the EM 39 data and the resistivity data.

Sincerely,
EBASCO SERVICES INCORPORATED

Timothy M. Deignan

Timothy M. Deignan
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EBASCO

RIGP-EDEN-096
March 29, 1989

Mr. Brent Lewis
Rockwell International
North American Space Operations
Rocky Flats Plant
Bldg 250
P.O. Box 464
Golden, CO 80402

Subject: Geophysical Logging Oversight at ~~33~~ 36-89BR HGB 9/18/89

Dear Brent:

On March 23, 1989 I oversaw borehole geophysical data logging operations by Colog Inc. in borehole 36-89 BR located northeast of the Plant area. An abbreviated synopsis of events follows:

Time	Activity
0815	I arrived onsite. Drill crew was preparing hole for logging. Colog auxiliary truck is onsite, however logging truck has not arrived.
0820	Colog logging truck arrived onsite.
0848	Fluid resistivity/temperature probe ready to log.
0923	SP/resistivity/IP probe started logging uphole.
0947	Sonic probe started logging uphole.
1037	Neutron/gamma/guard probe started logging uphole.
1111	Gamma-gamma density probe started logging uphole.
1154	EM-39 induction probe started logging downhole
1204	EM-039 induction probe started logging uphole.
1234	Colog finished logging operations. Additional processing of data was being performed.
1242	I departed site.

The following comments concerning data quality are presented:

1) Depth differences varied from 0.0 to 0.2 feet on first logging runs, including the EM-39. This is a significant improvement.

2) EM-39 downhole data are not as good as uphole data. This is due to the lightness of probe. The EM-39 probe would sometimes hang on the borehole wall then drop. Uphole data should be used for analysis and display.

3) Sonic data are poor quality above water table. This is not unusual.

4) The interval between 58.4 to 60.9 feet has higher densities (2.5-2.96) than the remainder of the formation. Bob Crowder mentioned that the induction inphase data indicates a change in magnetic susceptibility in the same depth interval, suggesting the presence of magnetite. This zone could be volcanic in origin, such as a flow or volcaniclastic deposit. The gamma ray decreases across this zone as for a sandstone. The resistivity data suggests that this zone is hard. Another possibility is reduced iron cementation. I suggest a look at this interval of the core with a binocular microscope to better assess these physical properties.

Sincerely yours,
EBASCO SERVICES INCORPORATED

Larry A. Irons

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DEC - 3 1989

EBASCO SERVICES INCORPORATED

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EBASCO

RIGP-EDEN-89-189
May 25, 1989

Mr. Brent Lewis
Rockwell International
North American Space Operations
Rocky Flats Plant
Bldg. 250
P.O. Box 464
Golden, CO 80403

Subject: Geophysical Logging Oversight at 37-89BR

Dear Brent:

On May 11th and 12th, 1989, I oversaw borehole geophysical logging operations at borehole 37-89BR southeast of the Rocky Flats Plant. A synopsis of events were as follows:

TIME	EVENT
0843	Arrive at site; drillers pulling pipe.
0952	Temperature and fluid resistivity probe lowered down hole. (Problem with temperature electronics; COLOG calls their office to attain a new probe).
1026	SP, resistivity, and IP tools lowered down hole.
1139	Sonic probe lowered down hole.
1409	Natural gamma, guard resistivity, and neutron tools lowered down hole.
1535	N. Smith (COLOG) arrives with new temperature/fluid resistivity probe.
1552	Gamma-gamma density and caliper probe lowered down hole.
1826	Depart site.

5-12-89

0705	Arrive at site.
0736	Temperature/fluid resistivity probe lowered down hole.
0922	EM 39 induction tool lowered down hole.
1054	Depart site.

Comments:

1) The digital depth recorder on the Mount Sopris system was incorrect (within reasonable limits) consistently in the same direction after logging. This will not adversely affect data quality.

2) The sonic probe and the temperature/fluid resistivity probe became stuck in the borehole at approximately 585 - 590 feet. The temperature/fluid resistivity data should be considered anomalous in this area. Sonic data was only acquired to 590 feet.

3) The drillers placed "fresh" water in the borehole at 0946 on 5-11-89. More water was added before logging operations commenced on 5-12-89. The fluid resistivity log should be interpreted with caution, especially as an indicator of the true value of R_W, in the upper section of the hole.

4) The lower 100 feet of the Laramie Formation contains numerous distinct intervals. These intervals are apparent on the resistivity and density traces as areas of high resistivity and low density. The average density of soft coal is 1.32 g/cc; the density trace exhibits distinct intervals possessing densities of approximately 1.35 g/cc. Several of these intervals are persistent throughout the Rocky Flats Plant area, and are termed coals #2, 3, and 4 (Spencer, 1961).

Sincerely yours,
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Timothy M. Deignan

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EBASCO

RIGP-EDEN-89-124
April 18, 1989

Mr. Brent Lewis
Rockwell International
North American Space Operations
Rocky Flats Plant
Bldg. 250
P.O. Box 464
Goldern, CO 80403

Subject: Geophysical Logging Oversight at 38-89BR

Dear Brent:

On April 13, 1989, I oversaw borehole geophysical logging operations at borehole 38-89BR north of the Rocky Flats Plant. A synopsis of events were as follows:

TIME	EVENT
0810	Arrived at site drillers pulling pipe.
0845	Temperature and fluid resistivity probe lowered down hole
0925	SP, IP, and resistivity tools lowered down hole
1012	Sonic probe lowered down hole
1128	Neutron, guard resistivity, and gamma ray tools lowered down hole
1157	Gamma - gamma density and caliper probe lowered down hole
1255	EM 39 induction tool lowered down hole
1325	New EM 39 tool lowered down hole
1415	Colog leaving; I departed site

Comments:

1) The digital depth recorder on the Mount Sopris System was incorrect by 0.1 to 0.3 feet consistently in the same direction after logging. This should not adversely effect data quality.

2) EM39 borehole induction log depth was incorrect by 0.3 feet. The data were depth shifted by COLOG, and a close correlation exists between the EM 39 data and resistivity data.

3) A new "weighted" EM 39 probe was put into use by COLOG; however, the instrument needs to go through calibration procedures before it can be utilized.

4) Two sandy intervals are present in well 38-89BR. The first interval is near 96 feet, and the second sandy unit is located at 107 feet. The second unit exhibits characteristics which may make it possible to screen the interval.

Sincerely yours,

EBASCO SERVICES INCORPORATED

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EBASCO

RIGP-EDEN-89-069
March 21, 1989

Mr. Brent Lewis
Rockwell International
North American Space Operations
Rocky Flats Plant
Bldg. 250
P.O. Box 464
Golden, CO 80403

Subject: Geophysical Logging Oversight at 41-89BR

Dear Brent:

HGB 9/18/89

On March 9, 1989, I oversaw borehole geophysical logging operations at borehole 41-89BR A southeast of the Rocky Flats Plant. A synopsis of events were as follows:

TIME	EVENT
1200	Arrived at drill site.
1240	Background radiation survey performed by COLOG.
1340	Rig reaming out hole and pulling pipe.
1415	Hole filled with water.
1428	Logging operations started with SP, IP, and resistivity tools.
1445	Neutron, guard resistivity, and gamma ray tools lowered down hole.
1510	Gamma - gamma density and caliper probe lowered down hole.
1525	Sonic probe lowered down hole.
1542	Excessive noise present in waveform from far receiver.
1605	Sonic probe lowered down hole again.
1635	Excessive noise still present in waveform from far receiver.
1645	Temperature and fluid resistivity tools lowered down hole.
1655-1715	Sonic probe reruns in attempt to alleviate excessive noise in waveform from far receiver.
1723	EM 39 induction tool lowered down hole.
1745	COLOG leaving; I departed site.

Comments:

1) The digital depth recorder on the Mount Sopris system was incorrect by 0.1 to 0.2 feet consistently in the same direction after logging. This should not adversely effect data quality.

2) EM39 borehole induction log depth was incorrect by 0.4 feet. Data were shifted by COLOG to remedy the problem, and EM 39 data exhibited close correlation with the resistivity tools.

3) Excess noise was present in the far receiver waveform of the sonic probe. The tool was run a number of times with the same outcome. The noise is not tool oriented, because signals were high quality on surface tests of the instrument. Most likely, the excess noise is due to adverse borehole rugosity conditions (crooked hole and/or eminent caving in of borehole). The sonic velocity is excessively high. Perhaps manual picking of arrival times can alleviate the high velocity data.

4) The ground electrode for the 64 inch normal and guard resistivity tools emerged from the borehole after only 15 feet of actual logging had been done. Resistivity values acquired from these tools should be interpreted with caution from a depth of 35 feet to the surface. The 16 inch normal and induction tools can be evaluated with confidence until approximately 10 feet of the surface.

5) The neutron porosity log needs filtering on the log display. This procedure will have no bearing on the original neutron data.

6) The temperature log should not be utilized for interpretation purposes because the borehole was filled with drilling fluid immediately prior to logging operations.

HCE 8/89

7) Borehole 41-89 BR caved in a short time after logging operations were concluded.

8) Purpose of logging run was to provide sonic and density data on weathered claystone to tie into the upcoming seismic reflection program.

Sincerely yours,

EBASCO SERVICES INCORPORATED

Timothy M. Deignan

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APR 23 1989

2.0 DESCRIPTION OF BOREHOLE GEOPHYSICAL PROBES

Temperature Probe

The first probe used in any borehole is usually the temperature probe. This probe continuously records the thermal gradient of the borehole fluid immediately surrounding the thermistor as the probe is lowered from the surface to the bottom of the hole.

The logging equipment is calibrated to present data in degrees Celsius. Temperature data provides information as to the source of inner borehole flow and static water levels.

Fluid Resistivity Probe

Fluid resistivity logs record the borehole fluid resistivity directly as the borehole fluid passes between electrodes within the probe. Changes in fluid resistivity can indicate the in-flow or out-flow of water as well as the water quality.

Both the temperature and fluid resistivity probes are best run in a borehole which has not been disturbed for 24 hours. However, hole conditions at the background wells required drilling rods to remain in the hole to just prior to logging. The disruption of the fluid column just prior to logging by pulling rods and the simultaneous introduction of fresh water to the hole to displace the drilling can mask evidence of changes in the borehole fluids.

SP Probe

The Spontaneous Potential (SP) probe measures variations in the natural electrochemical potential. The potential, (electrochemical) measured in millivolts, results if a contrast exists between the resistivities of the borehole fluid and the formation pore water. It can result

from oxidation-reduction (redox) from sulfide mineralization (e.g. pyrite) or from a "streaming" potential which results from fluid flow into or out of the formation.

Where salinity contrasts are significant, the SP curve can be used to differentiate permeable and impermeable lithologies (e.g. sandstones versus claystones).

IP Probe

The Induced Polarization (IP) probe applies an intermittent current downhole and measures the subsequent residual voltage produced by the polarization of the surrounding borehole. Polarization commonly occurs in minerals with high cation exchange capacity (e.g. clays or zeolites) and at the interface between pore fluid and conductive minerals (e.g. metallic sulfides).

Normal Probes

The 16 and 64 inch normal probes apply a current of constant intensity within the borehole and measure the resistivity of the formations to this current. The current induced by a normal probe is unfocussed, consequently resistivity values are often underestimated where large resistivity contrasts exist between formation beds.

Normal probes like all resistivity probes require a conductive borehole fluid.

The distances of 16 and 64 inches refer to the spacing between two electrodes within the probe. The 16 inch spacing measures the resistivity over a narrower band than the 64 inch spacing and can result in better bed definition. The 64 inch spacing measures the resistivity deeper into the formation and provide a better formation resistivity in the absence of thin beds.

Sonic Probe

The sonic probe generates a sound wave which travels through drilling fluid and formation to a receiver. The sonic waves received are measured with respect to sonic velocity, amplitude, and wave shape.

The sonic probe used in this study is comprised of a single transmitter and two receivers with a transmitter-to-receiver spacing of 36 inches. Because only a single transmitter is in this probe, the tool is sensitive to borehole rugosity and sonde tilt.

Guard Resistivity Probe

Like the normal probes the guard resistivity probe measures formation resistivity. This probe utilizes guard electrodes placed above and below a measuring electrode to focus the induced current horizontally into the formation. Because this is a focused resistivity log, thin-bed boundaries and formation resistivities are better defined.

Like all resistivity probes, the guard resistivity probe requires a conductive borehole fluid.

Neutron Density Probe

As the neutron probe is drawn up the borehole, neutrons are emitted from an Americium-241 Beryllium source into the surrounding strata. Some of these neutrons are slowed down or thermalized, by collisions with atomic nuclei in the surrounding strata, while other neutrons are returned to a detector and are recorded in counts per second. Because hydrogen is the most effective thermalizing element, a decrease in returned neutrons indicates an increase in hydrogen. This increase in hydrogen may imply an increase in water filled porosity or an increase in chemically bound hydrogen associated with clays.

The neutron probe used in this study is a single detector probe therefore it is sensitive to hole rugosity.

Natural Gamma Ray Probe

The natural gamma probe detects gamma radiation that naturally occurs in all rock and records the radiation in counts per second. The log, which shows relative changes in radiation is used for lithologic identification and stratigraphic correlation and is not directly sensitive to weathering.

Gamma-Gamma Density Probe

As the gamma-gamma probe is drawn up through the borehole, gamma rays are radiated from a radioactive source (Cesium-137) into the surrounding material. Some rays are scattered and absorbed by collisions with electrons within the material; other rays return to a radiation detector and are counted. The number of returned rays is inversely proportional to the approximate bulk density of the surrounding material. Densities of rock along the walls of a borehole are identified by a number of counts per second with a lesser density giving higher counts. By using a compensated density probe (2 detectors) and calibrating the system to known values, the counts can be translated to actual density values.

The gamma-gamma probe is run against the wall of the borehole or against the inside wall of well casing. A mechanical arm which acts as the caliper probe decentralizes the gamma-gamma probe.

Caliper Probe

The caliper probe is a single arm mechanical probe that is used to determine variation in the diameter of a borehole. The diameter generally increases in cavities and, depending on

the drilling technique used, in weathered zones. An apparent decrease in borehole diameter may result from mud or drill-cutting accumulation along the sides of the borehole and in the bottom of a boring. Data from the caliper log is used (1) to vertically locate cavities and weathered zones and (2) to correct changes in borehole diameter which directly affects the response of the gamma-gamma log and the sonic log. The caliper probe may also be used to determine the condition and variation in diameter of casing.

Induction Probe

The induction probe utilizes alternating current to induce an alternating magnetic field within the formation. This alternating magnetic field induces secondary currents within the formation, which in turn create secondary magnetic fields. The induction probe is sensitive to these secondary magnetic fields. The signal received by the induction log is proportional to the amount of secondary current extant in the formation. This secondary current is proportional to the formation conductivity. Although the induction probe directly measures formation conductivity, this data is transformed to formation resistivity in the log output to facilitate comparison of the induction curve with resistivity curves.

Unlike resistivity devices, the induction probe can be run in non-conductive borehole fluids.

3.0 ANALYTICAL METHODS

The primary purpose of logging background wells is to facilitate the selection of completion intervals. The target zone of completion is the uppermost permeable zone at least three feet thick. Consequently the analysis of borehole geophysical logs was restricted to the area around the uppermost permeable zones.

Analysis of borehole geophysical logs begins with inspection for direct evidence of zones of permeability. In the absence of such evidence, the presence of relatively permeable zones has been assumed to correspond to sandstones with relatively high porosities and low clay content.

3.1 Determination of Permeable Zones

Four curves were examined for direct evidence of permeability zones. None of these curves were a consistent indicator of permeability, however.

Both the Temperature and Fluid Resistivity curves characterize the borehole fluid. Localized changes within the fluid column indicate a mixing of borehole and formation waters laterally adjacent to a permeable zone. This phenomenon however is masked in many boreholes within this study because of mixing within the borehole caused by the removal of drilling rods from the hole just prior to logging.

The SP curve is a qualitative indicator of permeability where sufficient differences in salinity exist between the drilling fluid and formation water. However, both the formation water and drilling fluid used to drill the background wells are fresh. This results in little salinity contrast and characterless SP curves.

The Caliper curve can indicate the presence of mudcake in boreholes which are neither rugose nor oversized. Mudcake is a product of outflow of borehole fluid into the adjacent formation and is consequently an indicator of permeability.

Overall mudcake buildup may have been inhibited because no drilling additives were added to the drilling fluid (water) and consequently any drilling mud present was the product of natural breakdown of the drilled claystones. In addition, because the mud was not

artificially weighted up, only a small hydraulic head existed between the borehole fluid and formation water.

3.2 Estimation of Porosity and Clay Volume

3.2.1 Porosity Logs

Three apparent porosity curves have been generated by COLOG for the background wells. The Gamma-Gamma (sandstone) porosity, ϕG_{ss}, curve is based upon a matrix density of 2.65 g/cc and a fluid density of 1 g/cc. The Neutron (limestone) porosity, ϕN_{ss}, is based upon tool specific correlations for neutron counts and borehole diameter. For the purpose of porosity analysis the Neutron (sandstone) porosities, ϕN_{ss}, have been estimated for $\phi N_{ls} > 5\%$ as $\phi N_{ss} = \phi N_{ls} + 4$ porosity units. This calculation is based upon chart Por-13 in Schlumberger (1984). Sonic sandstone porosities, ϕS_{ss}, are based on the sonic travel time and an algorithm proposed by Raymer, Hunt and Gardner (1980).

3.2.2 Original crossplot and Clay Volume

Porosity analysis within the bedrock sandstones is complicated by the ubiquitous presence of clay. In order to estimate the porosity and clay volume in sandstones, crossplots of ϕG_{ss} and ϕN_{ss} were generated for individual wells prior to selection of the screened interval. As shown in Figure F-1, adjusted porosity values were based upon a clay line established from selected log data from claystones and an assumed clay density of 2.35 g/cc. Original calculations made prior to screen selection for background wells are presented below. Crossplot porosity and clay volume were not calculated for 32-89BR and 33-89BR.

3.2.3 Recalculated Crossplot Porosity and Clay Volume

Upon completion of the background borehole geophysical logging, a crossplot of ϕN_{ss} and ϕG_{ss}, Figure F-2, was constructed from the data provided by the eight wells listed in Table F-1. Well 37-89BR was not included in this crossplot because of its anomalous depth and the presence of the Fox Hills Formation. In order to utilize the sand-silt-clay model described as the Saraband model by Schlumberger (1987), a triangle was superposed on the data. Vertices at $\phi N_{ss} = \phi G_{ss} = 0$ and at $\phi G_{ss} = \phi N_{ss} = 100$ represent end points of that line segment upon which log data from clean quartzose sandstones should fall. Points to the right of this line segment indicate a quartz sand-clay combination. The third vertex represents an imporous claystone whose location is determined by the plot of sampled data points. The imporous claystone point was interpreted from this plot to be $\phi N_{ss} = 68$, $\phi G_{ss} = 20$.

The calculations for the volume of clay (Vcl) are:

$$Vcl = \Delta \phi_{ob} / \Delta \phi_{cl} = \Delta \phi_{ob/48}$$

where $\Delta \phi_{ob} = \phi N_{ss} - \phi G_{ss}$ for the sampled point,

and $\Delta \phi_{cl} = \phi N_{ss} - \phi G_{ss}$ for the claystone vertex.

***Note $\Delta \phi_{cl} = 68 - 20 = 48$.

The calculations for adjusted porosity are:

$$\phi_{adj} = \phi G_{ss} - Vcl \times 20$$

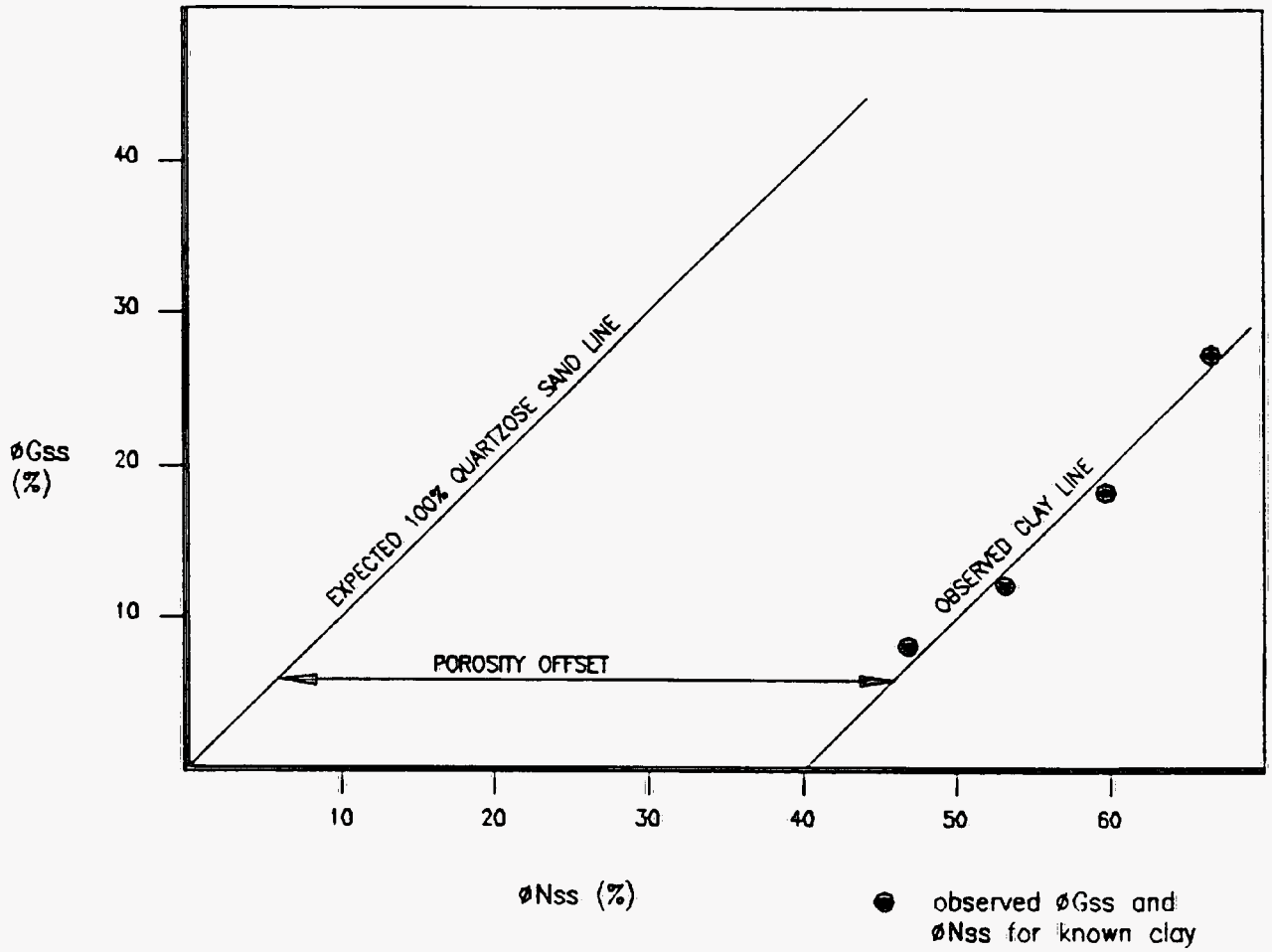
where ϕG_{ss} is the observed ϕG_{ss}, and

$20 = \phi G_{ss}$ of the claystone vertex.

Recalculated adjusted porosities and volumes of clay based upon the above formulae are presented for each well over the zones of logged below.

FIGURE E-1

ORIGINAL CROSSPLOT POROSITY AND CLAY VOLUME CALCULATIONS



PROCEDURE:

- øGss and øNss for clean clays are crossplotted.
- A line parallel to the sand line is fitted through this data and offset recorded.
- Vcl = Δøob/offset

  where Vcl = volume clay
  Δøob = øNss − øGss for the sampled point

- øadj = 0.18*Vcl

  where øadj = adjusted porosity.

  The constant 0.18 is based upon an assumed clay density of 2.35 g/cc (correct for montmorillonite).

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SHEET 1 of 3

CLIENT/SUBJECT Rockwell / RFP log analysis W.O. NO. 2029-33-04-

TASK DESCRIPTION Porosity Analysis of 34-89BR TASK NO. 0010

PREPARED BY HGB DEPT 1582 DATE 3/14/89

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE

APPROVED BY

DEPT DATE

Lithology	Depth	ϕ_p G-G $\rho_{b_{ss}}$	Neut ϕ_{LS}	ϕ_N Neut ϕ_{ss}	Vclay ① (%)	ϕ_{ss} ② (%)
silty ss	44	24	44.0	48	56	14
	45	30	41.0	45	35	24
No recov.	46	27	40.0	44	40	20
claystone	108	NA	64.0	68		
	109	33	63.0	67		
	110	25	61.0	65		
silty ss	123	20.5	32	36	36	14
sltst-ss	124	15	34	38	54	5
	125	22	33.7	37.7	37	15
	126	28	33.3	37.3	22	24
	127	23.5	32.4	36.4	30	18
slst, some sands	128	31	29	33	5	30
	129	21.5	30	34	29	16
	130	22.5	30.6	34.6	28	17
clayey sltst	131	16	35	39	54	6
	132	20.5	32.5	36.5	38	14
claystone &	135	27	67	71		
siltstone	136	30	67	71		
	137	29.5	62	66		
	138	23.5	62	66		
	139	22	60	64		
	140	22	60	64		

① Based on $V_{clay} = \frac{\phi_N - \phi_p}{42.5} \times 100\%$ (See X plot).

② Based on $\phi = \frac{\rho_{ma} - V_{clay}(\rho_{ma} - \rho_{clay}) - \rho_b}{(\rho_{ma} - \rho_f)} = \phi_{p_A} - 0.18\, V_{clay}$

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CLIENT/SUBJECT _____ W.O. NO. _____

TASK DESCRIPTION _____ TASK NO. _____

PREPARED BY HGE DEPT 1582 DATE 3/14/89

MATH CHECK BY _____ DEPT _____ DATE _____

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DEPT _____ DATE _____

where:

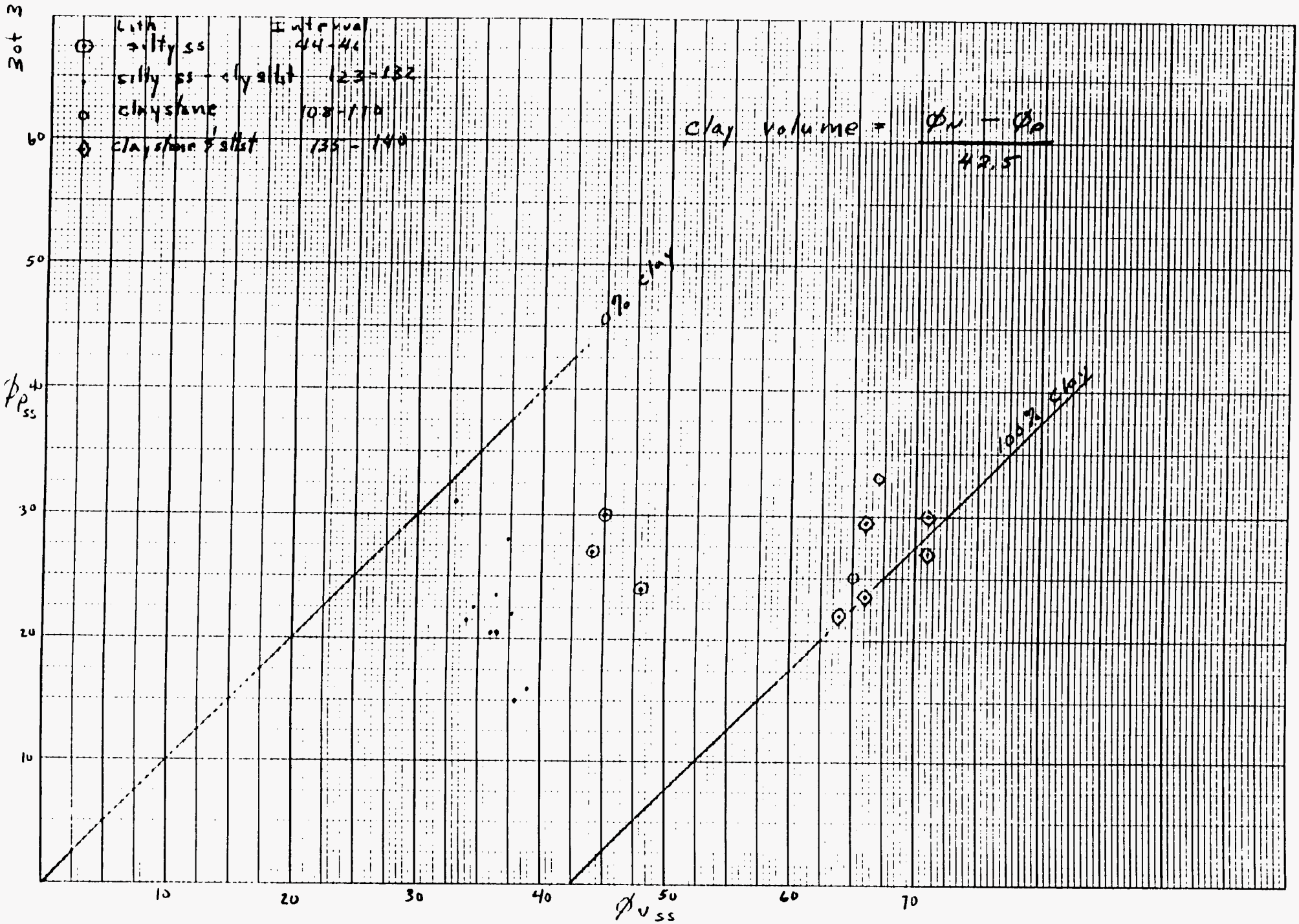
$$\phi = \frac{\rho_{ma} - \rho_b}{(\rho_{ma} - \rho_f)} - \frac{V_{clay}(\rho_{ma} - \rho_{clay})}{(\rho_{ma} - \rho_f)}$$

and $$\frac{\rho_{ma} - \rho_b}{(\rho_{ma} - \rho_f)} = \phi_{\rho_A} \quad \text{or} \quad 6\text{-}6\ \phi_{SS}$$

$\rho_{ma} = 2.65$

$\rho_{clay} = 2.35$ (montmorillonite)

$\rho_f = 1.00$



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SHEET 1 of 3

CLIENT/SUBJECT Rockwell/RFP 100 analysis W.O. NO. 2029-33-04-

TASK DESCRIPTION Porosity Analysis of 35-29CR TASK NO. 0010

PREPARED BY HGB DEPT 1582 DATE 3/24/89

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE

APPROVED BY

DEPT DATE

Lithology	Depth	(ϕ_{Gas}) ϕ_{Pbss}	(ϕ_{Neut}) ϕ_{Ls}	(ϕ_{Neut}) ϕ_{Ss}	V_{clay} ① (%)	ϕ_{ss} ② (%)
sdy silty clyst	51	22.5	40	44	51	13
	52	21	37.5	[illegible]	[illegible]	[illegible]
cly slty ss	53	23.0	35.5	39.5	39	16
"	55	22	[illegible]	42	48	13
	54	20	[illegible]	[illegible]	43	[illegible]
slty clyst	107	24.5	40.5	44.5	47	16
slty cly ss	108	23	35	39	38	16
"	109	20.5	32	36	37	14
"	110	19	34	38	45	11
"	111	20	39	43	54	10
slty ss	128	22.5	40	44	51	13
"	129	23	30.5	34.5	27	18
slty sdy clyst.	130	22	35.5	39.5	42	14
sdy clyst	185	20.5	41	45	58	10
cly ss	186	14.5	30	34	46	6
"	187	15	30	34	45	7
"	188	16	32.5	36.5	48	7
"	189	16.5	39.5	43.5	64	5
cly, slty ss	190	18	36	40	52	9
"	191	20	36	40	52	11
"	192	17	47	51	80	3
"	193	17.5	33	37	46	9
sdy, slty clyst	194	15.5	32	36	49	7
"	195	15	42	46	73	10
slty cly ss	201	20.5	48	52	75	7
slty ss	202	21	34.5	38.5	42	13
"	203	20.5	35	39	44	13
"	204	21.5	38	42	49	13
"	205	16	42	46	71	3

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SHEET 2 of 3

CLIENT/SUBJECT _____ W.O. NO. _____

TASK DESCRIPTION _____ TASK NO. _____

PREPARED BY _____ DEPT _____ DATE _____ | APPROVED BY

MATH CHECK BY _____ DEPT _____ DATE _____

METHOD REV. BY _____ DEPT _____ DATE _____ | DEPT _____ DATE _____

Lithology	Depth	(ϕ_{G-G}) ϕ_{Ross}	(ϕ_{Neut}) ϕ_{LS}	(ϕ_{Neut}) ϕ_{SS}	V_{clay} ① (%)	ϕ_{SS} ② (%)
silty clyst	175	26	55.5	59.5		
"	176	23	64	68		
"	177	24.5	65	69		
"	178	20	55.5	59.5		
"	179	19.5	57.5	61.5		
"	180	20	53.5	57.5		
"	181	24.5	62.5	66.5		
"	182	24.5	64	68		
"	183	25.5	59.5	63.5		
"	184	22	60	64		

① Based on $V_{clay} = \frac{\phi_N - \phi_p}{42} \times 100\%$ (see X plot)

② Based on $\phi = \frac{\rho_{ma} - V_{clay}(\rho_{ma} - \rho_{clay}) - \rho_b}{(\rho_{ma} - \rho_f)} = \phi_{\rho_A} - 0.18 V_{clay}$

where:

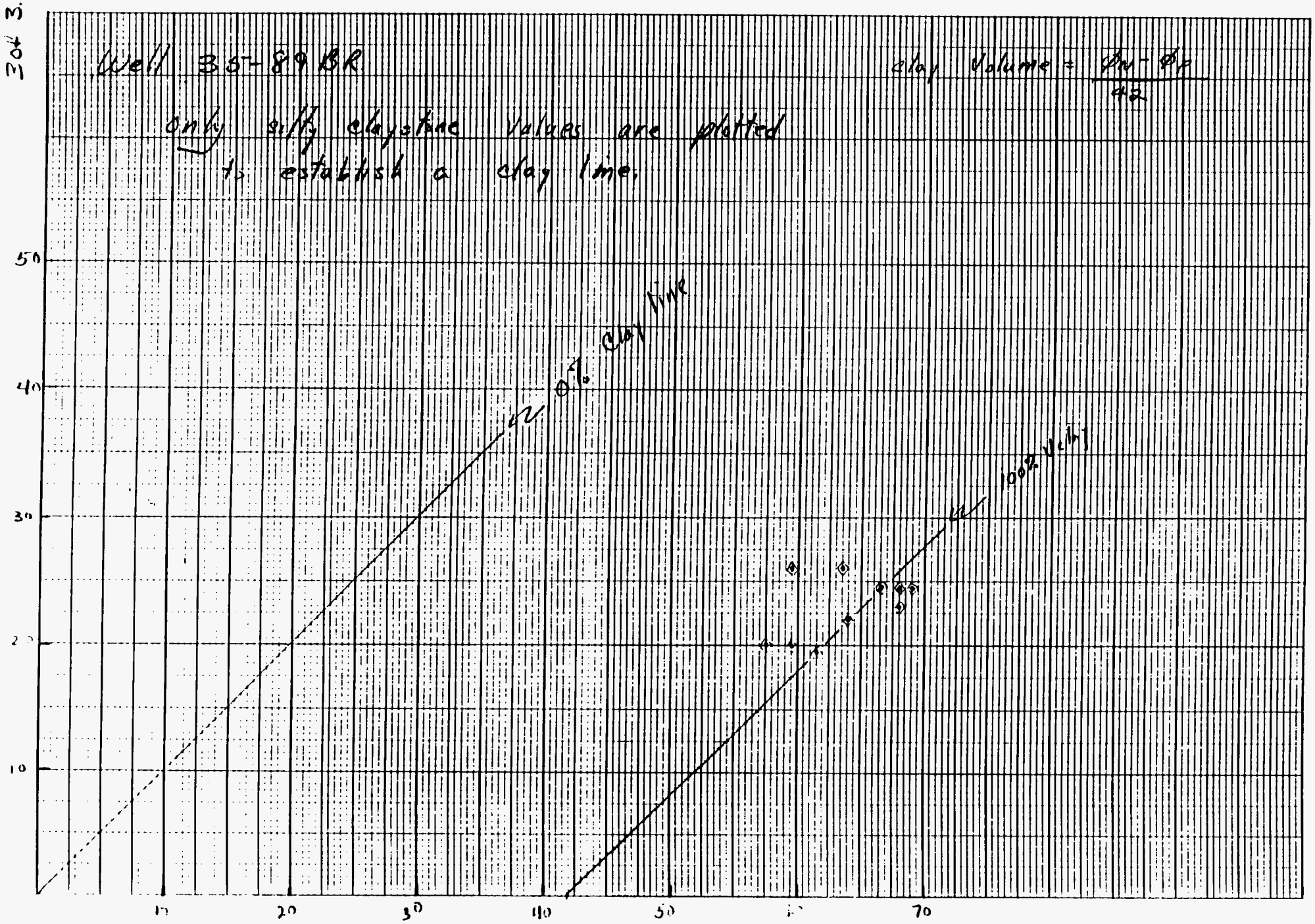
$$\phi = \frac{\rho_{ma} - \rho_b}{(\rho_{ma} - \rho_f)} - \frac{V_{clay}(\rho_{ma} - \rho_{clay})}{(\rho_{ma} - \rho_f)}$$

and $\frac{\rho_{ma} - \rho_b}{\rho_{ma} - \rho_f} = \phi_{\rho_A}$ or G-G ϕ_{SS}

$\rho_{ma} = 2.65$

$\rho_{clay} = 2.35$ (montmorillonite)

$\rho_f = 1.00$


Well 35-89 BR
clay Volume = $\frac{\phi_N - \phi_D}{42}$
only silty clay=like values are plotted to establish a clay line.
0% clay line
100% Kaolinite
10
20
30
40
50
10
20
30
40
50
70

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SHEET 1 of 2

CLIENT/SUBJECT Rockwell / RFP log analysis W.O. NO. 2029-23-04-

TASK DESCRIPTION Porosity Analysis of 36-89BR TASK NO. 0010

PREPARED BY HGB DEPT 1582 DATE 3/24/89

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE

APPROVED BY

DEPT DATE

Lithology	Depth	ϕ_{G-G} (ρ_{bss})	$\phi_{neut.}$ (ϕ_{LS})	$\phi_{neut.}$ (ϕ_{SS})	V_{clay} ① (%)	ϕ_{SS} ② (%)
	80	20	45	49	73	7
	81	14	31	35	53	4
	82	21	41	45	60	10
	84	20	40	44	60	9
	86	22	40	44	55	12
	88	22	38	42	50	13
	90	19	43	47	70	6
	92	20	40	44	60	9
	94	17	39	43	65	5
	95	28	50	54	65	16 ③
	96	28	64	68		

① Based on $V_{clay} = \frac{\phi_N - \phi_P}{40.0} \times 100\%$ (see X plot)

② Based on $\phi = \frac{\rho_{ma} - V_{clay}(\rho_{ma} - \rho_{clay}) - \rho_b}{(\rho_{ma} - \rho_f)} = \phi_{\rho_A} - 0.18\, V_{clay}$

where:

$$\phi = \frac{\rho_{ma} - \rho_b}{(\rho_{ma} - \rho_f)} - \frac{V_{clay}(\rho_{ma} - \rho_{clay})}{(\rho_{ma} - \rho_f)}$$

and $\frac{\rho_{ma} - \rho_b}{\rho_{ma} - \rho_f} = \phi_{\rho_A}$ or G-G ϕ_{ss}

$\rho_{ma} = 2.65$

$\rho_{clay} = 2.35$ (montmorillonite)

$\rho_f = 1.00$

③ Both the G-G ϕ + Neutron curves are shifting at this depth. This high ϕ value is not reliable.

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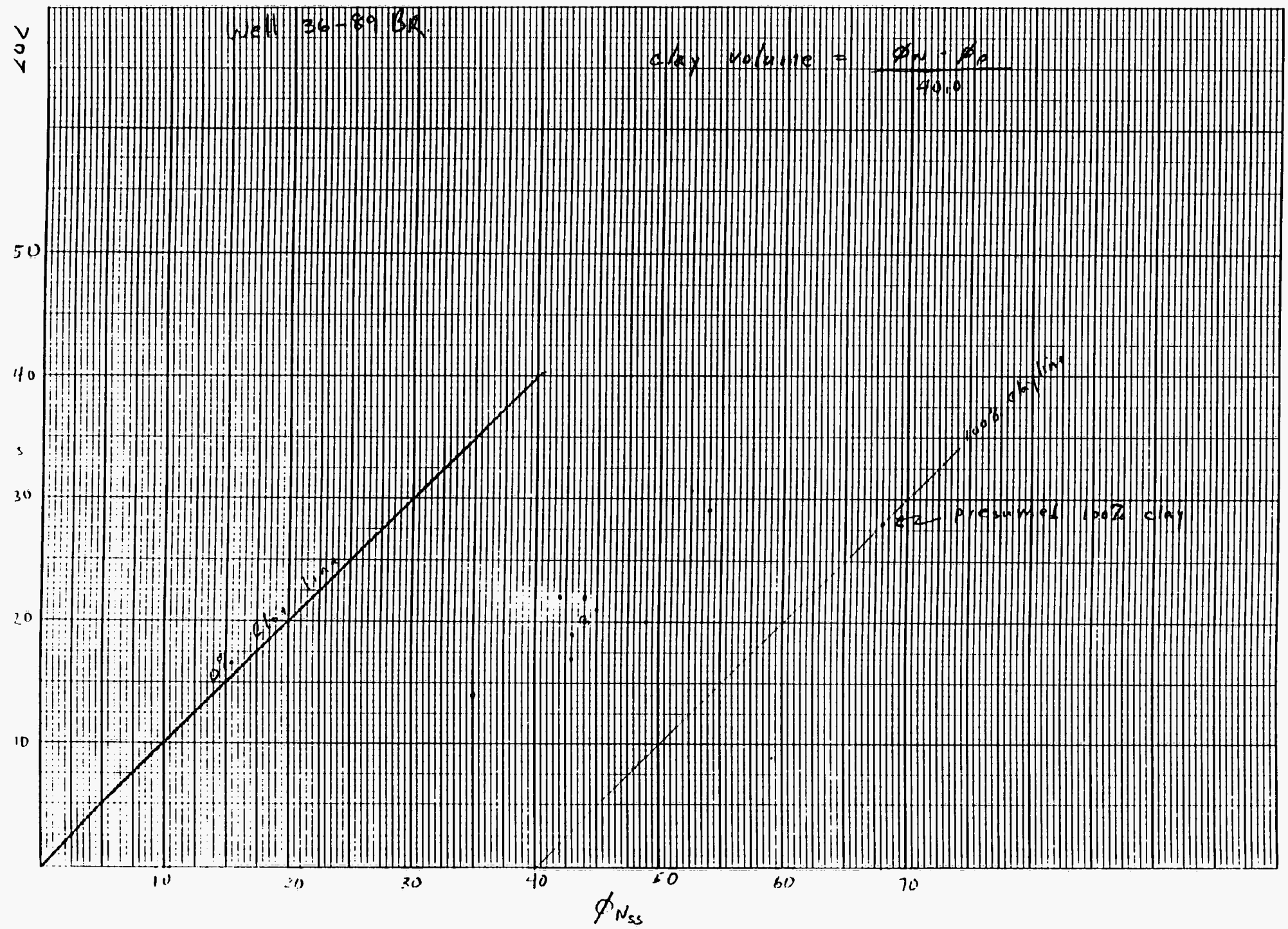

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CLIENT/SUBJECT Rockwell / RFD Log Analysis W.O. NO. 2029-33-04-

TASK DESCRIPTION Porosity Analysis of 37-89BR TASK NO. 0010

PREPARED BY HCB DEPT 1582 DATE 5/5/89

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE

APPROVED BY

DEPT DATE

Lithology ③	depth	GG Ø (%)	NØss (%)	NØss (%)	Vclay ① (%)	Ø effective ②
ss	38	25	44.5	48.5	62	14
	38.5	26.5	40.5	44.5	47	18
	39	32	44	48	42	24
	39.5	41	62	64	60	30
	40	40.5	73.5	77.5	97	23
	40.5	31	64	68	97	14
	41	22	40.5	44.5	59	11
abt	44	24	54	58		
	45	25	54	58		
	46	24	58	62		
clst	52	15	46	50		
	53	18.5	48	52		
clst	56	23	54	58		
	57	23	54	58		
	58	23	54	58		
ss	64	22	44	48	68	10
	64.5	21.5	40	44	59	11
	65	22	36	40	47	14
	65.5	26.5	38	42	41	19
	66	34	44	48	37	27
	66.5	31	46	50	50	22

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CLIENT/SUBJECT _____ W.O. NO. _____

TASK DESCRIPTION _____ TASK NO. _____

PREPARED BY _____ DEPT _____ DATE _____

MATH CHECK BY _____ DEPT _____ DATE _____

METHOD REV. BY _____ DEPT _____ DATE _____

APPROVED BY _____ DEPT _____ DATE _____

① Based on $V_{clay} = \frac{\phi_N - \phi_P}{38.0} \times 100\%$ (See X plot)

② Based on $\phi = \frac{\rho_{ma} - V_{clay}(\rho_{ma} - \rho_{clay}) - \rho_b}{(\rho_{ma} - \rho_f)} = \phi_{P_A} - 0.18 V_{clay}$

where:

$$\phi = \frac{\rho_{ma} - \rho_b}{(\rho_{ma} - \rho_f)} - \frac{V_{clay}(\rho_{ma} - \rho_{clay})}{(\rho_{ma} - \rho_f)}$$

and $\frac{\rho_{ma} - \rho_b}{\rho_{ma} - \rho_f} = \phi_{P_A}$ or G-G ϕ_{ss}

$\rho_{ma} = 2.65$

$\rho_{clay} = 2.35$ (montmorillonite)

$\rho_f = 1.00$

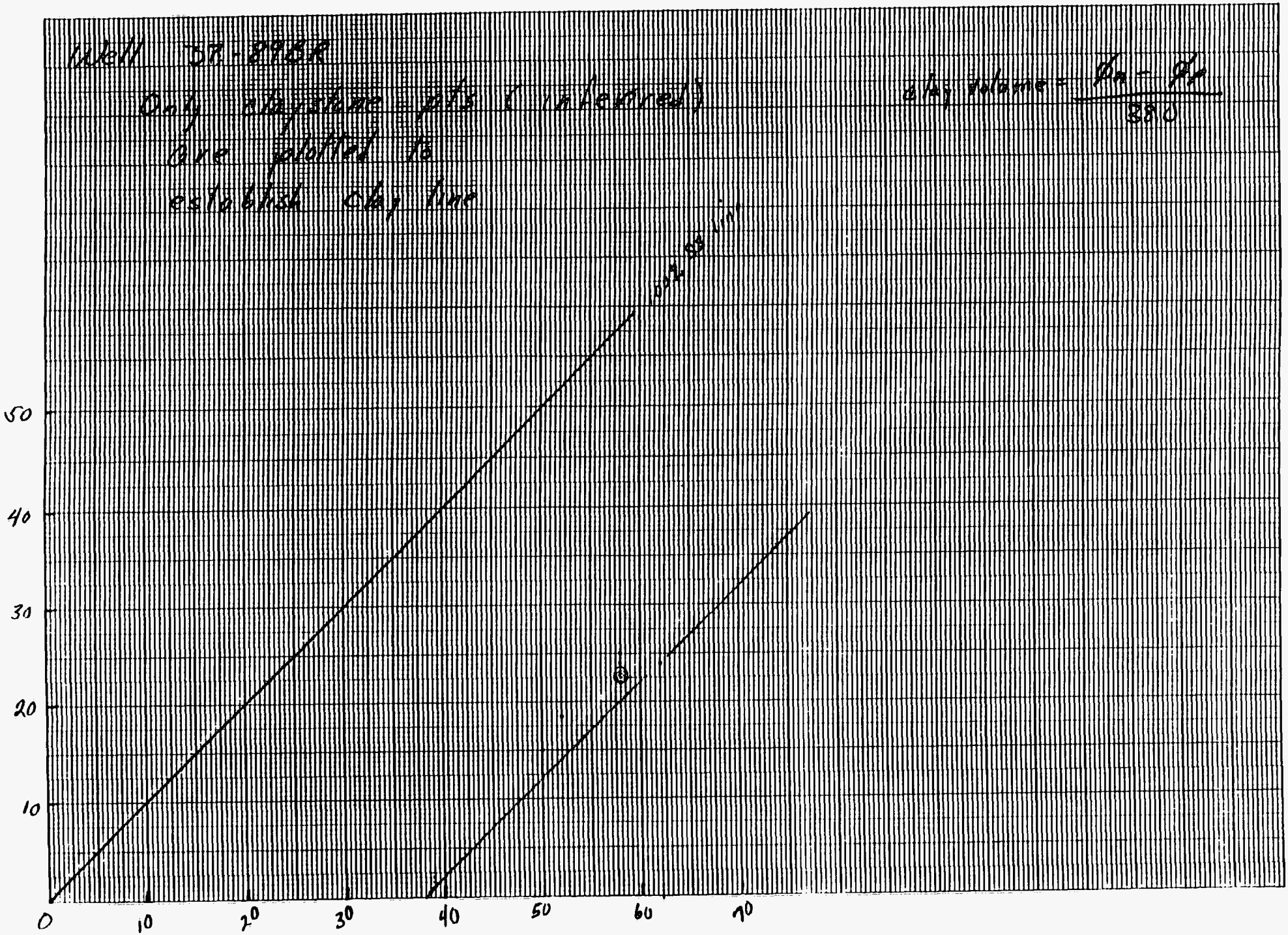
③ Inferred Lithology from Logs

RFW 10-05-003/A-5/85

Well 57-8956

Only physicane = pts (in hundreds) are plotted to establish clay line

clay volume = $\frac{\phi_n - \phi_d}{880}$



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MANAGERS DESIGNERS/CONSULTANTS

SHEET ___ of 2

CLIENT/SUBJECT Rockwell / RFP sa analysis — W.O. NO. 2029-33-04-

TASK DESCRIPTION Porosity analysis of 87-89 BR — TASK NO. 0010

PREPARED BY HGB DEPT 582 DATE 5/12/89

MATH CHECK BY ___ DEPT ___ DATE ___

METHOD REV. BY ___ DEPT ___ DATE ___

APPROVED BY ___ DEPT ___ DATE ___

Lithology	Depth	(ϕ_{G-G}) ϕ_{ss}	(ϕ_{neut}) ϕ_{ss}	(ϕ_{neut}) ϕ_{ss}	Vclay ① (%)	γ_{adj} ② (%)
SS+sltst	67	14	43.5	47.5	87	-2
	68	16	38	42	68	4
	69	19	37	41	47	11
	70	15.5	37.5	41.5	68	3
cly sltyss	71	17.5	37.5	41.5	62	6
	72	21	40	44	60	10
	73	20	37.5	41.5	56	10
	74	19.5	37.5	41.5	57	9
slty ss	75	19	37.5	41.5	58	9
	76	23	35	39	42	15
	77	21	38	42	55	11
	78	23	35.5	39.5	43	15
	79	19.5	35.5	39.5	52	10
	80	20.5	38	42	56	10
	81	20	39	43	60	9
	82	18	43	47	75	5
	83	17	46	50	86	15
	84	19.5	39	43	61	9
	85	21	38	42	55	10
ss	86	24	35	39	39	17
	87	24	42.5	46.5	58	14
	88	26	47.5	51.5	66	14
	89	21	40.5	44.5	61	10
sdy cly sltst	90	17	38.5	42.5	66	5
slty clst	91	19.5	39	43		
	92	18.5	53	57		
	93	21	49	53		
	94	22	56	60		
	95	26	53.5	57.5		
cly stst	96	22	58.5	62.5		

recommend: 84 to 38.5 based on adj ϕ and presence of mudcake on caliper.

RFN 10-05-003/A-5/85

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SHEET 2 of 3

CLIENT/SUBJECT _____ W.O. NO. _____

TASK DESCRIPTION Porosity Analysis of 37-89 PB TASK NO. _____

PREPARED BY HCB DEPT 1582 DATE 3/12/89 | APPROVED BY

MATH CHECK BY _____ DEPT _____ DATE _____

METHOD REV. BY _____ DEPT _____ DATE _____ | DEPT _____ DATE _____

Lithology	Depth	ϕ_{c-c} ϕ_{ss}	(ϕ neut) ϕ_{LS}	(ϕ neut) ϕ_{SS}	Vclay ①	ϕ adj. ② (%)
	100	12	31.5	35.5	61	1
	101	17	31.5	35.5	48	8
	102	21	37	41	52	12
	103	24	35	39	39	17
	104	21.5	32.5	36.5	39	14
	105	24	36	40	42	16
	106	22	35.5	39.5	45	14
	107	18	29.5	33.5	40	11
	108	3	19	23	52	-6
	109	20.5	51.5	54.5	88	5

① Based on $V_{clay} = \frac{\phi_N - \phi_e}{} \times 100\%$ (See X plot)

② Based on $\phi = \frac{\rho_{ma} - V_{clay}(\rho_{ma} - \rho_{clay}) - \rho_b}{(\rho_{ma} - \rho_f)} = \phi_{\rho_A} - 0.18 V_{clay}$

where:

$$\phi = \frac{\rho_{ma} - \rho_b}{(\rho_{ma} - \rho_f)} - \frac{V_{clay}(\rho_{ma} - \rho_{clay})}{(\rho_{ma} - \rho_f)}$$

and $\frac{\rho_{ma} - \rho_b}{\rho_{ma} - \rho_f} = \phi_{\rho_A}$ or G-G ϕ_{ss}

$\rho_{ma} = 2.65$

$\rho_{clay} = 2.35$ (Montmorillonite)

$\rho_f = 1.00$

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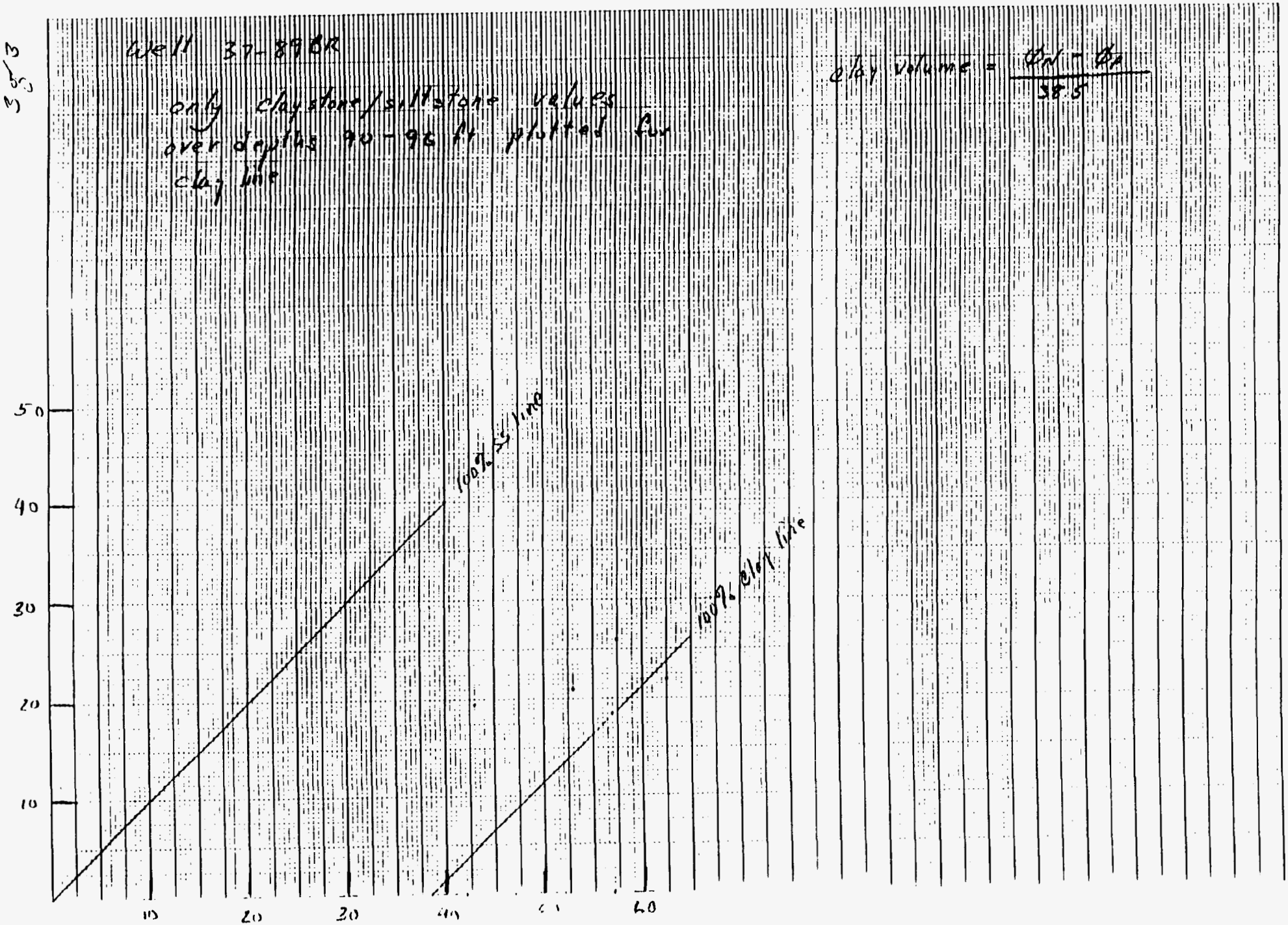
well 37-89BR

only claystone/siltstone values over depths 90-98 ft plotted for clay line

$$\text{clay volume} = \frac{\phi_N - \phi_A}{38.5}$$



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SHEET 1 of 3

CLIENT/SUBJECT Rockwell / RFP Log Analysis W.O. NO. 2629-33-04-

TASK DESCRIPTION Porosity Analysis of 38-89BR TASK NO. 0010

PREPARED BY HGB DEPT 1582 DATE 4/14/89

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE

APPROVED BY

DEPT DATE

Lithology	depth	G-G ϕ_{ss} (%)	N ϕ_{LS} (%)	N ϕ_{SS} (%)	Vclay ① (%)	ϕ_{ss} ② (%)
claystone	50	37	64.5	68.5		
	51	28	58	62		
	52	28	53	57		
	53	34.5	56	60		
	54	28	57	61		
	55	29	53.5	57.5		
	56	36	55	59		
	57	30	59	63		
	58	30.5	52	56		
	59	25.5	59.5	63.5		
	60	31	58	62		
	61	34.5	63	67		
	62	29.5	64.5	68.5		
clyst.	93	19.5	53	57	97	2
slty ss	94	18.5	43	47	74	5
	95	19	35	39	52	10
	96	22.5	35	39	43	15
	97	21.5	43	47	66	10
	98	25.5	50	54	74	12
	99	21	51.5	55.5	90	5
sdy sltst	100	19	48	52	86	4
	101	20	49	53	86	5
cly sltst	102	17.5	49	53	92	1
	103	19	50	54	91	3
cly sdy sltst	104	23	53	57	88	7
slty clyst	105	18.5	45	49	79	4
slty ss	106	18	32.5	36.5	48	9
	107	25	29.5	33.5	22	21
	108	23	31	35	31	17
cly sdy sltst	109	19.5	36	40	53	10
	110	19.5	43.5	47.5	73	6
	111	20	46.5	50.5	79	6

RFW 10-05-003/A-5/85

WESTON

SHEET 2 of 3

CLIENT/SUBJECT _____ W.O. NO. 2027-33-04

TASK DESCRIPTION Porosity Analysis of 22-29RK. TASK NO. 0010

PREPARED BY _____ DEPT _____ DATE _____

MATH CHECK BY _____ DEPT _____ DATE _____

METHOD REV. BY _____ DEPT _____ DATE _____

APPROVED BY _____

DEPT _____ DATE _____

① Based on $V_{clay} = \frac{\phi_N - \phi_P}{38.5} \times 100\%$ (See X plot)

② Based on $\phi = \frac{\rho_{ma} - V_{clay}(\rho_{ma} - \rho_{clay}) - \rho_b}{(\rho_{ma} - \rho_f)} = \phi_{P_A} - 0.18 V_{clay}$

where:

$$\phi = \frac{\rho_{ma} - \rho_b}{(\rho_{ma} - \rho_f)} - \frac{V_{clay}(\rho_{ma} - \rho_{clay})}{(\rho_{ma} - \rho_f)}$$

and $\frac{\rho_{ma} - \rho_b}{\rho_{ma} - \rho_f} = \phi_{P_A}$ or G-G ϕ_{ss}

$\rho_{ma} = 2.65$

$\rho_{clay} = 2.35$ (montmorillonite)

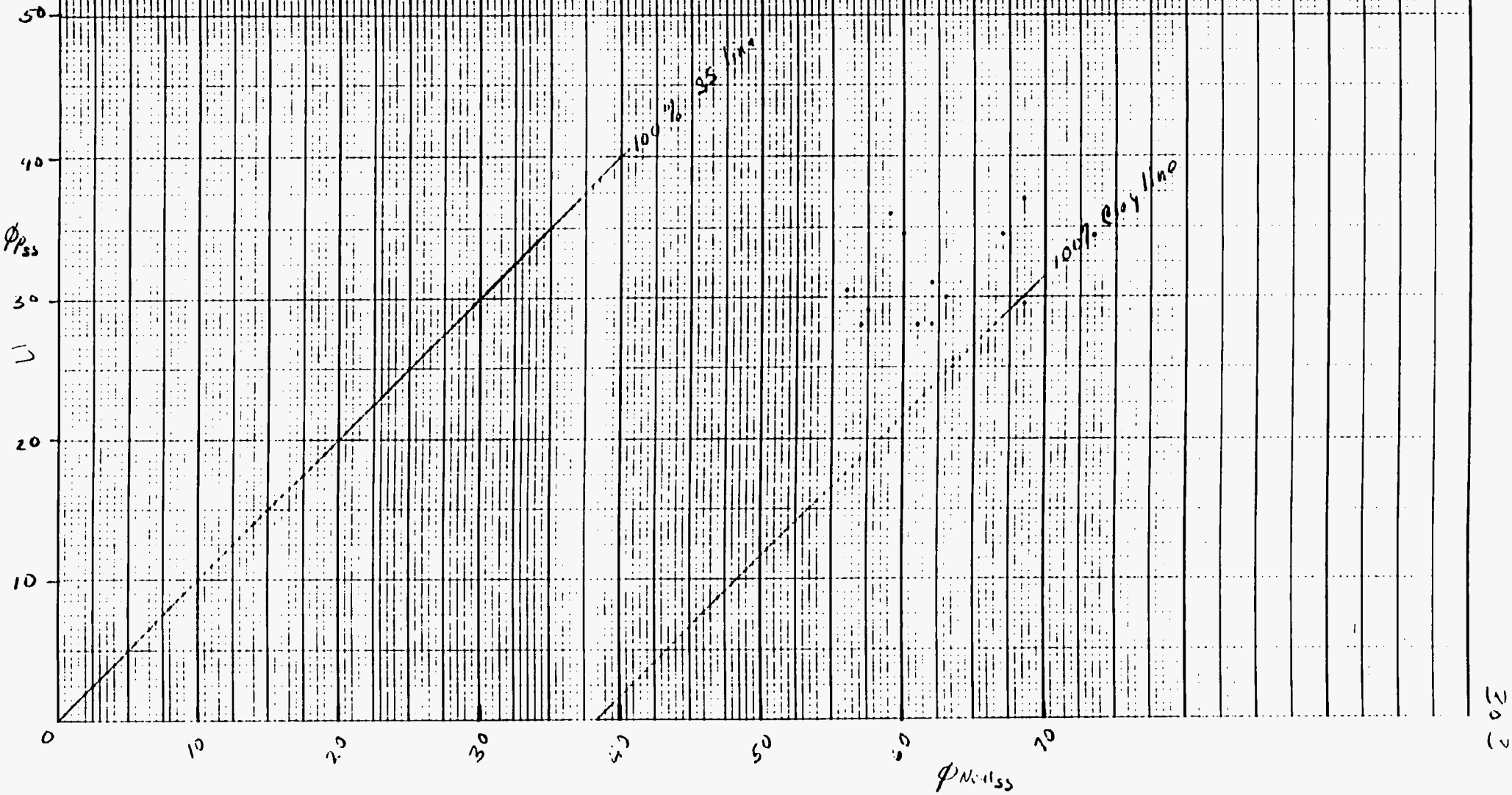
$\rho_f = 1.00$

RFW 10-05-003/A-5/85

Well 38-898K

Only claystone points between 50 and 62 ft depths plotted.

Clay Volume = $\frac{\phi_N - \phi_P}{38.5}$



46 1240
K&E 20 X 20 TO THE INCH KEUFFEL & ESSER CO.

WESTON

SHEET 1 of 3

CLIENT/SUBJECT Rockwell / RFP log analysis W.O. NO. 2029-33-04-

TASK DESCRIPTION Porosity Analysis of 41-89BR TASK NO. 0010

PREPARED BY HGB DEPT 1582 DATE 4/20/89

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE

APPROVED BY

DEPT DATE

Lithology	Depth	(ϕ_{G-G}) ϕ_{PSS}	(ϕ_{Neut}) ϕ_{LS}	(ϕ_{Neut}) ϕ_{SS}	Vclay ① (%)	ϕ_{SS} ② (%)
slty clyst	51	26.5	68	72		
	52	29	67	71		
	53	29	66	70		
	54	23.5	60.5	64.5		
	55	25	62	66		
	56	27	58	62		
	57	23	51	55		
cly sltst	58	21.5	47	51		
	59	20.5	44.5	48.5		
sdy sltst	71	21.5	41	45	54	12
	72	16.5	40.5	44.5	64	5
	73	4	30	34	69	-8 ④
sltj sd	74	-6 ③	14.5	18.5	56	-16 ④
	75	5	19.5	23.5	43	-2 ④
ss	76	22	31.5	35.5	31	16
	77	24	34	38	32	18
	78	25	35.5	39.5	33	19
	79	22.5	34.5	38.5	37	16
	80	22.5	34.5	38.5	37	16
	81	22	36	40	41	15
	82	25.5	42.5	46.5	48	17
sdy sltst	83	19	51	54	80	5
cly sltst	100	19	57.5	61.5		
	101	16.5	56	60		
	102	19.5	52.5	56.5		
	103	19.5	57	61		
	104	26	62	66		
slty clyst	105	30	67	71		
	106	23	51	54		
	107	28	52.5	56.5		
	108	36	60	64		

Recomend: 75.5 to 82.5 for screening.

RFW 10-05-003/A-5/85

WESTON

SHEET 2 of 3

CLIENT/SUBJECT Rockwell / RFP log analysis W.O. NO. 2029-33-04

TASK DESCRIPTION Porosity Analysis of 41-89 BR TASK NO. 0010

PREPARED BY HGB DEPT 1582 DATE 4/20/89

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE

APPROVED BY

DEPT DATE

① Based on $V_{clay} = \frac{\phi_N - \phi_P}{43.5} \times 100\%$ (See X plot)

② Based on $\phi = \frac{\rho_{ma} - V_{clay}(\rho_{ma} - \rho_{clay}) - \rho_b}{(\rho_{ma} - \rho_f)} = \phi_{P_A} - 0.18 V_{clay}$

where:

$$\phi = \frac{\rho_{ma} - \rho_b}{(\rho_{ma} - \rho_f)} - \frac{V_{clay}(\rho_{ma} - \rho_{clay})}{(\rho_{ma} - \rho_f)}$$

and $\frac{\rho_{ma} - \rho_b}{\rho_{ma} - \rho_f} = \phi_{P_A}$ or G-G ϕ_{SS}

$\rho_{ma} = 2.65$

$\rho_{clay} = 2.35$ (montmorillonite)

$\rho_f = 1.00$

③ Subzero SS Porosity reflects calcite cement noted in lith log

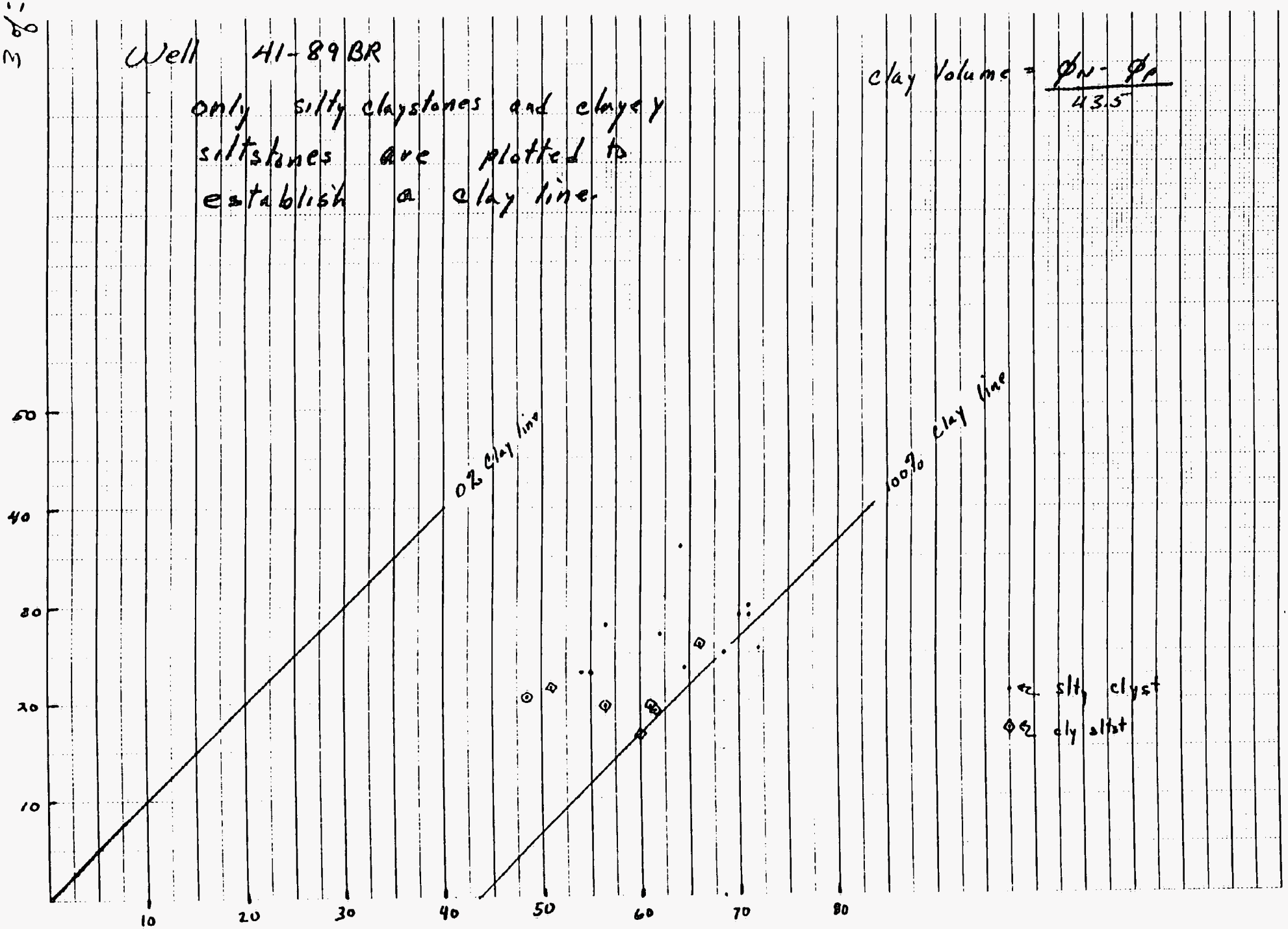
④ Subzero effective SS Porosity reflects influence of calcite cement reported over 73.2 to 75.8 in lith log.

FEW 10-05-003/A-5/85

Well 41-89BR

only silty claystones and clayey siltstones are plotted to establish a clay line.

$$\text{clay Volume} = \frac{\phi_N - \phi_P}{43.5}$$



46 1521

WESTON

SHEET 1 of 3

CLIENT/SUBJECT Rockwell/RFP Log Analysis W.O. NO. 2029-33-04-

TASK DESCRIPTION Porosity Analysis of 43-89BR TASK NO. 0010

PREPARED BY HGB DEPT 1582 DATE 4/26/89

MATH CHECK BY DEPT DATE

METHOD REV. BY DEPT DATE

APPROVED BY

DEPT DATE

Lithology	depth	G-G ϕ_{ss} (%)	N ϕ_{LS} (%)	N ϕ_{ss} (%)	V_{clay} ① (%)	ϕ_{ss} ② (%)
clst	41	25	44	48	58	15
ss	42	27.5	40	44	41	20
	43	28	39	43	38	21
	44	29	41	45	40	22
clst	45	31	50	54	58	21
	46	26	52	56	75	13
	47	28	65.5	69.5		
	48	29	56.5	60.5		
	49	28.5	59	63		
	54	34	68	72	Recommended	Screened
	55	35	71	75	interval:	
	56	34	64.5	68.5	41.2 - 45.7	
	57	31.5	67	71		
	58	37.5	64	68		
	59	33	69	73		
	60	38	61.5	65.5		
	61	39.5	68.5	72.5		
	62	32	68	72		
ss	71	7	43.5	47.5	101	-11 ③
	72	3	35	39	90	-13 ③
	73	10.5	30	34	59	0 ③
	74	14.5	25	29	36	8
silty ss	75	17.5	31.5	35.5	45	9
	76	16.5	34	38	54	7
	77	19	35.5	39.5	51	10
	78	19	33	37	45	11
	79	18.5	31	35	41	11
	80	21	31	35	35	15
	81	16.5	35	39	56	6
	82	17	34	38	53	7
	83	20	37	41	53	10
	84	19	38	42	58	9
	85	21	41	45	60	10

WESTON

SHEET 2 of 2

CLIENT/SUBJECT _____ W.O. NO. _____

TASK DESCRIPTION _____ TASK NO. _____

PREPARED BY _____ DEPT _____ DATE _____ APPROVED BY

MATH CHECK BY _____ DEPT _____ DATE _____

METHOD REV. BY _____ DEPT _____ DATE _____ DEPT _____ DATE _____

① Based on $V_{clay} = \frac{\phi_N - \phi_e}{40} \times 100\%$ (See X plot)

② Based on $\phi = \frac{\rho_{ma} - V_{clay}(\rho_{ma} - \rho_{clay}) - \rho_b}{(\rho_{ma} - \rho_f)} = \phi_{\rho_A} - 0.18 V_{clay}$

where:

$$\phi = \frac{\rho_{ma} - \rho_b}{(\rho_{ma} - \rho_f)} - \frac{V_{clay}(\rho_{ma} - \rho_{clay})}{(\rho_{ma} - \rho_f)}$$

and $\frac{\rho_{ma} - \rho_b}{\rho_{ma} - \rho_f} = \phi_{\rho_A}$ or G-G ϕ_{ss}

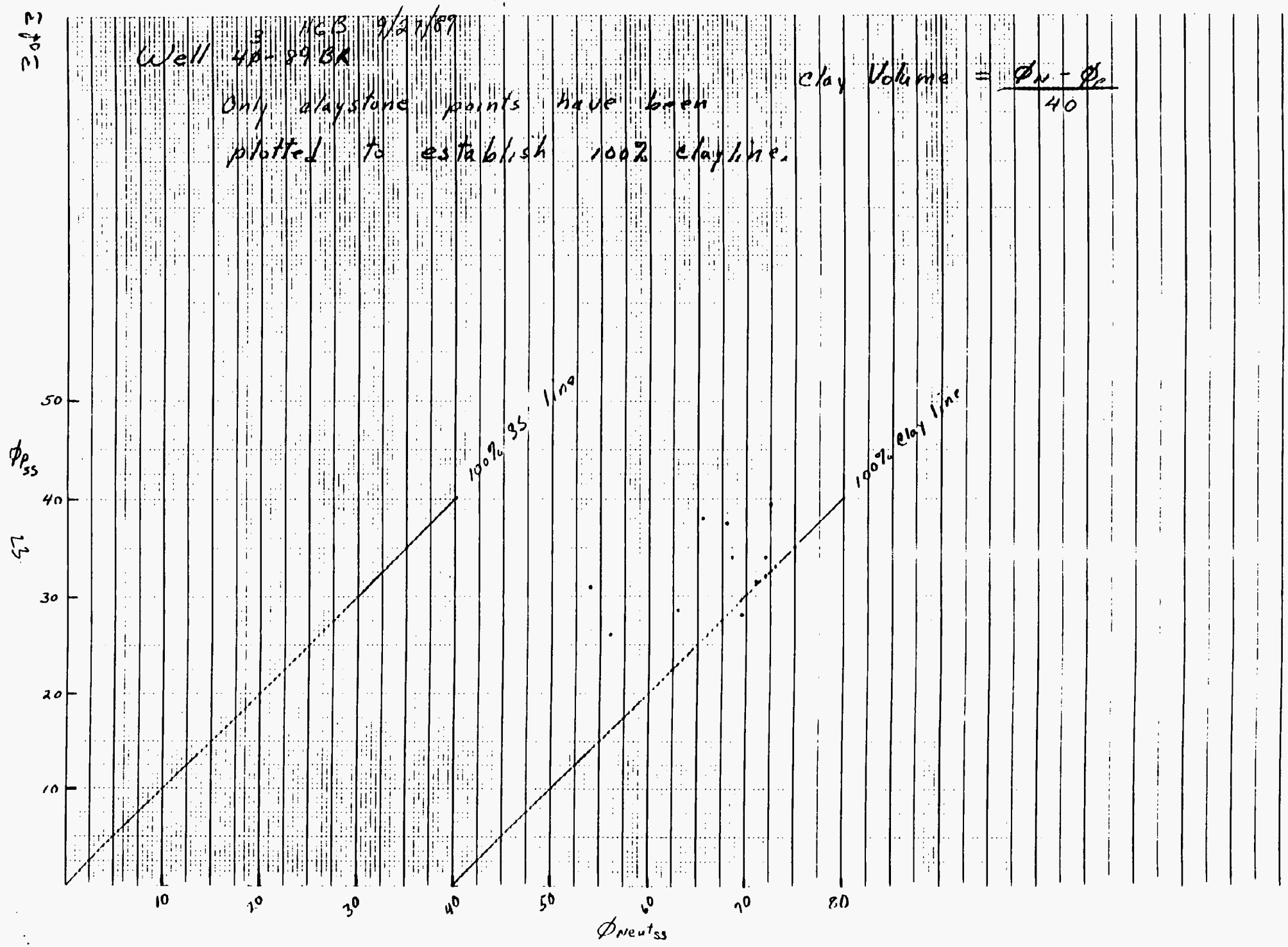
$\rho_{ma} = 2.65$

$\rho_{clay} = 2.35$ (montmorillonite)

$\rho_f = 1.00$

③ No calcite described in lithlog for this well over this interval, however this horizon has been decribed as cemented with calcite cement in 41-89BR. In 41 89BR subzero effective sandstone porosities in this interval were also calculated.

SFA 12.05.002/A.5/85


Well 48-89 BK
Only claystone points have been plotted to establish 100% clayline.
Clay Volume = $\frac{\phi_N - \phi_e}{40}$
100% SS line
100% clay line
$\phi_{P_{SS}}$
$\phi_{Neut_{SS}}$
50
40
30
20
10
10
20
30
40
50
60
70
80

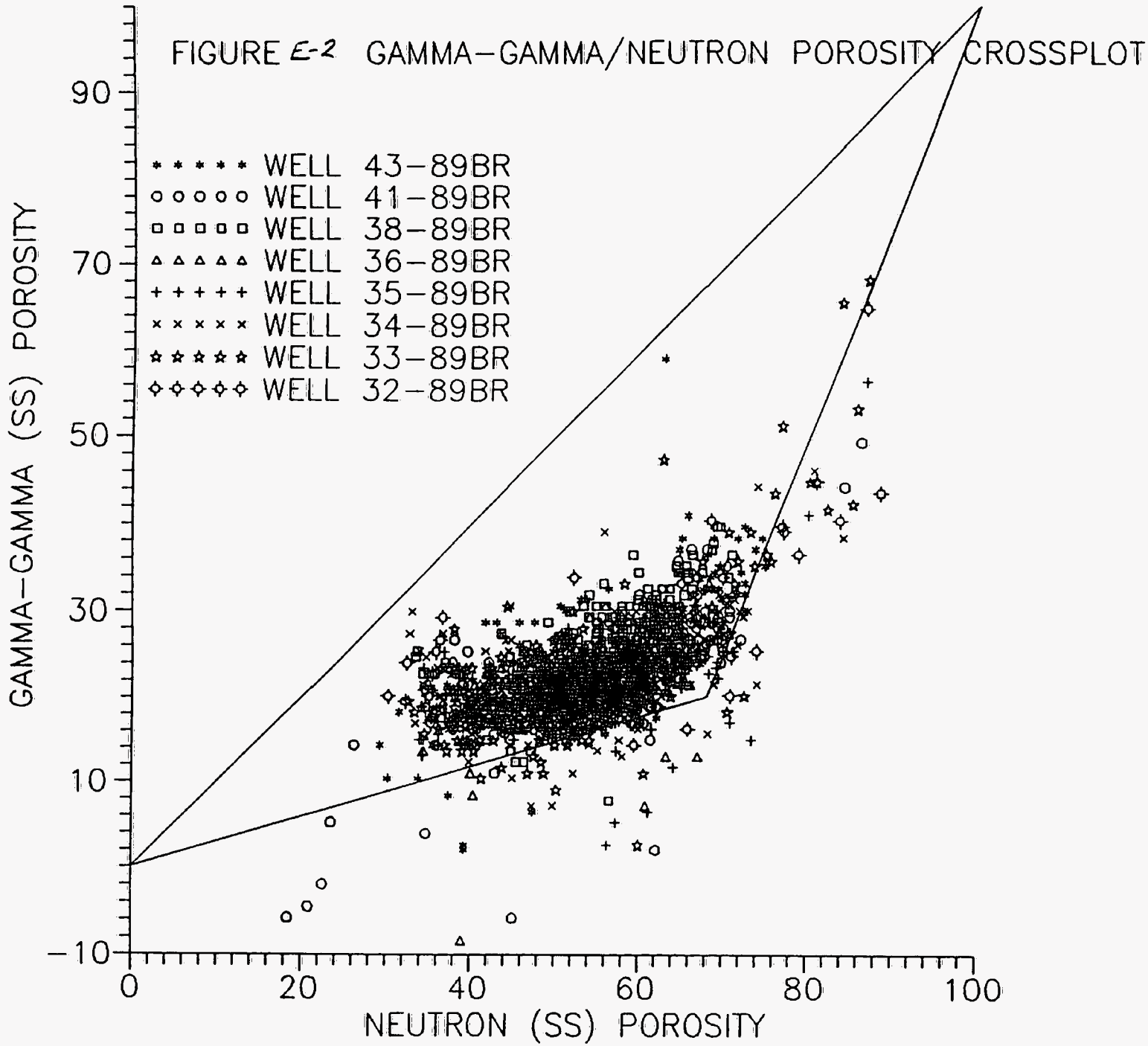


FIGURE E-2 GAMMA-GAMMA/NEUTRON POROSITY CROSSPLOT
WELL 43-89BR
WELL 41-89BR
WELL 38-89BR
WELL 36-89BR
WELL 35-89BR
WELL 34-89BR
WELL 33-89BR
WELL 32-89BR
GAMMA-GAMMA (SS) POROSITY
NEUTRON (SS) POROSITY
90
70
50
30
10
-10
0
20
40
60
80
100

TABLE E-1

BACKGROUND WELLS CROSSPLOTTED IN FIGURE F-2

Well	Interval Crossplotted (feet below Ground Level)
32-89BR	42 - 195
33-89BR	43 - 151
34-89BR	44 - 167
35-89BR	42 - 207
36-89BR	51 - 106
38-89BR	26 - 128
41-89BR	51 - 108
43-89BR	38 - 98

Over the crossplotted intervals data were selected at 0.5 feet intervals (e.g. 42.0, 42.5, 43.0... 195.0)

WELL 32-89BR
INTERVAL: 42-195

RECALCULATED POROSITY AND VOLUME CLAY

DEPTH*	NEUT POR* (LS) %	G-G POR* (SS) %	NEUT POR (SS) %	V CLAY (FRAC.)	ADJ POR (SS) %
195.0	49.7	21.4	53.7	0.67	8.00
194.5	44.0	22.7	48.0	0.53	12.18
194.0	46.8	20.1	50.8	0.64	7.35
193.5	44.8	16.9	48.8	0.66	3.59
193.0	40.0	16.2	44.0	0.58	4.68
192.5	36.8	16.2	40.8	0.51	6.01
192.0	37.8	20.8	41.8	0.44	12.02
191.5	38.0	21.4	42.0	0.43	12.87
191.0	38.3	17.5	42.3	0.52	7.21
190.5	39.5	20.1	43.5	0.49	10.38
190.0	40.0	19.5	44.0	0.51	9.26
189.5	38.5	18.8	42.5	0.49	8.98
189.0	37.0	18.8	41.0	0.46	9.58
188.5	39.2	19.5	43.2	0.49	9.60
188.0	39.0	20.1	43.0	0.48	10.61
187.5	36.2	14.3	40.2	0.54	3.50
187.0	36.2	16.2	40.2	0.50	6.24
186.5	35.4	18.2	39.4	0.44	9.33
186.0	35.2	19.5	39.2	0.41	11.27
185.5	35.1	17.5	39.1	0.45	8.55
185.0	36.7	14.3	40.7	0.55	3.29
184.5	40.1	15.6	44.1	0.59	3.70
184.0	44.3	15.6	48.3	0.68	1.97
183.5	45.5	18.8	49.5	0.64	6.06
183.0	44.5	16.9	48.5	0.66	3.72
182.5	45.3	15.6	49.3	0.70	1.53
182.0	45.7	15.6	49.7	0.71	1.38
181.5	48.2	18.8	52.2	0.70	4.92
181.0	52.3	18.8	56.3	0.78	3.22
180.5	51.0	22.7	55.0	0.67	9.28
180.0	52.4	23.4	56.4	0.69	9.63
179.5	51.0	22.1	55.0	0.69	8.37
179.0	47.4	14.9	51.4	0.76	-0.24
178.5	44.2	21.4	48.2	0.56	10.28
178.0	41.8	17.5	45.8	0.59	5.77
177.5	41.2	21.4	45.2	0.49	11.54
177.0	43.6	20.1	47.6	0.57	8.70
176.5	43.9	20.8	47.9	0.56	9.49
176.0	44.8	23.4	48.8	0.53	12.80
175.5	41.4	22.1	45.4	0.49	12.37
175.0	43.1	17.5	47.1	0.62	5.19
174.5	43.9	19.5	47.9	0.59	7.64
174.0	46.3	16.9	50.3	0.70	2.99
173.5	46.2	15.6	50.2	0.72	1.17
173.0	44.0	16.9	48.0	0.65	3.95
172.5	42.8	20.8	46.8	0.54	9.96
172.0	46.0	20.1	50.0	0.62	7.68
171.5	53.5	20.8	57.5	0.77	5.48
171.0	54.6	22.7	58.6	0.75	7.78
170.5	53.8	26.0	57.8	0.66	12.71
170.0	53.2	18.8	57.2	0.80	2.86
169.5	58.3	18.8	62.3	0.91	0.73
169.0	57.3	20.8	61.3	0.85	3.88
168.5	54.3	18.2	58.3	0.84	1.45
168.0	52.9	18.8	56.9	0.79	2.98
167.5	53.5	18.2	57.5	0.82	1.81
167.0	55.1	18.2	59.1	0.85	1.13
166.5	50.3	16.2	54.3	0.79	0.38
166.0	45.3	19.5	49.3	0.62	7.07
165.5	47.0	16.2	51.0	0.72	1.76
165.0	46.4	20.1	50.4	0.63	7.53
164.5	47.7	16.2	51.7	0.74	1.46
164.0	47.4	14.9	51.4	0.76	-0.24
163.5	48.9	19.5	52.9	0.70	5.57
163.0	48.4	16.9	52.4	0.74	2.08
162.5	48.4	23.4	52.4	0.60	11.30
162.0	48.2	21.4	52.2	0.64	8.62
161.5	48.1	16.9	52.1	0.73	2.22
161.0	50.4	21.4	54.4	0.69	7.70
160.5	48.4	15.6	52.4	0.77	0.27

160.0	50.5	20.8	54.5	0.70	6.73
159.5	50.5	21.4	54.5	0.69	7.64
159.0	54.2	20.8	58.2	0.78	5.18
158.5	51.0	25.3	55.0	0.62	12.97
158.0	51.4	18.2	55.4	0.78	2.68
157.5	50.7	23.4	54.7	0.65	10.33
157.0	47.7	21.4	51.7	0.63	8.81
156.5	46.2	17.5	50.2	0.68	3.91
156.0	47.0	18.2	51.0	0.68	4.53
155.5	48.4	18.2	52.4	0.71	3.91
155.0	49.9	20.8	53.9	0.69	6.97
154.5	50.9	20.8	54.9	0.71	6.56
154.0	51.8	18.2	55.8	0.78	2.52
153.5	53.1	24.7	57.1	0.68	11.16
153.0	52.5	19.5	56.5	0.77	4.04
152.5	54.4	20.8	58.4	0.78	5.11
152.0	51.5	16.9	55.5	0.80	0.79
151.5	51.9	23.4	55.9	0.68	9.82
151.0	52.9	23.4	56.9	0.70	9.43
150.5	58.2	23.4	62.2	0.81	7.20
150.0	55.6	24.0	59.6	0.74	9.21
149.5	55.4	24.0	59.4	0.74	9.29
149.0	56.6	16.9	60.6	0.91	-1.33
148.5	53.1	19.5	57.1	0.78	3.83
148.0	55.4	14.3	59.4	0.94	-4.52
147.5	55.0	16.9	59.0	0.88	-0.64
147.0	52.5	20.1	56.5	0.76	4.98
146.5	52.3	22.7	56.3	0.70	8.76
146.0	50.8	18.8	54.8	0.75	3.85
145.5	53.2	23.4	57.2	0.70	9.31
145.0	52.0	24.0	56.0	0.67	10.71
144.5	53.5	23.4	57.5	0.71	9.16
144.0	55.3	16.9	59.3	0.88	-0.79
143.5	56.4	23.4	60.4	0.77	7.95
143.0	58.1	29.2	62.1	0.68	15.53
142.5	59.8	28.6	63.8	0.73	13.91
142.0	60.8	27.9	64.8	0.77	12.55
141.5	62.0	29.2	66.0	0.77	13.88
141.0	63.8	24.7	67.8	0.90	6.73
140.5	60.6	24.0	64.6	0.85	7.13
140.0	55.1	20.8	59.1	0.80	4.81
139.5	54.9	24.0	58.9	0.73	9.51
139.0	53.7	20.1	57.7	0.78	4.49
138.5	55.6	20.1	59.6	0.82	3.70
138.0	55.7	20.1	59.7	0.83	3.63
137.5	47.5	27.3	51.5	0.51	17.16
137.0	35.7	20.1	39.7	0.41	11.97
136.5	31.2	16.9	35.2	0.38	9.26
136.0	31.4	22.7	35.4	0.26	17.44
135.5	30.6	20.8	34.6	0.29	15.01
135.0	31.0	20.1	35.0	0.31	13.96
134.5	34.9	22.7	38.9	0.34	15.98
134.0	40.6	18.2	44.6	0.55	7.18
133.5	46.9	24.0	50.9	0.56	12.83
133.0	53.7	29.2	57.7	0.59	17.37
132.5	48.2	33.8	52.2	0.38	26.08
132.0	47.4	20.8	51.4	0.64	8.02
131.5	48.3	25.3	52.3	0.56	14.10
131.0	56.4	21.4	60.4	0.81	5.20
130.5	66.8	20.1	70.8	1.06	-0.99
130.0	66.2	31.2	70.2	0.81	14.92
129.5	57.7	25.3	61.7	0.76	10.17
129.0	52.5	20.8	56.5	0.75	5.88
128.5	48.4	23.4	52.4	0.61	11.27
128.0	49.8	20.1	53.8	0.70	6.09
127.5	44.7	24.0	48.7	0.51	13.77
127.0	38.9	16.9	42.9	0.54	6.06
126.5	38.9	18.8	42.9	0.50	8.80
126.0	41.0	20.8	45.0	0.50	10.69
125.5	43.3	23.4	47.3	0.50	13.42
125.0	54.6	24.7	58.6	0.71	10.54
124.5	59.4	29.2	63.4	0.71	15.00
124.0	62.8	27.9	66.8	0.81	11.70
123.5	65.3	27.9	69.3	0.86	10.66

123.0	65.4	28.6	69.4	0.85	11.56
122.5	65.9	33.8	69.9	0.75	18.73
122.0	58.3	29.2	62.3	0.69	15.44
121.5	61.0	21.4	65.0	0.91	3.28
121.0	58.2	27.9	62.2	0.71	13.63
120.5	50.7	24.7	54.7	0.62	12.18
120.0	52.6	21.4	56.6	0.73	6.76
119.5	61.3	24.7	65.3	0.85	7.77
119.0	61.4	26.6	65.4	0.81	10.48
118.5	55.2	24.7	59.2	0.72	10.31
118.0	54.8	23.4	58.8	0.74	8.63
117.5	60.7	22.1	64.7	0.89	4.31
117.0	59.8	26.6	63.8	0.77	11.14
116.5	55.8	24.0	59.8	0.74	9.13
116.0	56.5	22.1	60.5	0.80	6.09
115.5	55.8	25.3	59.8	0.72	10.96
115.0	56.3	22.7	60.3	0.78	7.06
114.5	54.8	23.4	58.8	0.74	8.64
114.0	55.2	24.7	59.2	0.72	10.28
113.5	56.2	24.0	60.2	0.75	8.98
113.0	55.7	22.7	59.7	0.77	7.35
112.5	54.9	22.7	58.9	0.75	7.65
112.0	55.6	24.0	59.6	0.74	9.22
111.5	55.1	22.1	59.1	0.77	6.67
111.0	54.5	22.7	58.5	0.75	7.82
110.5	55.5	21.4	59.5	0.79	5.56
110.0	55.8	24.7	59.8	0.73	10.03
109.5	55.6	21.4	59.6	0.80	5.52
109.0	53.5	20.1	57.5	0.78	4.56
108.5	56.3	19.5	60.3	0.85	2.46
108.0	57.2	24.7	61.2	0.76	9.45
107.5	54.9	17.5	58.9	0.86	0.29
107.0	57.3	21.4	61.3	0.83	4.81
106.5	56.0	21.4	60.0	0.80	5.36
106.0	56.0	20.8	60.0	0.82	4.46
105.5	53.6	17.5	57.6	0.84	0.83
105.0	54.6	24.0	58.6	0.72	9.61
104.5	55.7	19.5	59.7	0.84	2.72
104.0	58.1	18.8	62.1	0.90	0.78
103.5	57.2	18.8	61.2	0.88	1.19
103.0	54.3	20.1	58.3	0.79	4.25
102.5	52.3	19.5	56.3	0.77	4.13
102.0	48.9	15.6	52.9	0.78	0.04
101.5	45.1	20.1	49.1	0.60	8.08
101.0	46.6	19.5	50.6	0.65	6.53
100.5	52.3	18.8	56.3	0.78	3.20
100.0	49.4	21.4	53.4	0.67	8.09
99.5	48.5	24.0	52.5	0.59	12.17
99.0	52.9	22.1	56.9	0.72	7.59
98.5	56.0	19.5	60.0	0.84	2.61
98.0	57.1	20.8	61.1	0.84	3.96
97.5	55.8	21.4	59.8	0.80	5.45
97.0	54.0	26.0	58.0	0.67	12.63
96.5	55.1	22.7	59.1	0.76	7.59
96.0	55.8	22.7	59.8	0.77	7.29
95.5	54.2	20.1	58.2	0.79	4.26
95.0	51.1	20.8	55.1	0.71	6.49
94.5	50.0	20.1	54.0	0.70	6.04
94.0	48.6	20.8	52.6	0.66	7.54
93.5	46.4	21.4	50.4	0.60	9.36
93.0	51.2	22.1	55.2	0.69	8.30
92.5	54.1	24.7	58.1	0.70	10.77
92.0	59.8	25.3	63.8	0.80	9.29
91.5	60.3	27.9	64.3	0.76	12.78
91.0	54.0	26.6	58.0	0.65	13.55
90.5	54.5	24.7	58.5	0.70	10.58
90.0	57.3	23.4	61.3	0.79	7.58
89.5	59.2	25.3	63.2	0.79	9.56
89.0	57.5	24.7	61.5	0.77	9.34
88.5	51.1	26.0	55.1	0.61	13.84
88.0	43.3	21.4	47.3	0.54	10.66
87.5	44.4	22.1	48.4	0.55	11.10
87.0	47.4	21.4	51.4	0.62	8.96
86.5	46.0	21.4	50.0	0.59	9.54

86.0	44.6	16.2	48.6	0.67	2.78
85.5	46.4	22.1	50.4	0.59	10.30
85.0	49.6	23.4	53.6	0.63	10.78
84.5	58.9	23.4	62.9	0.82	6.92
84.0	62.0	24.0	66.0	0.88	6.53
83.5	56.5	24.0	60.5	0.76	8.85
83.0	49.4	22.7	53.4	0.64	9.97
82.5	46.6	22.1	50.6	0.60	10.18
82.0	45.1	19.5	49.1	0.62	7.14
81.5	45.9	26.6	49.9	0.49	16.92
81.0	43.7	20.8	47.7	0.56	9.56
80.5	42.3	22.7	46.3	0.49	12.91
80.0	44.3	22.1	48.3	0.55	11.15
79.5	45.3	22.1	49.3	0.57	10.75
79.0	44.1	22.7	48.1	0.53	12.15
78.5	42.4	20.8	46.4	0.53	10.12
78.0	45.8	22.1	49.8	0.58	10.53
77.5	50.4	18.8	54.4	0.74	4.03
77.0	50.4	20.8	54.4	0.70	6.78
76.5	50.9	22.1	54.9	0.68	8.43
76.0	50.4	20.1	54.4	0.71	5.86
75.5	51.1	19.5	55.1	0.74	4.64
75.0	51.3	24.0	55.3	0.65	10.98
74.5	55.2	21.4	59.2	0.79	5.68
74.0	57.7	25.3	61.7	0.76	10.18
73.5	62.9	33.8	66.9	0.69	19.97
73.0	73.1	39.0	77.1	0.79	23.08
72.5	72.9	39.6	76.9	0.78	24.08
72.0	61.0	33.1	65.0	0.66	19.86
71.5	53.9	24.7	57.9	0.69	10.83
71.0	49.3	24.0	53.3	0.61	11.83
70.5	50.7	20.8	54.7	0.71	6.67
70.0	45.6	22.1	49.6	0.57	10.60
69.5	46.8	23.4	50.8	0.57	11.94
69.0	53.1	22.7	57.1	0.72	8.41
68.5	60.3	24.7	64.3	0.83	8.17
68.0	59.8	23.4	63.8	0.84	6.54
67.5	60.7	29.9	64.7	0.72	15.38
67.0	53.1	22.7	57.1	0.72	8.42
66.5	46.2	26.6	50.2	0.49	16.81
66.0	51.0	23.4	55.0	0.66	10.22
65.5	53.1	22.7	57.1	0.72	8.39
65.0	56.6	22.1	60.6	0.80	6.05
64.5	63.0	26.6	67.0	0.84	9.80
64.0	66.0	27.9	70.0	0.88	10.40
63.5	65.3	26.6	69.3	0.89	8.86
63.0	61.3	27.3	65.3	0.79	11.42
62.5	59.7	25.3	63.7	0.80	9.36
62.0	62.9	31.8	66.9	0.73	17.21
61.5	66.9	24.7	70.9	0.96	5.42
61.0	63.8	29.9	67.8	0.79	14.07
60.5	63.7	28.6	67.7	0.82	12.25
60.0	69.9	25.3	73.9	1.01	5.10
59.5	66.4	35.1	70.4	0.74	20.35
59.0	63.0	26.6	67.0	0.84	9.82
58.5	57.2	27.9	61.2	0.69	14.06
58.0	60.9	26.0	64.9	0.81	9.75
57.5	60.8	30.5	64.8	0.71	16.22
57.0	56.1	21.4	60.1	0.81	5.33
56.5	57.7	29.2	61.7	0.68	15.69
56.0	61.7	25.3	65.7	0.84	8.52
55.5	64.5	40.3	68.5	0.59	28.51
55.0	63.6	26.0	67.6	0.87	8.63
54.5	64.0	26.0	68.0	0.87	8.49
54.0	61.0	26.6	65.0	0.80	10.65
53.5	58.5	29.9	62.5	0.68	16.27
53.0	58.2	27.3	62.2	0.73	12.73
52.5	60.6	27.3	64.6	0.78	11.73
52.0	58.9	30.5	62.9	0.67	17.03
51.5	61.8	16.2	65.8	1.03	-4.42
51.0	82.5	64.9	86.5	0.45	55.94
50.5	76.8	44.8	80.8	0.75	29.81
50.0	79.7	40.3	83.7	0.91	22.16
49.5	84.4	43.5	88.4	0.94	24.80

49.0	74.8	36.4	78.8	0.88	18.67
48.5	62.8	24.0	66.8	0.89	6.21
48.0	52.3	28.6	56.3	0.58	17.02
47.5	44.1	25.3	48.1	0.47	15.85
47.0	38.2	23.4	42.2	0.39	15.53
46.5	32.6	29.2	36.6	0.15	26.17
46.0	32.3	26.6	36.3	0.20	22.61
45.5	31.8	25.3	35.8	0.22	20.95
45.0	30.8	21.4	34.8	0.28	15.88
44.5	28.4	24.0	32.4	0.18	20.53
44.0	26.2	20.1	30.2	0.21	15.94
43.5	28.2	19.5	32.2	0.26	14.19
43.0	30.6	18.8	34.6	0.33	12.25
42.5	34.6	22.7	38.6	0.33	16.13
42.0	57.3	30.5	61.3	0.64	17.69

* FROM DIGITAL RECORD OF BOREHOLE GEOPHYSICAL LOG
NEUT POR (SS) = NEUT POR (LS) + 4
V CLAY (FRAC.) = (NEUT POR (SS) - G-G POR (SS)) / 48
ADJ POR (SS) = G-G POR (SS) - (V CLAY (FRAC.) * 20)

WELL 33-89BR RECALCULATED POROSITY AND VOLUME CLAY
INTERVAL: 43-151

DEPTH*	NEUT POR* (LS) %	G-G POR* (SS) %	NEUT POR (SS) %	V CLAY (FRAC.)	ADJ POR (SS) %
151.0	28.6	19.5	32.6	0.27	13.99
150.5	30.5	15.6	34.5	0.39	7.73
150.0	35.7	14.3	39.7	0.53	3.68
149.5	36.5	18.2	40.5	0.46	8.89
149.0	35.1	14.9	39.1	0.50	4.86
148.5	34.7	16.9	38.7	0.45	7.81
148.0	34.5	14.9	38.5	0.49	5.11
147.5	35.0	13.6	39.0	0.53	3.09
147.0	34.0	17.5	38.0	0.43	8.99
146.5	31.6	17.5	35.6	0.38	10.02
146.0	31.6	18.2	35.6	0.36	10.91
145.5	34.1	18.8	38.1	0.40	10.80
145.0	35.7	19.5	39.7	0.42	11.05
144.5	37.1	14.9	41.1	0.54	4.06
144.0	38.9	16.9	42.9	0.54	6.05
143.5	42.8	11.0	46.8	0.74	-3.86
143.0	47.9	15.6	51.9	0.76	0.45
142.5	50.1	16.9	54.1	0.78	1.38
142.0	48.1	15.6	52.1	0.76	0.38
141.5	47.5	14.3	51.5	0.78	-1.23
141.0	49.5	18.2	53.5	0.74	3.45
140.5	47.4	16.9	51.4	0.72	2.50
140.0	44.6	17.5	48.6	0.65	4.58
139.5	43.4	18.2	47.4	0.61	6.01
139.0	42.7	17.5	46.7	0.61	5.40
138.5	41.8	17.5	45.8	0.59	5.76
138.0	42.9	16.2	46.9	0.64	3.48
137.5	44.4	12.3	48.4	0.75	-2.70
137.0	43.5	13.0	47.5	0.72	-1.40
136.5	39.8	19.5	43.8	0.51	9.35
136.0	37.8	20.1	41.8	0.45	11.10
135.5	36.6	16.9	40.6	0.49	7.00
135.0	36.5	17.5	40.5	0.48	7.98
134.5	37.0	18.2	41.0	0.48	8.67
134.0	36.0	18.2	40.0	0.45	9.11
133.5	32.9	14.3	36.9	0.47	4.87
133.0	33.2	13.6	37.2	0.49	3.82
132.5	39.7	11.7	43.7	0.67	-1.63
132.0	48.3	16.9	52.3	0.74	2.15
131.5	49.2	14.9	53.2	0.80	-1.02
131.0	47.0	16.9	51.0	0.71	2.68
130.5	47.9	18.8	51.9	0.69	5.03
130.0	47.6	17.5	51.6	0.71	3.33
129.5	44.7	11.0	48.7	0.78	-4.65
129.0	45.1	18.2	49.1	0.64	5.30
128.5	49.1	17.5	53.1	0.74	2.72
128.0	50.1	16.2	54.1	0.79	0.47
127.5	46.2	9.1	50.2	0.86	-8.04
127.0	44.2	14.9	48.2	0.69	1.07
126.5	42.0	16.2	46.0	0.62	3.83
126.0	38.6	22.1	42.6	0.43	13.54
125.5	37.3	16.9	41.3	0.51	6.72
125.0	36.7	16.9	40.7	0.50	6.98
124.5	36.1	18.2	40.1	0.46	9.04
124.0	35.6	14.9	39.6	0.51	4.68
123.5	36.4	18.8	40.4	0.45	9.86
123.0	38.7	14.9	42.7	0.58	3.36
122.5	47.1	18.8	51.1	0.67	5.39
122.0	54.7	24.7	58.7	0.71	10.53
121.5	56.6	11.0	60.6	1.03	-9.61
121.0	52.7	22.7	56.7	0.71	8.59
120.5	50.8	19.5	54.8	0.74	4.77
120.0	52.3	16.9	56.3	0.82	0.46
119.5	52.9	19.5	56.9	0.78	3.88
119.0	52.5	20.8	56.5	0.74	5.90
118.5	50.4	21.4	54.4	0.69	7.68
118.0	46.0	14.3	50.0	0.74	-0.61
117.5	42.2	16.2	46.2	0.63	3.74
117.0	41.6	20.1	45.6	0.53	9.52
116.5	43.0	22.1	47.0	0.52	11.69

116.0	44.8	24.7	48.8	0.50	14.63
115.5	46.6	22.7	50.6	0.58	11.12
115.0	53.5	24.7	57.5	0.68	11.02
114.5	59.3	23.4	63.3	0.83	6.76
114.0	55.1	25.3	59.1	0.70	11.27
113.5	51.6	22.1	55.6	0.70	8.11
113.0	51.0	26.0	55.0	0.60	13.88
112.5	49.3	18.2	53.3	0.73	3.54
112.0	50.1	14.9	54.1	0.82	-1.36
111.5	53.5	19.5	57.5	0.79	3.62
111.0	57.1	26.0	61.1	0.73	11.36
110.5	56.0	2.6	60.0	1.19	-21.30
110.0	58.8	47.4	62.8	0.32	40.99
109.5	63.5	35.7	67.5	0.66	22.47
109.0	60.6	29.9	64.6	0.72	15.39
108.5	72.8	51.3	76.8	0.53	40.69
108.0	82.7	68.2	86.7	0.39	60.47
107.5	81.2	42.2	85.2	0.89	24.32
107.0	72.0	43.5	76.0	0.68	29.95
106.5	66.5	18.2	70.5	1.09	-3.64
106.0	65.6	35.1	69.6	0.72	20.67
105.5	69.2	39.0	73.2	0.71	24.70
105.0	71.1	36.4	75.1	0.81	20.24
104.5	66.7	27.3	70.7	0.90	9.19
104.0	60.7	26.6	64.7	0.79	10.78
103.5	56.7	23.4	60.7	0.78	7.82
103.0	53.2	22.1	57.2	0.73	7.43
102.5	50.7	22.1	54.7	0.68	8.48
102.0	46.2	19.5	50.2	0.64	6.70
101.5	43.8	19.5	47.8	0.59	7.67
101.0	41.2	16.2	45.2	0.60	4.18
100.5	37.3	10.4	41.3	0.64	-2.47
100.0	36.4	13.6	40.4	0.56	2.50
99.5	38.6	16.9	42.6	0.54	6.17
99.0	39.0	18.2	43.0	0.52	7.85
98.5	37.0	17.5	41.0	0.49	7.73
98.0	37.3	19.5	41.3	0.46	10.38
97.5	41.1	21.4	45.1	0.49	11.55
97.0	47.1	16.9	51.1	0.71	2.62
96.5	49.7	16.2	53.7	0.78	0.65
96.0	51.2	19.5	55.2	0.74	4.58
95.5	54.0	26.6	58.0	0.65	13.58
95.0	53.0	27.9	57.0	0.61	15.81
94.5	51.8	24.0	55.8	0.66	10.80
94.0	55.8	18.2	59.8	0.87	0.84
93.5	56.5	31.2	60.5	0.61	18.94
93.0	55.0	23.4	59.0	0.74	8.54
92.5	54.2	33.1	58.2	0.52	-22.66
92.0	55.4	18.8	59.4	0.85	1.92
91.5	56.2	22.7	60.2	0.78	7.13
91.0	54.7	25.3	58.7	0.70	11.42
90.5	53.7	20.8	57.7	0.77	5.40
90.0	57.2	24.7	61.2	0.76	9.47
89.5	61.3	21.4	65.3	0.91	3.16
89.0	62.7	28.6	66.7	0.79	12.67
88.5	62.3	25.3	66.3	0.85	8.27
88.0	59.2	22.7	63.2	0.84	5.88
87.5	57.0	20.1	61.0	0.85	3.10
87.0	59.2	22.1	63.2	0.86	4.96
86.5	57.4	21.4	61.4	0.83	4.77
86.0	52.6	19.5	56.6	0.77	4.00
85.5	48.5	18.8	52.5	0.70	4.78
85.0	45.4	18.8	49.4	0.64	6.10
84.5	41.9	22.7	45.9	0.48	13.06
84.0	39.4	18.8	43.4	0.51	8.58
83.5	39.6	16.2	43.6	0.57	4.86
83.0	43.9	20.1	47.9	0.58	8.56
82.5	51.2	16.9	55.2	0.80	0.91
82.0	56.1	21.4	60.1	0.81	5.30
81.5	59.1	26.0	63.1	0.77	10.50
81.0	58.7	26.6	62.7	0.75	11.60
80.5	56.7	23.4	60.7	0.78	7.82
80.0	54.6	24.7	58.6	0.71	10.54
79.5	55.8	20.8	59.8	0.81	4.52

79.0	52.6	24.0	56.6	0.68	10.47
78.5	68.5	20.1	72.5	1.09	-1.71
78.0	79.7	65.6	83.7	0.38	58.05
77.5	76.1	44.8	80.1	0.74	30.11
77.0	67.3	33.1	71.3	0.80	17.21
76.5	64.6	30.5	68.6	0.79	14.63
76.0	67.0	31.8	71.0	0.82	15.48
75.5	71.6	35.7	75.6	0.83	19.10
75.0	78.2	41.6	82.2	0.85	24.63
74.5	81.6	53.3	85.6	0.67	39.76
74.0	76.9	44.8	80.9	0.75	29.76
73.5	69.7	35.1	73.7	0.81	18.96
73.0	62.9	29.2	66.9	0.79	13.52
72.5	62.4	31.8	66.4	0.72	17.41
72.0	59.8	20.1	63.8	0.91	1.93
71.5	56.8	27.9	60.8	0.68	14.23
71.0	57.6	27.3	61.6	0.72	12.95
70.5	58.7	26.0	62.7	0.76	10.70
70.0	58.9	24.7	62.9	0.80	8.75
69.5	61.2	22.7	65.2	0.88	5.04
69.0	59.9	22.7	63.9	0.86	5.58
68.5	56.7	23.4	60.7	0.78	7.84
68.0	58.9	24.0	62.9	0.81	7.83
67.5	60.9	29.2	64.9	0.74	14.34
67.0	60.6	24.7	64.6	0.83	8.05
66.5	56.8	27.3	60.8	0.70	13.31
66.0	53.7	24.7	57.7	0.69	10.91
65.5	53.5	24.0	57.5	0.70	10.09
65.0	54.5	26.0	58.5	0.68	12.44
64.5	56.6	22.7	60.6	0.79	6.95
64.0	58.1	29.2	62.1	0.68	15.54
63.5	57.4	26.6	61.4	0.73	12.12
63.0	49.4	25.3	53.4	0.59	13.62
62.5	45.8	26.6	49.8	0.48	16.98
62.0	49.6	24.7	53.6	0.60	12.63
61.5	54.7	26.0	58.7	0.68	12.36
61.0	62.6	30.5	66.6	0.75	15.48
60.5	67.7	35.7	71.7	0.75	20.73
60.0	66.6	39.0	70.6	0.66	25.77
59.5	54.7	29.2	58.7	0.61	16.93
59.0	40.3	30.5	44.3	0.29	24.77
58.5	34.6	23.4	38.6	0.32	17.06
58.0	34.0	27.9	38.0	0.21	23.72
57.5	34.1	20.1	38.1	0.37	12.66
57.0	32.2	16.2	36.2	0.42	7.91
56.5	29.3	18.2	33.3	0.31	11.90
56.0	30.1	18.8	34.1	0.32	12.47
55.5	35.2	20.8	39.2	0.38	13.09
55.0	39.2	22.1	43.2	0.44	13.29
54.5	39.5	24.7	43.5	0.39	16.84
54.0	38.4	23.4	42.4	0.40	15.46
53.5	33.9	20.8	37.9	0.36	13.67
53.0	32.8	23.4	36.8	0.28	17.80
52.5	33.4	16.9	37.4	0.43	8.33
52.0	33.3	20.8	37.3	0.34	13.89
51.5	33.3	20.8	37.3	0.35	13.88
51.0	33.9	23.4	37.9	0.30	17.33
50.5	36.1	23.4	40.1	0.35	16.42
50.0	37.1	21.4	41.1	0.41	13.25
49.5	40.1	23.4	44.1	0.43	14.75
49.0	43.0	24.0	47.0	0.48	14.46
48.5	46.7	27.3	50.7	0.49	17.49
48.0	46.6	25.3	50.6	0.53	14.80
47.5	45.1	24.0	49.1	0.52	13.58
47.0	43.0	22.1	47.0	0.52	11.69
46.5	42.2	22.1	46.2	0.50	12.04
46.0	38.0	22.7	42.0	0.40	14.72
45.5	43.7	26.0	47.7	0.45	16.94
45.0	47.4	26.6	51.4	0.52	16.33
44.5	47.2	26.0	51.2	0.53	15.48
44.0	47.8	26.6	51.8	0.53	16.12
43.5	48.1	29.9	52.1	0.46	20.61
43.0	49.3	27.9	53.3	0.53	17.34

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* FROM DIGITAL RECORD OF BOREHOLE GEOPHYSICAL LOG
NEUT POR (SS) = NEUT POR (LS) + 4
V CLAY (FRAC.) = (NEUT POR (SS) - G-G POR (SS)) / 48
ADJ POR (SS) = G-G POR (SS) - (V CLAY (FRAC.) * 20 )
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WELL 34-89BR
INTERVAL: 44-167

RECALCULATED POROSITY AND VOLUME CLAY

DEPTH*	NEUT POR* (LS) %	G-G POR* (SS) %	NEUT POR (SS) %	V CLAY (FRAC.)	ADJ POR (SS) %
167.0	50.8	26.0	54.8	0.60	13.99
166.5	52.6	21.4	56.6	0.73	6.78
166.0	51.4	20.1	55.4	0.73	5.43
165.5	50.3	18.2	54.3	0.75	3.14
165.0	52.9	18.2	56.9	0.81	2.07
164.5	51.4	20.1	55.4	0.73	5.46
164.0	50.3	18.2	54.3	0.75	3.13
163.5	48.5	19.5	52.5	0.69	5.72
163.0	52.0	19.5	56.0	0.76	4.28
162.5	51.0	20.1	55.0	0.73	5.60
162.0	50.6	18.8	54.6	0.75	3.92
161.5	52.5	20.1	56.5	0.76	5.00
161.0	51.7	18.2	55.7	0.78	2.55
160.5	53.0	20.1	57.0	0.77	4.77
160.0	53.6	14.9	57.6	0.89	-2.82
159.5	51.4	17.5	55.4	0.79	1.74
159.0	46.1	18.2	50.1	0.66	4.90
158.5	43.4	18.2	47.4	0.61	6.01
158.0	43.5	16.9	47.5	0.64	4.14
157.5	42.6	19.5	46.6	0.56	8.20
157.0	44.2	18.8	48.2	0.61	6.60
156.5	46.9	16.9	50.9	0.71	2.73
156.0	45.3	15.6	49.3	0.70	1.53
155.5	46.2	18.8	50.2	0.65	5.77
155.0	44.6	17.5	48.6	0.65	4.59
154.5	48.2	11.0	52.2	0.86	-6.12
154.0	43.3	7.2	47.3	0.84	-9.56
153.5	41.0	10.4	45.0	0.72	-4.03
153.0	42.9	14.3	46.9	0.68	0.72
152.5	44.9	17.5	48.9	0.65	4.45
152.0	45.7	16.2	49.7	0.70	2.29
151.5	42.9	18.8	46.9	0.58	7.15
151.0	45.3	18.8	49.3	0.63	6.14
150.5	46.5	19.5	50.5	0.65	6.57
150.0	49.2	20.1	53.2	0.69	6.34
149.5	48.7	24.7	52.7	0.58	13.02
149.0	48.8	20.1	52.8	0.68	6.54
148.5	51.8	21.4	55.8	0.72	7.11
148.0	56.1	24.0	60.1	0.75	8.99
147.5	57.9	24.0	61.9	0.79	8.24
147.0	59.5	22.1	63.5	0.86	4.82
146.5	57.1	20.8	61.1	0.84	3.98
146.0	56.9	21.4	60.9	0.82	4.97
145.5	53.3	22.1	57.3	0.73	7.39
145.0	51.5	18.2	55.5	0.78	2.65
144.5	51.7	16.9	55.7	0.81	0.72
144.0	50.7	16.9	54.7	0.79	1.14
143.5	51.8	23.4	55.8	0.68	9.86
143.0	55.4	18.2	59.4	0.86	1.02
142.5	60.5	21.4	64.5	0.90	3.50
142.0	61.9	24.7	65.9	0.86	7.52
141.5	62.1	21.4	66.1	0.93	2.81
141.0	55.5	18.2	59.5	0.86	0.96
140.5	58.5	22.1	62.5	0.84	5.22
140.0	60.0	21.4	64.0	0.89	3.70
139.5	59.1	25.3	63.1	0.79	9.58
139.0	60.0	22.1	64.0	0.87	4.63
138.5	61.7	24.0	65.7	0.87	6.66
138.0	61.1	24.0	65.1	0.86	6.91
137.5	63.2	24.0	67.2	0.90	6.05
137.0	62.4	29.2	66.4	0.78	13.71
136.5	65.5	31.8	69.5	0.78	16.14
136.0	67.9	29.9	71.9	0.88	12.37
135.5	68.4	29.9	72.4	0.89	12.13
135.0	66.8	27.3	70.8	0.91	9.12
134.5	66.2	30.5	70.2	0.83	13.97
134.0	65.4	29.9	69.4	0.82	13.40
133.5	60.3	23.4	64.3	0.85	6.31
133.0	55.5	21.4	59.5	0.79	5.58
132.5	50.0	21.4	54.0	0.68	7.86

132.0	43.2	20.8	47.2	0.55	9.76
131.5	40.8	15.6	44.8	0.61	3.41
131.0	36.2	15.6	40.2	0.51	5.32
130.5	34.9	17.5	38.9	0.45	8.61
130.0	31.0	22.7	35.0	0.26	17.62
129.5	28.7	27.3	32.7	0.11	25.00
129.0	30.3	21.4	34.3	0.27	16.06
128.5	30.6	24.7	34.6	0.21	20.57
128.0	29.0	29.9	33.0	0.07	28.55
127.5	29.9	25.3	33.9	0.18	21.74
127.0	32.0	23.4	36.0	0.26	18.13
126.5	32.4	20.1	36.4	0.34	13.34
126.0	32.6	27.3	36.6	0.19	23.38
125.5	33.6	22.7	37.6	0.31	16.54
125.0	33.6	22.7	37.6	0.31	16.55
124.5	34.4	16.2	38.4	0.46	7.03
124.0	34.8	14.9	38.8	0.50	5.01
123.5	31.4	14.3	35.4	0.44	5.49
123.0	32.2	20.1	36.2	0.34	13.42
122.5	32.7	19.5	36.7	0.36	12.30
122.0	39.3	17.5	43.3	0.54	6.80
121.5	47.6	19.5	51.6	0.67	6.11
121.0	60.8	27.3	64.8	0.78	11.63
120.5	80.1	38.3	84.1	0.95	19.24
120.0	76.6	46.1	80.6	0.72	31.76
119.5	66.7	30.5	70.7	0.84	13.80
119.0	58.4	23.4	62.4	0.81	7.11
118.5	58.3	24.7	62.3	0.78	9.01
118.0	57.7	24.0	61.7	0.79	8.32
117.5	59.6	25.3	63.6	0.80	9.40
117.0	57.2	21.4	61.2	0.83	4.84
116.5	54.0	13.0	58.0	0.94	-5.77
116.0	51.1	13.6	55.1	0.86	-3.62
115.5	45.8	7.2	49.8	0.89	-10.63
115.0	35.9	12.3	39.9	0.57	0.86
114.5	29.4	16.9	33.4	0.34	9.99
114.0	36.1	19.5	40.1	0.43	10.90
113.5	39.3	18.8	43.3	0.51	8.62
113.0	37.3	16.9	41.3	0.51	6.74
112.5	40.7	14.3	44.7	0.63	1.62
112.0	44.6	16.2	48.6	0.67	2.74
111.5	50.1	14.3	54.1	0.83	-2.31
111.0	58.7	20.1	62.7	0.89	2.38
110.5	64.9	21.4	68.9	0.99	1.65
110.0	61.1	25.3	65.1	0.83	8.77
109.5	64.2	15.6	68.2	1.10	-6.33
109.0	64.2	32.5	68.2	0.74	17.59
108.5	60.2	26.6	64.2	0.78	10.97
108.0	67.3	31.2	71.3	0.84	14.44
107.5	70.0	44.2	74.0	0.62	31.72
107.0	51.8	39.0	55.8	0.35	31.94
106.5	43.8	21.4	47.8	0.55	10.43
106.0	41.7	22.7	45.7	0.48	13.16
105.5	39.6	20.1	43.6	0.49	10.33
105.0	38.2	23.4	42.2	0.39	15.53
104.5	41.4	21.4	45.4	0.50	11.44
104.0	45.9	24.7	49.9	0.53	14.16
103.5	44.8	24.7	48.8	0.50	14.61
103.0	45.1	24.7	49.1	0.51	14.49
102.5	45.2	22.1	49.2	0.57	10.78
102.0	44.3	20.8	48.3	0.57	9.33
101.5	42.4	22.7	46.4	0.49	12.88
101.0	42.0	24.0	46.0	0.46	14.87
100.5	42.5	25.3	46.5	0.44	16.49
100.0	40.1	26.6	44.1	0.36	19.35
99.5	38.8	17.5	42.8	0.53	7.02
99.0	38.8	20.1	42.8	0.47	10.68
98.5	40.1	21.4	44.1	0.47	11.97
98.0	38.1	18.2	42.1	0.50	8.22
97.5	37.4	18.8	41.4	0.47	9.42
97.0	34.3	16.2	38.3	0.46	7.06
96.5	34.7	18.2	38.7	0.43	9.61
96.0	34.2	17.5	38.2	0.43	8.93
95.5	35.2	17.5	39.2	0.45	8.52

95.0	33.4	16.2	37.4	0.44	7.43
94.5	38.8	16.9	42.8	0.54	6.11
94.0	48.9	24.0	52.9	0.60	12.02
93.5	53.1	20.8	57.1	0.76	5.66
93.0	61.8	21.4	65.8	0.92	2.94
92.5	64.5	32.5	68.5	0.75	17.45
92.0	67.5	32.5	71.5	0.81	16.19
91.5	67.7	26.0	71.7	0.95	6.95
91.0	61.1	29.9	65.1	0.73	15.18
90.5	55.5	25.3	59.5	0.71	11.10
90.0	56.7	23.4	60.7	0.78	7.83
89.5	61.9	23.4	65.9	0.89	5.66
89.0	61.2	24.7	65.2	0.84	7.80
88.5	63.8	24.7	67.8	0.90	6.72
88.0	70.0	21.4	74.0	1.10	-0.49
87.5	68.3	29.2	72.3	0.90	11.26
87.0	60.9	24.0	64.9	0.85	7.02
86.5	57.4	20.1	61.4	0.86	2.95
86.0	54.9	22.1	58.9	0.77	6.73
85.5	54.0	19.5	58.0	0.80	3.43
85.0	55.1	22.7	59.1	0.76	7.58
84.5	55.3	25.3	59.3	0.71	11.18
84.0	53.3	22.7	57.3	0.72	8.34
83.5	51.8	19.5	55.8	0.76	4.35
83.0	50.2	24.0	54.2	0.63	11.46
82.5	54.0	18.8	58.0	0.82	2.51
82.0	52.4	16.9	56.4	0.82	0.44
81.5	51.5	26.6	55.5	0.60	14.58
81.0	52.8	22.7	56.8	0.71	8.55
80.5	54.2	20.8	58.2	0.78	5.20
80.0	49.8	18.2	53.8	0.74	3.36
79.5	49.6	24.0	53.6	0.62	11.73
79.0	50.4	16.2	54.4	0.80	0.33
78.5	49.0	18.8	53.0	0.71	4.61
78.0	47.7	14.9	51.7	0.77	-0.36
77.5	51.3	20.8	55.3	0.72	6.39
77.0	55.9	16.2	59.9	0.91	-1.94
76.5	57.0	19.5	61.0	0.86	2.18
76.0	57.2	25.3	61.2	0.75	10.39
75.5	55.5	29.9	59.5	0.62	17.51
75.0	56.3	26.0	60.3	0.72	11.67
74.5	63.4	25.3	67.4	0.88	7.80
74.0	59.2	32.5	63.2	0.64	19.69
73.5	55.4	24.0	59.4	0.74	9.31
73.0	53.1	26.0	57.1	0.65	13.00
72.5	50.6	20.8	54.6	0.70	6.68
72.0	50.6	19.5	54.6	0.73	4.86
71.5	60.6	29.2	64.6	0.74	14.47
71.0	63.7	26.6	67.7	0.86	9.51
70.5	60.0	25.3	64.0	0.80	9.24
70.0	55.2	26.0	59.2	0.69	12.15
69.5	55.3	23.4	59.3	0.75	8.41
69.0	52.5	17.5	56.5	0.81	1.31
68.5	50.2	22.1	54.2	0.67	8.72
68.0	45.4	20.8	49.4	0.60	8.84
67.5	48.3	20.1	52.3	0.67	6.73
67.0	51.5	20.8	55.5	0.72	6.31
66.5	50.3	22.7	54.3	0.66	9.59
66.0	47.6	18.2	51.6	0.70	4.25
65.5	48.6	22.1	52.6	0.64	9.37
65.0	49.4	22.1	53.4	0.65	9.05
64.5	51.9	22.1	55.9	0.70	7.99
64.0	53.8	21.4	57.8	0.76	6.29
63.5	47.0	20.8	51.0	0.63	8.21
63.0	43.3	18.8	47.3	0.59	6.97
62.5	45.4	18.2	49.4	0.65	5.19
62.0	47.3	22.1	51.3	0.61	9.90
61.5	47.7	23.4	51.7	0.59	11.56
61.0	49.0	16.2	53.0	0.77	0.93
60.5	52.7	19.5	56.7	0.77	3.99
60.0	53.6	22.7	57.6	0.73	8.19
59.5	51.0	21.4	55.0	0.70	7.45
59.0	42.0	25.3	46.0	0.43	16.73
58.5	37.7	25.3	41.7	0.34	18.51

58.0	39.6	20.8	43.6	0.48	11.28
57.5	42.8	16.2	46.8	0.64	3.51
57.0	44.5	22.1	48.5	0.55	11.08
56.5	43.5	16.9	47.5	0.64	4.12
56.0	49.8	26.0	53.8	0.58	14.39
55.5	48.2	26.6	52.2	0.53	15.98
55.0	47.1	26.0	51.1	0.52	15.52
54.5	46.2	20.1	50.2	0.63	7.62
54.0	47.7	26.0	51.7	0.54	15.25
53.5	52.8	26.0	56.8	0.64	13.13
53.0	56.7	26.6	60.7	0.71	12.44
52.5	56.2	28.6	60.2	0.66	15.38
52.0	55.9	26.0	59.9	0.71	11.85
51.5	59.3	25.3	63.3	0.79	9.53
51.0	63.2	33.8	67.2	0.70	19.86
50.5	64.1	32.5	68.1	0.74	17.62
50.0	68.9	29.9	72.9	0.90	11.96
49.5	62.8	34.4	66.8	0.68	20.91
49.0	56.9	24.7	60.9	0.76	9.58
48.5	55.8	26.0	59.8	0.70	11.90
48.0	53.2	26.0	57.2	0.65	12.99
47.5	52.7	26.6	56.7	0.63	14.10
47.0	53.0	29.9	57.0	0.57	18.56
46.5	49.0	22.7	53.0	0.63	10.13
46.0	40.7	26.6	44.7	0.38	19.10
45.5	40.4	25.3	44.4	0.40	17.38
45.0	40.6	30.5	44.6	0.29	24.66
44.5	42.7	24.7	46.7	0.46	15.51
44.0	42.8	24.0	46.8	0.47	14.53

* FROM DIGITAL RECORD OF BOREHOLE GEOPHYSICAL LOG
NEUT POR (SS) = NEUT POR (LS) + 4
V CLAY (FRAC.) = (NEUT POR (SS) - G-G POR (SS)) / 48
ADJ POR (SS) = G-G POR (SS) - (V CLAY (FRAC.) * 20)

WELL 35-89BR RECALCULATED POROSITY AND VOLUME CLAY
INTERVAL: 42-207

DEPTH*	NEUT POR* (LS) %	G-G POR* (SS) %	NEUT POR (SS) %	V CLAY (FRAC.)	ADJ POR (SS) %
207.0	47.2	24.0	51.2	0.57	12.72
206.5	45.5	18.2	49.5	0.65	5.13
206.0	44.6	18.8	48.6	0.62	6.44
205.5	43.7	17.5	47.7	0.63	4.96
205.0	42.1	16.2	46.1	0.62	3.81
204.5	39.8	18.8	43.8	0.52	8.43
204.0	38.1	20.8	42.1	0.44	11.91
203.5	37.5	20.1	41.5	0.44	11.24
203.0	35.5	20.1	39.5	0.40	12.06
202.5	33.0	18.2	37.0	0.39	10.34
202.0	34.8	20.8	38.8	0.38	13.26
201.5	40.8	16.2	44.8	0.60	4.33
201.0	49.1	20.8	53.1	0.67	7.30
200.5	55.7	24.0	59.7	0.74	9.18
200.0	56.7	24.7	60.7	0.75	9.65
199.5	52.8	19.5	56.8	0.78	3.93
199.0	50.8	17.5	54.8	0.78	1.99
198.5	51.6	16.2	55.6	0.82	-0.17
198.0	50.5	17.5	54.5	0.77	2.11
197.5	47.1	18.8	51.1	0.67	5.39
197.0	42.3	18.8	46.3	0.57	7.40
196.5	40.1	16.2	44.1	0.58	4.61
196.0	44.6	14.9	48.6	0.70	0.94
195.5	46.7	15.6	50.7	0.73	0.97
195.0	41.2	14.9	45.2	0.63	2.32
194.5	35.7	16.9	39.7	0.48	7.37
194.0	32.1	15.6	36.1	0.43	7.05
193.5	30.2	13.0	34.2	0.44	4.17
193.0	33.5	17.5	37.5	0.42	9.23
192.5	41.4	18.2	45.4	0.57	6.82
192.0	44.3	16.9	48.3	0.65	3.82
191.5	40.2	19.5	44.2	0.51	9.20
191.0	36.7	19.5	40.7	0.44	10.63
190.5	35.5	18.2	39.5	0.44	9.29
190.0	36.2	18.2	40.2	0.46	9.01
189.5	38.5	17.5	42.5	0.52	7.15
189.0	39.6	16.2	43.6	0.57	4.83
188.5	36.8	17.5	40.8	0.48	7.86
188.0	32.4	16.2	36.4	0.42	7.84
187.5	30.1	18.8	34.1	0.32	12.49
187.0	30.1	14.9	34.1	0.40	6.95
186.5	30.4	14.9	34.4	0.40	6.85
186.0	29.9	14.9	33.9	0.40	7.04
185.5	32.2	14.3	36.2	0.46	5.16
185.0	40.7	20.8	44.7	0.50	10.81
184.5	52.1	22.7	56.1	0.70	8.83
184.0	59.5	21.4	63.5	0.88	3.90
183.5	60.8	25.3	64.8	0.82	8.90
183.0	59.6	25.3	63.6	0.80	9.39
182.5	61.2	27.3	65.2	0.79	11.47
182.0	64.3	26.0	68.3	0.88	8.37
181.5	65.4	22.1	69.4	0.99	2.38
181.0	62.7	24.7	66.7	0.88	7.16
180.5	56.4	23.4	60.4	0.77	7.95
180.0	53.6	20.1	57.6	0.78	4.51
179.5	55.4	18.8	59.4	0.84	1.95
179.0	57.6	19.5	61.6	0.88	1.91
178.5	54.8	18.2	58.8	0.85	1.25
178.0	55.6	19.5	59.6	0.83	2.78
177.5	61.6	21.4	65.6	0.92	3.03
177.0	65.3	24.0	69.3	0.94	5.18
176.5	64.4	26.6	68.4	0.87	9.23
176.0	64.3	22.7	68.3	0.95	3.76
175.5	62.3	24.7	66.3	0.87	7.34
175.0	56.0	26.0	60.0	0.71	11.80
174.5	50.9	22.1	54.9	0.68	8.41
174.0	49.2	18.8	53.2	0.72	4.53
173.5	50.9	18.8	54.9	0.75	3.81
173.0	51.9	22.7	55.9	0.69	8.90
172.5	51.3	22.7	55.3	0.68	9.16

172.0	51.6	20.8	55.6	0.73	6.27
171.5	47.6	18.8	51.6	0.68	5.16
171.0	43.8	19.5	47.8	0.59	7.69
170.5	43.4	20.8	47.4	0.55	9.69
170.0	43.5	20.8	47.5	0.56	9.65
169.5	42.7	16.2	46.7	0.64	3.54
169.0	44.6	20.1	48.6	0.59	8.25
168.5	46.7	16.9	50.7	0.70	2.80
168.0	47.8	18.8	51.8	0.69	5.10
167.5	48.9	18.2	52.9	0.72	3.71
167.0	49.0	17.5	53.0	0.74	2.76
166.5	47.9	18.8	51.9	0.69	5.06
166.0	46.9	21.4	50.9	0.61	9.15
165.5	45.9	20.8	49.9	0.61	8.64
165.0	45.4	20.1	49.4	0.61	7.94
164.5	46.0	18.2	50.0	0.66	4.94
164.0	48.0	21.4	52.0	0.64	8.70
163.5	49.1	16.9	53.1	0.76	1.79
163.0	49.8	17.5	53.8	0.76	2.40
162.5	48.9	21.4	52.9	0.65	8.33
162.0	47.8	17.5	51.8	0.71	3.24
161.5	47.3	19.5	51.3	0.66	6.23
161.0	46.4	23.4	50.4	0.56	12.13
160.5	46.0	16.2	50.0	0.70	2.19
160.0	46.6	20.8	50.6	0.62	8.35
159.5	47.7	22.1	51.7	0.62	9.73
159.0	50.3	24.7	54.3	0.62	12.34
158.5	52.7	22.7	56.7	0.71	8.58
158.0	54.3	24.7	58.3	0.70	10.67
157.5	53.3	13.6	57.3	0.91	-4.55
157.0	54.3	21.4	58.3	0.77	6.07
156.5	55.4	27.3	59.4	0.67	13.88
156.0	56.2	24.7	60.2	0.74	9.87
155.5	58.7	23.4	62.7	0.82	7.02
155.0	59.8	20.1	63.8	0.91	1.95
154.5	60.4	23.4	64.4	0.85	6.29
154.0	55.7	22.7	59.7	0.77	7.34
153.5	51.0	22.1	55.0	0.69	8.35
153.0	49.5	19.5	53.5	0.71	5.31
152.5	47.4	21.4	51.4	0.62	8.93
152.0	46.8	18.2	50.8	0.68	4.59
151.5	47.2	22.7	51.2	0.59	10.88
151.0	47.9	21.4	51.9	0.63	8.73
150.5	52.0	18.2	56.0	0.79	2.44
150.0	54.0	26.0	58.0	0.67	12.65
149.5	53.4	25.3	57.4	0.67	11.98
149.0	53.1	20.1	57.1	0.77	4.72
148.5	55.8	22.7	59.8	0.77	7.28
148.0	59.9	25.3	63.9	0.80	9.27
147.5	61.9	24.7	65.9	0.86	7.52
147.0	60.2	24.7	64.2	0.82	8.22
146.5	56.4	24.0	60.4	0.76	8.87
146.0	55.3	24.0	59.3	0.73	9.34
145.5	55.5	20.8	59.5	0.81	4.63
145.0	52.8	23.4	56.8	0.70	9.45
144.5	48.1	23.4	52.1	0.60	11.41
144.0	45.0	19.5	49.0	0.61	7.18
143.5	45.5	20.1	49.5	0.61	7.88
143.0	49.7	23.4	53.7	0.63	10.75
142.5	54.7	26.6	58.7	0.67	13.28
142.0	57.3	29.9	61.3	0.65	16.78
141.5	56.7	26.0	60.7	0.72	11.51
141.0	53.8	24.7	57.8	0.69	10.87
140.5	52.6	22.1	56.6	0.72	7.70
140.0	53.9	24.0	57.9	0.71	9.93
139.5	56.3	28.6	60.3	0.66	15.36
139.0	59.0	29.9	63.0	0.69	16.05
138.5	58.4	28.6	62.4	0.70	14.47
138.0	55.4	23.4	59.4	0.75	8.36
137.5	53.5	26.0	57.5	0.66	12.83
137.0	53.0	25.3	57.0	0.66	12.13
136.5	51.1	21.4	55.1	0.70	7.39
136.0	48.5	22.1	52.5	0.63	9.40
135.5	48.5	18.8	52.5	0.70	4.78

135.0	50.6	20.1	54.6	0.72	5.76
134.5	51.7	21.4	55.7	0.71	7.17
134.0	54.7	21.4	58.7	0.78	5.91
133.5	59.5	20.1	63.5	0.90	2.06
133.0	59.2	20.8	63.2	0.88	3.09
132.5	51.9	22.1	55.9	0.71	7.98
132.0	47.1	22.7	51.1	0.59	10.91
131.5	49.3	21.4	53.3	0.66	8.17
131.0	50.8	23.4	54.8	0.65	10.31
130.5	44.4	21.4	48.4	0.56	10.18
130.0	35.3	22.1	39.3	0.36	14.90
129.5	30.6	21.4	34.6	0.27	15.95
129.0	30.4	23.4	34.4	0.23	18.78
128.5	33.0	20.1	37.0	0.35	13.11
128.0	40.9	22.7	44.9	0.46	13.49
127.5	52.4	25.3	56.4	0.65	12.38
127.0	60.2	25.3	64.2	0.81	9.13
126.5	62.9	26.0	66.9	0.85	8.92
126.0	63.7	29.2	67.7	0.80	13.20
125.5	63.7	25.3	67.7	0.88	7.68
125.0	67.1	25.3	71.1	0.95	6.28
124.5	66.8	16.9	70.8	1.12	-5.58
124.0	60.2	11.7	64.2	1.09	-10.17
123.5	59.1	22.1	63.1	0.85	5.00
123.0	62.9	25.3	66.9	0.87	7.99
122.5	61.4	22.7	65.4	0.89	4.97
122.0	56.1	16.9	60.1	0.90	-1.11
121.5	53.7	20.1	57.7	0.78	4.50
121.0	53.2	22.7	57.2	0.72	8.37
120.5	51.6	23.4	55.6	0.67	9.97
120.0	48.0	22.7	52.0	0.61	10.54
119.5	44.4	20.1	48.4	0.59	8.35
119.0	44.7	21.4	48.7	0.57	10.08
118.5	44.3	24.0	48.3	0.51	13.93
118.0	40.9	22.1	44.9	0.47	12.59
117.5	69.4	14.9	73.4	1.22	-9.43
117.0	82.6	56.5	86.6	0.63	43.98
116.5	75.9	40.9	79.9	0.81	24.65
116.0	67.2	25.3	71.2	0.96	6.21
115.5	65.2	29.9	69.2	0.82	13.50
115.0	64.3	28.6	68.3	0.83	12.03
114.5	65.9	25.3	69.9	0.93	6.76
114.0	65.2	23.4	69.2	0.95	4.30
113.5	61.2	23.4	65.2	0.87	5.96
113.0	60.9	24.0	64.9	0.85	6.99
112.5	61.0	28.6	65.0	0.76	13.41
112.0	56.5	29.2	60.5	0.65	16.17
111.5	47.5	27.9	51.5	0.49	18.11
111.0	39.2	19.5	43.2	0.49	9.61
110.5	34.9	14.3	38.9	0.51	4.04
110.0	34.1	19.5	38.1	0.39	11.72
109.5	32.4	18.8	36.4	0.37	11.50
109.0	31.5	20.8	35.5	0.31	14.64
108.5	32.8	25.3	36.8	0.24	20.55
108.0	35.5	23.4	39.5	0.34	16.65
107.5	38.9	21.4	42.9	0.45	12.47
107.0	40.9	24.0	44.9	0.43	15.33
106.5	45.2	24.0	49.2	0.52	13.56
106.0	51.9	20.1	55.9	0.74	5.24
105.5	56.2	25.3	60.2	0.73	10.82
105.0	57.2	27.3	61.2	0.71	13.12
104.5	57.0	23.4	61.0	0.78	7.72
104.0	57.4	23.4	61.4	0.79	7.55
103.5	58.1	26.0	62.1	0.75	10.91
103.0	56.9	20.8	60.9	0.84	4.05
102.5	56.1	20.1	60.1	0.83	3.47
102.0	56.3	22.7	60.3	0.78	7.07
101.5	56.5	23.4	60.5	0.77	7.91
101.0	55.6	22.7	59.6	0.77	7.38
100.5	55.9	23.4	59.9	0.76	8.18
100.0	56.5	24.7	60.5	0.75	9.76
99.5	56.9	24.7	60.9	0.75	9.59
99.0	56.5	22.7	60.5	0.79	7.00
98.5	56.0	21.4	60.0	0.80	5.35

98.0	56.1	20.1	60.1	0.83	3.47
97.5	56.5	19.5	60.5	0.85	2.40
97.0	57.6	23.4	61.6	0.80	7.47
96.5	58.0	20.8	62.0	0.86	3.62
96.0	57.4	20.8	61.4	0.85	3.86
95.5	57.1	21.4	61.1	0.83	4.88
95.0	55.9	23.4	59.9	0.76	8.15
94.5	58.5	23.4	62.5	0.81	7.09
94.0	59.0	27.9	63.0	0.73	13.29
93.5	58.3	27.3	62.3	0.73	12.67
93.0	59.4	26.6	63.4	0.77	11.33
92.5	59.4	26.6	63.4	0.77	11.30
92.0	58.4	24.7	62.4	0.79	8.98
91.5	57.3	25.3	61.3	0.75	10.36
91.0	53.9	25.3	57.9	0.68	11.74
90.5	51.6	23.4	55.6	0.67	9.95
90.0	51.9	22.7	55.9	0.69	8.89
89.5	53.2	22.1	57.2	0.73	7.44
89.0	55.3	20.1	59.3	0.82	3.82
88.5	57.5	16.2	61.5	0.94	-2.64
88.0	57.2	6.5	61.2	1.14	-16.28
87.5	53.3	5.2	57.3	1.09	-16.50
87.0	52.3	2.6	56.3	1.12	-19.77
86.5	53.2	16.9	57.2	0.84	0.09
86.0	56.7	20.8	60.7	0.83	4.13
85.5	57.5	23.4	61.5	0.79	7.50
85.0	56.1	20.8	60.1	0.82	4.40
84.5	50.7	23.4	54.7	0.65	10.34
84.0	49.5	23.4	53.5	0.63	10.82
83.5	52.3	23.4	56.3	0.69	9.67
83.0	53.3	26.0	57.3	0.65	12.93
82.5	52.6	24.7	56.6	0.67	11.38
82.0	50.4	22.7	54.4	0.66	9.53
81.5	49.7	22.1	53.7	0.66	8.90
81.0	48.2	18.8	52.2	0.69	4.93
80.5	46.6	22.1	50.6	0.59	10.20
80.0	47.1	22.1	51.1	0.60	10.00
79.5	49.3	22.7	53.3	0.64	10.01
79.0	50.4	22.1	54.4	0.67	8.60
78.5	49.6	24.7	53.6	0.60	12.63
78.0	47.5	22.7	51.5	0.60	10.76
77.5	46.9	22.1	50.9	0.60	10.08
77.0	47.3	21.4	51.3	0.62	8.97
76.5	47.9	18.8	51.9	0.69	5.07
76.0	47.6	23.4	51.6	0.59	11.63
75.5	47.8	22.7	51.8	0.60	10.64
75.0	51.7	19.5	55.7	0.75	4.41
74.5	56.5	21.4	60.5	0.81	5.15
74.0	57.0	23.4	61.0	0.78	7.71
73.5	55.5	24.7	59.5	0.73	10.16
73.0	56.1	26.0	60.1	0.71	11.77
72.5	56.8	26.0	60.8	0.73	11.48
72.0	60.7	24.0	64.7	0.85	7.07
71.5	62.6	29.9	66.6	0.77	14.56
71.0	56.1	27.9	60.1	0.67	14.53
70.5	50.3	23.4	54.3	0.64	10.49
70.0	49.3	24.7	53.3	0.60	12.78
69.5	48.3	20.8	52.3	0.66	7.66
69.0	46.8	21.4	50.8	0.61	9.20
68.5	48.0	21.4	52.0	0.64	8.70
68.0	51.7	24.0	55.7	0.66	10.83
67.5	53.1	25.3	57.1	0.66	12.08
67.0	51.9	21.4	55.9	0.72	7.07
66.5	48.7	19.5	52.7	0.69	5.66
66.0	46.5	22.1	50.5	0.59	10.22
65.5	48.0	22.7	52.0	0.61	10.54
65.0	48.1	24.0	52.1	0.59	12.33
64.5	47.9	18.2	51.9	0.70	4.15
64.0	47.8	21.4	51.8	0.63	8.79
63.5	48.8	20.1	52.8	0.68	6.53
63.0	51.1	22.1	55.1	0.69	8.34
62.5	53.3	23.4	57.3	0.71	9.24
62.0	54.2	24.0	58.2	0.71	9.78
61.5	55.3	21.4	59.3	0.79	5.66

61.0	56.3	23.4	60.3	0.77	7.99
60.5	55.8	26.0	59.8	0.70	11.88
60.0	54.1	24.7	58.1	0.70	10.76
59.5	52.2	24.0	56.2	0.67	10.64
59.0	51.0	22.1	55.0	0.69	8.38
58.5	52.2	22.7	56.2	0.70	8.81
58.0	54.6	20.1	58.6	0.80	4.10
57.5	58.3	24.7	62.3	0.78	8.99
57.0	59.7	26.6	63.7	0.77	11.19
56.5	52.3	26.6	56.3	0.62	14.29
56.0	44.2	20.8	48.2	0.57	9.34
55.5	40.5	22.1	44.5	0.47	12.75
55.0	38.7	21.4	42.7	0.44	12.56
54.5	36.7	20.1	40.7	0.43	11.58
54.0	34.5	20.1	38.5	0.38	12.50
53.5	34.5	20.8	38.5	0.37	13.39
53.0	35.4	23.4	39.4	0.33	16.70
52.5	36.1	22.1	40.1	0.38	14.57
52.0	37.6	20.8	41.6	0.43	12.12
51.5	39.6	21.4	43.6	0.46	12.19
51.0	40.4	22.1	44.4	0.46	12.80
50.5	42.1	19.5	46.1	0.55	8.41
50.0	44.4	24.7	48.4	0.49	14.80
49.5	46.2	25.3	50.2	0.52	14.95
49.0	47.6	26.6	51.6	0.52	16.24
48.5	47.9	22.7	51.9	0.61	10.58
48.0	48.5	22.7	52.5	0.62	10.34
47.5	49.2	24.7	53.2	0.59	12.80
47.0	51.1	27.9	55.1	0.57	16.62
46.5	52.7	27.3	56.7	0.61	15.02
46.0	56.0	28.6	60.0	0.65	15.49
45.5	58.9	28.6	62.9	0.72	14.27
45.0	60.0	29.2	64.0	0.72	14.74
44.5	59.0	26.6	63.0	0.76	11.50
44.0	57.2	26.0	61.2	0.73	11.32
43.5	58.3	26.0	62.3	0.76	10.86
43.0	63.2	24.0	67.2	0.90	6.03
42.5	64.7	28.6	68.7	0.84	11.84
42.0	64.4	28.6	68.4	0.83	11.96

* FROM DIGITAL RECORD OF BOREHOLE GEOPHYSICAL LOG
NEUT POR (SS) = NEUT POR (LS) + 4
V CLAY (FRAC.) = (NEUT POR (SS) - G-G POR (SS)) / 48
ADJ POR (SS) = G-G POR (SS) - (V CLAY (FRAC.) * 20)

WELL 36-89BR RECALCULATED POROSITY AND VOLUME CLAY
INTERVAL: 51-106

DEPTH*	NEUT POR* (LS) %	G-G POR* (SS) %	NEUT POR (SS) %	V CLAY (FRAC.)	ADJ POR (SS) %
106.0	64.3	33.1	68.3	0.73	18.47
105.5	60.3	26.6	64.3	0.78	10.93
105.0	54.5	24.0	58.5	0.72	9.66
104.5	56.4	22.7	60.4	0.78	7.05
104.0	53.4	21.4	57.4	0.75	6.43
103.5	55.7	23.4	59.7	0.76	8.24
103.0	57.1	22.1	61.1	0.81	5.84
102.5	62.1	21.4	66.1	0.93	2.83
102.0	63.0	13.0	67.0	1.12	-9.51
101.5	56.8	7.2	60.8	1.12	-15.20
101.0	59.3	13.0	63.3	1.05	-7.98
100.5	58.1	26.6	62.1	0.74	11.83
100.0	56.3	22.7	60.3	0.78	7.09
99.5	58.3	20.8	62.3	0.86	3.49
99.0	55.8	23.4	59.8	0.76	8.22
98.5	50.1	22.1	54.1	0.67	8.75
98.0	52.2	23.4	56.2	0.68	9.71
97.5	51.3	22.1	55.3	0.69	8.23
97.0	53.5	21.4	57.5	0.75	6.39
96.5	56.3	25.3	60.3	0.73	10.77
96.0	63.9	28.6	67.9	0.82	12.17
95.5	65.4	27.3	69.4	0.88	9.72
95.0	51.9	30.5	55.9	0.53	19.93
94.5	43.5	17.5	47.5	0.62	5.04
94.0	41.0	16.9	45.0	0.58	5.19
93.5	36.7	20.8	40.7	0.41	12.49
93.0	36.5	21.4	40.5	0.40	13.50
92.5	39.7	19.5	43.7	0.51	9.38
92.0	39.9	20.1	43.9	0.50	10.23
91.5	40.0	18.8	44.0	0.52	8.33
91.0	40.1	17.5	44.1	0.55	6.47
90.5	41.5	19.5	45.5	0.54	8.62
90.0	43.6	18.8	47.6	0.60	6.86
89.5	45.0	17.5	49.0	0.65	4.44
89.0	41.2	16.2	45.2	0.60	4.17
88.5	40.5	18.8	44.5	0.53	8.15
88.0	38.3	22.1	42.3	0.42	13.67
87.5	37.8	22.7	41.8	0.40	14.79
87.0	39.1	22.1	43.1	0.44	13.31
86.5	38.9	19.5	42.9	0.49	9.73
86.0	40.2	22.1	44.2	0.46	12.87
85.5	42.4	22.7	46.4	0.49	12.87
85.0	40.4	21.4	44.4	0.48	11.87
84.5	42.0	22.1	46.0	0.50	12.11
84.0	40.9	20.8	44.9	0.50	10.75
83.5	36.7	16.9	40.7	0.50	6.98
83.0	42.3	25.3	46.3	0.44	16.59
82.5	41.8	23.4	45.8	0.47	14.05
82.0	40.7	21.4	44.7	0.48	11.75
81.5	36.9	18.2	40.9	0.47	8.72
81.0	30.4	13.6	34.4	0.43	4.99
80.5	38.4	16.9	42.4	0.53	6.25
80.0	46.9	20.1	50.9	0.64	7.30
79.5	47.4	20.1	51.4	0.65	7.11
79.0	46.8	23.4	50.8	0.57	11.95
78.5	43.6	22.7	47.6	0.52	12.36
78.0	39.6	23.4	43.6	0.42	14.97
77.5	47.2	22.7	51.2	0.59	10.85
77.0	51.4	21.4	55.4	0.71	7.29
76.5	50.1	22.1	54.1	0.67	8.73
76.0	47.2	17.5	51.2	0.70	3.49
75.5	44.6	20.8	48.6	0.58	9.17
75.0	48.8	21.4	52.8	0.65	8.34
74.5	47.5	18.8	51.5	0.68	5.22
74.0	47.2	22.1	51.2	0.61	9.93
73.5	48.7	18.2	52.7	0.72	3.79
73.0	48.0	17.5	52.0	0.72	3.16
72.5	47.2	20.1	51.2	0.65	7.17
72.0	48.3	20.1	52.3	0.67	6.72
71.5	48.1	16.2	52.1	0.75	1.29

71.0	48.2	23.4	52.2	0.60	11.39
70.5	43.6	24.0	47.6	0.49	14.23
70.0	41.7	18.8	45.7	0.56	7.62
69.5	39.8	21.4	43.8	0.47	12.11
69.0	38.4	18.8	42.4	0.49	9.03
68.5	41.5	22.7	45.5	0.48	13.23
68.0	43.5	19.5	47.5	0.58	7.81
67.5	44.4	18.8	48.4	0.62	6.53
67.0	43.7	16.9	47.7	0.64	4.03
66.5	42.8	20.1	46.8	0.56	9.02
66.0	42.6	19.5	46.6	0.57	8.16
65.5	42.1	20.1	46.1	0.54	9.31
65.0	44.0	21.4	48.0	0.55	10.36
64.5	48.0	22.7	52.0	0.61	10.55
64.0	46.8	18.8	50.8	0.67	5.51
63.5	45.7	19.5	49.7	0.63	6.88
63.0	43.2	20.8	47.2	0.55	9.79
62.5	41.4	20.1	45.4	0.53	9.62
62.0	41.4	19.5	45.4	0.54	8.68
61.5	37.3	20.8	41.3	0.43	12.24
61.0	36.3	20.1	40.3	0.42	11.72
60.5	36.4	8.4	40.4	0.67	-4.88
60.0	35.0	-8.4	39.0	0.99	-28.20
59.5	30.0	-20.1	34.0	1.13	-42.67
59.0	26.6	-13.6	30.6	0.92	-32.04
58.5	36.0	11.0	40.0	0.60	-1.02
58.0	38.4	22.1	42.4	0.42	13.62
57.5	41.3	20.8	45.3	0.51	10.58
57.0	49.0	25.3	53.0	0.58	13.79
56.5	54.2	24.0	58.2	0.71	9.77
56.0	50.9	22.1	54.9	0.68	8.40
55.5	46.3	22.7	50.3	0.58	11.23
55.0	41.8	22.7	45.8	0.48	13.11
54.5	39.7	17.5	43.7	0.55	6.61
54.0	46.7	18.8	50.7	0.66	5.57
53.5	49.2	21.4	53.2	0.66	8.19
53.0	43.5	24.7	47.5	0.48	15.17
52.5	45.6	22.7	49.6	0.56	11.54
52.0	48.0	23.4	52.0	0.60	11.45
51.5	53.4	23.4	57.4	0.71	9.22
51.0	50.0	29.2	54.0	0.52	18.88

* FROM DIGITAL RECORD OF BOREHOLE GEOPHYSICAL LOG
NEUT POR (SS) = NEUT POR (LS) + 4
V CLAY (FRAC.) = (NEUT POR (SS) - G-G POR (SS)) / 48
ADJ POR (SS) = G-G POR (SS) - (V CLAY (FRAC.) * 20)

WELL 37-89BR RECALCULATED POROSITY AND VOLUME CLAY
INTERVAL: 32-640

DEPTH*	NEUT POR* (LS) %	G-G POR* (SS) %	NEUT POR (SS) %	V CLAY (FRAC.)	ADJ POR (SS) %
640.0	75.6	61.9	79.6	0.37	54.50
639.5	80.3	72.3	84.3	0.25	67.27
639.0	81.2	74.6	85.2	0.22	70.16
638.5	81.3	74.5	85.3	0.22	70.02
638.0	82.1	75.0	86.1	0.23	70.37
637.5	82.4	76.7	86.4	0.20	72.66
637.0	81.0	77.9	85.0	0.15	74.89
636.5	82.3	78.0	86.3	0.17	74.48
636.0	81.8	76.8	85.8	0.19	73.05
635.5	81.7	76.1	85.7	0.20	72.06
635.0	82.8	76.5	86.8	0.21	72.21
634.5	82.7	77.5	86.7	0.19	73.58
634.0	79.7	76.6	83.7	0.15	73.67
633.5	80.3	74.9	84.3	0.20	70.99
633.0	80.5	74.3	84.5	0.21	69.98
632.5	81.9	72.3	85.9	0.28	66.63
632.0	72.5	54.0	76.5	0.47	44.68
631.5	51.2	34.7	55.2	0.43	26.09
631.0	37.7	25.8	41.7	0.33	19.12
630.5	34.2	22.3	38.2	0.33	15.73
630.0	37.4	24.0	41.4	0.36	16.68
629.5	47.1	29.9	51.1	0.44	20.99
629.0	48.7	32.2	52.7	0.43	23.72
628.5	41.0	29.3	45.0	0.33	22.80
628.0	36.5	27.2	40.5	0.28	21.62
627.5	36.2	26.7	40.2	0.28	21.02
627.0	35.5	26.4	39.5	0.27	20.93
626.5	36.3	27.6	40.3	0.26	22.27
626.0	36.5	28.2	40.5	0.26	23.00
625.5	35.7	27.5	39.7	0.25	22.44
625.0	35.9	26.2	39.9	0.28	20.55
624.5	35.4	28.3	39.4	0.23	23.68
624.0	36.0	30.3	40.0	0.20	26.23
623.5	36.9	31.1	40.9	0.20	27.06
623.0	36.9	30.9	40.9	0.21	26.68
622.5	36.6	30.4	40.6	0.21	26.18
622.0	36.4	30.6	40.4	0.20	26.54
621.5	37.0	31.0	41.0	0.21	26.85
621.0	37.1	29.6	41.1	0.24	24.74
620.5	36.1	28.8	40.1	0.23	24.12
620.0	36.0	28.4	40.0	0.24	23.57
619.5	36.4	29.3	40.4	0.23	24.72
619.0	35.7	28.7	39.7	0.23	24.18
618.5	35.0	28.9	39.0	0.21	24.64
618.0	35.0	29.5	39.0	0.20	25.56
617.5	35.5	28.7	39.5	0.23	24.15
617.0	34.7	26.6	38.7	0.25	21.49
616.5	34.8	27.2	38.8	0.24	22.41
616.0	36.0	29.8	40.0	0.21	25.58
615.5	36.7	30.5	40.7	0.21	26.24
615.0	36.3	29.2	40.3	0.23	24.50
614.5	37.0	30.2	41.0	0.23	25.70
614.0	36.8	29.3	40.8	0.24	24.47
613.5	36.9	30.1	40.9	0.23	25.55
613.0	35.9	30.0	39.9	0.21	25.89
612.5	36.6	29.8	40.6	0.23	25.25
612.0	35.2	31.2	39.2	0.17	27.91
611.5	34.4	31.6	38.4	0.14	28.81
611.0	34.4	31.2	38.4	0.15	28.14
610.5	35.1	32.2	39.1	0.14	29.39
610.0	34.9	31.2	38.9	0.16	28.04
609.5	35.2	30.5	39.2	0.18	26.85
609.0	35.2	28.7	39.2	0.22	24.38
608.5	36.5	28.8	40.5	0.24	23.95
608.0	38.5	28.1	42.5	0.30	22.04
607.5	38.6	26.4	42.6	0.34	19.67
607.0	36.2	28.5	40.2	0.24	23.61
606.5	34.8	29.9	38.8	0.18	26.25
606.0	34.0	30.2	38.0	0.16	26.97
605.5	34.5	29.0	38.5	0.20	25.08

605.0	34.8	27.6	38.8	0.23	22.91
604.5	34.5	30.1	38.5	0.17	26.65
604.0	35.2	28.7	39.2	0.22	24.31
603.5	37.2	28.6	41.2	0.26	23.42
603.0	37.4	28.2	41.4	0.27	22.73
602.5	35.9	27.3	39.9	0.26	22.09
602.0	34.9	28.5	38.9	0.22	24.23
601.5	35.0	29.5	39.0	0.20	25.58
601.0	35.3	27.9	39.3	0.24	23.09
600.5	35.6	27.6	39.6	0.25	22.63
600.0	34.6	28.0	38.6	0.22	23.61
599.5	35.7	30.1	39.7	0.20	26.09
599.0	36.0	31.0	40.0	0.19	27.18
598.5	36.1	29.4	40.1	0.22	24.98
598.0	36.1	28.5	40.1	0.24	23.65
597.5	35.6	28.7	39.6	0.23	24.20
597.0	36.0	29.2	40.0	0.22	24.72
596.5	34.8	30.4	38.8	0.17	26.90
596.0	34.4	31.5	38.4	0.14	28.66
595.5	34.5	30.5	38.5	0.17	27.22
595.0	34.5	30.3	38.5	0.17	26.91
594.5	34.7	31.2	38.7	0.16	28.13
594.0	35.4	30.2	39.4	0.19	26.37
593.5	35.1	31.4	39.1	0.16	28.20
593.0	35.6	32.2	39.6	0.15	29.16
592.5	35.6	29.6	39.6	0.21	25.35
592.0	34.9	26.5	38.9	0.26	21.38
591.5	34.5	27.3	38.5	0.23	22.66
591.0	35.4	27.9	39.4	0.24	23.04
590.5	36.2	28.7	40.2	0.24	23.94
590.0	37.5	28.4	41.5	0.27	22.91
589.5	36.6	30.2	40.6	0.22	25.92
589.0	36.6	31.3	40.6	0.19	27.40
588.5	36.4	32.1	40.4	0.17	28.60
588.0	35.5	31.5	39.5	0.17	28.15
587.5	35.7	29.2	39.7	0.22	24.82
587.0	35.1	29.2	39.1	0.21	25.04
586.5	35.1	28.5	39.1	0.22	24.14
586.0	35.1	27.9	39.1	0.23	23.22
585.5	35.4	30.8	39.4	0.18	27.22
585.0	35.3	29.4	39.3	0.21	25.28
584.5	32.8	27.6	36.8	0.19	23.77
584.0	33.7	29.9	37.7	0.16	26.67
583.5	34.3	30.7	38.3	0.16	27.59
583.0	34.3	26.8	38.3	0.24	22.04
582.5	34.3	25.9	38.3	0.26	20.75
582.0	35.3	28.2	39.3	0.23	23.54
581.5	36.5	29.9	40.5	0.22	25.53
581.0	35.7	29.1	39.7	0.22	24.68
580.5	34.5	29.7	38.5	0.18	26.06
580.0	33.8	29.6	37.8	0.17	26.20
579.5	33.6	28.8	37.6	0.18	25.08
579.0	32.5	27.7	36.5	0.18	24.10
578.5	32.0	26.2	36.0	0.20	22.12
578.0	32.4	27.0	36.4	0.20	23.05
577.5	31.9	25.7	35.9	0.21	21.51
577.0	31.3	26.7	35.3	0.18	23.07
576.5	31.1	27.6	35.1	0.16	24.45
576.0	30.7	25.8	34.7	0.19	22.07
575.5	28.5	27.5	32.5	0.10	25.36
575.0	33.3	34.1	37.3	0.07	32.79
574.5	53.0	54.0	57.0	0.06	52.67
574.0	70.8	71.8	74.8	0.06	70.58
573.5	78.2	72.5	82.2	0.20	68.51
573.0	75.2	56.7	79.2	0.47	47.29
572.5	62.1	40.0	66.1	0.54	29.20
572.0	50.6	29.1	54.6	0.53	18.42
571.5	41.6	24.4	45.6	0.44	15.49
571.0	32.7	23.9	36.7	0.27	18.57
570.5	27.7	23.9	31.7	0.16	20.65
570.0	25.8	22.3	29.8	0.15	19.25
569.5	27.0	22.6	31.0	0.17	19.13
569.0	28.0	24.5	32.0	0.16	21.34
568.5	26.3	23.6	30.3	0.14	20.85

568.0	27.5	24.2	31.5	0.15	21.19
567.5	30.8	20.2	34.8	0.30	14.13
567.0	31.6	14.3	35.6	0.44	5.46
566.5	30.7	16.0	34.7	0.39	8.21
566.0	29.8	14.1	33.8	0.41	5.94
565.5	28.8	10.0	32.8	0.48	0.50
565.0	30.7	10.8	34.7	0.50	0.86
564.5	34.4	13.2	38.4	0.53	2.64
564.0	38.2	15.3	42.2	0.56	4.16
563.5	39.5	16.4	43.5	0.56	5.17
563.0	40.8	17.7	44.8	0.56	6.46
562.5	43.7	20.7	47.7	0.56	9.47
562.0	53.4	36.4	57.4	0.44	27.65
561.5	70.6	61.2	74.6	0.28	55.58
561.0	79.3	75.7	83.3	0.16	72.48
560.5	79.9	75.7	83.9	0.17	72.29
560.0	78.8	73.7	82.8	0.19	69.92
559.5	78.0	64.2	82.0	0.37	56.77
559.0	65.2	42.9	69.2	0.55	31.96
558.5	50.9	25.3	54.9	0.62	12.89
558.0	42.3	19.0	46.3	0.57	7.69
557.5	34.8	14.2	38.8	0.51	3.99
557.0	30.7	10.5	34.7	0.50	0.47
556.5	31.0	6.9	35.0	0.58	-4.75
556.0	32.9	8.7	36.9	0.59	-3.08
555.5	30.8	11.5	34.8	0.49	1.80
555.0	27.1	16.8	31.1	0.30	10.80
554.5	26.1	20.4	30.1	0.20	16.39
554.0	26.3	21.8	30.3	0.18	18.23
553.5	30.0	21.6	34.0	0.26	16.43
553.0	30.6	18.2	34.6	0.34	11.40
552.5	28.6	14.1	32.6	0.38	6.43
552.0	30.1	11.2	34.1	0.48	1.65
551.5	32.3	12.5	36.3	0.50	2.51
551.0	32.7	15.7	36.7	0.44	6.92
550.5	31.4	15.6	35.4	0.41	7.32
550.0	31.3	18.7	35.3	0.35	11.80
549.5	33.0	21.3	37.0	0.33	14.80
549.0	33.1	20.8	37.1	0.34	14.07
548.5	31.1	21.7	35.1	0.28	16.15
548.0	30.1	21.8	34.1	0.26	16.68
547.5	29.9	22.2	33.9	0.24	17.38
547.0	29.4	23.8	33.4	0.20	19.72
546.5	29.6	24.8	33.6	0.18	21.10
546.0	31.0	22.3	35.0	0.26	17.02
545.5	32.0	14.5	36.0	0.45	5.52
545.0	32.1	13.6	36.1	0.47	4.28
544.5	32.4	14.3	36.4	0.46	5.04
544.0	32.0	15.5	36.0	0.43	6.95
543.5	31.3	18.8	35.3	0.34	11.87
543.0	31.2	20.9	35.2	0.30	14.97
542.5	32.0	23.6	36.0	0.26	18.40
542.0	31.7	23.8	35.7	0.25	18.82
541.5	30.9	21.1	34.9	0.29	15.37
541.0	32.4	21.8	36.4	0.30	15.76
540.5	31.7	24.5	35.7	0.23	19.79
540.0	30.8	23.6	34.8	0.23	18.94
539.5	30.5	24.4	34.5	0.21	20.25
539.0	31.8	25.0	35.8	0.23	20.45
538.5	34.1	25.7	38.1	0.26	20.56
538.0	36.3	24.7	40.3	0.32	18.19
537.5	35.9	22.5	39.9	0.36	15.30
537.0	32.8	23.2	36.8	0.28	17.51
536.5	29.6	26.1	33.6	0.16	22.98
536.0	29.4	24.2	33.4	0.19	20.40
535.5	31.8	23.4	35.8	0.26	18.19
535.0	37.8	21.0	41.8	0.43	12.29
534.5	39.8	19.4	43.8	0.51	9.22
534.0	46.5	28.3	50.5	0.46	18.96
533.5	59.6	41.2	63.6	0.47	31.86
533.0	71.9	56.2	75.9	0.41	47.96
532.5	82.3	67.3	86.3	0.40	59.34
532.0	76.1	54.9	80.1	0.53	44.39
531.5	57.4	33.7	61.4	0.58	22.18

531.0	51.4	33.3	55.4	0.46	24.06
530.5	64.6	54.2	68.6	0.30	48.23
530.0	79.4	73.0	83.4	0.22	68.66
529.5	84.7	78.4	88.7	0.21	74.15
529.0	84.7	78.6	88.7	0.21	74.43
528.5	84.3	78.3	88.3	0.21	74.19
528.0	83.6	77.4	87.6	0.21	73.22
527.5	77.9	70.4	81.9	0.24	65.67
527.0	70.2	53.4	74.2	0.43	44.75
526.5	57.4	31.6	61.4	0.62	19.17
526.0	44.1	18.5	48.1	0.62	6.21
525.5	38.6	15.5	42.6	0.56	4.25
525.0	37.6	14.4	41.6	0.57	3.00
524.5	40.6	16.4	44.6	0.59	4.60
524.0	44.1	19.0	48.1	0.61	6.89
523.5	46.0	25.4	50.0	0.51	15.14
523.0	59.4	33.2	63.4	0.63	20.57
522.5	58.6	30.0	62.6	0.68	16.36
522.0	49.4	19.2	53.4	0.71	4.95
521.5	44.7	15.8	48.7	0.69	2.10
521.0	42.2	12.3	46.2	0.71	-1.85
520.5	35.6	11.0	39.6	0.60	-0.96
520.0	32.3	10.6	36.3	0.54	-0.17
519.5	30.4	9.2	34.4	0.53	-1.32
519.0	27.5	10.6	31.5	0.44	1.86
518.5	26.4	14.1	30.4	0.34	7.33
518.0	27.0	16.5	31.0	0.30	10.51
517.5	27.7	19.2	31.7	0.26	13.93
517.0	27.1	18.4	31.1	0.27	13.06
516.5	27.7	17.9	31.7	0.29	12.16
516.0	29.8	17.4	33.8	0.34	10.51
515.5	31.4	13.0	35.4	0.47	3.69
515.0	33.0	13.0	37.0	0.50	2.98
514.5	32.0	12.1	36.0	0.50	2.20
514.0	32.6	12.8	36.6	0.50	2.91
513.5	36.2	15.1	40.2	0.52	4.58
513.0	40.6	14.4	44.6	0.63	1.77
512.5	43.6	14.1	47.6	0.70	0.09
512.0	44.4	15.1	48.4	0.69	1.17
511.5	46.9	17.0	50.9	0.71	2.82
511.0	42.2	16.7	46.2	0.61	4.47
510.5	40.3	24.2	44.3	0.42	15.86
510.0	55.7	39.7	59.7	0.42	31.36
509.5	69.8	45.5	73.8	0.59	33.78
509.0	58.8	30.5	62.8	0.67	17.03
508.5	42.6	19.6	46.6	0.56	8.39
508.0	34.6	15.7	38.6	0.48	6.13
507.5	33.6	13.2	37.6	0.51	2.98
507.0	36.6	10.6	40.6	0.62	-1.88
506.5	39.9	11.5	43.9	0.67	-1.98
506.0	39.4	12.7	43.4	0.64	-0.15
505.5	39.2	16.8	43.2	0.55	5.81
505.0	39.2	17.4	43.2	0.54	6.59
504.5	41.0	16.8	45.0	0.59	5.06
504.0	41.6	17.2	45.6	0.59	5.40
503.5	42.5	18.6	46.5	0.58	7.02
503.0	41.7	20.0	45.7	0.53	9.32
502.5	41.9	19.5	45.9	0.55	8.52
502.0	42.2	18.3	46.2	0.58	6.73
501.5	43.6	18.5	47.6	0.61	6.36
501.0	46.5	25.8	50.5	0.51	15.55
500.5	56.4	38.7	60.4	0.45	29.62
500.0	55.5	38.6	59.5	0.43	29.94
499.5	40.8	25.3	44.8	0.41	17.17
499.0	33.0	18.4	37.0	0.39	10.65
498.5	33.1	17.3	37.1	0.41	9.06
498.0	41.7	21.3	45.7	0.51	11.09
497.5	48.4	20.3	52.4	0.67	6.94
497.0	45.7	19.4	49.7	0.63	6.82
496.5	43.8	17.3	47.8	0.64	4.61
496.0	46.1	17.2	50.1	0.69	3.52
495.5	48.6	18.9	52.6	0.70	4.86
495.0	47.3	16.2	51.3	0.73	1.59
494.5	42.6	8.3	46.6	0.80	-7.64

494.0	41.5	9.4	45.5	0.75	-5.67
493.5	38.5	13.1	42.5	0.61	0.81
493.0	34.4	11.2	38.4	0.57	-0.09
492.5	34.0	14.5	38.0	0.49	4.76
492.0	33.2	14.5	37.2	0.47	5.00
491.5	30.2	15.0	34.2	0.40	6.95
491.0	29.8	16.6	33.8	0.36	9.49
490.5	29.6	16.8	33.6	0.35	9.75
490.0	31.4	18.0	35.4	0.36	10.66
489.5	38.0	20.0	42.0	0.46	10.79
489.0	48.0	23.0	52.0	0.60	10.86
488.5	52.2	25.7	56.2	0.64	13.01
488.0	54.2	28.7	58.2	0.62	16.36
487.5	56.6	30.6	60.6	0.62	18.05
487.0	58.1	32.2	62.1	0.62	19.66
486.5	57.2	34.6	61.2	0.55	23.59
486.0	62.0	45.7	66.0	0.42	37.18
485.5	77.3	66.3	81.3	0.31	60.07
485.0	82.7	68.9	86.7	0.37	61.41
484.5	73.1	51.3	77.1	0.54	40.54
484.0	59.0	31.3	63.0	0.66	18.07
483.5	51.0	21.0	55.0	0.71	6.84
483.0	45.9	16.6	49.9	0.69	2.76
482.5	36.3	20.3	40.3	0.42	11.93
482.0	32.1	21.1	36.1	0.31	14.76
481.5	33.6	15.0	37.6	0.47	5.56
481.0	31.8	15.8	35.8	0.42	7.43
480.5	29.8	19.6	33.8	0.30	13.65
480.0	31.6	15.0	35.6	0.43	6.45
479.5	33.0	6.7	37.0	0.63	-5.93
479.0	33.1	9.6	37.1	0.57	-1.83
478.5	30.5	13.7	34.5	0.43	5.03
478.0	29.0	18.1	33.0	0.31	11.93
477.5	28.8	20.0	32.8	0.27	14.64
477.0	30.0	20.4	34.0	0.28	14.69
476.5	30.2	20.3	34.2	0.29	14.49
476.0	30.5	20.8	34.5	0.29	15.04
475.5	30.4	21.7	34.4	0.27	16.39
475.0	29.0	22.3	33.0	0.22	17.79
474.5	27.6	22.0	31.6	0.20	18.04
474.0	27.4	20.8	31.4	0.22	16.36
473.5	28.5	19.3	32.5	0.28	13.73
473.0	33.2	19.3	37.2	0.37	11.82
472.5	37.2	16.4	41.2	0.52	6.08
472.0	35.0	15.9	39.0	0.48	6.32
471.5	31.4	15.9	35.4	0.41	7.84
471.0	32.0	16.3	36.0	0.41	8.16
470.5	36.2	15.8	40.2	0.51	5.63
470.0	43.0	18.6	47.0	0.59	6.74
469.5	47.8	19.6	51.8	0.67	6.23
469.0	43.2	18.1	47.2	0.61	5.99
468.5	34.6	15.2	38.6	0.49	5.41
468.0	33.8	12.4	37.8	0.53	1.81
467.5	34.1	13.6	38.1	0.51	3.42
467.0	31.7	16.6	35.7	0.40	8.67
466.5	33.6	15.7	37.6	0.46	6.55
466.0	36.2	17.7	40.2	0.47	8.28
465.5	37.1	17.2	41.1	0.50	7.19
465.0	34.4	17.9	38.4	0.43	9.42
464.5	32.7	18.7	36.7	0.37	11.26
464.0	31.1	18.8	35.1	0.34	12.05
463.5	31.1	18.4	35.1	0.35	11.47
463.0	29.6	17.4	33.6	0.34	10.65
462.5	28.7	16.7	32.7	0.33	9.99
462.0	29.3	17.6	33.3	0.33	11.01
461.5	29.3	16.7	33.3	0.34	9.86
461.0	32.8	20.3	36.8	0.34	13.48
460.5	43.1	24.9	47.1	0.46	15.65
460.0	50.1	24.9	54.1	0.61	12.68
459.5	45.3	20.9	49.3	0.59	9.06
459.0	43.7	21.3	47.7	0.55	10.23
458.5	48.1	24.2	52.1	0.58	12.51
458.0	54.9	28.1	58.9	0.64	15.29
457.5	46.4	24.8	50.4	0.53	14.07

457.0	34.0	14.9	38.0	0.48	5.20
456.5	30.3	14.2	34.3	0.42	5.77
456.0	29.9	15.6	33.9	0.38	7.91
455.5	29.8	17.9	33.8	0.33	11.28
455.0	33.9	21.9	37.9	0.33	15.18
454.5	39.6	21.8	43.6	0.45	12.77
454.0	36.6	21.6	40.6	0.40	13.64
453.5	35.8	16.8	39.8	0.48	7.26
453.0	38.3	14.6	42.3	0.58	3.06
452.5	39.3	15.5	43.3	0.58	3.93
452.0	38.0	15.0	42.0	0.56	3.78
451.5	35.6	11.8	39.6	0.58	0.14
451.0	34.2	15.0	38.2	0.48	5.32
450.5	31.2	17.4	35.2	0.37	9.93
450.0	28.0	16.1	32.0	0.33	9.49
449.5	30.6	16.2	34.6	0.38	8.52
449.0	45.1	20.8	49.1	0.59	8.94
448.5	57.9	31.7	61.9	0.63	19.16
448.0	70.2	48.0	74.2	0.55	37.06
447.5	83.5	68.8	87.5	0.39	61.01
447.0	88.7	76.5	92.7	0.34	69.82
446.5	85.4	65.6	89.4	0.50	55.61
446.0	72.0	46.0	76.0	0.62	33.55
445.5	60.6	27.2	64.6	0.78	11.65
445.0	53.1	19.8	57.1	0.78	4.27
444.5	48.7	19.5	52.7	0.69	5.63
444.0	47.1	18.2	51.1	0.69	4.44
443.5	45.7	18.2	49.7	0.66	5.07
443.0	43.3	17.8	47.3	0.62	5.49
442.5	41.4	17.8	45.4	0.57	6.32
442.0	46.5	15.9	50.5	0.72	1.51
441.5	48.3	19.9	52.3	0.67	6.40
441.0	48.6	21.3	52.6	0.65	8.28
440.5	51.1	23.1	55.1	0.67	9.82
440.0	52.4	25.8	56.4	0.64	13.02
439.5	49.8	18.3	53.8	0.74	3.47
439.0	47.8	15.6	51.8	0.76	0.47
438.5	47.7	18.0	51.7	0.70	3.94
438.0	44.0	17.5	48.0	0.63	4.85
437.5	37.0	14.3	41.0	0.56	3.20
437.0	33.2	17.1	37.2	0.42	8.69
436.5	25.9	13.6	29.9	0.34	6.86
436.0	15.6	10.6	19.6	0.19	6.80
435.5	21.9	15.7	25.9	0.21	11.46
435.0	40.6	25.1	44.6	0.40	17.02
434.5	46.8	27.3	50.8	0.49	17.53
434.0	42.6	20.1	46.6	0.55	9.05
433.5	36.9	15.8	40.9	0.52	5.31
433.0	36.1	15.9	40.1	0.51	5.74
432.5	40.2	20.5	44.2	0.49	10.68
432.0	36.1	24.7	40.1	0.32	18.30
431.5	36.2	33.4	40.2	0.14	30.56
431.0	43.9	40.9	47.9	0.15	38.03
430.5	47.5	34.9	51.5	0.34	28.06
430.0	43.9	25.4	47.9	0.47	16.10
429.5	42.3	19.3	46.3	0.56	8.06
429.0	41.7	18.4	45.7	0.57	6.95
428.5	39.2	18.5	43.2	0.51	8.18
428.0	40.8	22.0	44.8	0.47	12.50
427.5	45.6	26.9	49.6	0.47	17.39
427.0	49.1	23.8	53.1	0.61	11.59
426.5	51.7	23.4	55.7	0.67	9.95
426.0	47.6	20.7	51.6	0.64	7.78
425.5	44.4	13.9	48.4	0.72	-0.40
425.0	44.5	13.1	48.5	0.74	-1.70
424.5	42.5	12.8	46.5	0.70	-1.30
424.0	39.1	10.1	43.1	0.69	-3.65
423.5	35.4	9.5	39.4	0.62	-3.03
423.0	34.8	9.4	38.8	0.61	-2.80
422.5	38.0	10.2	42.0	0.66	-3.03
422.0	40.8	14.9	44.8	0.62	2.39
421.5	42.3	15.4	46.3	0.64	2.58
421.0	40.8	15.6	44.8	0.61	3.35
420.5	37.1	15.7	41.1	0.53	5.13

420.0	36.5	16.3	40.5	0.50	6.17
419.5	40.4	19.6	44.4	0.52	9.26
419.0	36.9	20.8	40.9	0.42	12.50
418.5	42.7	20.5	46.7	0.54	9.64
418.0	47.0	21.0	51.0	0.63	8.46
417.5	43.5	16.3	47.5	0.65	3.32
417.0	38.8	15.6	42.8	0.57	4.32
416.5	42.0	16.9	46.0	0.61	4.72
416.0	47.7	23.8	51.7	0.58	12.16
415.5	49.3	25.5	53.3	0.58	13.84
415.0	49.3	26.3	53.3	0.56	15.00
414.5	54.7	25.8	58.7	0.69	12.05
414.0	55.9	25.5	59.9	0.72	11.13
413.5	49.0	27.7	53.0	0.53	17.19
413.0	42.6	22.0	46.6	0.51	11.72
412.5	37.0	18.8	41.0	0.46	9.50
412.0	32.8	18.5	36.8	0.38	10.93
411.5	29.9	18.9	33.9	0.31	12.60
411.0	29.2	21.6	33.2	0.24	16.74
410.5	28.8	25.9	32.8	0.14	22.98
410.0	29.0	26.5	33.0	0.14	23.73
409.5	29.2	26.4	33.2	0.14	23.57
409.0	28.9	24.5	32.9	0.18	20.93
408.5	28.5	21.8	32.5	0.22	17.30
408.0	29.9	19.1	33.9	0.31	12.97
407.5	30.0	16.6	34.0	0.36	9.28
407.0	29.5	16.5	33.5	0.35	9.49
406.5	29.0	17.1	33.0	0.33	10.46
406.0	28.1	14.8	32.1	0.36	7.58
405.5	26.3	15.7	30.3	0.30	9.63
405.0	24.8	16.7	28.8	0.25	11.71
404.5	24.9	14.6	28.9	0.30	8.59
404.0	27.3	14.8	31.3	0.34	7.96
403.5	34.6	16.8	38.6	0.45	7.73
403.0	43.2	20.0	47.2	0.57	8.70
402.5	49.3	19.7	53.3	0.70	5.75
402.0	53.0	19.5	57.0	0.78	3.92
401.5	53.7	19.7	57.7	0.79	3.82
401.0	50.8	21.1	54.8	0.70	7.04
400.5	47.2	18.7	51.2	0.68	5.14
400.0	45.2	9.8	49.2	0.82	-6.57
399.5	36.0	7.7	40.0	0.67	-5.83
399.0	24.0	7.9	28.0	0.42	-0.42
398.5	24.2	9.5	28.2	0.39	1.66
398.0	34.2	13.3	38.2	0.52	2.95
397.5	35.3	20.1	39.3	0.40	12.02
397.0	30.1	21.1	34.1	0.27	15.70
396.5	32.0	14.3	36.0	0.45	5.21
396.0	33.7	14.6	37.7	0.48	4.92
395.5	35.0	15.6	39.0	0.49	5.89
395.0	41.3	14.3	45.3	0.64	1.45
394.5	47.3	9.9	51.3	0.86	-7.37
394.0	50.7	-3.2	54.7	1.21	-27.30
393.5	42.4	-21.1	46.4	1.41	-49.19
393.0	32.7	-24.3	36.7	1.27	-49.63
392.5	34.2	-6.8	38.2	0.94	-25.56
392.0	40.0	10.5	44.0	0.70	-3.41
391.5	35.0	16.5	39.0	0.47	7.10
391.0	30.8	18.6	34.8	0.34	11.87
390.5	31.0	22.2	35.0	0.26	16.94
390.0	30.4	20.6	34.4	0.29	14.82
389.5	31.8	17.6	35.8	0.38	10.04
389.0	37.3	22.3	41.3	0.40	14.41
388.5	43.4	29.8	47.4	0.37	22.46
388.0	52.0	30.4	56.0	0.53	19.66
387.5	53.6	30.8	57.6	0.56	19.61
387.0	52.4	29.8	56.4	0.55	18.74
386.5	60.4	39.2	64.4	0.53	28.65
386.0	81.2	61.7	85.2	0.49	51.86
385.5	90.9	77.5	94.9	0.36	70.21
385.0	92.2	79.9	96.2	0.34	73.15
384.5	92.2	77.2	96.2	0.40	69.31
384.0	84.9	65.0	88.9	0.50	55.11
383.5	74.2	54.1	78.2	0.50	44.02

383.0	78.7	57.1	82.7	0.53	46.39
382.5	83.9	62.6	87.9	0.53	52.01
382.0	84.1	63.1	88.1	0.52	52.66
381.5	89.2	70.1	93.2	0.48	60.47
381.0	85.7	68.9	89.7	0.43	60.30
380.5	60.5	48.6	64.5	0.33	42.01
380.0	43.0	27.4	47.0	0.41	19.20
379.5	46.2	22.4	50.2	0.58	10.82
379.0	55.4	28.3	59.4	0.65	15.35
378.5	53.9	28.6	57.9	0.61	16.34
378.0	35.6	24.4	39.6	0.32	18.13
377.5	13.4	25.5	17.4	-0.17	28.89
377.0	26.7	32.9	30.7	-0.04	33.75
376.5	43.0	37.9	47.0	0.19	34.06
376.0	54.7	38.1	58.7	0.43	29.49
375.5	49.6	32.6	53.6	0.44	23.79
375.0	36.2	24.4	40.2	0.33	17.84
374.5	14.3	23.9	18.3	-0.12	26.22
374.0	20.8	31.3	24.8	-0.13	33.96
373.5	49.9	43.1	53.9	0.23	38.54
373.0	57.4	40.2	61.4	0.44	31.30
372.5	47.5	40.5	51.5	0.23	35.92
372.0	41.0	41.9	45.0	0.06	40.64
371.5	46.4	52.1	50.4	-0.04	52.81
371.0	56.6	57.4	60.6	0.07	56.04
370.5	60.1	48.3	64.1	0.33	41.75
370.0	57.8	37.0	61.8	0.52	26.58
369.5	54.0	28.7	58.0	0.61	16.42
369.0	60.8	30.1	64.8	0.72	15.64
368.5	64.1	38.7	68.1	0.61	26.41
368.0	62.5	39.8	66.5	0.56	28.69
367.5	60.2	36.1	64.2	0.59	24.37
367.0	58.7	35.0	62.7	0.58	23.44
366.5	57.9	30.4	61.9	0.66	17.29
366.0	46.9	31.1	50.9	0.41	22.89
365.5	46.2	30.2	50.2	0.42	21.81
365.0	47.8	31.1	51.8	0.43	22.45
364.5	50.9	29.2	54.9	0.53	18.51
364.0	50.5	24.8	54.5	0.62	12.38
363.5	46.5	26.9	50.5	0.49	17.02
363.0	44.1	29.6	48.1	0.38	21.92
362.5	38.5	31.3	42.5	0.23	26.70
362.0	37.7	37.1	41.7	0.10	35.18
361.5	45.9	37.7	49.9	0.25	32.57
361.0	52.4	29.5	56.4	0.56	18.26
360.5	52.3	23.7	56.3	0.68	10.17
360.0	46.1	22.7	50.1	0.57	11.31
359.5	42.4	22.2	46.4	0.51	12.06
359.0	42.9	22.6	46.9	0.50	12.55
358.5	39.6	19.5	43.6	0.50	9.43
358.0	39.1	19.9	43.1	0.48	10.25
357.5	43.0	19.4	47.0	0.58	7.89
357.0	45.5	17.4	49.5	0.67	4.08
356.5	40.2	15.6	44.2	0.59	3.76
356.0	37.2	16.7	41.2	0.51	6.44
355.5	34.6	16.5	38.6	0.46	7.32
355.0	33.0	14.6	37.0	0.47	5.22
354.5	31.5	13.4	35.5	0.46	4.22
354.0	28.1	13.9	32.1	0.38	6.37
353.5	28.4	16.5	32.4	0.33	9.86
353.0	31.6	15.4	35.6	0.42	7.01
352.5	30.8	12.8	34.8	0.46	3.66
352.0	32.4	9.7	36.4	0.56	-1.43
351.5	32.3	11.9	36.3	0.51	1.79
351.0	30.0	15.6	34.0	0.38	7.95
350.5	31.8	14.8	35.8	0.44	6.06
350.0	36.1	15.5	40.1	0.51	5.21
349.5	39.3	17.1	43.3	0.55	6.13
349.0	38.7	16.6	42.7	0.54	5.79
348.5	38.3	15.0	42.3	0.57	3.62
348.0	38.4	13.5	42.4	0.60	1.53
347.5	34.6	16.2	38.6	0.47	6.91
347.0	36.5	21.6	40.5	0.40	13.64
346.5	42.9	24.5	46.9	0.47	15.14

346.0	42.1	23.8	46.1	0.46	14.51
345.5	33.5	22.0	37.5	0.32	15.55
345.0	28.5	21.0	32.5	0.24	16.15
344.5	35.7	18.6	39.7	0.44	9.87
344.0	45.3	21.0	49.3	0.59	9.20
343.5	54.9	28.6	58.9	0.63	15.95
343.0	58.8	37.5	62.8	0.53	27.04
342.5	52.1	37.1	56.1	0.40	29.17
342.0	48.4	41.4	52.4	0.23	36.87
341.5	59.9	46.3	63.9	0.37	38.98
341.0	49.9	36.0	53.9	0.37	28.49
340.5	38.4	38.9	42.4	0.07	37.37
340.0	46.8	47.6	50.8	0.07	46.28
339.5	51.3	45.8	55.3	0.20	41.90
339.0	60.9	42.0	64.9	0.48	32.43
338.5	58.5	33.4	62.5	0.60	21.35
338.0	52.6	20.3	56.6	0.76	5.19
337.5	46.7	15.5	50.7	0.73	0.76
337.0	37.9	16.8	41.9	0.52	6.31
336.5	31.2	16.8	35.2	0.38	9.16
336.0	29.3	18.0	33.3	0.32	11.55
335.5	28.5	17.7	32.5	0.31	11.54
335.0	27.7	16.1	31.7	0.32	9.66
334.5	29.1	14.5	33.1	0.39	6.80
334.0	32.6	16.7	36.6	0.41	8.37
333.5	40.9	19.7	44.9	0.52	9.26
333.0	45.7	21.9	49.7	0.58	10.25
332.5	47.0	25.6	51.0	0.53	14.96
332.0	58.0	37.4	62.0	0.51	27.19
331.5	67.6	46.8	71.6	0.52	36.50
331.0	72.6	49.4	76.6	0.57	38.11
330.5	67.7	44.2	71.7	0.57	32.73
330.0	56.6	35.7	60.6	0.52	25.37
329.5	47.3	28.8	51.3	0.47	19.35
329.0	42.1	25.9	46.1	0.42	17.53
328.5	48.2	28.6	52.2	0.49	18.80
328.0	42.5	31.5	46.5	0.31	25.28
327.5	37.3	31.3	41.3	0.21	27.10
327.0	36.2	27.5	40.2	0.26	22.23
326.5	35.2	21.5	39.2	0.37	14.12
326.0	36.9	20.8	40.9	0.42	12.49
325.5	39.3	22.9	43.3	0.43	14.37
325.0	42.8	18.6	46.8	0.59	6.92
324.5	38.4	21.2	42.4	0.44	12.43
324.0	31.9	21.8	35.9	0.30	15.84
323.5	34.8	19.2	38.8	0.41	10.97
323.0	34.7	17.3	38.7	0.45	8.33
322.5	31.9	18.3	35.9	0.37	10.98
322.0	31.6	17.7	35.6	0.37	10.23
321.5	31.6	15.3	35.6	0.42	6.78
321.0	32.4	15.2	36.4	0.44	6.35
320.5	32.3	17.6	36.3	0.39	9.82
320.0	31.0	19.7	35.0	0.32	13.32
319.5	28.8	23.2	32.8	0.20	19.19
319.0	33.2	25.6	37.2	0.24	20.70
318.5	34.5	24.0	38.5	0.30	17.97
318.0	31.7	18.8	35.7	0.35	11.74
317.5	31.9	17.4	35.9	0.39	9.69
317.0	29.7	17.7	33.7	0.33	11.09
316.5	28.0	23.1	32.0	0.19	19.33
316.0	27.6	27.3	31.6	0.09	25.53
315.5	33.0	29.6	37.0	0.16	26.46
315.0	42.9	32.3	46.9	0.30	26.20
314.5	30.2	28.5	34.2	0.12	26.10
314.0	38.6	31.0	42.6	0.24	26.15
313.5	57.4	39.1	61.4	0.47	29.77
313.0	55.6	35.5	59.6	0.50	25.49
312.5	52.8	32.6	56.8	0.50	22.49
312.0	66.1	40.3	70.1	0.62	27.89
311.5	70.1	42.9	74.1	0.65	29.96
311.0	49.6	31.9	53.6	0.45	22.83
310.5	38.1	22.4	42.1	0.41	14.20
310.0	34.0	24.4	38.0	0.28	18.69
309.5	34.4	26.2	38.4	0.25	21.08

309.0	34.8	22.5	38.8	0.34	15.64
308.5	33.7	21.3	37.7	0.34	14.53
308.0	35.9	19.2	39.9	0.43	10.55
307.5	36.3	19.1	40.3	0.44	10.31
307.0	36.4	18.1	40.4	0.46	8.84
306.5	37.4	13.6	41.4	0.58	1.97
306.0	38.3	18.6	42.3	0.49	8.76
305.5	40.0	24.1	44.0	0.42	15.77
305.0	42.7	23.3	46.7	0.49	13.50
304.5	38.1	19.3	42.1	0.48	9.73
304.0	30.1	11.9	34.1	0.46	2.69
303.5	25.4	6.0	29.4	0.49	-3.83
303.0	24.8	9.5	28.8	0.40	1.50
302.5	27.5	16.2	31.5	0.32	9.84
302.0	31.2	20.8	35.2	0.30	14.88
301.5	36.2	21.6	40.2	0.39	13.85
301.0	32.5	18.7	36.5	0.37	11.24
300.5	26.7	23.3	30.7	0.15	20.24
300.0	29.7	28.9	33.7	0.10	26.86
299.5	39.3	33.9	43.3	0.20	30.00
299.0	45.6	32.4	49.6	0.36	25.17
298.5	39.7	23.4	43.7	0.42	14.89
298.0	40.2	21.1	44.2	0.48	11.49
297.5	48.5	21.6	52.5	0.64	8.72
297.0	51.1	26.2	55.1	0.60	14.13
296.5	52.3	24.3	56.3	0.67	10.91
296.0	45.0	25.4	49.0	0.49	15.55
295.5	32.3	22.0	36.3	0.30	15.98
295.0	27.2	19.3	31.2	0.25	14.40
294.5	26.9	17.8	30.9	0.27	12.40
294.0	27.8	16.0	31.8	0.33	9.43
293.5	28.4	14.7	32.4	0.37	7.26
293.0	28.5	15.1	32.5	0.36	7.86
292.5	28.7	17.8	32.7	0.31	11.52
292.0	28.2	17.7	32.2	0.30	11.66
291.5	26.6	16.4	30.6	0.30	10.44
291.0	25.4	13.8	29.4	0.32	7.34
290.5	21.5	17.8	25.5	0.16	14.67
290.0	30.3	25.7	34.3	0.18	22.08
289.5	43.3	31.5	47.3	0.33	24.96
289.0	47.2	28.1	51.2	0.48	18.53
288.5	47.8	23.6	51.8	0.59	11.80
288.0	50.4	22.7	54.4	0.66	9.51
287.5	53.5	23.4	57.5	0.71	9.20
287.0	53.2	23.6	57.2	0.70	9.62
286.5	49.6	19.9	53.6	0.70	5.81
286.0	42.8	18.8	46.8	0.58	7.11
285.5	36.5	19.8	40.5	0.43	11.25
285.0	32.1	21.8	36.1	0.30	15.90
284.5	30.6	23.1	34.6	0.24	18.25
284.0	28.5	23.4	32.5	0.19	19.60
283.5	29.3	24.3	33.3	0.19	20.50
283.0	30.9	23.0	34.9	0.25	18.00
282.5	31.0	22.0	35.0	0.27	16.55
282.0	33.8	19.0	37.8	0.39	11.19
281.5	34.7	18.8	38.7	0.41	10.47
281.0	30.9	20.5	34.9	0.30	14.47
280.5	28.7	23.0	32.7	0.20	18.90
280.0	25.4	25.3	29.4	0.09	23.63
279.5	24.2	25.6	28.2	0.05	24.52
279.0	38.8	33.9	42.8	0.18	30.18
278.5	65.0	51.3	69.0	0.37	43.89
278.0	74.0	51.9	78.0	0.54	41.04
277.5	68.4	40.8	72.4	0.66	27.71
277.0	65.2	29.9	69.2	0.82	13.52
276.5	55.6	23.9	59.6	0.74	9.08
276.0	50.4	22.7	54.4	0.66	9.53
275.5	50.4	26.4	54.4	0.58	14.70
275.0	47.9	27.2	51.9	0.51	16.97
274.5	46.7	27.7	50.7	0.48	18.15
274.0	46.1	25.1	50.1	0.52	14.76
273.5	36.7	23.7	40.7	0.35	16.68
273.0	40.9	20.7	44.9	0.50	10.64
272.5	49.0	19.9	53.0	0.69	6.04

272.0	53.4	21.8	57.4	0.74	6.91
271.5	54.5	21.9	58.5	0.76	6.68
271.0	49.0	22.4	53.0	0.64	9.67
270.5	46.8	22.2	50.8	0.60	10.28
270.0	40.9	19.0	44.9	0.54	8.15
269.5	32.5	17.2	36.5	0.40	9.14
269.0	31.0	17.0	35.0	0.37	9.54
268.5	32.8	14.1	36.8	0.47	4.65
268.0	31.5	15.8	35.5	0.41	7.63
267.5	30.5	14.4	34.5	0.42	6.07
267.0	28.4	10.0	32.4	0.47	0.63
266.5	24.9	12.7	28.9	0.34	5.91
266.0	24.9	16.0	28.9	0.27	10.62
265.5	27.5	18.2	31.5	0.28	12.69
265.0	28.6	17.7	32.6	0.31	11.54
264.5	28.8	19.9	32.8	0.27	14.46
264.0	28.6	18.5	32.6	0.29	12.64
263.5	27.3	19.2	31.3	0.25	14.14
263.0	26.2	18.9	30.2	0.23	14.22
262.5	27.7	19.1	31.7	0.26	13.82
262.0	25.4	17.5	29.4	0.25	12.58
261.5	27.3	13.5	31.3	0.37	6.05
261.0	26.9	15.7	30.9	0.32	9.33
260.5	34.5	29.1	38.5	0.20	25.24
260.0	40.0	30.6	44.0	0.28	25.05
259.5	42.8	23.3	46.8	0.49	13.52
259.0	52.4	31.6	56.4	0.52	21.21
258.5	52.2	37.2	56.2	0.40	29.31
258.0	49.3	29.6	53.3	0.49	19.74
257.5	46.5	23.4	50.5	0.56	12.12
257.0	41.8	20.8	45.8	0.52	10.41
256.5	37.4	17.6	41.4	0.50	7.66
256.0	35.5	15.6	39.5	0.50	5.71
255.5	37.7	16.6	41.7	0.52	6.20
255.0	40.6	17.0	44.6	0.58	5.48
254.5	39.1	18.4	43.1	0.51	8.11
254.0	40.9	21.9	44.9	0.48	12.26
253.5	49.0	24.4	53.0	0.60	12.42
253.0	44.6	22.8	48.6	0.54	12.08
252.5	35.8	20.6	39.8	0.40	12.55
252.0	32.3	18.0	36.3	0.38	10.40
251.5	30.4	17.8	34.4	0.35	10.90
251.0	33.5	19.2	37.5	0.38	11.58
250.5	41.5	21.5	45.5	0.50	11.52
250.0	47.0	23.8	51.0	0.57	12.49
249.5	49.9	22.9	53.9	0.65	10.01
249.0	51.5	21.7	55.5	0.70	7.56
248.5	51.4	23.4	55.4	0.67	9.99
248.0	48.1	23.8	52.1	0.59	12.07
247.5	44.6	18.3	48.6	0.63	5.68
247.0	42.1	20.1	46.1	0.54	9.32
246.5	44.8	22.0	48.8	0.56	10.82
246.0	47.2	24.2	51.2	0.56	12.90
245.5	47.6	22.9	51.6	0.60	10.87
245.0	50.4	23.9	54.4	0.63	11.18
244.5	53.0	27.2	57.0	0.62	14.75
244.0	53.9	31.0	57.9	0.56	19.76
243.5	56.9	34.6	60.9	0.55	23.64
243.0	63.0	39.6	67.0	0.57	28.24
242.5	67.8	39.7	71.8	0.67	26.37
242.0	57.3	32.4	61.3	0.60	20.33
241.5	50.8	25.4	54.8	0.61	13.19
241.0	50.7	20.4	54.7	0.71	6.14
240.5	50.9	20.5	54.9	0.72	6.22
240.0	50.7	20.3	54.7	0.72	5.91
239.5	48.8	16.3	52.8	0.76	1.15
239.0	47.1	16.5	51.1	0.72	2.06
238.5	42.3	19.0	46.3	0.57	7.62
238.0	38.5	21.8	42.5	0.43	13.19
237.5	45.8	23.0	49.8	0.56	11.84
237.0	54.3	28.4	58.3	0.62	15.89
236.5	55.4	26.6	59.4	0.68	12.86
236.0	58.3	26.1	62.3	0.75	10.98
235.5	57.1	28.8	61.1	0.67	15.37

235.0	56.1	25.7	60.1	0.72	11.40
234.5	56.7	23.4	60.7	0.78	7.82
234.0	55.1	20.7	59.1	0.80	4.70
233.5	50.0	19.3	54.0	0.72	4.81
233.0	49.4	20.8	53.4	0.68	7.28
232.5	53.8	13.1	57.8	0.93	-5.51
232.0	50.9	4.1	54.9	1.06	-17.06
231.5	42.2	-1.7	46.2	1.00	-21.62
231.0	38.3	6.5	42.3	0.75	-8.39
230.5	33.4	13.9	37.4	0.49	4.09
230.0	29.7	21.3	33.7	0.26	16.16
229.5	29.2	23.9	33.2	0.19	20.04
229.0	30.3	23.7	34.3	0.22	19.31
228.5	27.7	22.6	31.7	0.19	18.77
228.0	29.2	20.8	33.2	0.26	15.65
227.5	34.0	18.5	38.0	0.41	10.32
227.0	34.4	15.6	38.4	0.47	6.13
226.5	34.1	16.2	38.1	0.46	7.05
226.0	33.3	19.0	37.3	0.38	11.41
225.5	31.4	21.6	35.4	0.29	15.80
225.0	33.9	21.6	37.9	0.34	14.75
224.5	36.7	19.7	40.7	0.44	10.97
224.0	36.3	18.7	40.3	0.45	9.71
223.5	34.3	16.7	38.3	0.45	7.71
223.0	33.3	18.3	37.3	0.40	10.41
222.5	34.3	15.3	38.3	0.48	5.73
222.0	34.8	14.0	38.8	0.52	3.60
221.5	33.9	17.4	37.9	0.43	8.93
221.0	27.5	21.2	31.5	0.21	16.92
220.5	39.4	34.4	43.4	0.19	30.62
220.0	67.1	53.8	71.1	0.36	46.57
219.5	73.2	51.1	77.2	0.54	40.24
219.0	64.0	39.9	68.0	0.58	28.22
218.5	53.6	32.1	57.6	0.53	21.46
218.0	43.3	22.2	47.3	0.52	11.72
217.5	39.0	17.3	43.0	0.53	6.60
217.0	39.6	16.9	43.6	0.56	5.76
216.5	36.5	16.5	40.5	0.50	6.51
216.0	32.7	16.6	36.7	0.42	8.21
215.5	30.6	19.4	34.6	0.32	13.13
215.0	29.0	18.4	33.0	0.31	12.27
214.5	27.4	18.7	31.4	0.27	13.38
214.0	27.1	16.4	31.1	0.31	10.23
213.5	27.3	18.7	31.3	0.26	13.36
213.0	27.9	19.4	31.9	0.26	14.12
212.5	27.3	17.2	31.3	0.29	11.34
212.0	27.9	15.3	31.9	0.34	8.43
211.5	28.6	15.9	32.6	0.35	8.91
211.0	28.9	18.0	32.9	0.31	11.73
210.5	25.4	17.3	29.4	0.25	12.29
210.0	30.5	19.0	34.5	0.32	12.50
209.5	35.8	23.8	39.8	0.33	17.20
209.0	36.5	24.6	40.5	0.33	17.93
208.5	41.2	20.9	45.2	0.51	10.70
208.0	46.3	20.2	50.3	0.63	7.61
207.5	40.7	21.7	44.7	0.48	12.14
207.0	37.4	19.2	41.4	0.46	9.95
206.5	36.5	17.9	40.5	0.47	8.42
206.0	35.3	16.3	39.3	0.48	6.76
205.5	32.8	16.9	36.8	0.41	8.66
205.0	32.0	16.7	36.0	0.40	8.71
204.5	32.5	15.7	36.5	0.43	6.97
204.0	32.0	15.9	36.0	0.42	7.44
203.5	32.1	16.5	36.1	0.41	8.28
203.0	33.2	16.8	37.2	0.43	8.30
202.5	34.7	15.2	38.7	0.49	5.39
202.0	36.5	16.9	40.5	0.49	7.09
201.5	35.6	18.4	39.6	0.44	9.64
201.0	34.1	16.2	38.1	0.46	7.01
200.5	33.4	16.1	37.4	0.44	7.22
200.0	33.2	16.4	37.2	0.43	7.74
199.5	32.9	18.0	36.9	0.39	10.09
199.0	31.0	20.6	35.0	0.30	14.51
198.5	26.7	22.1	30.7	0.18	18.59

198.0	31.7	19.8	35.7	0.33	13.25
197.5	40.3	21.7	44.3	0.47	12.22
197.0	38.5	24.0	42.5	0.38	16.35
196.5	31.2	22.9	35.2	0.26	17.73
196.0	28.1	18.0	32.1	0.29	12.20
195.5	27.2	16.0	31.2	0.32	9.72
195.0	27.4	16.9	31.4	0.30	10.92
194.5	29.3	18.0	33.3	0.32	11.55
194.0	29.9	17.8	33.9	0.34	11.02
193.5	29.9	16.5	33.9	0.36	9.23
193.0	29.2	16.3	33.2	0.35	9.26
192.5	29.2	20.2	33.2	0.27	14.78
192.0	28.0	23.8	32.0	0.17	20.35
191.5	28.8	23.8	32.8	0.19	20.04
191.0	30.6	22.2	34.6	0.26	17.05
190.5	32.4	19.8	36.4	0.35	12.85
190.0	32.4	21.4	36.4	0.31	15.15
189.5	30.4	20.7	34.4	0.29	14.95
189.0	28.9	19.1	32.9	0.29	13.35
188.5	29.8	18.5	33.8	0.32	12.13
188.0	30.8	18.6	34.8	0.34	11.86
187.5	30.6	18.3	34.6	0.34	11.42
187.0	28.8	14.7	32.8	0.38	7.18
186.5	28.0	15.2	32.0	0.35	8.26
186.0	28.7	16.7	32.7	0.33	10.07
185.5	30.5	18.9	34.5	0.32	12.45
185.0	30.9	18.0	34.9	0.35	11.01
184.5	31.4	17.7	35.4	0.37	10.26
184.0	32.5	14.0	36.5	0.47	4.63
183.5	32.1	16.0	36.1	0.42	7.59
183.0	31.9	20.5	35.9	0.32	14.02
182.5	32.2	20.2	36.2	0.33	13.50
182.0	34.0	19.2	38.0	0.39	11.42
181.5	34.7	15.3	38.7	0.49	5.57
181.0	32.1	14.8	36.1	0.44	5.87
180.5	32.6	15.6	36.6	0.44	6.83
180.0	35.2	18.0	39.2	0.44	9.24
179.5	36.5	15.4	40.5	0.52	5.00
179.0	37.9	16.5	41.9	0.53	5.92
178.5	35.0	15.1	39.0	0.50	5.10
178.0	33.8	15.9	37.8	0.46	6.70
177.5	32.7	15.8	36.7	0.44	7.06
177.0	31.4	14.7	35.4	0.43	6.14
176.5	32.1	15.7	36.1	0.43	7.14
176.0	32.8	18.3	36.8	0.39	10.55
175.5	33.1	20.6	37.1	0.34	13.77
175.0	32.9	21.9	36.9	0.31	15.68
174.5	33.5	20.8	37.5	0.35	13.79
174.0	33.2	17.5	37.2	0.41	9.26
173.5	34.0	14.4	38.0	0.49	4.57
173.0	36.9	19.1	40.9	0.46	9.95
172.5	41.7	20.1	45.7	0.53	9.44
172.0	44.8	17.4	48.8	0.65	4.39
171.5	43.9	17.5	47.9	0.63	4.87
171.0	40.7	17.0	44.7	0.58	5.52
170.5	39.1	15.8	43.1	0.57	4.40
170.0	42.6	15.7	46.6	0.64	2.82
169.5	41.8	16.6	45.8	0.61	4.44
169.0	40.1	15.7	44.1	0.59	3.80
168.5	41.9	17.6	45.9	0.59	5.88
168.0	42.0	17.5	46.0	0.59	5.64
167.5	43.4	16.2	47.4	0.65	3.28
167.0	43.7	15.3	47.7	0.68	1.80
166.5	43.4	17.5	47.4	0.62	5.07
166.0	46.1	16.8	50.1	0.69	2.94
165.5	48.2	17.5	52.2	0.72	3.05
165.0	46.3	16.7	50.3	0.70	2.71
164.5	39.4	15.0	43.4	0.59	3.20
164.0	37.4	15.9	41.4	0.53	5.34
163.5	36.5	17.0	40.5	0.49	7.24
163.0	37.7	17.7	41.7	0.50	7.63
162.5	37.8	17.3	41.8	0.51	7.15
162.0	35.7	15.4	39.7	0.51	5.26
161.5	36.5	16.7	40.5	0.50	6.75

161.0	37.5	16.9	41.5	0.51	6.71
160.5	37.0	17.3	41.0	0.50	7.35
160.0	38.8	17.2	42.8	0.53	6.56
159.5	41.7	19.3	45.7	0.55	8.21
159.0	47.2	20.3	51.2	0.64	7.39
158.5	48.9	24.1	52.9	0.60	12.09
158.0	51.0	24.5	55.0	0.64	11.76
157.5	61.7	32.4	65.7	0.69	18.53
157.0	75.0	45.5	79.0	0.70	31.56
156.5	66.2	41.3	70.2	0.60	29.30
156.0	49.8	27.2	53.8	0.55	16.14
155.5	41.8	19.2	45.8	0.55	8.19
155.0	41.9	19.6	45.9	0.55	8.68
154.5	48.4	20.7	52.4	0.66	7.53
154.0	54.1	19.8	58.1	0.80	3.77
153.5	58.6	20.3	62.6	0.88	2.63
153.0	58.8	22.0	62.8	0.85	4.97
152.5	56.3	17.5	60.3	0.89	-0.28
152.0	53.5	14.2	57.5	0.90	-3.89
151.5	48.2	10.9	52.2	0.86	-6.28
151.0	42.5	14.7	46.5	0.66	1.51
150.5	37.2	16.9	41.2	0.51	6.75
150.0	34.1	16.9	38.1	0.44	8.04
149.5	34.8	12.8	38.8	0.54	1.92
149.0	38.0	13.7	42.0	0.59	1.93
148.5	41.5	15.5	45.5	0.62	3.05
148.0	44.6	17.0	48.6	0.66	3.84
147.5	44.6	17.7	48.6	0.64	4.82
147.0	46.3	20.4	50.3	0.62	7.94
146.5	41.1	19.4	45.1	0.54	8.66
146.0	32.7	15.5	36.7	0.44	6.59
145.5	29.1	15.4	33.1	0.37	8.01
145.0	34.4	18.0	38.4	0.43	9.47
144.5	42.7	18.5	46.7	0.59	6.68
144.0	43.3	17.7	47.3	0.62	5.37
143.5	37.6	15.8	41.6	0.54	5.04
143.0	34.4	15.0	38.4	0.49	5.31
142.5	34.5	15.8	38.5	0.47	6.29
142.0	38.1	17.9	42.1	0.50	7.83
141.5	42.9	19.4	46.9	0.57	7.93
141.0	44.5	20.4	48.5	0.59	8.74
140.5	43.5	19.6	47.5	0.58	7.98
140.0	43.8	20.6	47.8	0.57	9.23
139.5	44.5	18.9	48.5	0.62	6.55
139.0	47.1	19.4	51.1	0.66	6.23
138.5	54.6	26.1	58.6	0.68	12.58
138.0	56.8	27.0	60.8	0.70	12.99
137.5	53.9	19.5	57.9	0.80	3.56
137.0	49.9	18.4	53.9	0.74	3.59
136.5	45.6	16.6	49.6	0.69	2.80
136.0	44.9	14.6	48.9	0.71	0.34
135.5	45.8	15.6	49.8	0.71	1.33
135.0	45.1	16.9	49.1	0.67	3.52
134.5	49.1	16.1	53.1	0.77	0.68
134.0	51.5	16.4	55.5	0.82	0.04
133.5	49.1	18.0	53.1	0.73	3.36
133.0	50.2	18.4	54.2	0.74	3.53
132.5	50.9	21.9	54.9	0.69	8.19
132.0	46.1	22.0	50.1	0.59	10.21
131.5	44.4	15.9	48.4	0.68	2.30
131.0	48.5	16.8	52.5	0.75	1.86
130.5	52.9	19.1	56.9	0.79	3.41
130.0	57.3	20.9	61.3	0.84	4.06
129.5	58.3	22.7	62.3	0.83	6.17
129.0	59.1	19.2	63.1	0.91	0.93
128.5	54.8	15.7	58.8	0.90	-2.30
128.0	52.3	16.1	56.3	0.84	-0.74
127.5	52.6	18.2	56.6	0.80	2.13
127.0	53.3	18.1	57.3	0.82	1.71
126.5	56.2	17.1	60.2	0.90	-0.80
126.0	54.8	19.4	58.8	0.82	2.93
125.5	49.7	21.7	53.7	0.67	8.31
125.0	44.6	20.8	48.6	0.58	9.23
124.5	41.7	20.3	45.7	0.53	9.72

124.0	40.4	16.9	44.4	0.57	5.40
123.5	47.1	17.7	51.1	0.70	3.72
123.0	47.7	19.4	51.7	0.67	5.90
122.5	45.6	21.3	49.6	0.59	9.51
122.0	49.9	27.9	53.9	0.54	16.99
121.5	55.0	34.2	59.0	0.52	23.87
121.0	56.7	28.1	60.7	0.68	14.54
120.5	54.4	22.8	58.4	0.74	7.88
120.0	53.4	21.8	57.4	0.74	6.97
119.5	47.8	22.1	51.8	0.62	9.74
119.0	41.7	21.7	45.7	0.50	11.69
118.5	45.9	18.5	49.9	0.65	5.45
118.0	46.9	17.4	50.9	0.70	3.40
117.5	38.8	17.7	42.8	0.52	7.20
117.0	33.1	20.9	37.1	0.34	14.11
116.5	31.2	20.3	35.2	0.31	14.14
116.0	31.6	22.0	35.6	0.28	16.32
115.5	29.5	23.4	33.5	0.21	19.16
115.0	30.3	21.7	34.3	0.26	16.45
114.5	29.3	20.2	33.3	0.27	14.71
114.0	28.5	18.5	32.5	0.29	12.64
113.5	30.9	16.8	34.9	0.38	9.23
113.0	32.9	14.4	36.9	0.47	4.99
112.5	31.8	14.8	35.8	0.44	6.05
112.0	37.1	15.3	41.1	0.54	4.59
111.5	48.2	17.7	52.2	0.72	3.31
111.0	55.6	22.2	59.6	0.78	6.63
110.5	58.5	21.7	62.5	0.85	4.66
110.0	59.3	23.6	63.3	0.83	7.08
109.5	58.8	25.1	62.8	0.78	9.43
109.0	46.4	18.3	50.4	0.67	4.98
108.5	27.5	10.9	31.5	0.43	2.37
108.0	16.8	1.4	20.8	0.40	-6.61
107.5	17.8	7.4	21.8	0.30	1.32
107.0	27.8	16.6	31.8	0.32	10.31
106.5	34.7	22.1	38.7	0.35	15.23
106.0	35.2	21.8	39.2	0.36	14.52
105.5	34.0	22.1	38.0	0.33	15.46
105.0	35.9	23.7	39.9	0.34	16.99
104.5	35.6	22.6	39.6	0.35	15.52
104.0	33.1	21.8	37.1	0.32	15.38
103.5	33.3	22.8	37.3	0.30	16.70
103.0	34.8	23.5	38.8	0.32	17.11
102.5	35.9	22.8	39.9	0.36	15.67
102.0	35.6	20.0	39.6	0.41	11.88
101.5	31.9	17.8	35.9	0.38	10.31
101.0	31.1	16.8	35.1	0.38	9.18
100.5	29.6	13.3	33.6	0.42	4.77
100.0	30.3	13.2	34.3	0.44	4.37
99.5	27.8	15.3	31.8	0.34	8.37
99.0	35.1	14.7	39.1	0.51	4.53
98.5	43.6	18.6	47.6	0.60	6.56
98.0	48.1	18.1	52.1	0.71	3.95
97.5	46.5	19.6	50.5	0.65	6.66
97.0	46.0	19.1	50.0	0.64	6.19
96.5	49.1	18.7	53.1	0.72	4.37
96.0	58.3	22.8	62.3	0.82	6.29
95.5	58.9	26.6	62.9	0.76	11.52
95.0	55.3	25.7	59.3	0.70	11.77
94.5	57.1	23.2	61.1	0.79	7.39
94.0	56.1	21.9	60.1	0.80	5.98
93.5	53.6	19.5	57.6	0.79	3.68
93.0	49.5	21.4	53.5	0.67	7.97
92.5	50.7	20.1	54.7	0.72	5.68
92.0	51.0	19.4	55.0	0.74	4.61
91.5	44.9	21.3	48.9	0.57	9.83
91.0	39.7	19.3	43.7	0.51	9.17
90.5	38.8	18.3	42.8	0.51	8.04
90.0	38.2	17.3	42.2	0.52	6.87
89.5	38.9	17.9	42.9	0.52	7.43
89.0	40.2	22.8	44.2	0.44	13.91
88.5	41.4	24.5	45.4	0.44	15.73
88.0	46.3	26.0	50.3	0.51	15.81
87.5	43.8	26.7	47.8	0.44	17.88

87.0	38.7	22.8	42.7	0.41	14.51
86.5	37.2	22.1	41.2	0.40	14.17
86.0	35.6	22.8	39.6	0.35	15.82
85.5	38.6	21.9	42.6	0.43	13.27
85.0	37.2	21.0	41.2	0.42	12.55
84.5	35.4	17.3	39.4	0.46	8.03
84.0	38.3	18.9	42.3	0.49	9.09
83.5	44.3	21.0	48.3	0.57	9.63
83.0	44.8	16.7	48.8	0.67	3.37
82.5	41.8	15.6	45.8	0.63	3.06
82.0	42.8	17.6	46.8	0.61	5.43
81.5	40.9	18.6	44.9	0.55	7.60
81.0	38.9	20.4	42.9	0.47	10.95
80.5	39.3	20.4	43.3	0.48	10.88
80.0	38.8	20.7	42.8	0.46	11.47
79.5	37.7	20.7	41.7	0.44	12.00
79.0	35.7	19.5	39.7	0.42	11.11
78.5	36.3	21.3	40.3	0.39	13.41
78.0	35.9	21.6	39.9	0.38	14.00
77.5	36.8	19.1	40.8	0.45	9.98
77.0	37.2	20.2	41.2	0.44	11.48
76.5	34.7	21.8	38.7	0.35	14.71
76.0	35.7	23.2	39.7	0.34	16.34
75.5	38.0	21.5	42.0	0.43	12.98
75.0	37.8	19.1	41.8	0.47	9.61
74.5	37.7	20.7	41.7	0.44	11.95
74.0	37.6	18.6	41.6	0.48	8.96
73.5	37.9	18.1	41.9	0.50	8.18
73.0	37.4	21.0	41.4	0.43	12.41
72.5	39.1	20.7	43.1	0.47	11.35
72.0	39.4	21.3	43.4	0.46	12.03
71.5	38.0	21.1	42.0	0.44	12.39
71.0	37.4	17.5	41.4	0.50	7.51
70.5	36.4	15.3	40.4	0.52	4.85
70.0	37.6	15.7	41.6	0.54	4.90
69.5	36.5	17.6	40.5	0.48	8.12
69.0	36.8	18.2	40.8	0.47	8.76
68.5	36.4	15.9	40.4	0.51	5.62
68.0	39.0	15.8	43.0	0.57	4.49
67.5	42.5	13.8	46.5	0.68	0.20
67.0	41.8	13.7	45.8	0.67	0.33
66.5	37.0	14.2	41.0	0.56	2.97
66.0	36.8	12.9	40.8	0.58	1.22
65.5	37.8	12.7	41.8	0.60	0.64
65.0	40.1	16.2	44.1	0.58	4.52
64.5	41.4	16.2	45.4	0.61	4.09
64.0	42.2	16.6	46.2	0.62	4.26
63.5	45.4	18.4	49.4	0.65	5.46
63.0	46.0	17.4	50.0	0.68	3.87
62.5	44.5	18.7	48.5	0.62	6.32
62.0	45.7	17.9	49.7	0.66	4.67
61.5	45.8	19.2	49.8	0.64	6.39
61.0	45.0	17.9	49.0	0.65	4.90
60.5	43.6	19.6	47.6	0.58	7.88
60.0	45.9	18.2	49.9	0.66	4.98
59.5	48.2	20.1	52.2	0.67	6.70
59.0	49.5	20.5	53.5	0.69	6.74
58.5	52.3	20.0	56.3	0.76	4.83
58.0	50.2	18.6	54.2	0.74	3.75
57.5	48.7	19.1	52.7	0.70	5.10
57.0	51.3	19.7	55.3	0.74	4.90
56.5	51.6	19.8	55.6	0.75	4.91
56.0	48.4	22.0	52.4	0.63	9.28
55.5	44.5	21.0	48.5	0.57	9.49
55.0	43.7	19.6	47.7	0.58	7.97
54.5	44.2	17.7	48.2	0.64	4.97
54.0	43.8	15.7	47.8	0.67	2.36
53.5	42.8	14.0	46.8	0.68	0.35
53.0	42.5	15.2	46.5	0.65	2.22
52.5	41.7	16.7	45.7	0.60	4.57
52.0	40.0	17.2	44.0	0.56	6.02
51.5	39.1	18.1	43.1	0.52	7.64
51.0	39.9	19.1	43.9	0.52	8.72
50.5	40.6	21.7	44.6	0.48	12.19

50.0	41.0	20.4	45.0	0.51	10.13
49.5	39.7	16.7	43.7	0.56	5.42
49.0	38.8	16.7	42.8	0.54	5.82
48.5	39.7	15.8	43.7	0.58	4.14
48.0	42.1	18.6	46.1	0.57	7.10
47.5	47.4	21.4	51.4	0.62	8.95
47.0	54.7	21.5	58.7	0.78	5.98
46.5	55.5	23.0	59.5	0.76	7.76
46.0	50.2	22.1	54.2	0.67	8.65
45.5	48.1	21.9	52.1	0.63	9.32
45.0	55.0	21.0	59.0	0.79	5.09
44.5	51.6	22.0	55.6	0.70	8.05
44.0	44.8	20.1	48.8	0.60	8.13
43.5	40.3	17.0	44.3	0.57	5.59
43.0	37.0	15.7	41.0	0.53	5.10
42.5	36.0	13.9	40.0	0.54	3.08
42.0	34.7	16.0	38.7	0.47	6.50
41.5	47.7	28.1	51.7	0.49	18.25
41.0	65.5	41.1	69.5	0.59	29.20
40.5	64.5	41.6	68.5	0.56	30.41
40.0	50.4	35.0	54.4	0.40	26.92
39.5	39.9	25.2	43.9	0.39	17.39
39.0	37.5	19.2	41.5	0.46	9.96
38.5	38.7	18.4	42.7	0.51	8.25
38.0	37.2	19.5	41.2	0.45	10.47
37.5	35.6	18.1	39.6	0.45	9.06
37.0	36.0	19.1	40.0	0.44	10.33
36.5	38.2	20.1	42.2	0.46	10.90
36.0	42.5	19.4	46.5	0.57	8.06
35.5	41.3	19.3	45.3	0.54	8.42
35.0	38.8	19.2	42.8	0.49	9.35
34.5	38.9	21.1	42.9	0.45	12.08
34.0	39.3	21.8	43.3	0.45	12.85
33.5	40.4	20.1	44.4	0.51	9.90
33.0	40.6	20.7	44.6	0.50	10.76
32.5	39.2	20.7	43.2	0.47	11.30
32.0	38.1	21.4	42.1	0.43	12.73

* FROM DIGITAL RECORD OF BOREHOLE GEOPHYSICAL LOG
NEUT POR (SS) = NEUT POR (LS) + 4
V CLAY (FRAC.) = (NEUT POR (SS) - G-G POR (SS)) / 48
ADJ POR (SS) = G-G POR (SS) - (V CLAY (FRAC.) * 20)

WELL 38-89BR
INTERVAL: 26-128

RECALCULATED POROSITY AND VOLUME CLAY

DEPTH*	NEUT POR* (LS) %	G-G POR* (SS) %	NEUT POR (SS) %	V CLAY (FRAC.)	ADJ POR (SS) %
128.0	60.4	35.1	64.4	0.61	22.85
127.5	57.0	32.5	61.0	0.59	20.59
127.0	47.7	29.9	51.7	0.46	20.76
126.5	39.6	27.3	43.6	0.34	20.45
126.0	38.5	22.7	42.5	0.41	14.50
125.5	42.4	18.8	46.4	0.57	7.36
125.0	50.7	21.4	54.7	0.69	7.56
124.5	57.4	22.7	61.4	0.80	6.63
124.0	56.3	23.4	60.3	0.77	7.98
123.5	54.5	25.3	58.5	0.69	11.51
123.0	51.6	21.4	55.6	0.71	7.18
122.5	48.5	21.4	52.5	0.65	8.50
122.0	45.8	19.5	49.8	0.63	6.83
121.5	44.5	18.2	48.5	0.63	5.54
121.0	43.8	18.8	47.8	0.60	6.76
120.5	41.3	18.2	45.3	0.57	6.87
120.0	41.0	20.8	45.0	0.50	10.70
119.5	43.7	20.8	47.7	0.56	9.56
119.0	45.4	21.4	49.4	0.58	9.78
118.5	44.4	20.1	48.4	0.59	8.35
118.0	41.4	16.9	45.4	0.59	4.99
117.5	40.8	13.6	44.8	0.65	0.66
117.0	41.4	12.3	45.4	0.69	-1.42
116.5	40.6	16.2	44.6	0.59	4.42
116.0	43.1	20.8	47.1	0.55	9.82
115.5	45.6	21.4	49.6	0.59	9.71
115.0	45.2	16.9	49.2	0.67	3.43
114.5	42.6	26.0	46.6	0.43	17.39
114.0	40.1	17.5	44.1	0.55	6.47
113.5	37.9	16.9	41.9	0.52	6.47
113.0	36.3	16.2	40.3	0.50	6.23
112.5	38.0	14.9	42.0	0.56	3.65
112.0	43.2	13.6	47.2	0.70	-0.34
111.5	47.3	17.5	51.3	0.70	3.44
111.0	46.3	20.1	50.3	0.63	7.56
110.5	45.0	18.8	49.0	0.63	6.28
110.0	43.4	19.5	47.4	0.58	7.83
109.5	40.3	19.5	44.3	0.52	9.14
109.0	36.1	19.5	40.1	0.43	10.90
108.5	33.0	24.0	37.0	0.27	18.64
108.0	31.0	22.7	35.0	0.26	17.60
107.5	29.6	25.3	33.6	0.17	21.88
107.0	29.4	24.7	33.4	0.18	21.05
106.5	30.3	22.7	34.3	0.24	17.92
106.0	32.5	17.5	36.5	0.40	9.62
105.5	38.0	17.5	42.0	0.51	7.34
105.0	45.3	18.2	49.3	0.65	5.20
104.5	51.5	21.4	55.5	0.71	7.23
104.0	53.3	22.7	57.3	0.72	8.33
103.5	51.9	20.8	55.9	0.73	6.14
103.0	49.7	18.8	53.7	0.73	4.31
102.5	48.7	17.5	52.7	0.73	2.86
102.0	48.9	17.5	52.9	0.74	2.79
101.5	48.8	19.5	52.8	0.69	5.61
101.0	48.8	20.1	52.8	0.68	6.52
100.5	48.3	18.2	52.3	0.71	3.95
100.0	48.0	18.8	52.0	0.69	5.00
99.5	50.3	20.1	54.3	0.71	5.89
99.0	51.3	20.8	55.3	0.72	6.38
98.5	50.9	24.7	54.9	0.63	12.10
98.0	50.8	25.3	54.8	0.61	13.06
97.5	48.5	22.1	52.5	0.63	9.40
97.0	43.0	21.4	47.0	0.53	10.77
96.5	37.8	18.8	41.8	0.48	9.28
96.0	35.1	22.7	39.1	0.34	15.90
95.5	34.0	20.8	38.0	0.36	13.59
95.0	35.3	18.8	39.3	0.43	10.31
94.5	38.3	19.5	42.3	0.47	9.99
94.0	43.2	18.2	47.2	0.60	6.09
93.5	49.3	23.4	53.3	0.62	10.93

93.0	53.1	19.5	57.1	0.78	3.79
92.5	53.9	26.6	57.9	0.65	13.61
92.0	55.3	24.0	59.3	0.74	9.32
91.5	57.6	24.7	61.6	0.77	9.31
91.0	55.4	24.7	59.4	0.72	10.20
90.5	51.3	25.3	55.3	0.63	12.83
90.0	48.0	24.0	52.0	0.58	12.38
89.5	48.4	24.7	52.4	0.58	13.11
89.0	49.9	22.1	53.9	0.66	8.83
88.5	48.2	22.7	52.2	0.61	10.45
88.0	48.6	25.3	52.6	0.57	13.97
87.5	51.6	25.3	55.6	0.63	12.70
87.0	51.7	24.7	55.7	0.65	11.76
86.5	50.3	20.1	54.3	0.71	5.91
86.0	50.0	22.1	54.0	0.67	8.77
85.5	49.9	22.7	53.9	0.65	9.75
85.0	48.1	27.3	52.1	0.52	16.92
84.5	45.1	28.6	49.1	0.43	20.01
84.0	42.0	24.0	46.0	0.46	14.89
83.5	40.6	24.7	44.6	0.41	16.40
83.0	41.7	22.1	45.7	0.49	12.22
82.5	42.3	20.8	46.3	0.53	10.16
82.0	42.1	20.8	46.1	0.53	10.21
81.5	43.8	23.4	47.8	0.51	13.22
81.0	45.9	23.4	49.9	0.55	12.34
80.5	48.3	20.8	52.3	0.66	7.66
80.0	49.6	19.5	53.6	0.71	5.24
79.5	47.8	19.5	51.8	0.67	6.00
79.0	46.4	21.4	50.4	0.60	9.35
78.5	46.1	20.1	50.1	0.62	7.63
78.0	46.4	22.7	50.4	0.58	11.19
77.5	45.7	21.4	49.7	0.59	9.64
77.0	45.4	22.1	49.4	0.57	10.69
76.5	44.6	22.7	48.6	0.54	11.94
76.0	45.1	22.1	49.1	0.56	10.81
75.5	47.5	21.4	51.5	0.63	8.89
75.0	47.1	18.8	51.1	0.67	5.37
74.5	43.6	20.8	47.6	0.56	9.60
74.0	41.4	22.1	45.4	0.49	12.36
73.5	41.5	23.4	45.5	0.46	14.17
73.0	40.7	16.2	44.7	0.59	4.38
72.5	42.3	12.3	46.3	0.71	-1.80
72.0	44.5	22.1	48.5	0.55	11.06
71.5	43.9	22.1	47.9	0.54	11.33
71.0	44.5	22.1	48.5	0.55	11.09
70.5	45.3	21.4	49.3	0.58	9.80
70.0	46.8	19.5	50.8	0.65	6.45
69.5	49.1	18.2	53.1	0.73	3.63
69.0	50.1	20.1	54.1	0.71	5.99
68.5	49.8	20.1	53.8	0.70	6.10
68.0	46.2	23.4	50.2	0.56	12.19
67.5	45.0	22.7	49.0	0.55	11.77
67.0	47.0	18.2	51.0	0.68	4.50
66.5	48.4	24.0	52.4	0.59	12.21
66.0	48.7	26.6	52.7	0.54	15.78
65.5	52.5	7.8	56.5	1.01	-12.50
65.0	54.5	27.9	58.5	0.64	15.17
64.5	49.3	30.5	53.3	0.48	21.02
64.0	46.3	26.6	50.3	0.49	16.79
63.5	50.7	26.6	54.7	0.58	14.94
63.0	56.8	25.3	60.8	0.74	10.55
62.5	60.7	26.0	64.7	0.81	9.84
62.0	64.8	29.2	68.8	0.82	12.73
61.5	67.0	36.4	71.0	0.72	21.95
61.0	63.5	34.4	67.5	0.69	20.64
60.5	59.0	27.9	63.0	0.73	13.29
60.0	57.5	31.2	61.5	0.63	18.52
59.5	59.6	32.5	63.6	0.65	19.50
59.0	59.5	25.3	63.5	0.79	9.44
58.5	54.7	30.5	58.7	0.59	18.76
58.0	51.9	30.5	55.9	0.53	19.94
57.5	55.3	26.0	59.3	0.69	12.09
57.0	59.2	30.5	63.2	0.68	16.91
56.5	58.0	31.2	62.0	0.64	18.33

56.0	55.2	36.4	59.2	0.48	26.86
55.5	53.9	30.5	57.9	0.57	19.12
55.0	53.8	28.6	57.8	0.61	16.37
54.5	55.0	27.9	59.0	0.65	14.95
54.0	56.8	28.6	60.8	0.67	15.12
53.5	58.0	31.8	62.0	0.63	19.24
53.0	55.9	34.4	59.9	0.53	23.82
52.5	53.9	29.9	57.9	0.58	18.21
52.0	53.3	27.9	57.3	0.61	15.68
51.5	55.7	26.6	59.7	0.69	12.86
51.0	57.7	27.9	61.7	0.70	13.85
50.5	61.5	34.4	65.5	0.65	21.46
50.0	64.6	37.0	68.6	0.66	23.87
49.5	64.8	37.7	68.8	0.65	24.70
49.0	61.8	33.8	65.8	0.67	20.41
48.5	60.1	29.2	64.1	0.73	14.70
48.0	59.1	26.6	63.1	0.76	11.42
47.5	55.5	26.6	59.5	0.68	12.95
47.0	52.1	27.3	56.1	0.60	15.24
46.5	51.1	27.9	55.1	0.57	16.60
46.0	50.9	27.3	54.9	0.57	15.77
45.5	50.0	29.2	54.0	0.52	18.88
45.0	50.0	26.0	54.0	0.58	14.32
44.5	49.9	24.7	53.9	0.61	12.50
44.0	49.3	25.3	53.3	0.58	13.67
43.5	48.3	25.3	52.3	0.56	14.10
43.0	46.4	24.0	50.4	0.55	13.03
42.5	48.4	25.3	52.4	0.56	14.04
42.0	53.1	29.2	57.1	0.58	17.60
41.5	58.9	29.2	62.9	0.70	15.20
41.0	61.3	31.8	65.3	0.70	17.88
40.5	61.6	35.1	65.6	0.64	22.34
40.0	60.6	30.5	64.6	0.71	16.31
39.5	59.3	28.6	63.3	0.72	14.11
39.0	59.6	31.2	63.6	0.68	17.64
38.5	56.4	30.5	60.4	0.62	18.08
38.0	51.5	29.2	55.5	0.55	18.29
37.5	50.9	28.6	54.9	0.55	17.59
37.0	51.7	24.7	55.7	0.65	11.74
36.5	51.1	24.0	55.1	0.65	11.08
36.0	51.8	24.7	55.8	0.65	11.70
35.5	57.7	30.5	61.7	0.65	17.55
35.0	62.2	32.5	66.2	0.70	18.41
34.5	62.3	36.4	66.3	0.62	23.91
34.0	60.6	34.4	64.6	0.63	21.83
33.5	58.7	32.5	62.7	0.63	19.87
33.0	55.8	31.2	59.8	0.60	19.25
32.5	54.5	28.6	58.5	0.62	16.10
32.0	53.4	26.6	57.4	0.64	13.79
31.5	54.0	27.3	58.0	0.64	14.46
31.0	55.9	28.6	59.9	0.65	15.54
30.5	57.0	29.2	61.0	0.66	15.96
30.0	55.4	27.9	59.4	0.66	14.80
29.5	51.7	33.1	55.7	0.47	23.71
29.0	50.0	31.8	54.0	0.46	22.56
28.5	50.8	30.5	54.8	0.51	20.39
28.0	55.9	31.2	59.9	0.60	19.18
27.5	61.8	34.4	65.8	0.65	21.34
27.0	66.6	33.8	70.6	0.77	18.41
26.5	65.6	39.6	69.6	0.62	27.12
26.0	65.2	39.6	69.2	0.62	27.29

* FROM DIGITAL RECORD OF BOREHOLE GEOPHYSICAL LOG
NEUT POR (SS) = NEUT POR (LS) + 4
V CLAY (FRAC.) = (NEUT POR (SS) - G-G POR (SS)) / 48
ADJ POR (SS) = G-G POR (SS) - (V CLAY (FRAC.) * 20)

WELL 41-89BR
INTERVAL: 51-108

RECALCULATED POROSITY AND VOLUME CLAY

DEPTH*	NEUT POR* (LS) %	G-G POR* (SS) %	NEUT POR (SS) %	V CLAY (FRAC.)	ADJ POR (SS) %
108.0	60.6	35.7	64.6	0.60	23.70
107.5	55.9	31.8	59.9	0.58	20.12
107.0	52.9	27.9	56.9	0.60	15.85
106.5	46.9	20.8	50.9	0.63	8.22
106.0	50.4	22.7	54.4	0.66	9.52
105.5	62.2	28.6	66.2	0.78	12.88
105.0	66.7	29.9	70.7	0.85	12.85
104.5	60.6	27.9	64.6	0.76	12.66
104.0	61.8	26.6	65.8	0.82	10.31
103.5	61.4	24.0	65.4	0.86	6.77
103.0	57.2	20.1	61.2	0.86	3.01
102.5	53.9	18.8	57.9	0.81	2.57
102.0	52.9	19.5	56.9	0.78	3.88
101.5	52.3	18.2	56.3	0.79	2.31
101.0	56.0	16.9	60.0	0.90	-1.06
100.5	57.4	14.9	61.4	0.97	-4.44
100.0	57.5	18.8	61.5	0.89	1.03
99.5	54.5	19.5	58.5	0.81	3.21
99.0	54.7	20.1	58.7	0.80	4.08
98.5	54.7	21.4	58.7	0.78	5.90
98.0	57.3	22.1	61.3	0.82	5.75
97.5	57.6	24.7	61.6	0.77	9.28
97.0	64.4	26.6	68.4	0.87	9.23
96.5	59.9	25.3	63.9	0.80	9.25
96.0	51.7	20.8	55.7	0.73	6.22
95.5	44.0	20.1	48.0	0.58	8.52
95.0	39.7	18.8	43.7	0.52	8.46
94.5	37.5	19.5	41.5	0.46	10.29
94.0	43.5	20.8	47.5	0.56	9.65
93.5	53.2	22.7	57.2	0.72	8.36
93.0	58.7	24.7	62.7	0.79	8.83
92.5	63.1	26.6	67.1	0.84	9.77
92.0	65.8	26.6	69.8	0.90	8.65
91.5	65.7	24.0	69.7	0.95	5.01
91.0	61.7	24.0	65.7	0.87	6.69
90.5	59.4	22.1	63.4	0.86	4.88
90.0	55.4	20.8	59.4	0.80	4.70
89.5	51.1	20.1	55.1	0.73	5.58
89.0	49.0	22.7	53.0	0.63	10.14
88.5	46.2	20.1	50.2	0.63	7.59
88.0	47.8	20.8	51.8	0.65	7.85
87.5	49.6	18.8	53.6	0.72	4.35
87.0	53.7	21.4	57.7	0.76	6.32
86.5	56.2	22.1	60.2	0.79	6.21
86.0	55.2	18.8	59.2	0.84	1.99
85.5	54.1	18.8	58.1	0.82	2.45
85.0	45.9	20.8	49.9	0.61	8.66
84.5	38.1	22.7	42.1	0.40	14.67
84.0	43.1	23.4	47.1	0.49	13.51
83.5	46.6	20.1	50.6	0.64	7.42
83.0	50.9	18.8	54.9	0.75	3.81
82.5	50.4	18.8	54.4	0.74	4.02
82.0	42.3	25.3	46.3	0.44	16.59
81.5	38.1	24.0	42.1	0.38	16.49
81.0	36.1	21.4	40.1	0.39	13.67
80.5	35.7	20.1	39.7	0.41	11.96
80.0	34.2	22.7	38.2	0.32	16.27
79.5	34.9	21.4	38.9	0.36	14.14
79.0	34.2	22.7	38.2	0.32	16.27
78.5	33.3	23.4	37.3	0.29	17.56
78.0	35.6	25.3	39.6	0.30	19.36
77.5	35.1	21.4	39.1	0.37	14.07
77.0	33.8	24.0	37.8	0.29	18.31
76.5	34.0	26.6	38.0	0.24	21.90
76.0	31.7	22.7	35.7	0.27	17.34
75.5	22.2	14.3	26.2	0.25	9.34
75.0	19.5	5.2	23.5	0.38	-2.42
74.5	16.9	-4.5	20.9	0.53	-15.13
74.0	14.5	-5.8	18.5	0.51	-15.96
73.5	18.6	-2.0	22.6	0.51	-12.17

73.0	30.7	3.9	34.7	0.64	-8.93
72.5	38.9	11.0	42.9	0.66	-2.24
72.0	40.3	16.9	44.3	0.57	5.48
71.5	40.5	18.8	44.5	0.53	8.14
71.0	40.9	21.4	44.9	0.49	11.66
70.5	38.7	19.5	42.7	0.48	9.82
70.0	38.8	15.6	42.8	0.57	4.24
69.5	35.2	16.9	39.2	0.46	7.60
69.0	31.8	14.3	35.8	0.45	5.34
68.5	33.9	16.2	37.9	0.45	7.20
68.0	39.9	18.2	43.9	0.54	7.47
67.5	50.6	20.1	54.6	0.72	5.75
67.0	58.1	2.0	62.1	1.25	-23.11
66.5	44.3	-26.0	48.3	1.55	-56.90
66.0	34.9	-38.3	38.9	1.61	-70.47
65.5	41.1	-5.8	45.1	1.06	-27.08
65.0	40.9	19.5	44.9	0.53	8.87
64.5	38.5	20.8	42.5	0.45	11.74
64.0	41.0	22.1	45.0	0.48	12.55
63.5	42.1	19.5	46.1	0.55	8.39
63.0	49.4	21.4	53.4	0.67	8.12
62.5	52.7	29.2	56.7	0.57	17.76
62.0	62.2	37.0	66.2	0.61	24.85
61.5	80.2	44.2	84.2	0.83	27.48
61.0	82.1	49.4	86.1	0.77	34.04
60.5	64.0	37.0	68.0	0.65	24.10
60.0	53.1	24.7	57.1	0.68	11.16
59.5	47.1	19.5	51.1	0.66	6.31
59.0	44.7	20.8	48.7	0.58	9.16
58.5	46.4	20.8	50.4	0.62	8.44
58.0	47.8	20.8	51.8	0.65	7.86
57.5	49.6	24.7	53.6	0.60	12.61
57.0	51.0	22.7	55.0	0.67	9.28
56.5	55.2	25.3	59.2	0.71	11.22
56.0	57.2	27.3	61.2	0.71	13.12
55.5	61.5	23.4	65.5	0.88	5.85
55.0	62.3	25.3	66.3	0.85	8.25
54.5	62.0	26.6	66.0	0.82	10.23
54.0	60.3	24.0	64.3	0.84	7.23
53.5	65.2	26.6	69.2	0.89	8.90
53.0	65.4	29.2	69.4	0.84	12.49
52.5	65.5	28.6	69.5	0.85	11.50
52.0	66.7	29.2	70.7	0.86	11.95
51.5	65.9	25.3	69.9	0.93	6.75
51.0	68.0	26.6	72.0	0.94	7.74

• FROM DIGITAL RECORD OF BOREHOLE GEOPHYSICAL LOG
NEUT POR (SS) = NEUT POR (LS) + 4
V CLAY (FRAC.) = (NEUT POR (SS) - G-G POR (SS)) / 48
ADJ POR (SS) = G-G POR (SS) - (V CLAY (FRAC.) * 20)

WELL 43-89BR
INTERVAL: 38-98

RECALCULATED POROSITY AND VOLUME CLAY

DEPTH*	NEUT POR* (LS) %	G-G POR* (SS) %	NEUT POR (SS) %	V CLAY (FRAC.)	ADJ POR (SS) %
98.0	58.8	59.1	62.8	0.08	57.5
97.5	61.8	40.9	65.8	0.52	30.5
97.0	60.6	34.4	64.6	0.63	21.8
96.5	57.8	30.5	61.8	0.65	17.5
96.0	56.1	26.0	60.1	0.71	11.8
95.5	53.2	26.6	57.2	0.64	13.9
95.0	50.4	23.4	54.4	0.65	10.5
94.5	45.7	21.4	49.7	0.59	9.7
94.0	45.7	25.3	49.7	0.51	15.2
93.5	49.7	25.3	53.7	0.59	13.5
93.0	55.2	25.3	59.2	0.71	11.2
92.5	54.5	25.3	58.5	0.69	11.5
92.0	55.5	26.0	59.5	0.70	12.0
91.5	57.6	22.1	61.6	0.82	5.6
91.0	56.9	22.7	60.9	0.80	6.8
90.5	50.7	24.7	54.7	0.63	12.2
90.0	52.0	24.7	56.0	0.65	11.6
89.5	48.2	23.4	52.2	0.60	11.4
89.0	46.6	20.1	50.6	0.63	7.4
88.5	47.4	24.7	51.4	0.56	13.6
88.0	53.0	26.0	57.0	0.65	13.1
87.5	62.9	25.3	66.9	0.87	8.0
87.0	65.9	31.2	69.9	0.81	15.0
86.5	56.4	25.3	60.4	0.73	10.7
86.0	47.7	23.4	51.7	0.59	11.6
85.5	44.7	23.4	48.7	0.53	12.8
85.0	41.1	20.8	45.1	0.51	10.6
84.5	38.2	19.5	42.2	0.47	10.0
84.0	37.9	19.5	41.9	0.47	10.2
83.5	37.1	18.2	41.1	0.48	8.6
83.0	36.8	20.1	40.8	0.43	11.5
82.5	34.3	18.2	38.3	0.42	9.8
82.0	34.1	17.5	38.1	0.43	9.0
81.5	34.0	16.2	38.0	0.45	7.2
81.0	35.2	16.2	39.2	0.48	6.7
80.5	31.9	18.8	35.9	0.36	11.7
80.0	31.3	20.8	35.3	0.30	14.7
79.5	33.2	21.4	37.2	0.33	14.9
79.0	31.3	18.2	35.3	0.36	11.1
78.5	31.2	17.5	35.2	0.37	10.2
78.0	32.8	18.8	36.8	0.37	11.3
77.5	36.1	18.8	40.1	0.44	10.0
77.0	35.6	18.8	39.6	0.43	10.2
76.5	36.1	17.5	40.1	0.47	8.1
76.0	33.3	16.9	37.3	0.43	8.4
75.5	31.0	17.5	35.0	0.36	10.2
75.0	31.7	17.5	35.7	0.38	10.0
74.5	27.5	18.2	31.5	0.28	12.6
74.0	25.3	14.3	29.3	0.31	8.1
73.5	26.2	10.4	30.2	0.41	2.1
73.0	29.8	10.4	33.8	0.49	0.6
72.5	33.4	8.4	37.4	0.60	-3.6
72.0	35.3	2.6	39.3	0.76	-12.7
71.5	35.3	2.0	39.3	0.78	-13.6
71.0	43.4	6.5	47.4	0.85	-10.5
70.5	52.0	15.6	56.0	0.84	-1.2
70.0	52.1	24.7	56.1	0.66	11.6
69.5	49.5	23.4	53.5	0.63	10.8
69.0	51.3	24.7	55.3	0.64	11.9
68.5	51.3	27.3	55.3	0.58	15.6
68.0	46.6	30.5	50.6	0.42	22.1
67.5	40.9	24.0	44.9	0.43	15.3
67.0	40.7	19.5	44.7	0.52	9.0
66.5	40.9	20.8	44.9	0.50	10.7
66.0	43.4	24.7	47.4	0.47	15.2
65.5	44.6	22.1	48.6	0.55	11.0
65.0	44.7	23.4	48.7	0.53	12.8
64.5	45.1	20.1	49.1	0.60	8.1
64.0	51.6	22.1	55.6	0.70	8.1
63.5	52.7	26.6	56.7	0.63	14.1

63.0	58.1	17.5	62.1	0.93	-1.0
62.5	64.6	32.5	68.6	0.75	17.4
62.0	68.5	31.8	72.5	0.85	14.9
61.5	69.8	37.0	73.8	0.77	21.7
61.0	68.5	39.6	72.5	0.69	25.9
60.5	64.8	38.3	68.8	0.63	25.6
60.0	61.1	38.3	65.1	0.56	27.2
59.5	60.8	37.0	64.8	0.58	25.4
59.0	68.6	33.1	72.6	0.82	16.7
58.5	67.7	38.3	71.7	0.70	24.4
58.0	64.1	36.4	68.1	0.66	23.2
57.5	65.4	32.5	69.4	0.77	17.1
57.0	66.8	31.2	70.8	0.83	14.7
56.5	67.5	31.8	71.5	0.83	15.3
56.0	64.4	33.8	68.4	0.72	19.3
55.5	64.9	34.4	68.9	0.72	20.1
55.0	70.9	35.1	7[illegible].9	0.83	18.5
54.5	70.6	38.3	74.6	0.76	23.2
54.0	68.1	34.4	72.1	0.79	18.7
53.5	63.6	32.5	67.6	0.73	17.8
53.0	59.1	30.5	63.1	0.68	16.9
52.5	57.5	27.9	61.5	0.70	13.9
52.0	56.1	27.3	60.1	0.68	13.6
51.5	52.2	29.2	56.2	0.56	18.0
51.0	49.2	26.0	53.2	0.57	14.6
50.5	47.1	27.3	5[illegible].1	0.50	17.3
50.0	48.3	26.0	5[illegible].3	0.55	15.0
49.5	54.0	26.6	58.0	0.65	13.6
49.0	59.1	28.6	63.1	0.72	14.2
48.5	56.7	30.5	60.7	0.63	17.9
48.0	56.7	29.2	60.7	0.66	16.1
47.5	55.4	26.6	59.4	0.68	13.0
47.0	65.7	27.9	69.7	0.87	10.5
46.5	60.1	30.5	64.1	0.70	16.5
46.0	51.5	26.6	55.5	0.60	14.6
45.5	53.1	24.7	57.1	0.68	11.2
45.0	49.7	31.2	53.7	0.47	21.8
44.5	43.5	28.6	47.5	0.39	20.7
44.0	41.7	28.6	45.7	0.36	21.4
43.5	39.7	24.0	43.7	0.41	15.8
43.0	39.0	28.6	43.0	0.30	22.5
42.5	37.7	28.6	41.7	0.27	23.1
42.0	39.4	27.3	43.4	0.34	20.5
41.5	41.7	26.0	45.7	0.41	17.8
41.0	44.0	25.3	48.0	0.47	15.9
40.5	51.4	26.0	55.4	0.61	13.7
40.0	58.0	29.2	62.0	0.68	15.6
39.5	52.3	32.5	56.3	0.50	22.5
39.0	47.2	29.9	51.2	0.44	21.0
38.5	49.0	31.2	53.0	0.45	22.1
38.0	55.2	28.6	59.2	0.64	15.8

* FROM DIGITAL RECORD OF BOREHOLE GEOPHYSICAL LOG
NEUT POR (SS) = NEUT POR (LS) + 4
V CLAY (FRAC.) = (NEUT POR (SS) - G-G POR (SS)) / 48
ADJ POR (SS) = G-G POR (SS) - (V CLAY (FRAC.) * 20)

3.2.4 Natural Gamma Ray and Induced Potential as a Clay Volume Indicator

Two other curves, Natural Gamma Ray (GR) and Induced Polarization (IP), have been used in other locations as Vcl indicators. Initially no attempt has been made to generate a Vcl from either curve because of the absence of values representative of clean bedrock sand. After the recalculation of Vcl values, crossplots of GR and IP versus Vcl as calculated in section 3.2.3 were generated for Well 32-89BR, and best fit lines established, see Figures E-3 and E-4. The low values for goodness of fit (R^2) for 32-89BR and for seven other background wells, Table E-2, indicate the GR and IP curves are poor indicators of clay volume at this location.

4.0 BOREHOLE GEOPHYSICAL LOGS

The borehole geophysical logs presented below are listed in Table E-3.

5.0 SUMMARY PLOTS

Summary plots by well align on a small scale well construction, a simplified lithology log and the respective borehole geophysical curves presented in section 4.0 in order to illustrate the rationale for the completion zone. Table E-4 lists the summary plots presented below.

FIG. E-3 CLAY VOLUME/GAMMA RAY CROSSPLOT

32-89BR: Y=.0062488891X-0.0574100084

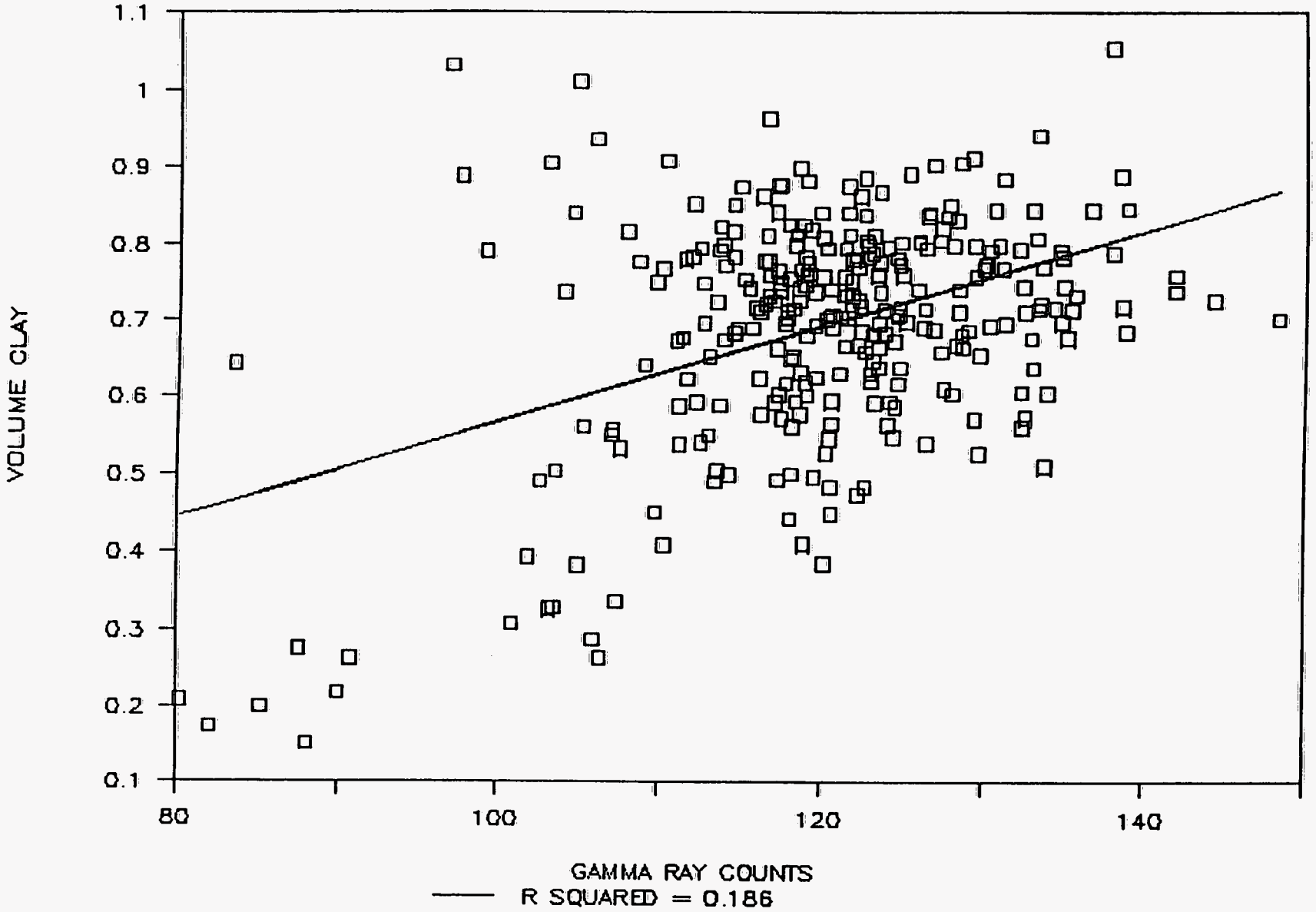

FIG. E-4 CLAY VOLUME/IP CROSSPLOT

32-89BR: Y=.1834573502X-0.6422281798

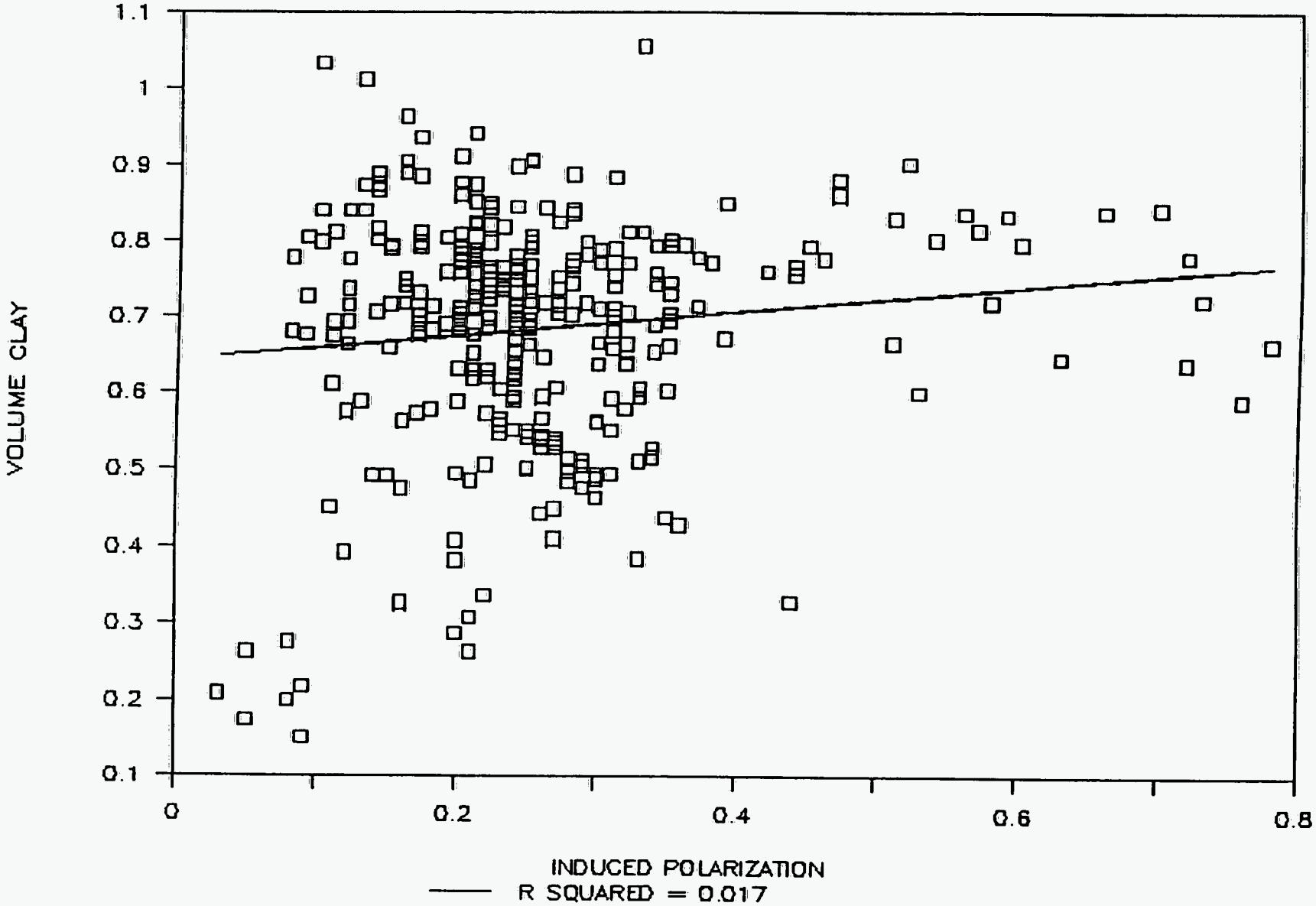

TABLE E-2

GOODNESS OF FIT FOR GR AND IP AS INDICATORS OF Vclay

	GR as an indicator of Vclay		IP as an indicator of Vclay	
Well	Interval*	R^2	Interval*	R^2
32-89BR	42-187	0.186	42-195	0.017
33-89BR	43-143	0.129	43-150	0.159
34-89BR	44-159	0.434	55-167	0.023
35-89BR	42-199	0.181	43-207	0.043
36-89BR	51-97	0.011	52-106	0.000
38-89BR	26-120	0.055	26-128	0.000
41-89BR	51-100	0.032	53-108	0.058
43-89BR	38-90	0.124	39-98	0.109

* Interval is in feet below ground level and reflects the respective available range for GR and IP.

Over the crossplotted intervals data were selected at 0.5 foot intervals (e.g. 42.0, 42.5, 43.0...187.0).

TABLE F-3

BOREHOLE GEOPHYSICAL LOGS COMPLIED IN SECTION 4.0

WELL	Fluid Temp. & fluid REs.	SP, IP, 16" & 64" Normal	Full Wave form Sonic	Guard REs., Neut.Den.,GR:	G-G Density Caliper	EM-39 Induction
32-89BR	x	x	x	x	x	x
33-89BR	x	x	x	x	x	x
34-89BR	x	x	x	x	x	x
35-89BR	x	x	x	x	x	x
36-89BR	x	x	x	x	x	x
37-89BR	x	x	x	x	x	x
38-89BR	x	x	x	x	x	x
41-89BR	x	x	x	x	x	x
41-89BRA	x	x	x	x	x	x
43-89BR	x	x	x	x	x	x

6.0 REFERENCES

Raymer, L.L., Hunt, E.R., and Gardner, J.S.: "An Improved Sonic Transit Time-To-Porosity Transform," Trans., 1980 SPWLA Annual Logging Symposium, paper P.

Rockwell International, 1989: Rocky Flats Plant ER Program SOPs (in publication).

Schlumberger, 1984, Log Interpretation Charts, Schlumberger Well Services, Houston (1984).

Schlumberger, 1987 Log Interpretation Principles/Applications, Schlumberger Education Services, Houston (1987).

NOTICE

This document (or documents) is oversized for 16mm microfilming, but is available in its entirety on the 35mm fiche card referenced below:

Document # 000373

Titled: WELL NO. 32-89 BR Plate E-1

Fiche location: A-SW-M29

NOTICE

This document (or documents) is oversized for 16mm microfilming, but is available in its entirety on the 35mm fiche card referenced below:

Document # 000373

Titled: WELL NO. 33-89 BR Plate E-2

Fiche location: A-SW-M29

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Document # 000373

Titled: WELL NO. 34-89BR Plate E-3

Fiche location: A-SW-M29

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Document # 000373

Titled: WELL NO. 35-89 BR Plate E-4

Fiche location: A-SW-M29

NOTICE

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Document # 000373

Titled: WELL NO. 36-89BR Plate E-5

Fiche location: A-SW-M29

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Document # 000373

Titled: WELL NO. 37-89BR Plate E-6

Fiche location: A-SW-M29

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Document # 000373

Titled: WELL NO. 38-89 BR Plate E-7

Fiche location: A-SW-M30

NOTICE

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Document # 000373

Titled: WELL No. 41-89BR Plate E-8

Fiche location: A-SW-M30

NOTICE

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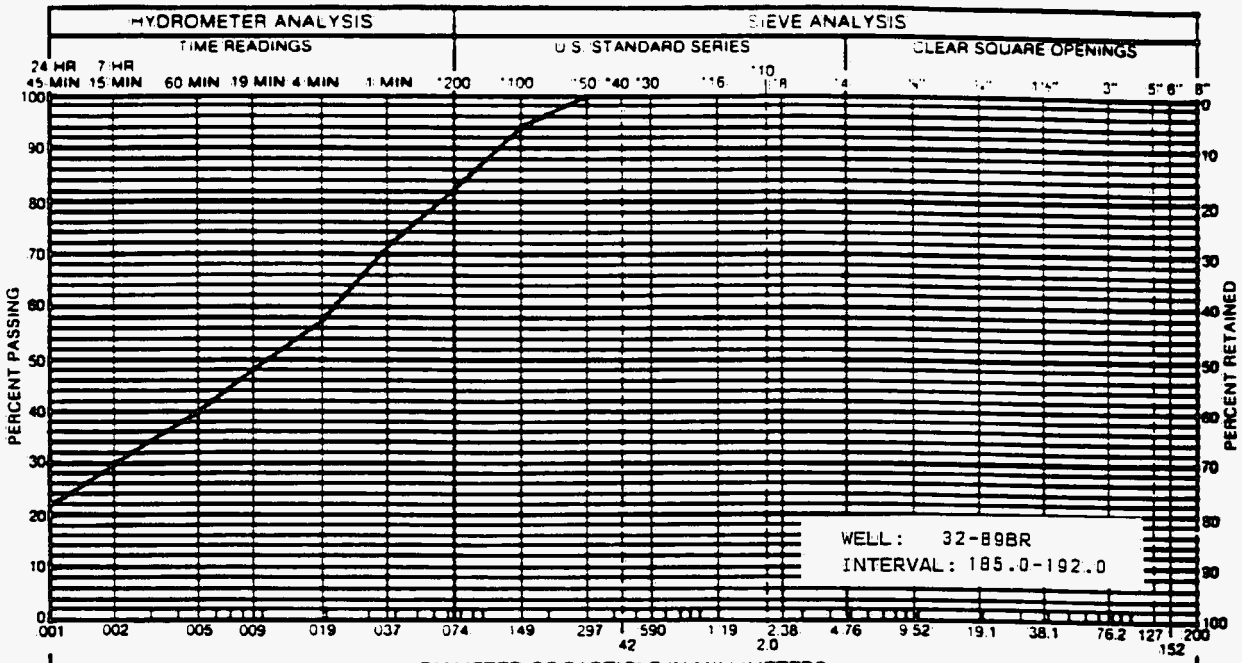
Document # 000373

Titled: WELL No. 43-89 BR Plate E-9

Fiche location: A-SW-M30

APPENDIX F

GEOTECHNICAL TESTING RESULTS

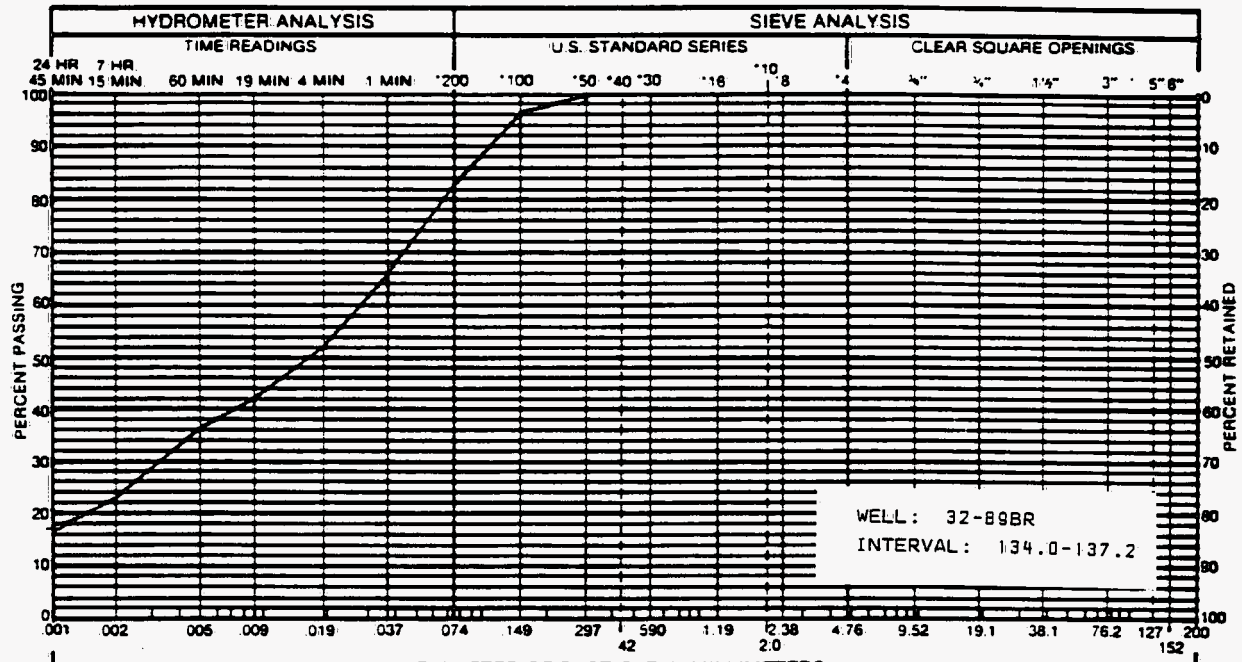


CLAY TO SILT	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	

GRAVEL 0 % SAND 18 % SILT AND CLAY 82 %

LIQUID LIMIT - % PLASTICITY INDEX - %

SAMPLE OF Sandy clay FROM 3289 185-192



CLAY TO SILT	SAND			GRAVEL		COBBLES
	FINE	MEDIUM	COARSE	FINE	COARSE	

GRAVEL 0 % SAND 17 % SILT AND CLAY 83 %

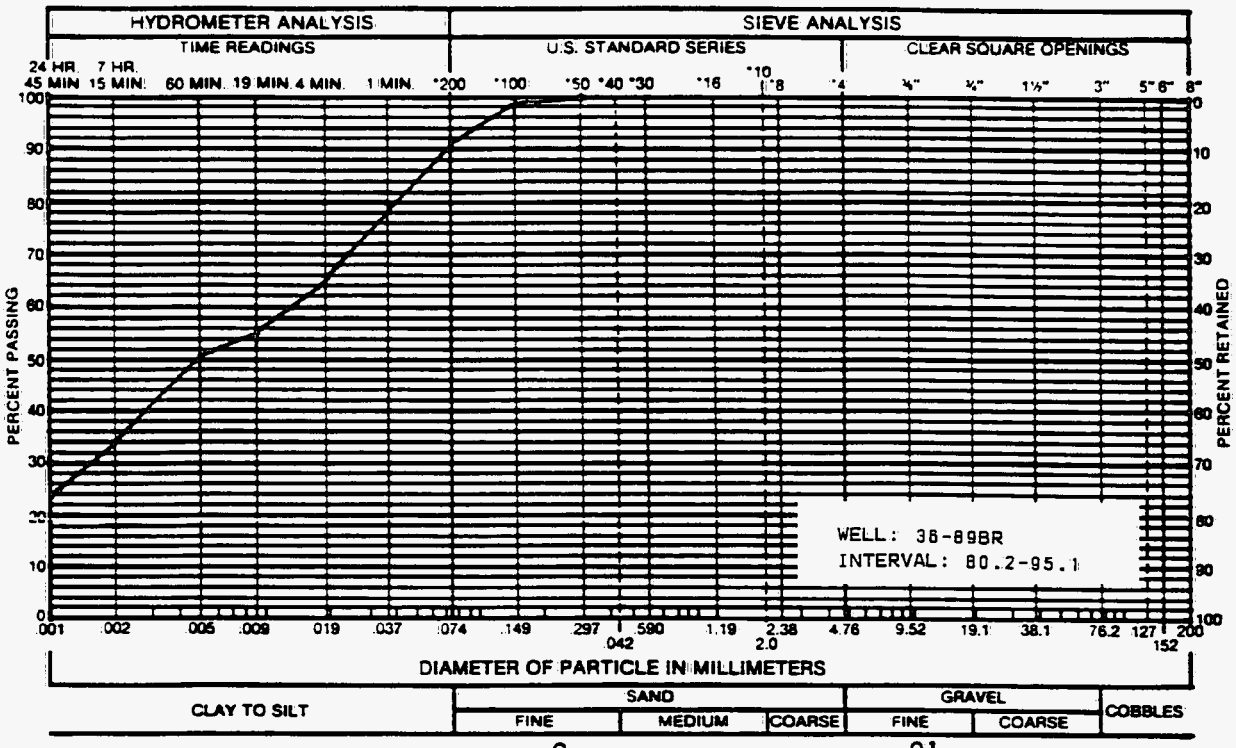
LIQUID LIMIT % PLASTICITY INDEX %

SAMPLE OF FROM RIT 134-1372

6 013 89	Chen-Northern, Inc.	GRADATION TEST RESULTS	Fig. 1

CA-2-79

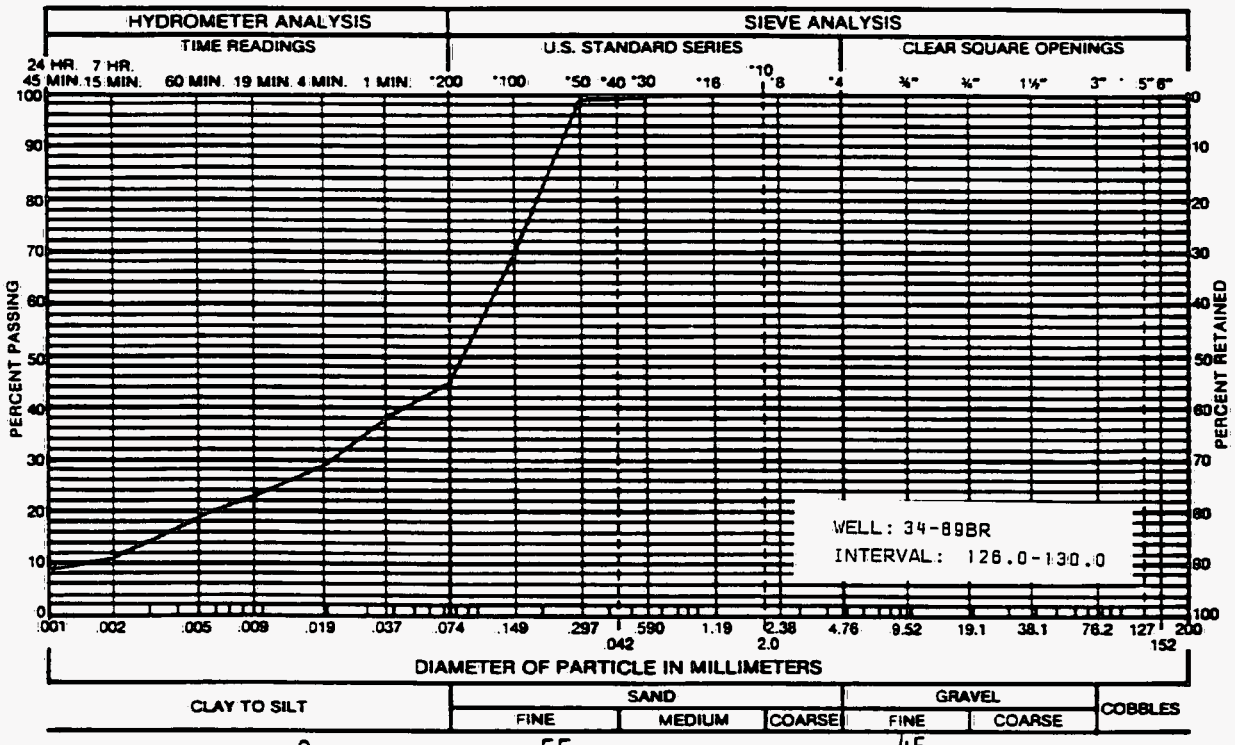
chen and associates, inc.



GRAVEL % SAND 9 % SILT AND CLAY 91 %

LIQUID LIMIT % PLASTICITY INDEX %

SAMPLE OF Claystone FROM 36898095



GRAVEL 0 % SAND 55 % SILT AND CLAY 45 %

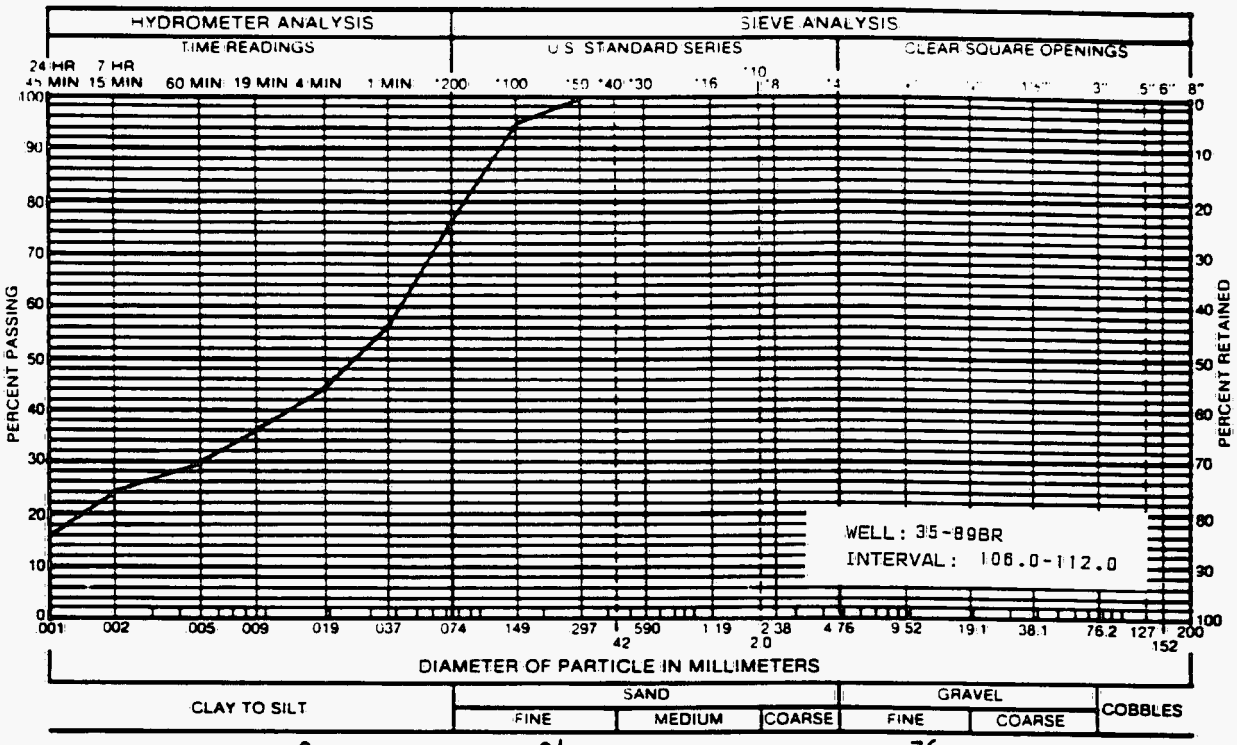
LIQUID LIMIT % PLASTICITY INDEX %

SAMPLE OF Very clayey sandstone FROM 3489126130

6 013 89

GRADATION TEST RESULTS

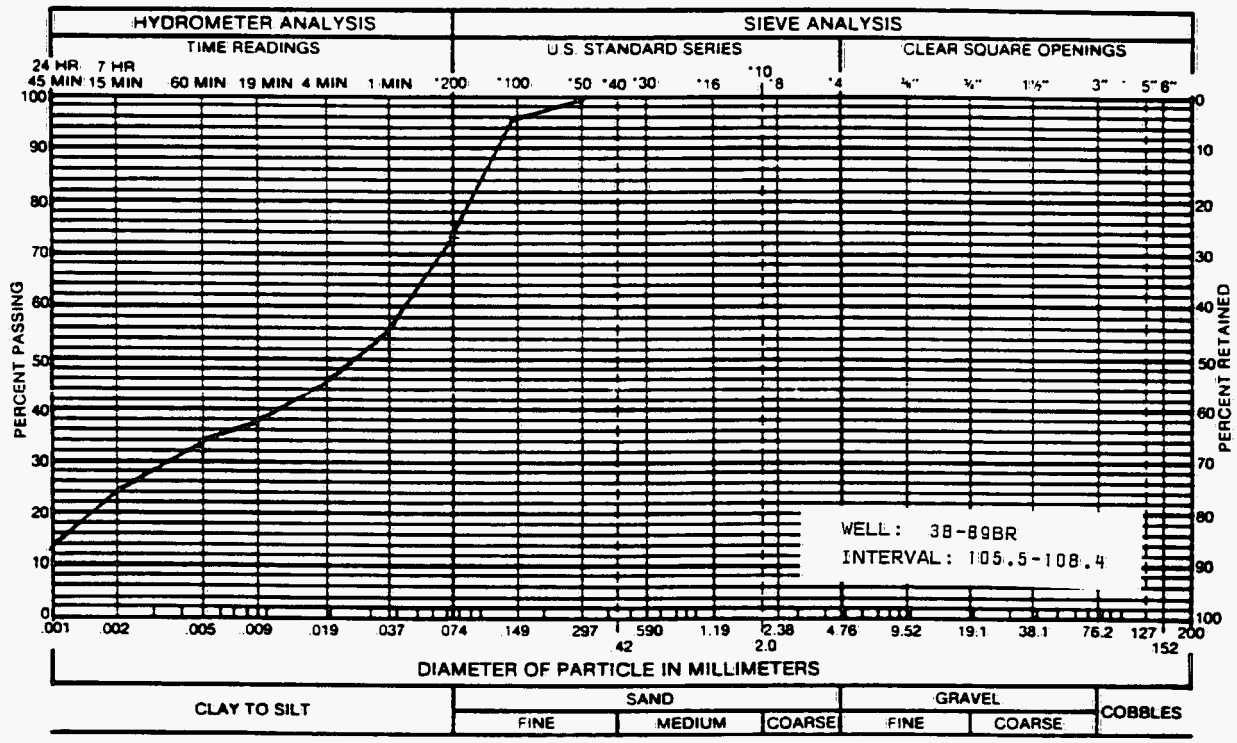
Fig. 1



GRAVEL 0 % SAND 24 % SILT AND CLAY 76 %

LIQUID LIMIT % PLASTICITY INDEX %

SAMPLE OF FROM 3589106112



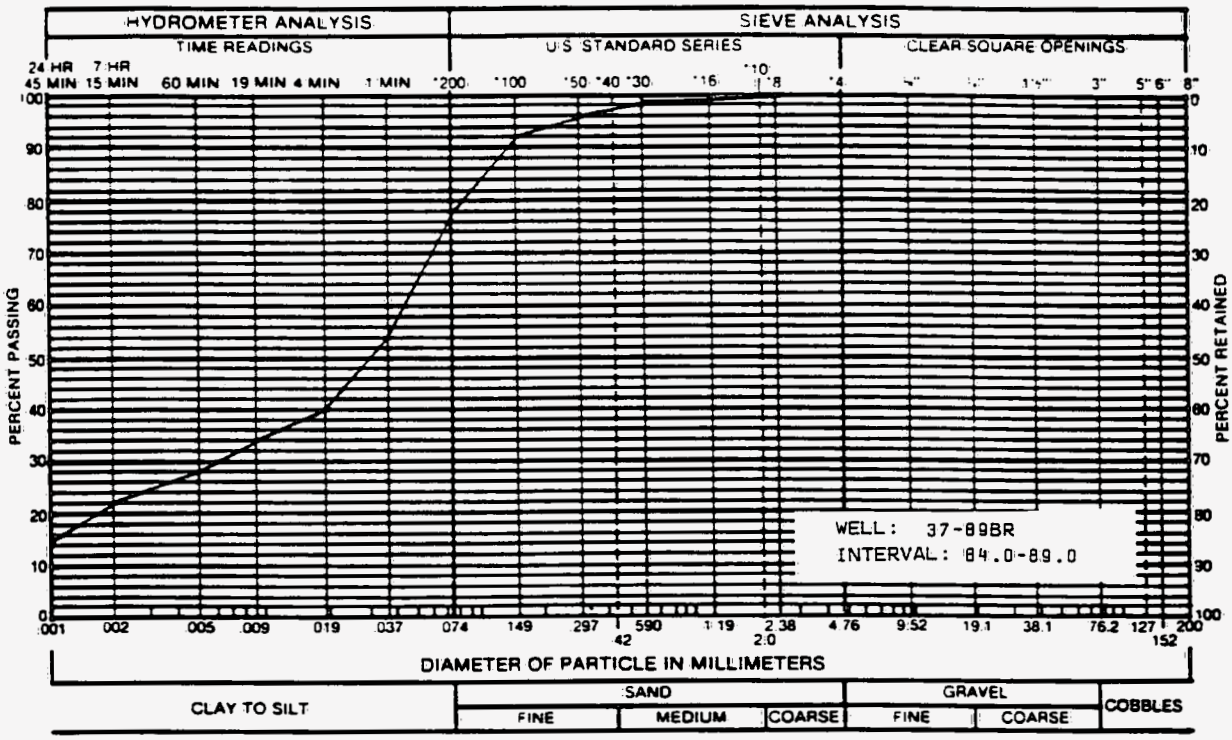
GRAVEL 0 % SAND 27 % SILT AND CLAY 73 %

LIQUID LIMIT % PLASTICITY INDEX %

SAMPLE OF FROM 3889105108

6 013 89	*Chen-Northern, Inc.*	GRADATION TEST RESULTS	Fig. 1

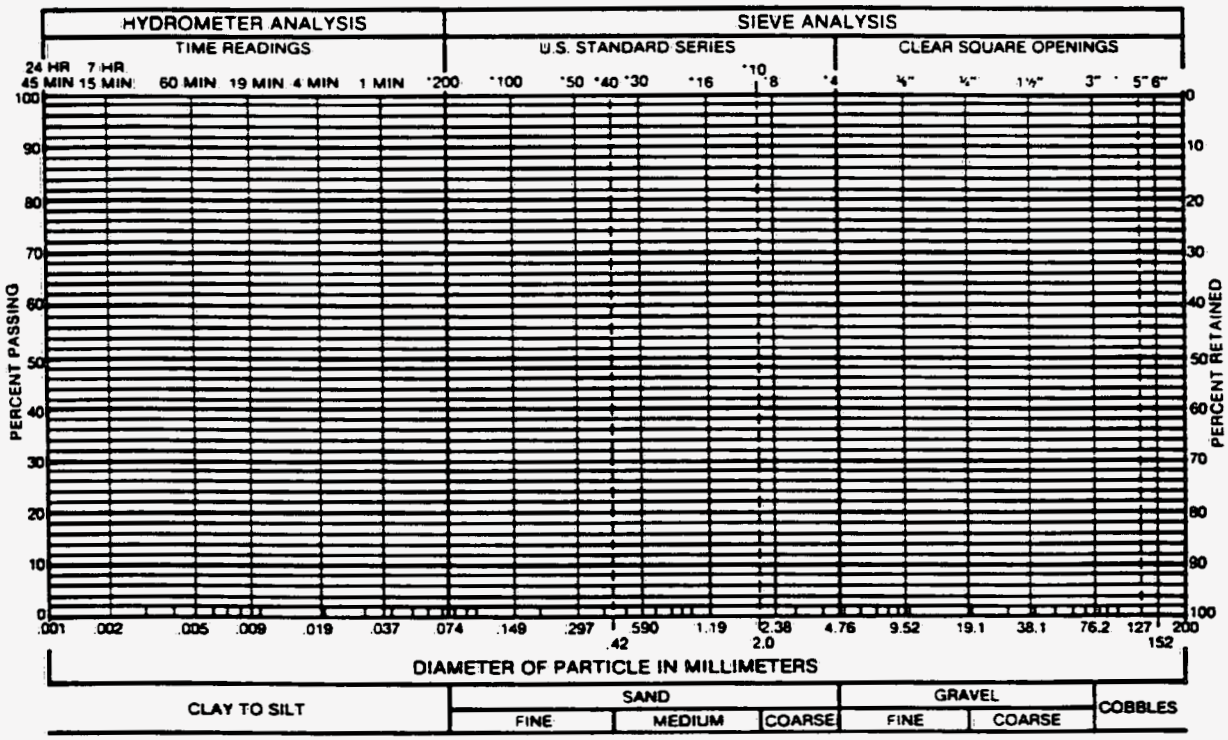
CA-2-79



GRAVEL % SAND 23 % SILT AND CLAY 77 %

LIQUID LIMIT % PLASTICITY INDEX %

SAMPLE OF 3789BR8485 FROM



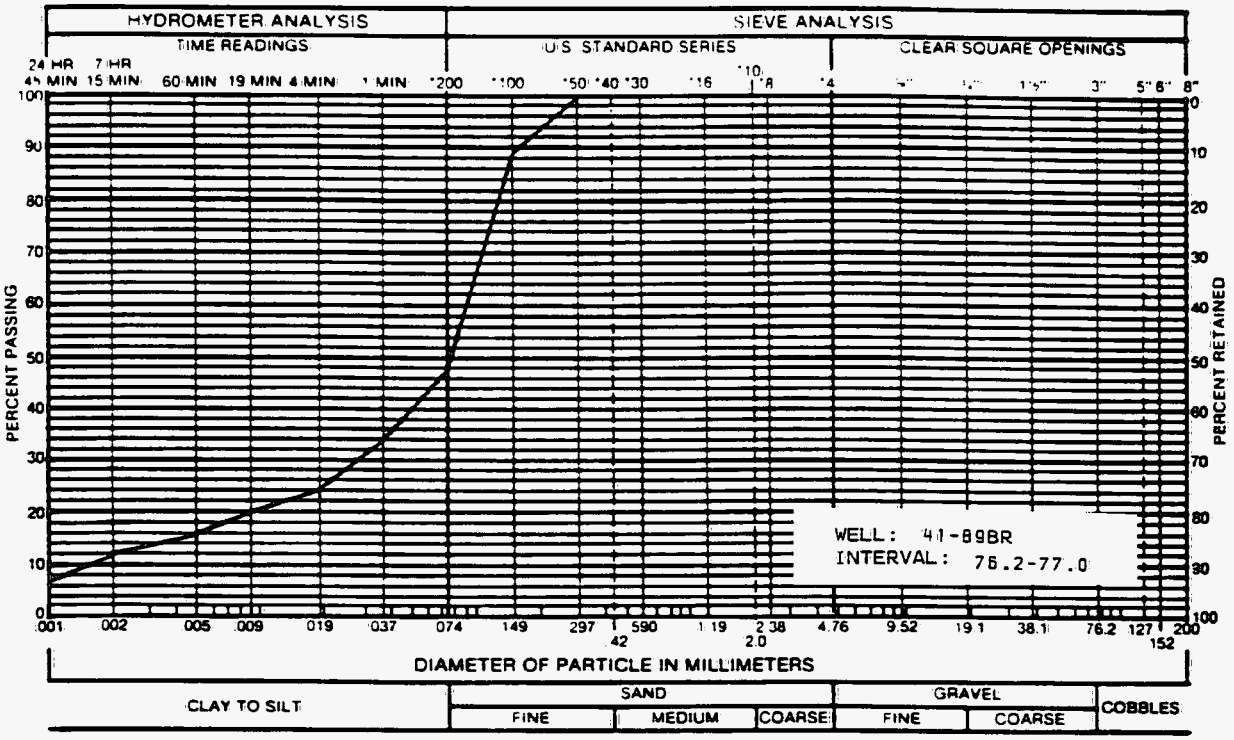
GRAVEL % SAND % SILT AND CLAY %

LIQUID LIMIT % PLASTICITY INDEX %

SAMPLE OF FROM

6 013 89	*Chen-Northern, Inc.*	GRADATION TEST RESULTS	Fig. 1

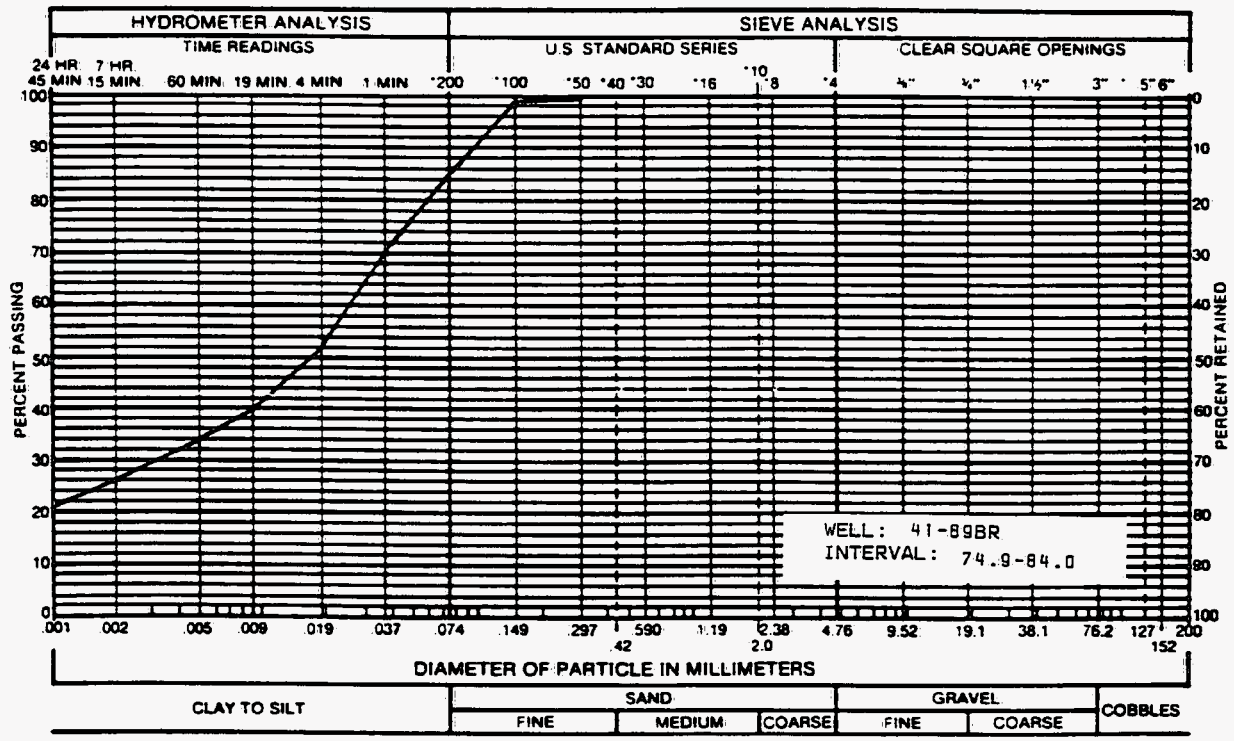
CA-2-79



GRAVEL 0 % SAND 53 % SILT AND CLAY 47 %

LIQUID LIMIT % PLASTICITY INDEX %

SAMPLE OF FROM 41897677



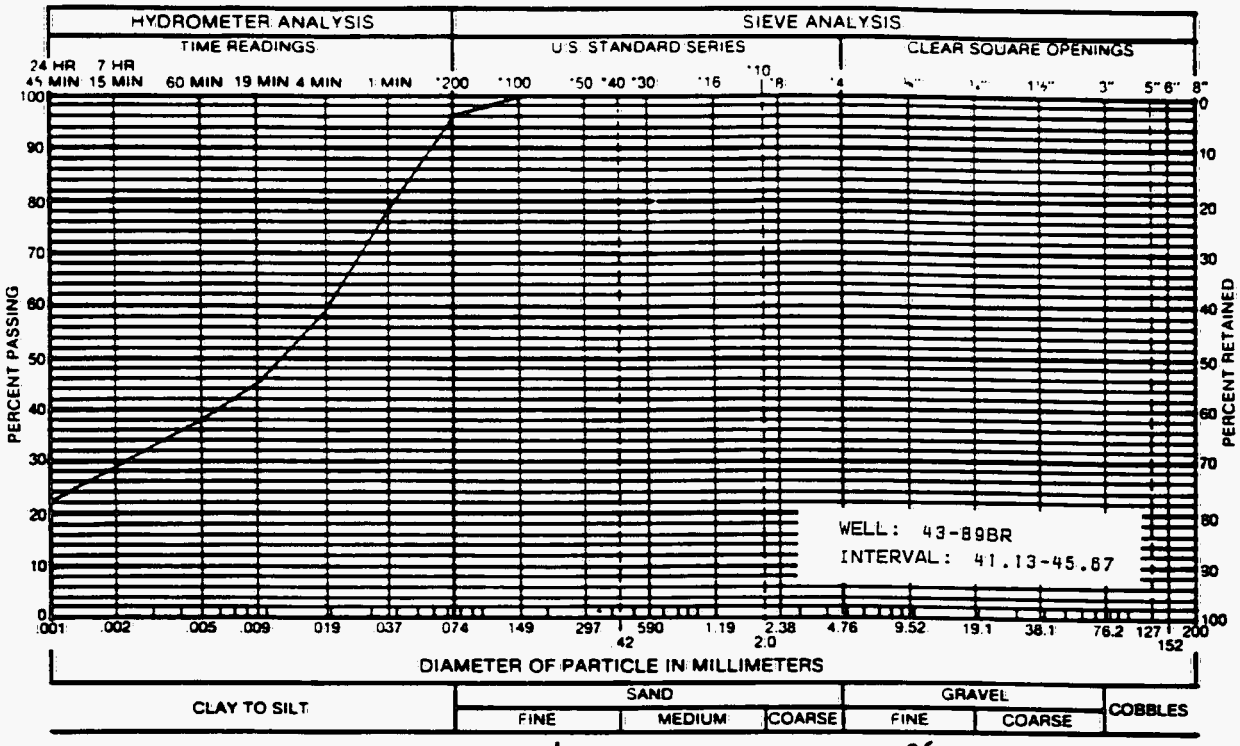
GRAVEL % SAND 15 % SILT AND CLAY 85 %

LIQUID LIMIT % PLASTICITY INDEX %

SAMPLE OF FROM 41897584

6 013 89	*Chen-Northern, Inc.*	GRADATION TEST RESULTS	Fig. 2

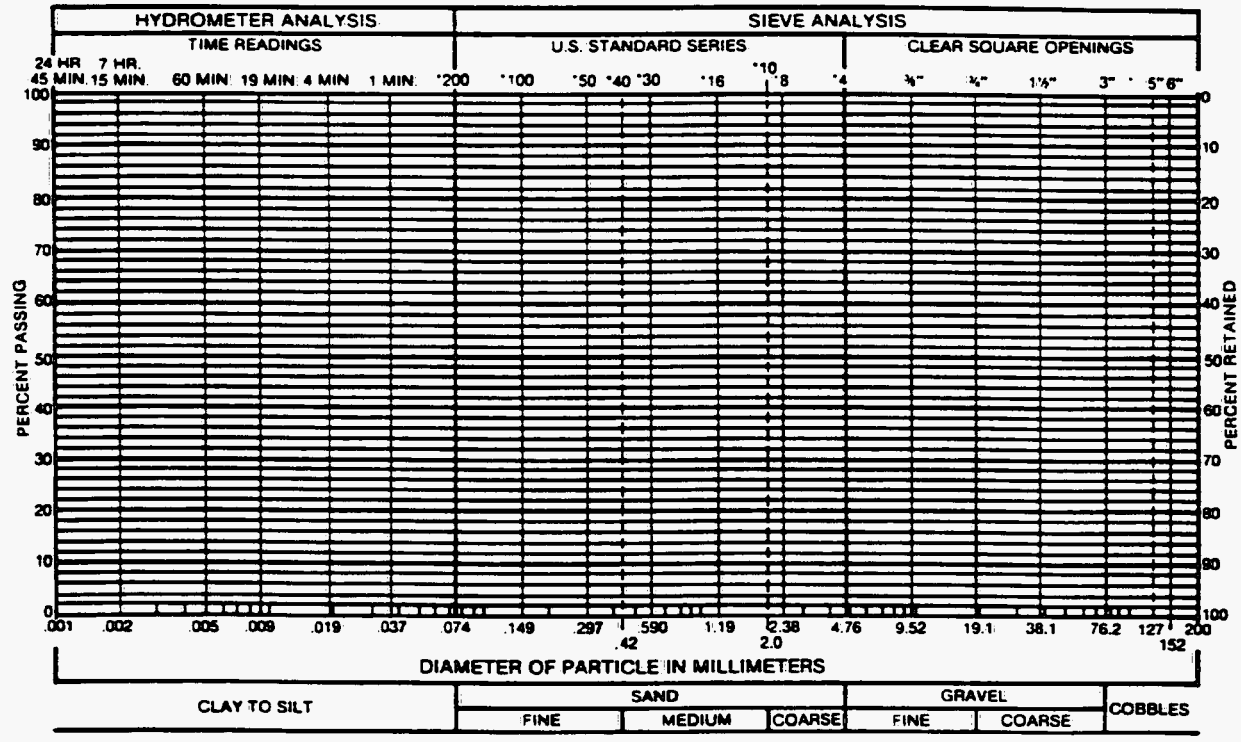
CA-2-79



GRAVEL % SAND 4 % SILT AND CLAY 96 %

LIQUID LIMIT % PLASTICITY INDEX %

SAMPLE OF FROM 438941-45 at depth 41.24 - 45.67



GRAVEL % SAND % SILT AND CLAY %

LIQUID LIMIT % PLASTICITY INDEX %

SAMPLE OF FROM

6 013 89	*Chen-Northern, Inc.*	GRADATION TEST RESULTS	Fig. 1

CA-2-79

APPENDIX G

DATA SUMMARIES

APPENDIX G-1

GROUND WATER DATA

ROCKY FLATS ALLUVIAL GROUND WATER

METALS

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date Sampled	Qtr.	Aluminum (Al), diss. mg/l	Antimony (Sb), diss. mg/l	Arsenic (As), diss. mg/l	Barium (Ba), diss. mg/l	Beryllium (Be), diss. mg/l	Cadmium (Cd), diss. mg/l	Calcium (Ca), diss. mg/l
01-89A	06/14/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	18.6000
02-89	06/14/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	22.0000
03-89	06/14/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	71.4000
04-89	06/15/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	47.0000
05-89	06/07/89		Data not yet received						
06-89	06/07/89		Data not yet received						
07-89	06/06/89		Data not yet received						
08-89	06/05/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	44.8000

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date Sampled	Qtr.	Cesium (Cs), diss. mg/l	Chromium (Cr), diss. mg/l	Cobalt (Co), diss. mg/l	Copper (Cu), diss. mg/l	Iron (Fe), diss. mg/l	Lead (Pb), diss. mg/l	Lithium (Li), diss. mg/l
01-89A	06/14/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.1000 U
02-89	06/14/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.1000 U
03-89	06/14/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.1000 U
04-89	06/15/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.1000 U
05-89	06/07/89		Data not yet received						
06-89	06/07/89		Data not yet received						
07-89	06/06/89		Data not yet received						
08-89	06/05/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1290	0.0050 U	0.0100 U

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date Sampled	Qtr.	Magnesium (Mg), diss. mg/l	Manganese (Mn), diss. mg/l	Mercury (Hg), diss. mg/l	Molybdenum (Mo), diss. mg/l	Nickel (Ni), diss. mg/l	Potassium (K), diss. mg/l	Selenium (Se), diss. mg/l
01-89A	06/14/89		5.0000 U	0.1510	0.0002 U	0.1000 U	0.0400 U	5.0000 U	0.0050 U
02-89	06/14/89		5.0000 U	0.2570	0.0002 U	0.1000 U	0.0400 U	5.0000 U	0.0050 U
03-89	06/14/89		5.2300	0.0847	0.0002 U	0.1000 U	0.0400 U	5.0000 U	0.0050 U
04-89	06/15/89		5.0000 U	0.2680	0.0002 U	0.1000 U	0.0400 U	5.0000 U	0.0050 U
05-89	06/07/89		Data not yet received						
06-89	06/07/89		Data not yet received						
07-89	06/06/89		Data not yet received						
08-89	06/05/89		5.7900	0.0283	0.0002 U	0.0136	0.0400 U	5.0000 U	0.0050 U

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date Sampled	Qtr.	Silver (Ag), diss. mg/l	Sodium (Na), diss. mg/l	Strontium (Sr), diss. mg/l	Thallium (Tl), diss. mg/l	Tin (Sn), diss. mg/l	Vanadium (V), diss. mg/l	Zinc (Zn), diss. mg/l
01-89A	06/14/89		0.0100 U	6.8900	1.0000 U	0.0100 U	0.1000 U	0.0500 U	0.0200 U
02-89	06/14/89		0.0100 U	7.7700	1.0000 U	0.0100 U	0.1000 U	0.0500 U	0.0200 U
03-89	06/14/89		0.0100 U	5.0000 U	1.0000 U	0.0400 U	0.1000 U	0.0500 U	0.0200 U
04-89	06/15/89		0.0100 U	8.9000	1.0000 U	0.0400 U	0.1000 U	0.0500 U	0.0200 U
05-89	06/07/89		Data not yet received						
06-89	06/07/89		Data not yet received						
07-89	06/06/89		Data not yet received						
08-89	06/05/89		0.0100 U	8.5500	1.0000 U	0.0100 U	0.1000 U	0.0500 U	0.0200 U

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date Sampled	Qtr.	Aluminum (Al), diss. mg/l	Antimony (Sb), diss. mg/l	Arsenic (As), diss. mg/l	Barium (Ba), diss. mg/l	Beryllium (Be), diss. mg/l	Cadmium (Cd), diss. mg/l	Calcium (Ca), diss. mg/l
47-89	06/14/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	64.5000
48-89	06/15/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	30.9000
55-86	06/08/89		Data not yet received						

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date Sampled	Qtr.	Cesium (Cs), diss. mg/l	Chromium (Cr), diss. mg/l	Cobalt (Co), diss. mg/l	Copper (Cu), diss. mg/l	Iron (Fe), diss. mg/l	Lead (Pb), diss. mg/l	Lithium (Li), diss. mg/l
47-89	06/14/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.1000 U
48-89	06/15/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.1000 U
55-86	06/08/89		Data not yet received						

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date Sampled	Qtr.	Magnesium (Mg), diss. mg/l	Manganese (Mn), diss. mg/l	Mercury (Hg), diss. mg/l	Molybdenum (Mo), diss. mg/l	Nickel (Ni), diss. mg/l	Potassium (K), diss. mg/l	Selenium (Se), diss. mg/l
47-89	06/14/89		5.3200	0.1390	0.0002 U	0.1000 U	0.0400 U	5.0000 U	0.0050 U
48-89	06/15/89		5.0000 U	0.0150 U	0.0002 U	0.1000 U	0.0400 U	5.0000 U	0.0050 U
55-86	06/08/89		Data not yet received						

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date Sampled	Qtr.	Silver (Ag), diss. mg/l	Sodium (Na), diss. mg/l	Strontium (Sr), diss. mg/l	Thallium (Tl), diss. mg/l	Tin (Sn), diss. mg/l	Vanadium (V), diss. mg/l	Zinc (Zn), diss. mg/l
47-89	06/14/89		0.0100 U	5.0000 U	1.0000 U	0.0100 U	0.1000 U	0.0500 U	0.0200 U
48-89	06/15/89		0.0100 U	9.0200	1.0000 U	0.0400 U	0.1000 U	0.0500 U	0.0200 U
55-86	06/08/89		Data not yet received						

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

MAJOR IONS

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date Sampled	Qtr.	Total Dissolved Solids MG/L	Chloride MG/L	Nitrate+ Nitrite-Nitrogen MG/L	Sulfate MG/L	HCO3- MG/L
01-89A	06/14/89		170	7	0.88	18	72
02-89	06/14/89		150	5	0.87	16	83
03-89	06/14/89		300	8	1.2	39	450
04-89	06/15/89		220	11	0.92	22	150
05-89	06/07/89		210	3	2.1	10	72
06-89	06/07/89		160	4	2.0	16	100
07-89	06/06/89		210	4	2.0	21	130
08-89	06/05/89		280	4	2.3	29	140
47-89	06/14/89		250	4	0.66	32	200

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date Sampled	Qtr.	CO3= MG/L	pH pH Unit	Total Organic Carbon MG/L	Fluoride MG/L	Sulfide MG/L
01-89A	06/14/89		5 U	7.0	NR	NR	NR
02-89	06/14/89		5 U	7.2	NR	NR	NR
03-89	06/14/89		5 U	7.5	NR	NR	NR
04-89	06/15/89		5 U	7.9	NR	NR	NR
05-89	06/07/89		5 U	6.6	NR	NR	NR
06-89	06/07/89		5 U	7.0	NR	NR	NR
07-89	06/06/89		5 U	7.7	NR	NR	NR
08-89	06/05/89		5 U	7.3	NR	NR	NR
47-89	06/14/89		5 U	7.9	NR	NR	NR

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date Sampled	Qtr.	Cyanide, Total MG/L	Hexavalent Chromium (Cr+6) MG/L	Specific Conductance uMHOS/cm	Suspended Solids MG/L	Turbidity MG/L
01-89A	06/14/89		2.5 U	NR	NR	200	NR
02-89	06/14/89		2.5 U	NR	NR	41	NR
03-89	06/14/89		2.5 U	NR	NR	1500	NR
04-89	06/15/89		2.5 U	NR	NR	18	NR
05-89	06/07/89		NR	NR	NR	960	NR
06-89	06/07/89		NR	NR	NR	250	NR
07-89	06/06/89		NR	NR	NR	690	NR
08-89	06/05/89		2.5 U	NR	NR	560	NR
47-89	06/14/89		2.5 U	NR	NR	120	NR

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date Sampled	Qtr.	Solids %	Oil and Grease MG/L	Ignitability Degrees F.	Phosphate MG/L
01-89A	06/14/89		NR	NR	NR	NR
02-89	06/14/89		NR	NR	NR	NR
03-89	06/14/89		NR	NR	NR	NR
04-89	06/15/89		NR	NR	NR	NR
05-89	06/07/89		NR	NR	NR	NR
06-89	06/07/89		NR	NR	NR	NR
07-89	06/06/89		NR	NR	NR	NR
08-89	06/05/89		NR	NR	NR	NR
47-89	06/14/89		NR	NR	NR	NR

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date Sampled	Qtr.	Total Dissolved Solids MG/L	Chloride MG/L	Nitrate+ Nitrite-Nitrogen MG/L	Sulfate MG/L	HCO3- MG/L
48-89	06/15/89		180	14	1.2	16	100
55-86	06/08/89		260	5	1.3	26	86

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date Sampled	Qtr.	CO3= MG/L	pH pH Unit	Total Organic Carbon MG/L	Fluoride MG/L	Sulfide MG/L
48-89	06/15/89		5 U	7.2	NR	NR	NR
55-86	06/08/89		5 U	6.9	NR	NR	NR

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date Sampled	Qtr.	Cyanide, Total MG/L	Hexavalent Chromium (Cr+6) MG/L	Specific Conductance uMHOS/cm	Suspended Solids MG/L	Turbidity MG/L
48-89	06/15/89		2.5 U	NR	NR	12	NR
55-86	06/08/89		NR	NR	NR	1000	NR

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date Sampled	Qtr.	Solids %	Oil and Grease MG/L	Ignitability Degrees F.	Phosphate MG/L
48-89	06/15/89		NR	NR	NR	NR
55-86	06/08/89		NR	NR	NR	NR

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

RADIONUCLIDES

Groundwater Dissolved Radiochemistry Results

for Regulated Units at Rocky Flats Plant

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date Sampled	Qtr.	Uranium 233, 234 PCI/L	(MDA)	Uranium 235 PCI/L	(MDA)	Uranium 238 PCI/L	(MDA)	Radium 226
01-89A	06/14/89		Data not yet received						
02-89	06/14/89		Data not yet received						
03-89	06/14/89		Data not yet received						
04-89	06/15/89		Data not yet received						
05-89	06/07/89		Data not yet received						
06-89	06/07/89		Data not yet received						
07-89	06/06/89		Data not yet received						
08-89	06/05/89		Data not yet received						
47-89	06/14/89		Data not yet received						
48-89	06/15/89		Data not yet received						
55-86	06/08/89		Data not yet received						

Notes: NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Groundwater Dissolved Radiochemistry Results

for Regulated Units at Rocky Flats Plant

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date Sampled	Qtr.	Radium 228
01-89A	06/14/89		Data not yet received
02-89	06/14/89		Data not yet received
03-89	06/14/89		Data not yet received
04-89	06/15/89		Data not yet received
05-89	06/07/89		Data not yet received
06-89	06/07/89		Data not yet received
07-89	06/06/89		Data not yet received
08-89	06/05/89		Data not yet received
47-89	06/14/89		Data not yet received
48-89	06/15/89		Data not yet received
55-86	06/08/89		Data not yet received

Notes: NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

COLLUVIAL GROUND WATER

METALS

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND COLLUVIUM

Well Number	Date Sampled	Qtr.	Aluminum (Al), diss. mg/l	Antimony (Sb), diss. mg/l	Arsenic (As), diss. mg/l	Barium (Ba), diss. mg/l	Beryllium (Be), diss. mg/l	Cadmium (Cd), diss. mg/l	Calcium (Ca), diss. mg/l
09-89	04/19/89		DRY						
10-89	05/05/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	5.0000 U
10-89	05/05/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	76.8000
11-89	05/15/89		DRY						
12-89	05/15/89		DRY						
13-89	05/12/89		DRY						
14-89	05/11/89		DRY						
15-89	05/04/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	63.0000
15-89	05/04/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	65.6000
16-89	05/16/89		DRY						

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND COLLUVIUM

Well Number	Date Sampled	Qtr.	Cesium (Cs), diss. mg/l	Chromium (Cr), diss. mg/l	Cobalt (Co), diss. mg/l	Copper (Cu), diss. mg/l	Iron (Fe), diss. mg/l	Lead (Pb), diss. mg/l	Lithium (Li), diss. mg/l
09-89	04/19/89		DRY						
10-89	05/05/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.0100 U
10-89	05/05/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.1720
11-89	05/15/89		DRY						
12-89	05/15/89		DRY						
13-89	05/12/89		DRY						
14-89	05/11/89		DRY						
15-89	05/04/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.0100 U
15-89	05/04/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0250 U	0.0100 U
16-89	05/16/89		DRY						

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND COLLUVIUM

Well Number	Date Sampled	Qtr.	Magnesium (Mg), diss. mg/l	Manganese (Mn), diss. mg/l	Mercury (Hg), diss. mg/l	Molybdenum (Mo), diss. mg/l	Nickel (Ni), diss. mg/l	Potassium (K), diss. mg/l	Selenium (Se), diss. mg/l
09-89	04/19/89		DRY						
10-89	05/05/89		5.0000 U	0.0150 U	0.0002 U	0.0136	0.0400 U	5.0000 U	0.0050 U
10-89	05/05/89		15.3000	0.0880	0.0002 U	0.0100 U	0.0400 U	5.0000 U	0.0050 U
11-89	05/15/89		DRY						
12-89	05/15/89		DRY						
13-89	05/12/89		DRY						
14-89	05/11/89		DRY						
15-89	05/04/89		10.1000	0.0150 U	0.0002 U	0.0100 U	0.0400 U	5.0000 U	0.0050 U
15-89	05/04/89		10.6000	0.0150 U	0.0002 U	0.0100 U	0.0400 U	5.0000 U	0.0050 U
16-89	05/16/89		DRY						

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND COLLUVIUM

Well Number	Date Sampled	Qtr.	Silver (Ag), diss. mg/l	Sodium (Na), diss. mg/l	Strontium (Sr), diss. mg/l	Thallium (Tl), diss. mg/l	Tin (Sn), diss. mg/l	Vanadium (V), diss. mg/l	Zinc (Zn), diss. mg/l
09-89	04/19/89		DRY						
10-89	05/05/89		0.0100 U	5.0000 U	1.0000 U	0.0100 U	0.1000 U	0.0500 U	0.0200 U
10-89	05/05/89		0.0100 U	98.7000	1.0000 U	0.0400 U	0.1000 U	0.0500 U	0.0200 U
11-89	05/15/89		DRY						
12-89	05/15/89		DRY						
13-89	05/12/89		DRY						
14-89	05/11/89		DRY						
15-89	05/04/89		0.0100 U	27.4000	1.0000 U	0.0100 U	0.1000 U	0.0500 U	0.0200 U
15-89	05/04/89		0.0100 U	28.1000	1.0000 U	0.0400 U	0.1000 U	0.0500 U	0.0200 U
16-89	05/16/89		DRY						

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND COLLUVIUM

Well Number	Date Sampled	Qtr.	Aluminum (Al), diss. mg/l	Antimony (Sb), diss. mg/l	Arsenic (As), diss. mg/l	Barium (Ba), diss. mg/l	Beryllium (Be), diss. mg/l	Cadmium (Cd), diss. mg/l	Calcium (Ca), diss. mg/l
46-89	05/05/89		DRY						
50-89	05/17/89		DRY						

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND COLLUVIUM

Well Number	Date Sampled	Qtr.	Cesium (Cs), diss. mg/l	Chromium (Cr), diss. mg/l	Cobalt (Co), diss. mg/l	Copper (Cu), diss. mg/l	Iron (Fe), diss. mg/l	Lead (Pb), diss. mg/l	Lithium (Li), diss. mg/l
46-89	05/05/89		DRY						
50-89	05/17/89		DRY						

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND COLLUVIUM

Well Number	Date Sampled	Qtr.	Magnesium (Mg), diss. mg/l	Manganese (Mn), diss. mg/l	Mercury (Hg), diss. mg/l	Molybdenum (Mo), diss. mg/l	Nickel (Ni), diss. mg/l	Potassium (K), diss. mg/l	Selenium (Se), diss. mg/l
46-89	05/05/89		DRY						
50-89	05/17/89		DRY						

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND COLLUVIUM

Well Number	Date Sampled	Qtr.	Silver (Ag), diss. mg/l	Sodium (Na), diss. mg/l	Strontium (Sr), diss. mg/l	Thallium (Tl), diss. mg/l	Tin (Sn), diss. mg/l	Vanadium (V), diss. mg/l	Zinc (Zn), diss. mg/l
46-89	05/05/89		DRY						
50-89	05/17/89		DRY						

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

MAJOR IONS

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND COLLUVIUM

Well Number	Date Sampled	Qtr.	Total Dissolved Solids MG/L	Chloride MG/L	Nitrate+ Nitrite-Nitrogen MG/L	Sulfate MG/L	HCO3- MG/L
09-89	04/19/89		DRY				
10-89	05/05/89		INSUFFICIENT SAMPLE FOR INORGANIC ANALYSIS				
10-89	05/05/89		520	11	0.05 U	86	470
11-89	05/15/89		DRY				
12-89	05/15/89		DRY				
13-89	05/12/89		DRY				
14-89	05/11/89		DRY				
15-89	05/04/89		2900	18	0.20	41	230
15-89	05/04/89		290	20	0.18	45	230
16-89	05/16/89		DRY				

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND COLLUVIUM

Well Number	Date Sampled	Qtr.	CO3= MG/L	pH pH Unit	Total Organic Carbon MG/L	Fluoride MG/L	Sulfide MG/L
09-89	04/19/89		DRY				
10-89	05/05/89		INSUFFICIENT SAMPLE FOR INORGANIC ANALYSIS				
10-89	05/05/89		5 U	7.4	NR	NR	NR
11-89	05/15/89		DRY				
12-89	05/15/89		DRY				
13-89	05/12/89		DRY				
14-89	05/11/89		DRY				
15-89	05/04/89		5 U	7.1	NR	NR	NR
15-89	05/04/89		5 U	7.1	NR	NR	NR
16-89	05/16/89		DRY				

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND COLLUVIUM

Well Number	Date Sampled	Qtr.	Cyanide, Total MG/L	Hexavalent Chromium (Cr+6) MG/L	Specific Conductance uMHOS/cm	Suspended Solids MG/L	Turbidity MG/L
09-89	04/19/89		DRY				
10-89	05/05/89		INSUFFICIENT SAMPLE FOR INORGANIC ANALYSIS				
10-89	05/05/89		2.5 U	NR	NR	5 U	NR
11-89	05/15/89		DRY				
12-89	05/15/89		DRY				
13-89	05/12/89		DRY				
14-89	05/11/89		DRY				
15-89	05/04/89		2.5 U	NR	NR	900	NR
15-89	05/04/89		2.5 U	NR	NR	40	NR
16-89	05/16/89		DRY				

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND COLLUVIUM

Well Number	Date Sampled	Qtr.	Solids %	Oil and Grease MG/L	Ignitability Degrees F.	Phosphate MG/L
09-89	04/19/89		DRY			
10-89	05/05/89		INSUFFICIENT SAMPLE FOR INORGANIC ANALYSIS			
10-89	05/05/89		NR	NR	NR	NR
11-89	05/15/89		DRY			
12-89	05/15/89		DRY			
13-89	05/12/89		DRY			
14-89	05/11/89		DRY			
15-89	05/04/89		NR	NR	NR	NR
15-89	05/04/89		NR	NR	NR	NR
16-89	05/16/89		DRY			

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND COLLUVIUM

Well Number	Date Sampled	Qtr.	Total Dissolved Solids MG/L	Chloride MG/L	Nitrate+ Nitrite-Nitrogen MG/L	Sulfate MG/L	HCO3- MG/L
46-89	05/05/89		DRY				
50-89	05/17/89		DRY				

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND COLLUVIUM

Well Number	Date Sampled	Qtr.	CO3= MG/L	pH pH Unit	Total Organic Carbon MG/L	Fluoride MG/L	Sulfide MG/L
46-89	05/05/89		DRY				
50-89	05/17/89		DRY				

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND COLLUVIUM

Well Number	Date Sampled	Qtr.	Cyanide, Total MG/L	Hexavalent Chromium (Cr+6) MG/L	Specific Conductance uMHOS/cm	Suspended Solids MG/L	Turbidity MG/L
46-89	05/05/89		DRY				
50-89	05/17/89		DRY				

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND COLLUVIUM

Well Number	Date Sampled	Qtr.	Solids %	Oil and Grease MG/L	Ignitability Degrees F.	Phosphate MG/L
46-89	05/05/89		DRY			
50-89	05/17/89		DRY			

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

RADIONUCLIDES

Groundwater Dissolved Radiochemistry Results

for Regulated Units at Rocky Flats Plant

1989 BACKGROUND COLLUVIUM

Well Number	Date Sampled	Qtr.	Uranium 233, 234 PCI/L	(MDA)	Uranium 235 PCI/L	(MDA)	Uranium 238 PCI/L	(MDA)	Radium 226
09-89	04/19/89		DRY						
10-89	05/05/89		Data not yet received						
10-89	05/05/89		Data not yet received						
11-89	05/15/89		DRY						
12-89	05/15/89		DRY						
13-89	05/12/89		DRY						
14-89	05/11/89		DRY						
15-89	05/04/89		Data not yet received						
15-89	05/04/89		Data not yet received						
16-89	05/16/89		DRY						
46-89	05/05/89		DRY						
50-89	05/17/89		DRY						

Notes: NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Groundwater Dissolved Radiochemistry Results

for Regulated Units at Rocky Flats Plant

1989 BACKGROUND COLLUVIUM

Well Number	Date Sampled	Qtr.	Radium 228
09-89	04/19/89		DRY
10-89	05/05/89		Data not yet received
10-89	05/05/89		Data not yet received
11-89	05/15/89		DRY
12-89	05/15/89		DRY
13-89	05/12/89		DRY
14-89	05/11/89		DRY
15-89	05/04/89		Data not yet received
15-89	05/04/89		Data not yet received
16-89	05/16/89		DRY
46-89	05/05/89		DRY
50-89	05/17/89		DRY

Notes: NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

VALLEY FILL ALLUVIAL GROUND WATER

METALS

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date Sampled	Qtr.	Aluminum (Al), diss. mg/l	Antimony (Sb), diss. mg/l	Arsenic (As), diss. mg/l	Barium (Ba), diss. mg/l	Beryllium (Be), diss. mg/l	Cadmium (Cd), diss. mg/l	Calcium (Ca), diss. mg/l
18-89	04/25/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	18.9000
19-89	04/25/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	36.4000
20-89	04/24/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	40.3000
20-89	04/24/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	5.0000 U
20-89	04/24/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	41.9000
21-89	04/26/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	40.3000
22-89	04/27/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	103.0000
23-89	04/26/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	68.1000
24-89	04/27/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	76.7000
25-89	04/27/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	70.2000

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date Sampled	Qtr.	Cesium (Cs), diss. mg/l	Chromium (Cr), diss. mg/l	Cobalt (Co), diss. mg/l	Copper (Cu), diss. mg/l	Iron (Fe), diss. mg/l	Lead (Pb), diss. mg/l	Lithium (Li), diss. mg/l
18-89	04/25/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.0100 U
19-89	04/25/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.9440	0.0050 U	0.0116
20-89	04/24/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.0133
20-89	04/24/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.0100 U
20-89	04/24/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.0134
21-89	04/26/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.0154
22-89	04/27/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0250 U	0.0167
23-89	04/26/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.0126
24-89	04/27/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.0164
25-89	04/27/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.0223

NR = Analyte not reported
U = Analyzed but not detected
• = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date Sampled	Qtr.	Magnesium (Mg), diss. mg/l	Manganese (Mn), diss. mg/l	Mercury (Hg), diss. mg/l	Molybdenum (Mo), diss. mg/l	Nickel (Ni), diss. mg/l	Potassium (K), diss. mg/l	Selenium (Se), diss. mg/l
18-89	04/25/89		5.0000 U	0.0649	0.0003	0.0100 U	0.0400 U	5.0000 U	0.0050 U
19-89	04/25/89		8.6100	0.2080	0.0002 U	0.0100 U	0.0400 U	5.0000 U	0.0050 U
20-89	04/24/89		8.1900	0.0150 U	0.0002 U	0.0100 U	0.0400 U	5.0000 U	0.0050 U
20-89	04/24/89		5.0000 U	0.0150 U	0.0002 U	0.0100 U	0.0400 U	5.0000 U	0.0050 U
20-89	04/24/89		8.5000	0.0150 U	0.0003	0.0100 U	0.0400 U	5.0000 U	0.0050 U
21-89	04/26/89		8.5100	0.0150 U	0.0002 U	0.0100 U	0.0400 U	5.0000 U	0.0050 U
22-89	04/27/89		18.1000	0.6860	0.0002 U	0.0100 U	0.0400 U	5.0000 U	0.0050 U
23-89	04/26/89		11.8000	0.0150 U	0.0002 U	0.0100 U	0.0400 U	5.0000 U	0.0050 U
24-89	04/27/89		13.8000	0.0150 U	0.0002 U	0.0100 U	0.0400 U	5.0000 U	0.0050 U
25-89	04/27/89		16.6000	0.0546	0.0002 U	0.0100 U	0.0400 U	5.0000 U	0.0114

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
• = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date Sampled	Qtr.	Silver (Ag), diss. mg/l	Sodium (Na), diss. mg/l	Strontium (Sr), diss. mg/l	Thallium (Tl), diss. mg/l	Tin (Sn), diss. mg/l	Vanadium (V), diss. mg/l	Zinc (Zn), diss. mg/l
18-89	04/25/89		0.0100 U	19.3000	1.0000 U	0.0400 U	0.1000 U	0.0500 U	0.0200 U
19-89	04/25/89		0.0100 U	34.7000	1.0000 U	0.0400 U	0.1000 U	0.0500 U	0.0200 U
20-89	04/24/89		0.0100 U	27.3000	1.0000 U	0.0400 U	0.1000 U	0.0500 U	0.0200 U
20-89	04/24/89		0.0100 U	5.0000 U	1.0000 U	0.0100 U	0.1000 U	0.0500 U	0.0200 U
20-89	04/24/89		0.0100 U	25.9000	1.0000 U	0.0400 U	0.1000 U	0.0500 U	0.0200 U
21-89	04/26/89		0.0100 U	33.8000	1.0000 U	0.0400 U	0.1000 U	0.0500 U	0.0200 U
22-89	04/27/89		0.0100 U	45.9000	1.0000 U	0.0400 U	0.1000 U	0.0500 U	0.0212
23-89	04/26/89		0.0100 U	31.4000	1.0000 U	0.0400 U	0.1000 U	0.0500 U	0.0200 U
24-89	04/27/89		0.0100 U	37.3000	1.0000 U	0.0400 U	0.1000 U	0.0500 U	0.0200 U
25-89	04/27/89		0.0100 U	74.7000	1.0000 U	0.0400 U	0.1000 U	0.0500 U	0.0200 U

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date Sampled	Qtr.	Aluminum (Al), diss. mg/l	Antimony (Sb), diss. mg/l	Arsenic (As), diss. mg/l	Barium (Ba), diss. mg/l	Beryllium (Be), diss. mg/l	Cadmium (Cd), diss. mg/l	Calcium (Ca), diss. mg/l
26-89	05/10/89		DRY						

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date Sampled	Qtr.	Cesium (Cs), diss. mg/l	Chromium (Cr), diss. mg/l	Cobalt (Co), diss. mg/l	Copper (Cu), diss. mg/l	Iron (Fe), diss. mg/l	Lead (Pb), diss. mg/l	Lithium (Li), diss. mg/l
26-89	05/10/89		DRY						

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date Sampled	Qtr.	Magnesium (Mg), diss. mg/l	Manganese (Mn), diss. mg/l	Mercury (Hg), diss. mg/l	Molybdenum (Mo), diss. mg/l	Nickel (Ni), diss. mg/l	Potassium (K), diss. mg/l	Selenium (Se), diss. mg/l
26-89	05/10/89		DRY						

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date Sampled	Qtr.	Silver (Ag), diss. mg/l	Sodium (Na), diss. mg/l	Strontium (Sr), diss. mg/l	Thallium (Tl), diss. mg/l	Tin (Sn), diss. mg/l	Vanadium (V), diss. mg/l	Zinc (Zn), diss. mg/l
26-89	05/10/89		DRY						

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

MAJOR IONS

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date Sampled	Qtr.	Total Dissolved Solids MG/L	Chloride MG/L	Nitrate+ Nitrite-Nitrogen MG/L	Sulfate MG/L	HCO3- MG/L
18-89	04/25/89		800	3 U	0.69	13	110
19-89	04/25/89		370	6	0.05 U	41	230
20-89	04/24/89		220	8.4	0.05 U	32	180
20-89	04/24/89		INSUFFICIENT SAMPLE FOR INORGANIC ANALYSIS				
20-89	04/24/89		200	8.4	0.05 U	40	180
21-89	04/26/89		290	8	0.05 U	53	180
22-89	04/27/89		380	19	0.05 U	52	610
23-89	04/26/89		360	14	0.05	56	280
24-89	04/27/89		460	21	0.05 U	77	280
25-89	04/27/89		470	26	0.08	120	280

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date Sampled	Qtr.	CO3= MG/L	pH pH Unit	Total Organic Carbon MG/L	Fluoride MG/L	Sulfide MG/L
18-89	04/25/89		5 U	7.0	NR	NR	NR
19-89	04/25/89		5 U	6.8	NR	NR	NR
20-89	04/24/89		5 U	7.5	NR	NR	NR
20-89	04/24/89		INSUFFICIENT SAMPLE FOR INORGANIC ANALYSIS				
20-89	04/24/89		5 U	7.4	NR	NR	NR
21-89	04/26/89		5 U	7.5	NR	NR	NR
22-89	04/27/89		5 U	7.6	NR	NR	NR
23-89	04/26/89		5 U	7.4	NR	NR	NR
24-89	04/27/89		5 U	7.5	NR	NR	NR
25-89	04/27/89		5 U	8.0	NR	NR	NR

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date Sampled	Qtr.	Cyanide, Total MG/L	Hexavalent Chromium (Cr+6) MG/L	Specific Conductance uMHOS/cm	Suspended Solids MG/L	Turbidity MG/L
18-89	04/25/89		2.5 U	NR	NR	2700	NR
19-89	04/25/89		2.5 U	NR	NR	18,000	NR
20-89	04/24/89		2.5 U	NR	NR	NR	NR
20-89	04/24/89		INSUFFICIENT SAMPLE FOR INORGANIC ANALYSIS				
20-89	04/24/89		2.5 U	NR	NR	NR	NR
21-89	04/26/89		2.5 U	NR	NR	2000	NR
22-89	04/27/89		2.5 U	NR	NR	99	NR
23-89	04/26/89		2.5 U	NR	NR	5800	NR
24-89	04/27/89		2.5 U	NR	NR	47	NR
25-89	04/27/89		2.5 U	NR	NR	92	NR

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date Sampled	Qtr.	Solids %	Oil and Grease MG/L	Ignitability Degrees F.	Phosphate MG/L
18-89	04/25/89		NR	NR	NR	NR
19-89	04/25/89		NR	NR	NR	NR
20-89	04/24/89		NR	NR	NR	NR
20-89	04/24/89		INSUFFICIENT SAMPLE FOR INORGANIC ANALYSIS			
20-89	04/24/89		NR	NR	NR	NR
21-89	04/26/89		NR	NR	NR	NR
22-89	04/27/89		NR	NR	NR	NR
23-89	04/26/89		NR	NR	NR	NR
24-89	04/27/89		NR	NR	NR	NR
25-89	04/27/89		NR	NR	NR	NR

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date Sampled	Qtr.	Total Dissolved Solids MG/L	Chloride MG/L	Nitrate+ Nitrite-Nitrogen MG/L	Sulfate MG/L	HCO3- MG/L
26-89	05/10/89		DRY				

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date Sampled	Qtr.	CO3= MG/L	pH pH Unit	Total Organic Carbon MG/L	Fluoride MG/L	Sulfide MG/L
26-89	05/10/89		DRY				

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date Sampled	Qtr.	Cyanide, Total MG/L	Hexavalent Chromium (Cr+6) MG/L	Specific Conductance uMHOS/cm	Suspended Solids MG/L	Turbidity MG/L
26-89	05/10/89		DRY				

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date Sampled	Qtr.	Solids %	Oil and Grease MG/L	Ignitability Degrees F.	Phosphate MG/L
26-89	05/10/89		DRY			

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

RADIONUCLIDES

Groundwater Dissolved Radiochemistry Results

for Regulated Units at Rocky Flats Plant

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date Sampled	Qtr.	Uranium 233, 234 PCI/L	(MDA)	Uranium 235 PCI/L	(MDA)	Uranium 238 PCI/L	(MDA)	Radium 226
18-89	04/25/89		Data not yet received						
19-89	04/25/89		Data not yet received						
20-89	04/24/89		Data not yet received						
20-89	04/24/89		Data not yet received						
20-89	04/24/89		Data not yet received						
21-89	04/26/89		Data not yet received						
22-89	04/27/89		Data not yet received						
23-89	04/26/89		Data not yet received						
24-89	04/27/89		Data not yet received						
25-89	04/27/89		Data not yet received						
26-89	05/10/89		DRY						

Notes: NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Groundwater Dissolved Radiochemistry Results

for Regulated Units at Rocky Flats Plant

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date Sampled	Qtr.	Radium 228
18-89	04/25/89		Data not yet received
19-89	04/25/89		Data not yet received
20-89	04/24/89		Data not yet received
20-89	04/24/89		Data not yet received
20-89	04/24/89		Data not yet received
21-89	04/26/89		Data not yet received
22-89	04/27/89		Data not yet received
23-89	04/26/89		Data not yet received
24-89	04/27/89		Data not yet received
25-89	04/27/89		Data not yet received
26-89	05/10/89		DRY

Notes: NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

WEATHERED CLAYSTONE GROUND WATER

METALS

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date Sampled	Qtr.	Aluminum (Al), diss. mg/l	Antimony (Sb), diss. mg/l	Arsenic (As), diss. mg/l	Barium (Ba), diss. mg/l	Beryllium (Be), diss. mg/l	Cadmium (Cd), diss. mg/l	Calcium (Ca), diss. mg/l
27-89BR	05/24/89		DRY						
28-89BR	06/20/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	51.1000
29-89BR	05/25/89		DRY						
30-89BR	05/22/89		DRY						
31-89BR	05/25/89		Data not yet received						
31-89BR	05/25/89		Data not yet received						
39-89BR	05/24/89		DRY						
40-89BR	05/22/89		DRY						
42-89BR	05/24/89		DRY						

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date Sampled	Qtr.	Cesium (Cs), diss. mg/l	Chromium (Cr), diss. mg/l	Cobalt (Co), diss. mg/l	Copper (Cu), diss. mg/l	Iron (Fe), diss. mg/l	Lead (Pb), diss. mg/l	Lithium (Li), diss. mg/l
27-89BR	05/24/89		DRY						
28-89BR	06/20/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.1000 U
29-89BR	05/25/89		DRY						
30-89BR	05/22/89		DRY						
31-89BR	05/25/89		Data not yet received						
31-89BR	05/25/89		Data not yet received						
39-89BR	05/24/89		DRY						
40-89BR	05/22/89		DRY						
42-89BR	05/24/89		DRY						

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date Sampled	Qtr.	Magnesium (Mg), diss. mg/l	Manganese (Mn), diss. mg/l	Mercury (Hg), diss. mg/l	Molybdenum (Mo), diss. mg/l	Nickel (Ni), diss. mg/l	Potassium (K), diss. mg/l	Selenium (Se), diss. mg/l
27-89BR	05/24/89		DRY						
28-89BR	06/20/89		45.3000	0.1260	0.0002 U	0.1000 U	0.0400 U	5.0000 U	0.0050 U
29-89BR	05/25/89		DRY						
30-89BR	05/22/89		DRY						
31-89BR	05/25/89		Data not yet received						
31-89BR	05/25/89		Data not yet received						
39-89BR	05/24/89		DRY						
40-89BR	05/22/89		DRY						
42-89BR	05/24/89		DRY						

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date Sampled	Qtr.	Silver (Ag), diss. mg/l	Sodium (Na), diss. mg/l	Strontium (Sr), diss. mg/l	Thallium (Tl), diss. mg/l	Tin (Sn), diss. mg/l	Vanadium (V), diss. mg/l	Zinc (Zn), diss. mg/l
27-89BR	05/24/89		DRY						
28-89BR	06/20/89		0.0100 U	26.2000	1.0000 U	0.0100 U	0.1000 U	0.0500 U	0.0594
29-89BR	05/25/89		DRY						
30-89BR	05/22/89		DRY						
31-89BR	05/25/89		Data not yet received						
31-89BR	05/25/89		Data not yet received						
39-89BR	05/24/89		DRY						
40-89BR	05/22/89		DRY						
42-89BR	05/24/89		DRY						

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date Sampled	Qtr.	Aluminum (Al), diss. mg/l	Antimony (Sb), diss. mg/l	Arsenic (As), diss. mg/l	Barium (Ba), diss. mg/l	Beryllium (Be), diss. mg/l	Cadmium (Cd), diss. mg/l	Calcium (Ca), diss. mg/l
44-89BR	05/31/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	73.4000
45-89BR	06/21/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	41.6000

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date Sampled	Qtr.	Cesium (Cs), diss. mg/l	Chromium (Cr), diss. mg/l	Cobalt (Co), diss. mg/l	Copper (Cu), diss. mg/l	Iron (Fe), diss. mg/l	Lead (Pb), diss. mg/l	Lithium (Li), diss. mg/l
44-89BR	05/31/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.0381
45-89BR	06/21/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.1000 U

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date Sampled	Qtr.	Magnesium (Mg), diss. mg/l	Manganese (Mn), diss. mg/l	Mercury (Hg), diss. mg/l	Molybdenum (Mo), diss. mg/l	Nickel (Ni), diss. mg/l	Potassium (K), diss. mg/l	Selenium (Se), diss. mg/l
44-89BR	05/31/89		15.7000	0.0526	0.0002 U	0.0113	0.0400 U	5.0000 U	0.0050 U
45-89BR	06/21/89		8.1700	0.0150 U	0.0002 U	0.1000 U	0.0400 U	5.0000 U	0.0050 U

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date Sampled	Qtr.	Silver (Ag), diss. mg/l	Sodium (Na), diss. mg/l	Strontium (Sr), diss. mg/l	Thallium (Tl), diss. mg/l	Tin (Sn), diss. mg/l	Vanadium (V), diss. mg/l	Zinc (Zn), diss. mg/l
44-89BR	05/31/89		0.0100 U	36.9000	1.0000 U	0.0500 U	0.1000 U	0.0500 U	0.0200 U
45-89BR	06/21/89		0.0100 U	15.7000	1.0000 U	0.0100 U	0.1000 U	0.0500 U	0.1070

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

MAJOR IONS

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date Sampled	Qtr.	Total Dissolved Solids MG/L	Chloride MG/L	Nitrate+ Nitrite-Nitrogen MG/L	Sulfate MG/L	HCO3- MG/L
27-89BR	05/24/89		DRY				
28-89BR	06/20/89		270	3 U	0.10	28	400
29-89BR	05/25/89		DRY				
30-89BR	05/22/89		DRY				
31-89BR	05/25/89		210	3 U	0.66	13	200
31-89BR	05/25/89		210	3 U	0.44	11	200
39-89BR	05/24/89		DRY				
40-89BR	05/22/89		DRY				
42-89BR	05/24/89		DRY				

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date Sampled	Qtr.	CO3= MG/L	pH pH Unit	Total Organic Carbon MG/L	Fluoride MG/L	Sulfide MG/L
27-89BR	05/24/89		DRY				
28-89BR	06/20/89		5 U	8.2	NR	NR	NR
29-89BR	05/25/89		DRY				
30-89BR	05/22/89		DRY				
31-89BR	05/25/89		5 U	7.6	NR	NR	NR
31-89BR	05/25/89		5 U	7.6	NR	NR	NR
39-89BR	05/24/89		DRY				
40-89BR	05/22/89		DRY				
42-89BR	05/24/89		DRY				

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date Sampled	Qtr.	Cyanide, Total MG/L	Hexavalent Chromium (Cr+6) MG/L	Specific Conductance uMHOS/cm	Suspended Solids MG/L	Turbidity MG/L
27-89BR	05/24/89		DRY				
28-89BR	06/20/89		2.5 U	NR	NR	29,000	NR
29-89BR	05/25/89		DRY				
30-89BR	05/22/89		DRY				
31-89BR	05/25/89		NR	NR	NR	2,900	NR
31-89BR	05/25/89		NR	NR	NR	2,000	NR
39-89BR	05/24/89		DRY				
40-89BR	05/22/89		DRY				
42-89BR	05/24/89		DRY				

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date Sampled	Qtr.	Solids %	Oil and Grease MG/L	Ignitability Degrees F.	Phosphate MG/L
27-89BR	05/24/89		DRY			
28-89BR	06/20/89		NR	NR	NR	NR
29-89BR	05/25/89		DRY			
30-89BR	05/22/89		DRY			
31-89BR	05/25/89		NR	NR	NR	NR
31-89BR	05/25/89		NR	NR	NR	NR
39-89BR	05/24/89		DRY			
40-89BR	05/22/89		DRY			
42-89BR	05/24/89		DRY			

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date Sampled	Qtr.	Total Dissolved Solids MG/L	Chloride MG/L	Nitrate+ Nitrite-Nitrogen MG/L	Sulfate MG/L	HCO3- MG/L
44-89BR	05/31/89		320	11	0.18	44	260
45-89BR	06/21/89		220	6	0.58	24	180

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date Sampled	Qtr.	CO3= MG/L	pH pH Unit	Total Organic Carbon MG/L	Fluoride MG/L	Sulfide MG/L
44-89BR	05/31/89		5 U	7.4	NR	NR	NR
45-89BR	06/21/89		5 U	7.5	NR	NR	NR

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date Sampled	Qtr.	Cyanide, Total MG/L	Hexavalent Chromium (Cr+6) MG/L	Specific Conductance uMHOS/cm	Suspended Solids MG/L	Turbidity MG/L
44-89BR	05/31/89		2.5 U	NR	NR	5 U	NR
45-89BR	06/21/89		3.6	NR	NR	40	NR

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date Sampled	Qtr.	Solids %	Oil and Grease MG/L	Ignitability Degrees F.	Phosphate MG/L
44-89BR	05/31/89		NR	NR	NR	NR
45-89BR	06/21/89		NR	NR	NR	NR

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

RADIONUCLIDES

Groundwater Dissolved Radiochemistry Results

for Regulated Units at Rocky Flats Plant

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date Sampled	Qtr.	Uranium 233, 234 PCI/L	(MDA)	Uranium 235 PCI/L	(MDA)	Uranium 238 PCI/L	(MDA)	Radium 226
27-89BR	05/24/89		DRY						
28-89BR	06/20/89		Data not yet received						
29-89BR	05/25/89		DRY						
30-89BR	05/22/89		DRY						
31-89BR	05/25/89		Data not yet received						
31-89BR	05/25/89		Data not yet received						
39-89BR	05/24/89		DRY						
40-89BR	05/22/89		DRY						
42-89BR	05/24/89		DRY						
44-89BR	05/31/89		Data not yet received						
45-89BR	06/21/89		Data not yet received						

Notes: NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Groundwater Dissolved Radiochemistry Results

for Regulated Units at Rocky Flats Plant

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date Sampled	Qtr.	Radium 228
27-89BR	05/24/89		DRY
28-89BR	06/20/89		Data not yet received
29-89BR	05/25/89		DRY
30-89BR	05/22/89		DRY
31-89BR	05/25/89		Data not yet received
31-89BR	05/25/89		Data not yet received
39-89BR	05/24/89		DRY
40-89BR	05/22/89		DRY
42-89BR	05/24/89		DRY
44-89BR	05/31/89		Data not yet received
45-89BR	06/21/89		Data not yet received

Notes: NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

WEATHERED SANDSTONE GROUND WATER

METALS

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED SANDSTONE

Well Number	Date Sampled	Qtr.	Aluminum (Al), diss. mg/l	Antimony (Sb), diss. mg/l	Arsenic (As), diss. mg/l	Barium (Ba), diss. mg/l	Beryllium (Be), diss. mg/l	Cadmium (Cd), diss. mg/l	Calcium (Ca), diss. mg/l
17-89BR	06/05/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	65.7000
49-89BR	06/14/89		0.2000 U	0.1760	0.0100 U	0.2000 U	0.0050 U	0.0050 U	34.4000
49-89BR	06/14/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	36.2000

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED SANDSTONE

Well Number	Date Sampled	Qtr.	Cesium (Cs), diss. mg/l	Chromium (Cr), diss. mg/l	Cobalt (Co), diss. mg/l	Copper (Cu), diss. mg/l	Iron (Fe), diss. mg/l	Lead (Pb), diss. mg/l	Lithium (Li), diss. mg/l
17-89BR	06/05/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.0106
49-89BR	06/14/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	1.7900
49-89BR	06/14/89		1.0000 U	0.0122	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.1000 U

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED SANDSTONE

Well Number	Date Sampled	Qtr.	Magnesium (Mg), diss. mg/l	Manganese (Mn), diss. mg/l	Mercury (Hg), diss. mg/l	Molybdenum (Mo), diss. mg/l	Nickel (Ni), diss. mg/l	Potassium (K), diss. mg/l	Selenium (Se), diss. mg/l
17-89BR	06/05/89		9.4100	0.2920	0.0002 U	0.0150	0.0400 U	5.0000 U	0.0050 U
49-89BR	06/14/89		5.8900	0.0190	0.0002 U	0.1000 U	0.0400 U	10.2000	0.0050 U
49-89BR	06/14/89		6.0500	0.0178	0.0002 U	0.1000 U	0.0400 U	5.0000 U	0.0050 U

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED SANDSTONE

Well Number	Date Sampled	Qtr.	Silver (Ag), diss. mg/l	Sodium (Na), diss. mg/l	Strontium (Sr), diss. mg/l	Thallium (Tl), diss. mg/l	Tin (Sn), diss. mg/l	Vanadium (V), diss. mg/l	Zinc (Zn), diss. mg/l
17-89BR	06/05/89		0.0100 U	25.6000	1.0000 U	0.0500 U	0.1000 U	0.0500 U	0.0200 U
49-89BR	06/14/89		0.0100 U	21.2000	2.0300	0.0100 U	0.1000 U	0.0500 U	0.0200 U
49-89BR	06/14/89		0.0100 U	13.7000	1.0000 U	0.0100 U	0.1000 U	0.0500 U	0.0200 U

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

MAJOR IONS

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED SANDSTONE

Well Number	Date Sampled	Qtr.	Total Dissolved Solids MG/L	Chloride MG/L	Nitrate+ Nitrite-Nitrogen MG/L	Sulfate MG/L	HCO3- MG/L
17-89BR	06/05/89		220	15	0.18	48	230
49-89BR	06/14/89		170	6	1.4	16	140
49-89BR	06/14/89		170	6	1.6	16	140

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED SANDSTONE

Well Number	Date Sampled	Qtr.	CO3= MG/L	pH pH Unit	Total Organic Carbon MG/L	Fluoride MG/L	Sulfide MG/L
17-89BR	06/05/89		5 U	7.2	NR	NR	NR
49-89BR	06/14/89		5 U	7.7	NR	NR	NR
49-89BR	06/14/89		5 U	7.5	NR	NR	NR

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED SANDSTONE

Well Number	Date Sampled	Qtr.	Cyanide, Total MG/L	Hexavalent Chromium (Cr+6) MG/L	Specific Conductance uMHOS/cm	Suspended Solids MG/L	Turbidity MG/L
17-89BR	06/05/89		2.5 U	NR	NR	210	NR
49-89BR	06/14/89		2.5 U	NR	NR	260	NR
49-89BR	06/14/89		2.5 U	NR	NR	92	NR

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED SANDSTONE

Well Number	Date Sampled	Qtr.	Solids %	Oil and Grease MG/L	Ignitability Degrees F.	Phosphate MG/L
17-89BR	06/05/89		NR	NR	NR	NR
49-89BR	06/14/89		NR	NR	NR	NR
49-89BR	06/14/89		NR	NR	NR	NR

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

RADIONUCLIDES

Groundwater Dissolved Radiochemistry Results

for Regulated Units at Rocky Flats Plant

1989 BACKGROUND WEATHERED SANDSTONE

Well Number	Date Sampled	Qtr.	Uranium 233, 234 PCI/L	(MDA)	Uranium 235 PCI/L	(MDA)	Uranium 238 PCI/L	(MDA)	Radium 226
17-89BR	06/05/89		Data not yet received						
49-89BR	06/14/89		Data not yet received						
49-89BR	06/14/89		Data not yet received						

Notes: NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Groundwater Dissolved Radiochemistry Results

for Regulated Units at Rocky Flats Plant

1989 BACKGROUND WEATHERED SANDSTONE

Well Number	Date Sampled	Qtr.	Radium 228
17-89BR	06/05/89		Data not yet received
49-89BR	06/14/89		Data not yet received
49-89BR	06/14/89		Data not yet received

Notes: NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

UNWEATHERED SANDSTONE GROUND WATER

METALS

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND UNWEATHERED SANDSTONE

Well Number	Date Sampled	Qtr.	Aluminum (Al), diss. mg/l	Antimony (Sb), diss. mg/l	Arsenic (As), diss. mg/l	Barium (Ba), diss. mg/l	Beryllium (Be), diss. mg/l	Cadmium (Cd), diss. mg/l	Calcium (Ca), diss. mg/l
32-89BR	06/27/89		Data not yet received						
33-89BR	06/29/89		Data not yet received						
34-89BR	06/16/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	12.8000
35-89BR	07/06/89		Data not yet received						
36-89BR	06/27/89		Data not yet received						
37-89BR	06/23/89		Data not yet received						
41-89BR	06/23/89		Data not yet received						
43-89BR	06/23/89		DRY						

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND UNWEATHERED SANDSTONE

Well Number	Date Sampled	Qtr.	Cesium (Cs), diss. mg/l	Chromium (Cr), diss. mg/l	Cobalt (Co), diss. mg/l	Copper (Cu), diss. mg/l	Iron (Fe), diss. mg/l	Lead (Pb), diss. mg/l	Lithium (Li), diss. mg/l
32-89BR	06/27/89		Data not yet received						
33-89BR	06/29/89		Data not yet received						
34-89BR	06/16/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0250 U	0.1000 U
35-89BR	07/06/89		Data not yet received						
36-89BR	06/27/89		Data not yet received						
37-89BR	06/23/89		Data not yet received						
41-89BR	06/23/89		Data not yet received						
43-89BR	06/23/89		DRY						

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND UNWEATHERED SANDSTONE

Well Number	Date Sampled	Qtr.	Magnesium (Mg), diss. mg/l	Manganese (Mn), diss. mg/l	Mercury (Hg), diss. mg/l	Molybdenum (Mo), diss. mg/l	Nickel (Ni), diss. mg/l	Potassium (K), diss. mg/l	Selenium (Se), diss. mg/l
32-89BR	06/27/89		Data not yet received						
33-89BR	06/29/89		Data not yet received						
34-89BR	06/16/89		5.0000 U	0.0150 U	0.0002 U	0.1000 U	0.0400 U	5.0000 U	0.0050 U
35-89BR	07/06/89		Data not yet received						
36-89BR	06/27/89		Data not yet received						
37-89BR	06/23/89		Data not yet received						
41-89BR	06/23/89		Data not yet received						
43-89BR	06/23/89		DRY						

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND UNWEATHERED SANDSTONE

Well Number	Date Sampled	Qtr.	Silver (Ag), diss. mg/l	Sodium (Na), diss. mg/l	Strontium (Sr), diss. mg/l	Thallium (Tl), diss. mg/l	Tin (Sn), diss. mg/l	Vanadium (V), diss. mg/l	Zinc (Zn), diss. mg/l
32-89BR	06/27/89		Data not yet received						
33-89BR	06/29/89		Data not yet received						
34-89BR	06/16/89		0.0100 U	67.8000	1.0000 U	0.0400 U	0.1000 U	0.0500 U	0.3740
35-89BR	07/06/89		Data not yet received						
36-89BR	06/27/89		Data not yet received						
37-89BR	06/23/89		Data not yet received						
41-89BR	06/23/89		Data not yet received						
43-89BR	06/23/89		DRY						

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value
R = Data rejected during validation.

MAJOR IONS

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND UNWEATHERED SANDSTONE

Well Number	Date Sampled	Qtr.	Total Dissolved Solids MG/L	Chloride MG/L	Nitrate+ Nitrite-Nitrogen MG/L	Sulfate MG/L	HCO3- MG/L
32-89BR	06/27/89		240	4.7	0.14	31	130
33-89BR	06/29/89		260	3 U	0.35	54	120
34-89BR	06/16/89		230	6	0.06	5 U	210
35-89BR	07/06/89		760	360	0.05 U	55	67
36-89BR	06/27/89		1300	220	0.16	620	100
37-89BR	06/23/89		420	110	0.05 U	8	250
41-89BR	06/23/89		560	200	0.05 U	5 U	270
43-89BR	06/23/89		DRY				

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND UNWEATHERED SANDSTONE

Well Number	Date Sampled	Qtr.	CO3= MG/L	pH pH Unit	Total Organic Carbon MG/L	Fluoride MG/L	Sulfide MG/L
32-89BR	06/27/89		22	9.4	NR	NR	NR
33-89BR	06/29/89		31	9.5	NR	NR	NR
34-89BR	06/16/89		9	8.7	NR	NR	NR
35-89BR	07/06/89		5 U	8.6	NR	NR	NR
36-89BR	06/27/89		18	9.4	NR	NR	NR
37-89BR	06/23/89		18	8.9	NR	NR	NR
41-89BR	06/23/89		6	8.5	NR	NR	NR
43-89BR	06/23/89		DRY				

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND UNWEATHERED SANDSTONE

Well Number	Date Sampled	Qtr.	Cyanide, Total MG/L	Hexavalent Chromium (Cr+6) MG/L	Specific Conductance uMHOS/cm	Suspended Solids MG/L	Turbidity MG/L
32-89BR	06/27/89		NR	NR	NR	440	NR
33-89BR	06/29/89		NR	NR	NR	1600	NR
34-89BR	06/16/89		2.5 U	NR	NR	140	NR
35-89BR	07/06/89		NR	NR	NR	62	NR
36-89BR	06/27/89		2.5 U	NR	NR	810	NR
37-89BR	06/23/89		NR	NR	NR	10	NR
41-89BR	06/23/89		NR	NR	NR	30	NR
43-89BR	06/23/89		DRY				

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND UNWEATHERED SANDSTONE

Well Number	Date Sampled	Qtr.	Solids %	Oil and Grease MG/L	Ignitability Degrees F.	Phosphate MG/L
32-89BR	06/27/89		NR	NR	NR	NR
33-89BR	06/29/89		NR	NR	NR	NR
34-89BR	06/16/89		NR	NR	NR	NR
35-89BR	07/06/89		NR	NR	NR	NR
36-89BR	06/27/89		NR	NR	NR	NR
37-89BR	06/23/89		NR	NR	NR	NR
41-89BR	06/23/89		NR	NR	NR	NR
43-89BR	06/23/89		DRY			

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

RADIONUCLIDES

Groundwater Dissolved Radiochemistry Results

for Regulated Units at Rocky Flats Plant

1989 BACKGROUND UNWEATHERED SANDSTONE

Well Number	Date Sampled	Qtr.	Uranium 233, 234 PCI/L	(MDA)	Uranium 235 PCI/L	(MDA)	Uranium 238 PCI/L	(MDA)	Radium 226
32-89BR	06/27/89		Data not yet received						
33-89BR	06/29/89		Data not yet received						
34-89BR	06/16/89		Data not yet received						
35-89BR	07/06/89		Data not yet received						
36-89BR	06/27/89		Data not yet received						
37-89BR	06/23/89		Data not yet received						
41-89BR	06/23/89		Data not yet received						
43-89BR	06/23/89		DRY						

Notes: NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Groundwater Dissolved Radiochemistry Results

for Regulated Units at Rocky Flats Plant

1989 BACKGROUND UNWEATHERED SANDSTONE

Well Number	Date Sampled	Qtr.	Radium 228
32-89BR	06/27/89		Data not yet received
33-89BR	06/29/89		Data not yet received
34-89BR	06/16/89		Data not yet received
35-89BR	07/06/89		Data not yet received
36-89BR	06/27/89		Data not yet received
37-89BR	06/23/89		Data not yet received
41-89BR	06/23/89		Data not yet received
43-89BR	06/23/89		DRY

Notes: NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

APPENDIX G-2

SURFACE WATER DATA

METALS

Surface Water Dissolved Metals Results

For Stations at Rockwell (Rocky Flats)

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr.	Aluminum (Al), diss. mg/l	Antimony (Sb), diss. mg/l	Arsenic (As), diss. mg/l	Barium (Ba), diss. mg/l	Beryllium (Be), diss. mg/l	Cadmium (Cd), diss. mg/l	Calcium (Ca), diss. mg/l
SW-04	03/02/89		Data not yet received						
SW-04	05/30/89		DRY						
SW-05	02/28/89		0.2000 U	0.0600 U	NR	0.2000 U	0.0050 U	0.0050 U	26.5000
SW-05	05/30/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	20.9000
SW-06	02/24/89		0.4850	0.0600 U	NR	0.2000 U	0.0050 U	0.0050 U	25.5000
SW-06	02/24/89		0.2520	0.0600 U	NR	0.2000 U	0.0050 U	0.0050 U	23.9000
SW-06	02/24/89		0.2000 U	0.0600 U	NR	0.2000 U	0.0050 U	0.0050 U	5.0000 U
SW-06	05/31/89		0.4540	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	14.5000
SW-07	02/27/89		Data not yet received						
SW-07	05/31/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	23.6000
SW-104	03/02/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	78.4000
SW-107	02/28/89		0.2000 U	0.0600 U	NR	0.2000 U	0.0050 U	0.0050 U	20.3000
SW-107	05/26/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	21.4000

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
• = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value

Surface Water Dissolved Metals Results

For Stations at Rockwell (Rocky Flats)

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr.	Cesium (Cs), diss. mg/l	Chromium (Cr), diss. mg/l	Cobalt (Co), diss. mg/l	Copper (Cu), diss. mg/l	Iron (Fe), diss. mg/l	Lead (Pb), diss. mg/l	Lithium (Li), diss. mg/l
SW-04	03/02/89		Data not yet received						
SW-04	05/30/89		DRY						
SW-05	02/28/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	NR	0.1000 U
SW-05	05/30/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.0100 U
SW-06	02/24/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	1.7800	NR	0.1000 U
SW-06	02/24/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.9010	NR	0.1000 U
SW-06	02/24/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	NR	0.1000 U
SW-06	05/31/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.3710	0.0131	0.0100 U
SW-07	02/27/89		Data not yet received						
SW-07	05/31/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.0100 U
SW-104	03/02/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	4.6900	0.0050 U	0.1000 U
SW-107	02/28/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	NR	0.1000 U
SW-107	05/26/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.4530	0.0050 U	0.0100 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Dissolved Metals Results

For Stations at Rockwell (Rocky Flats)

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr.	Magnesium (Mg), diss. mg/l	Manganese (Mn), diss. mg/l	Mercury (Hg), diss. mg/l	Molybdenum (Mo), diss. mg/l	Nickel (Ni), diss. mg/l	Potassium (K), diss. mg/l	Selenium (Se), diss. mg/l
SW-04	03/02/89		Data not yet received						
SW-04	05/30/89		DRY						
SW-05	02/28/89		6.4300	0.0150 U	NR	0.1000 U	0.0400 U	5.0000 U	NR
SW-05	05/30/89		5.0000	0.0150 U	0.0002 U	0.0234	0.0400 U	5.0000 U	0.0050 U
SW-06	02/24/89		7.7300	0.3680	NR	0.1000 U	0.0400 U	5.0000 U	NR
SW-06	02/24/89		7.4900	0.3380	NR	0.1000 U	0.0400 U	5.0000 U	NR
SW-06	02/24/89		5.0000 U	0.0150 U	NR	0.1000 U	0.0400 U	5.0000 U	NR
SW-06	05/31/89		5.0000 U	0.0290	0.0002 U	0.0176	0.0400 U	5.0000 U	0.0050 U
SW-07	02/27/89		Data not yet received						
SW-07	05/31/89		6.0900	0.0768	0.0002 U	0.0119	0.0400 U	5.0000 U	0.0050 U
SW-104	03/02/89		6.8300	0.4800	0.0003	0.1000 U	0.0400 U	5.0000 U	0.0050 U
SW-107	02/28/89		5.9200	0.0150 U	NR	0.1000 U	0.0400 U	5.0000 U	NR
SW-107	05/26/89		5.4000	0.0364	0.0004	0.0178	0.0400 U	5.0000 U	0.0050 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Dissolved Metals Results

For Stations at Rockwell (Rocky Flats)

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr.	Silver (Ag), diss. mg/l	Sodium (Na), diss. mg/l	Strontium (Sr), diss. mg/l	Thallium (Tl), diss. mg/l	Tin (Sn), diss. mg/l	Vanadium (V), diss. mg/l	Zinc (Zn), diss. mg/l
SW-04	03/02/89		Data not yet received						
SW-04	05/30/89		DRY						
SW-05	02/28/89		0.0100 U	17.1000	0.1610	NR	0.1000 U	0.0500 U	0.0200 U
SW-05	05/30/89		0.0100 U	15.1000	1.0000 U	0.0100 U	0.1000 U	0.0500 U	0.0200 U
SW-06	02/24/89		0.0100 U	29.3000	0.1730	NR	0.1000 U	0.0500 U	0.0242
SW-06	02/24/89		0.0100 U	27.0000	0.1630	NR	0.1000 U	0.0500 U	0.0200 U
SW-06	02/24/89		0.0100 U	5.0000 U	0.1000 U	NR	0.1000 U	0.0500 U	0.0294
SW-06	05/31/89		0.0100 U	21.4000	1.0000 U	0.0100 U	0.1000 U	0.0500 U	0.0228
SW-07	02/27/89		Data not yet received						
SW-07	05/31/89		0.0100 U	33.8000	1.0000 U	0.0500 U	0.1000 U	0.0500 U	0.0200 U
SW-104	03/02/89		0.0125	11.2000	0.2060	0.0500 U	0.1000 U	0.0500 U	0.0200 U
SW-107	02/28/89		0.0100 U	32.3000	0.1290	NR	0.1000 U	0.0500 U	0.0200 U
SW-107	05/26/89		0.0100 U	15.6000	1.0000 U	0.0500 U	0.1000 U	0.0500 U	0.0200 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Dissolved Metals Results

For Stations at Rockwell (Rocky Flats)

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr.	Aluminum (Al), diss. mg/l	Antimony (Sb), diss. mg/l	Arsenic (As), diss. mg/l	Barium (Ba), diss. mg/l	Beryllium (Be), diss. mg/l	Cadmium (Cd), diss. mg/l	Calcium (Ca), diss. mg/l
SW-108	03/02/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	68.0000
SW-108	05/30/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	63.9000
SW-108	05/30/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	64.0000
SW-108	05/30/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	5.0000 U
SW-41	03/01/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	20.4000
SW-41	05/26/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	34.8000
SW-80	03/01/89		0.2000 U	0.0600 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	31.5000
SW-80	05/24/89		DRY						

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Dissolved Metals Results

For Stations at Rockwell (Rocky Flats)

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr.	Cesium (Cs), diss. mg/l	Chromium (Cr), diss. mg/l	Cobalt (Co), diss. mg/l	Copper (Cu), diss. mg/l	Iron (Fe), diss. mg/l	Lead (Pb), diss. mg/l	Lithium (Li), diss. mg/l
SW-108	03/02/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.1000 U
SW-108	05/30/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.0166
SW-108	05/30/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.0165
SW-108	05/30/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.0100 U
SW-41	03/01/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.1000 U
SW-41	05/26/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	0.1000 U	0.0050 U	0.0100 U
SW-80	03/01/89		1.0000 U	0.0100 U	0.0500 U	0.0250 U	2.0300	0.0050 U	0.1000 U
SW-80	05/24/89		DRY						

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value

Surface Water Dissolved Metals Results

For Stations at Rockwell (Rocky Flats)

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr.	Magnesium (Mg), diss. mg/l	Manganese (Mn), diss. mg/l	Mercury (Hg), diss. mg/l	Molybdenum (Mo), diss. mg/l	Nickel (Ni), diss. mg/l	Potassium (K), diss. mg/l	Selenium (Se), diss. mg/l
SW-108	03/02/89		10.0000	0.0506	0.0006	0.1000 U	0.0400 U	5.0000 U	0.0050 U
SW-108	05/30/89		11.8000	0.1630	0.0002 U	0.0100 U	0.0400 U	5.0000 U	0.0050 U
SW-108	05/30/89		11.8000	0.1620	0.0005	0.0100 U	0.0400 U	5.0000 U	0.0050 U
SW-108	05/30/89		5.0000 U	0.0150 U	0.0002 U	0.0124	0.0400 U	5.0000 U	0.0050 U
SW-41	03/01/89		5.8200	0.0396	0.0002 U	0.1000 U	0.0400 U	5.0000 U	0.0050 U
SW-41	05/26/89		9.0400	0.0566	0.0004	0.0105	0.0400 U	5.0000 U	0.0050 U
SW-80	03/01/89		5.0000 U	0.1500	0.0013	0.1000 U	0.0400 U	5.0000 U	0.0050 U
SW-80	05/24/89		DRY						

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value

Surface Water Dissolved Metals Results

For Stations at Rockwell (Rocky Flats)

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr.	Silver (Ag), diss. mg/l	Sodium (Na), diss. mg/l	Strontium (Sr), diss. mg/l	Thallium (Tl), diss. mg/l	Tin (Sn), diss. mg/l	Vanadium (V), diss. mg/l	Zinc (Zn), diss. mg/l
SW-108	03/02/89		0.0100 U	13.2000	0.2960	0.0500 U	0.1000 U	0.0500 U	0.0200 U
SW-108	05/30/89		0.0100 U	20.1000	1.0000 U	0.0500 U	0.1000 U	0.0500 U	0.0200 U
SW-108	05/30/89		0.0100 U	20.0000	1.0000 U	0.0100 U	0.1000 U	0.0500 U	0.0200 U
SW-108	05/30/89		0.0100 U	5.0000 U	1.0000 U	0.0100 U	0.1000 U	0.0500 U	0.0200 U
SW-41	03/01/89		0.0100 U	29.4000	0.1240	0.0400 U	0.1000 U	0.0500 U	0.0200 U
SW-41	05/26/89		0.0100 U	26.1000	1.0000 U	0.0500 U	0.1000 U	0.0500 U	0.0200 U
SW-80	03/01/89		0.0100 U	8.3800	0.1380	0.0400 U	0.1000 U	0.0500 U	0.0200 U
SW-80	05/24/89		DRY						

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value

Surface Water Total Metals Results

For Stations at Rockwell (Rocky Flats)

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr.	Aluminum (Al), total mg/l	Arsenic (As), total mg/l	Barium (Ba), total mg/l	Beryllium (Be), total mg/l	Cadmium (Cd), total mg/l	Calcium (Ca), total mg/l	Cesium (Cs), total mg/l
SW-04	03/02/89		Data not yet received						
SW-04	05/30/89		DRY						
SW-05	02/28/89		0.2000 U	NR	0.2000 U	0.0050 U	0.0050 U	24.2000	1.0000 U
SW-05	05/30/89		0.2000 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	19.9000	1.0000 U
SW-06	02/24/89		0.9160	NR	0.2000 U	0.0050 U	0.0050 U	26.2000	1.0000 U
SW-06	02/24/89		1.0600	NR	0.2000 U	0.0050 U	0.0050 U	24.1000	1.0000 U
SW-06	02/24/89		0.2000 U	NR	0.2000 U	0.0050 U	0.0050 U	5.0000 U	1.0000 U
SW-06	05/31/89		1.6700	0.0100 U	0.2000 U	0.0050 U	0.0050 U	16.3000	1.0000 U
SW-07	02/27/89		Data not yet received						
SW-07	05/31/89		1.2100	0.0100 U	0.2000 U	0.0050 U	0.0050 U	26.2000	1.0000 U
SW-104	03/02/89		8.3600	0.0105	0.2000 U	0.0050 U	0.0050 U	98.1000	1.0000 U
SW-107	02/28/89		0.2000 U	NR	0.2000 U	0.0050 U	0.0050 U	20.0000	1.0000 U
SW-107	05/26/89		0.2360	0.0100 U	0.2000 U	0.0050 U	0.0050 U	19.1000	1.0000 U

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value

Surface Water Total Metals Results

For Stations at Rockwell (Rocky Flats)

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr.	Chromium (Cr), total mg/l	Cobalt (Co), total mg/l	Copper (Cu), total mg/l	Silver (Ag), total mg/l	Antimony (Sb), total mg/l	Iron (Fe), total mg/l	Lead (Pb), total mg/l
SW-04	03/02/89		Data not yet received						
SW-04	05/30/89		DRY						
SW-05	02/28/89		0.0100 U	0.0500 U	0.0250 U	0.0100 U	0.0600 U	0.1240	NR
SW-05	05/30/89		0.0100 U	0.0500 U	0.0250 U	0.0100 U	0.0600 U	0.3600	0.0050 U
SW-06	02/24/89		0.0100 U	0.0500 U	0.0250 U	0.0100 U	0.0600 U	2.4100	NR
SW-06	02/24/89		0.0100 U	0.0500 U	0.0250 U	0.0100 U	0.0600 U	2.2100	NR
SW-06	02/24/89		0.0100 U	0.0500 U	0.0250 U	0.0100 U	0.0600 U	0.1000 U	NR
SW-06	05/31/89		0.0106	0.0500 U	0.0250 U	0.0100 U	0.0600 U	1.6400	0.0050 U
SW-07	02/27/89		Data not yet received						
SW-07	05/31/89		0.0100 U	0.0500 U	0.0250 U	0.0100 U	0.0600 U	0.9460	0.0050 U
SW-104	03/02/89		0.0100 U	0.0500 U	0.0250 U	0.0174	0.0600 U	22.6000	0.0185
SW-107	02/28/89		0.0100 U	0.0500 U	0.0250 U	0.0100 U	0.0600 U	0.1490	NR
SW-107	05/26/89		0.0100 U	0.0500 U	0.0250 U	0.0100 U	0.0600 U	1.2000	0.0050 U

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value

Surface Water Total Metals Results

For Stations at Rockwell (Rocky Flats)

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr.	Lithium (Li), total mg/l	Magnesium (Mg), total mg/l	Manganese (Mn), total mg/l	Mercury (Hg), total mg/l	Molybdenum (Mo), total mg/l	Nickel (Ni), total mg/l	Potassium (K), total mg/l
SW-04	03/02/89		Data not yet received						
SW-04	05/30/89		DRY						
SW-05	02/28/89		0.1000 U	5.7600	0.0150 U	NR	0.1000 U	0.0400 U	5.0000 U
SW-05	05/30/89		0.0100 U	5.1900	0.0162	0.0002 U	0.0138	0.0400 U	5.0000 U
SW-06	02/24/89		0.1000 U	8.0000	0.3780	NR	0.1000 U	0.0400 U	5.0000 U
SW-06	02/24/89		0.1000 U	7.6300	0.3710	NR	0.1000 U	0.0400 U	5.0000 U
SW-06	02/24/89		0.1000 U	5.0000 U	0.0150 U	NR	0.1000 U	0.0400 U	5.0000 U
SW-06	05/31/89		0.0100 U	5.0000 U	0.0848	0.0003	0.0106	0.0400 U	5.0000 U
SW-07	02/27/89		Data not yet received						
SW-07	05/31/89		0.0100 U	6.5800	0.1050	0.0003	0.0144	0.0400 U	5.0000 U
SW-104	03/02/89		0.1000 U	9.0400	0.7160	0.0003	0.1000 U	0.0400 U	5.0000 U
SW-107	02/28/89		0.1000 U	5.7800	0.0175	NR	0.1000 U	0.0400 U	5.0000 U
SW-107	05/26/89		0.0100 U	5.0000 U	0.1580	0.0002 U	0.0105	0.0400 U	5.0000 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Total Metals Results

For Stations at Rockwell (Rocky Flats)

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr.	Sodium (Na), total mg/l	Selenium (Se), total mg/l	Strontium (Sr), total mg/l	Thallium (Tl), total mg/l	Tin (Sn), Total mg/l	Vanadium (V), total mg/l	Zinc (Zn), total mg/l
SW-04	03/02/89		Data not yet received						
SW-04	05/30/89		DRY						
SW-05	02/28/89		15.3000	NR	0.1400	NR	0.1000 U	0.0500 U	0.0200 U
SW-05	05/30/89		15.2000	0.0050 U	1.0000 U	0.0100 U	0.1000 U	0.0500 U	0.0200 U
SW-06	02/24/89		30.2000	NR	0.1770	NR	0.1000 U	0.0500 U	0.0268
SW-06	02/24/89		27.8000	NR	0.1710	NR	0.1000 U	0.0500 U	0.0536
SW-06	02/24/89		5.0000 U	NR	0.1000 U	NR	0.1000 U	0.0500 U	0.0200 U
SW-06	05/31/89		22.0000	0.0050 U	1.0000 U	0.0100 U	0.1000 U	0.0500 U	0.0676
SW-07	02/27/89		Data not yet received						
SW-07	05/31/89		33.3000	0.0050 U	1.0000 U	0.0100 U	0.1000 U	0.0500 U	0.0200 U
SW-104	03/02/89		14.4000	0.0050 U	0.2550	0.0500 U	0.1000 U	0.0500 U	0.0281
SW-107	02/28/89		30.8000	NR	0.1230	NR	0.1000 U	0.0500 U	0.0200 U
SW-107	05/26/89		15.7000	0.0050 U	1.0000 U	0.0100 U	0.1000 U	0.0500 U	0.0200 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Total Metals Results

For Stations at Rockwell (Rocky Flats)

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr.	Aluminum (Al), total mg/l	Arsenic (As), total mg/l	Barium (Ba), total mg/l	Beryllium (Be), total mg/l	Cadmium (Cd), total mg/l	Calcium (Ca), total mg/l	Cesium (Cs), total mg/l
SW-108	03/02/89		0.2000 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	67.0000	1.0000 U
SW-108	05/30/89		4.9800	0.0100 U	0.2000 U	0.0050 U	0.0050 U	63.9000	1.0000 U
SW-108	05/30/89		4.9300	0.0100 U	0.2000 U	0.0050 U	0.0050 U	63.0000	1.0000 U
SW-108	05/30/89		1.0500	0.0100 U	0.2000 U	0.0050 U	0.0050 U	58.0000	1.0000 U
SW-41	03/01/89		0.2000 U	0.0100 U	0.2000 U	0.0050 U	0.0050 U	21.7000	1.0000 U
SW-41	05/26/89		2.1400	0.0100 U	0.2000 U	0.0050 U	0.0050 U	34.0000	1.0000 U
SW-80	03/01/89		64.1000	0.1160	4.4900	0.0097	0.0690	226.0000	2.5300
SW-80	05/24/89		DRY						

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value

Surface Water Total Metals Results

For Stations at Rockwell (Rocky Flats)

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr.	Chromium (Cr), total mg/l	Cobalt (Co), total mg/l	Copper (Cu), total mg/l	Silver (Ag), total mg/l	Antimony (Sb), total mg/l	Iron (Fe), total mg/l	Lead (Pb), total mg/l
SW-108	03/02/89		0.0100 U	0.0500 U	0.0250 U	0.0106	0.0600 U	0.3960	0.0050 U
SW-108	05/30/89		0.0100 U	0.0500 U	0.0250 U	0.0100 U	0.0600 U	4.3200	0.0050 U
SW-108	05/30/89		0.0100 U	0.0500 U	0.0250 U	0.0100 U	0.0600 U	4.1900	0.0062
SW-108	05/30/89		0.0100 U	0.0500 U	0.0250 U	0.0100 U	0.0600 U	1.3500	0.0050 U
SW-41	03/01/89		0.0100 U	0.0500 U	0.0250 U	0.0100 U	0.0600 U	0.1320	0.0050 U
SW-41	05/26/89		0.0100 U	0.0500 U	0.0250 U	0.0100 U	0.0600 U	5.4800	0.0050 U
SW-80	03/01/89		0.0598	0.0730	0.1800	0.1480	0.0600 U	651.0000	0.2330
SW-80	05/24/89		DRY						

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value

Surface Water Total Metals Results

For Stations at Rockwell (Rocky Flats)

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr.	Lithium (Li), total mg/l	Magnesium (Mg), total mg/l	Manganese (Mn), total mg/l	Mercury (Hg), total mg/l	Molybdenum (Mo), total mg/l	Nickel (Ni), total mg/l	Potassium (K), total mg/l
SW-108	03/02/89		0.1000 U	9.4700	0.0534	0.0003	0.1000 U	0.0400 U	5.0000 U
SW-108	05/30/89		0.0192	12.3000	0.2180	0.0004	0.0176	0.0400 U	5.0000 U
SW-108	05/30/89		0.0183	12.2000	0.2140	0.0012	0.0188	0.0400 U	5.0000 U
SW-108	05/30/89		0.0162	11.5000	0.1820	0.0013	0.0133	0.0400 U	5.0000 U
SW-41	03/01/89		0.1000 U	6.1000	0.0212	0.0011	0.1000 U	0.0400 U	5.0000 U
SW-41	05/26/89		0.0100 U	8.8100	0.2090	0.0002 U	0.0115	0.0400 U	5.0000 U
SW-80	03/01/89		0.1000 U	24.9000	0.4800	NR	0.1990	0.2500	9.8600
SW-80	05/24/89		DRY						

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Total Metals Results

For Stations at Rockwell (Rocky Flats)

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr.	Sodium (Na), total mg/l	Selenium (Se), total mg/l	Strontium (Sr), total mg/l	Thallium (Tl), total mg/l	Tin (Sn), Total mg/l	Vanadium (V), total mg/l	Zinc (Zn), total mg/l
SW-108	03/02/89		12.5000	0.0050 U	0.2850	NR	0.1000 U	0.0500 U	0.0200 U
SW-108	05/30/89		21.5000	0.0050 U	1.0000 U	0.0100 U	0.1000 U	0.0500 U	0.0200 U
SW-108	05/30/89		21.9000	0.0050 U	1.0000 U	0.0100 U	0.1000 U	0.0500 U	0.0200 U
SW-108	05/30/89		21.8000	0.0050 U	1.0000 U	0.0100 U	0.1000 U	0.0500 U	0.0200 U
SW-41	03/01/89		30.0000	0.0050 U	0.1270	0.0400 U	0.1000 U	0.0500 U	0.0200 U
SW-41	05/26/89		26.4000	0.0050 U	1.0000 U	0.0100 U	0.1000 U	0.0500 U	0.0892
SW-80	03/01/89		12.8000	0.0050 U	1.2000	0.0400 U	0.9690	0.3640	0.7230
SW-80	05/24/89		DRY						

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

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Surface Water Inorganic Results

For Stations at Rockwell (Rocky Flats)

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Total Dissolved Solids MG/L	Chloride MG/L	Nitrate+ Nitrite-Nitrogen MG/L	Sulfate MG/L	HCO3- MG/L
SW04	03/02/89	180	7	0.12	34	150
SW04	05/30/89	DRY				
SW05	02/28/89	130	6	0.91	29	110
SW05	05/30/89	140	4	0.40	23	94
SW06	02/24/89	200	14	0.25	23	120
SW06	02/24/89	200	15	0.64	5	120
SW06	02/24/89	INSUFFICIENT SAMPLE FOR INORGANIC ANALYSIS				
SW06	05/31/89	140	20	0.16	36	56
SW07	02/27/89	140	28	2.0	17	30
SW07	05/31/89	200	62	2.1	29	59
SW104	03/02/89	290	14	0.05 U	5 U	320
SW107	02/28/89	160	62	0.39	16	48
SW107	05/26/89	140	17	0.05 U	13	89

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Surface Water Inorganic Results

For Stations at Rockwell (Rocky Flats)

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled		CO3= MG/L		pH pH Unit	Total Organic Carbon MG/L	Fluoride MG/L	Sulfide MG/L
SW04	03/02/89		5	U	8.1	NR	NR	NR
SW04	05/30/89		DRY					
SW05	02/28/89		5	U	7.8	NR	NR	NR
SW05	05/30/89		5	U	7.4	NR	NR	NR
SW06	02/24/89		5	U	7.3	NR	NR	NR
SW06	02/24/89		5	U	7.2	NR	NR	NR
SW06	02/24/89		INSUFFICIENT SAMPLE FOR INORGANIC ANALYSIS					
SW06	05/31/89		5	U	7.2	NR	NR	NR
SW07	02/27/89		5	U	7.3	NR	NR	NR
SW07	05/31/89		5	U	7.2	NR	NR	NR
SW104	03/02/89		5	U	7.1	NR	NR	NR
SW107	02/28/89		5	U	7.7	NR	NR	NR
SW107	05/26/89		5	U	7.7	NR	NR	NR

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Surface Water Inorganic Results

For Stations at Rockwell (Rocky Flats)

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Cyanide, Total MG/L	Hexavalent Chromium (Cr+6) MG/L	Specific Conductance uMHOS/cm	Suspended Solids MG/L	Turbidity MG/L
SW04	03/02/89	NR	NR	NR	5 U	NR
SW04	05/30/89	DRY				
SW05	02/28/89	2.5 U	NR	NR	8	NR
SW05	05/30/89	2.5 U	NR	NR	6	NR
SW06	02/24/89	2.5 U	NR	NR	18	NR
SW06	02/24/89	2.5 U	NR	NR	18	NR
SW06	02/24/89	INSUFFICIENT SAMPLE FOR INORGANIC ANALYSIS				
SW06	05/31/89	2.5 U	NR	NR	26	NR
SW07	02/27/89	NR	NR	NR	15	NR
SW07	05/31/89	4.3	NR	NR	19	NR
SW104	03/02/89	2.5 U	NR	NR	340	NR
SW107	02/28/89	2.5 U	NR	NR	11	NR
SW107	05/26/89	2.5 U	NR	NR	7	NR

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Surface Water Inorganic Results

For Stations at Rockwell (Rocky Flats)

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Solids %	Oil and Grease MG/L	Ignitability Degrees F.	Phosphate MG/L
SW04	03/02/89	NR	NR	NR	NR
SW04	05/30/89	DRY			
SW05	02/28/89	NR	NR	NR	NR
SW05	05/30/89	NR	NR	NR	NR
SW06	02/24/89	NR	NR	NR	NR
SW06	02/24/89	NR	NR	NR	NR
SW06	02/24/89	INSUFFICIENT SAMPLE FOR INORGANIC ANALYSIS			
SW06	05/31/89	NR	NR	NR	NR
SW07	02/27/89	NR	NR	NR	NR
SW07	05/31/89	NR	NR	NR	NR
SW104	03/02/89	NR	NR	NR	NR
SW107	02/28/89	NR	NR	NR	NR
SW107	05/26/89	NR	NR	NR	NR

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Surface Water Inorganic Results

For Stations at Rockwell (Rocky Flats)

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Total Dissolved Solids MG/L	Chloride MG/L	Nitrate+ Nitrite-Nitrogen MG/L	Sulfate MG/L	HCO3- MG/L
SW108	03/02/89	220	5	0.30	33	200
SW108	05/30/89	280	4	0.05 U	46	230
SW108	05/30/89	260	5	0.05 U	45	230
SW108	05/30/89	INSUFFICIENT SAMPLE FOR INORGANIC ANALYSIS				
SW41	03/01/89	160	62	0.29	17	48
SW41	05/26/89	200	6	0.05 U	32	170
SW80	03/01/89	120	10	1* U	16	150
SW80	05/24/89	DRY				

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Surface Water Inorganic Results

For Stations at Rockwell (Rocky Flats)

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled		CO3= MG/L		pH pH Unit	Total Organic Carbon MG/L	Fluoride MG/L	Sulfide MG/L
SW108	03/02/89		5	U	7.7	NR	NR	NR
SW108	05/30/89		5	U	7.6	NR	NR	NR
SW108	05/30/89		5	U	7.6	NR	NR	NR
SW108	05/30/89		INSUFFICIENT SAMPLE FOR INORGANIC ANALYSIS					
SW41	03/01/89		5	U	7.6	NR	NR	NR
SW41	05/26/89		5	U	7.0	NR	NR	NR
SW80	03/01/89		5	U	6.5	NR	NR	NR
SW80	05/24/89		DRY					

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Surface Water Inorganic Results

For Stations at Rockwell (Rocky Flats)

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Cyanide, Total MG/L	Hexavalent Chromium (Cr+6) MG/L	Specific Conductance uMHOS/cm	Suspended Solids MG/L	Turbidity MG/L
SW108	03/02/89	2.5 U	NR	NR	5 U	NR
SW108	05/30/89	2.5 U	NR	NR	96	NR
SW108	05/30/89	2.5 U	NR	NR	92	NR
SW108	05/30/89	INSUFFICIENT SAMPLE FOR INORGANIC ANALYSIS				
SW41	03/01/89	2.5 U	NR	NR	5 U	NR
SW41	05/26/89	2.5 U	NR	NR	92	NR
SW80	03/01/89	2.5 U	NR	NR	4200	NR
SW80	05/24/89	DRY				

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Surface Water Inorganic Results

For Stations at Rockwell (Rocky Flats)

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Solids %	Oil and Grease MG/L	Ignitability Degrees F.	Phosphate MG/L
SW108	03/02/89	NR	NR	NR	NR
SW108	05/30/89	NR	NR	NR	NR
SW108	05/30/89	NR	NR	NR	NR
SW108	05/30/89	INSUFFICIENT SAMPLE FOR INORGANIC ANALYSIS			
SW41	03/01/89	NR	NR	NR	NR
SW41	05/26/89	NR	NR	NR	NR
SW80	03/01/89	NR	NR	NR	NR
SW80	05/24/89	DRY			

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

RADIONUCLIDES

Surface Water Dissolved Radiochemistry Results

for Regulated Units at Rocky Flats Plant

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Uranium 233, 234 PCI/L (MDA)	Uranium 235 PCI/L (MDA)	Uranium 238 PCI/L (MDA)	Radium 226
SW04	03/02/89	0.8 ± 0.2	0.0 ± 0.1	0.6 ± 0.2	NR
SW04	05/30/89	DRY			
SW05	02/28/89	0.8 ± 0.3	0.0 ± 0.1	0.3 ± 0.2	NR
SW05	05/30/89	***			
SW06	02/24/89	0.3 ± 0.1	0.0 ± 0.1	0.2 ± 0.2	NR
SW06	02/24/89	0.7 ± 0.2	0.0 ± 0.1	0.3 ± 0.2	NR
SW06	02/24/89	0.0 ± 0.1	0.0 ± 0.1	0.0 ± 0.1	NR
SW06	05/31/89	***			
SW07	02/27/89	0.5 ± 1.3	0.1 ± 0.2	0.1 ± 1.2	NR
SW07	05/31/89	***			
SW104	03/02/89	2.6 ± 0.5	0.3 ± 0.1	1.7 ± 0.4	NR
SW107	02/28/89	0.2 ± 0.1	0.0 ± 0.1	0.1 ± 0.1	NR
SW107	05/26/89	***			
SW108	03/02/89	0.7 ± 0.2	0.0 ± 0.1	0.5 ± 0.2	NR
SW108	05/30/89	***			
SW108	05/30/89	***			
SW108	05/30/89	***			

Notes: NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Surface Water Dissolved Radiochemistry Results

for Regulated Units at Rocky Flats Plant

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Radium 228
SW04	03/02/89	NR
SW04	05/30/89	DRY
SW05	02/28/89	NR
SW05	05/30/89	***
SW06	02/24/89	NR
SW06	02/24/89	NR
SW06	02/24/89	NR
SW06	05/31/89	***
SW07	02/27/89	NR
SW07	05/31/89	***
SW104	03/02/89	NR
SW107	02/28/89	NR
SW107	05/26/89	***
SW108	03/02/89	NR
SW108	05/30/89	***
SW108	05/30/89	***
SW108	05/30/89	***

Notes: NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Surface Water Dissolved Radiochemistry Results

for Regulated Units at Rocky Flats Plant

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Uranium 233, 234 PCI/L	(MDA)	Uranium 235 PCI/L	(MDA)	Uranium 238 PCI/L	(MDA)	Radium 226
SW41	03/01/89	0.1 ± 0.2		0.0 ± 0.1		0.0 ± 0.1		NR
SW41	05/26/89	***						
SW80	03/01/89	0.0 ± 0.1		0.0 ± 0.1		-0.1 ± 0.1		NR
SW80	05/24/89	DRY						

Notes: NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Surface Water Dissolved Radiochemistry Results

for Regulated Units at Rocky Flats Plant

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Radium 228
SW41	03/01/89	NR
SW41	05/26/89	***
SW80	03/01/89	NR
SW80	05/24/89	DRY

Notes: NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Surface Water Total Radiochemistry Results

for Regulated Units at Rocky Flats Plant

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Gross Alpha pCi/g	Gross Beta pCi/g	Uranium 233, 234 pCi/g	Uranium 235 pCi/g
SW04	03/02/89	1 ± 3	0 ± 3	0.9 ± 0.3	0.0 ± 0.1
SW04	05/30/89	DRY			
SW05	02/28/89	2 ± 2	4 ± 2	0.2 ± 0.2	0.0 ± 0.1*
SW05	05/30/89	Data not yet received			
SW06	02/24/89	1 ± 2	7 ± 3	0.4 ± 0.2	0.0 ± 0.1
SW06	02/24/89	1 ± 2	8 ± 3	0.4 ± 0.1	0.0 ± 0.1
SW06	02/24/89	-1 ± 1	-1 ± 2	0.1 ± 0.1	0.0 ± 0.1
SW06	05/31/89	Data not yet received			
SW07	02/27/89	2 ± 2	2 ± 2	0.5 ± 1.3	0.1 ± 0.2
SW07	05/31/89	Data not yet received			
SW104	03/02/89	25 ± 12	22 ± 5	0.5 ± 0.2	0.0 ± 0.1
SW107	02/28/89	1 ± 2	1 ± 2	0.1 ± 0.1	0.0 ± 0.1
SW107	05/26/89	Data not yet received			
SW108	03/02/89	6 ± 5	1 ± 3	0.8 ± 0.3	0.0 ± 0.1
SW108	05/30/89	Data not yet received			
SW108	05/30/89	Data not yet received			
SW108	05/30/89	Data not yet received			

Notes: NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Surface Water Total Radiochemistry Results

for Regulated Units at Rocky Flats Plant

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Uranium 238 pCi/g	Strontium 89,90 pCi/g	Plutonium 239 pCi/g	Americium 241 pCi/g
SW04	03/02/89	0.5 ± 0.2	0.2 ± 0.4	0.00 ± 0.02	0.00 ± 0.02
SW04	05/30/89	DRY			
SW05	02/28/89	0.0 ± 0.1*	0.3 ± 0.5*	0.01 ± 0.02	0.00 ± 0.02
SW05	05/30/89	Data not yet received			
SW06	02/24/89	0.2 ± 0.2	1.5 ± 0.5	0.00 ± 0.02	0.02 ± 0.01
SW06	02/24/89	0.3 ± 0.2	1.1 ± 0.5	0.00 ± 0.02	0.01 ± 0.03
SW06	02/24/89	0.0 ± 0.1	-0.1 ± 0.4	0.00 ± 0.02	0.00 ± 0.02
SW06	05/31/89	Data not yet received			
SW07	02/27/89	0.2 ± 1.2	0.3 ± 0.4	0.00 ± 0.02	-0.01 ± 0.02
SW07	05/31/89	Data not yet received			
SW104	03/02/89	0.7 ± 0.2	1.1 ± 0.5	0.08 ± 0.03	0.00 ± 0.02
SW107	02/28/89	0.0 ± 0.1	-0.1 ± 0.4	0.00 ± 0.02	-0.01 ± 0.02
SW107	05/26/89	Data not yet received			
SW108	03/02/89	0.4 ± 0.2	-0.1 ± 0.5	0.01 ± 0.02	0.00 ± 0.03
SW108	05/30/89	Data not yet received			
SW108	05/30/89	Data not yet received			
SW108	05/30/89	Data not yet received			

Notes: NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Surface Water Total Radiochemistry Results

for Regulated Units at Rocky Flats Plant

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Cesium 137 pCi/g	Tritium pCi/ml	
SW04	03/02/89	-0.3 ± 0.6	70 ± 150	
SW04	05/30/89	DRY		
SW05	02/28/89	-0.4 ± 0.5	140 ± 140	
SW05	05/30/89	Data not yet received		
SW06	02/24/89	-0.1 ± 0.5	100 ± 150	
SW06	02/24/89	0.1 ± 0.5	100 ± 150	
SW06	02/24/89	0.2 ± 0.5	80 ± 150	*
SW06	05/31/89	Data not yet received		
SW07	02/27/89	0.3 ± 0.6	200 ± 150	
SW07	05/31/89	Data not yet received		
SW104	03/02/89	-0.3 ± 0.6	50 ± 150	
SW107	02/28/89	0.0 ± 0.6	70 ± 140	
SW107	05/26/89	Data not yet received		
SW108	03/02/89	-0.2 ± 0.5	120 ± 150	
SW108	05/30/89	Data not yet received		
SW108	05/30/89	Data not yet received		
SW108	05/30/89	Data not yet received		

Notes: NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Surface Water Total Radiochemistry Results

for Regulated Units at Rocky Flats Plant

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Gross Alpha pCi/g	Gross Beta pCi/g	Uranium 233, 234 pCi/g	Uranium 235 pCi/g
SW41	03/01/89	1 ± 2	2 ± 2	0.1 ± 0.1	0.0 ± 0.1
SW41	05/26/89	Data not yet received			
SW80	03/01/89	250 ± 140	200 ± 110	0.2 ± 0.2	0.0 ± 0.1
SW80	05/24/89	DRY			

Notes: NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Surface Water Total Radiochemistry Results

for Regulated Units at Rocky Flats Plant

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Uranium 238 pCi/g	Strontium 89,90 pCi/g	Plutonium 239 pCi/g	Americium 241 pCi/g
SW41	03/01/89	0.1 ± 0.1	0.2 ± 0.5	0.00 ± 0.02	0.02 ± 0.03
SW41	05/26/89	Data not yet received			
SW80	03/01/89	0.3 ± 0.2	1.1 ± 0.6	1.0 ± 0.1	0.10 ± 0.07
SW80	05/24/89	DRY			

Notes: NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Surface Water Total Radiochemistry Results

for Regulated Units at Rocky Flats Plant

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled		Cesium 137 pCi/g	Tritium pCi/ml
SW41	03/01/89		-0.1 ± 0.5	100 ± 140
SW41	05/26/89		Data not yet received	
SW80	03/01/89		12 ± 2	190 ± 140
SW80	05/24/89		DRY	

Notes: NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

APPENDIX G-3

STREAM SEDIMENT DATA

METALS

Total Metals Results for

Sediment Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Aluminum (Al), total mg/kg	Arsenic (As), total mg/kg	Barium (Ba), total mg/kg	Beryllium (Be), total mg/kg	Cadmium (Cd), total mg/kg	Calcium (Ca), total mg/kg	Cesium (Cs), total mg/kg
SD022	02/22/89	4560	NR	56.2	1.1 U	1.1 U	3870	228 U
SD022	02/22/89	200 U	NR	200 U	5.0 U	5.0 U	5000 U	1000 U
SD021	02/22/89	7110	NR	171	1.8 U	1.8 U	52500	357 U
SD020	02/22/89	1620	NR	47.0 U	1.2 U	1.2 U	1180 U	235 U
SD023	02/21/89	7440	NR	82.1	1.4 U	1.4 U	1810	283 U
SD004	02/21/89	6850	NR	134 U	3.3 U	3.3 U	3340 U	669 U
SD004	02/21/89	3070	NR	49.3 U	1.2 U	1.2 U	1230 U	247 U
SD016	02/23/89	816	NR	51.3 U	1.3 U	1.3 U	1280 U	257 U
SD017	02/23/89	549	NR	50.0 U	1.2 U	1.2 U	1250 U	250 U
SD018	02/23/89	8080	NR	182	3.2 U	3.2 U	11100	647 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Total Metals Results for

Sediment Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Chromium (Cr), total mg/kg	Cobalt (Co), total mg/kg	Copper (Cu), total mg/kg	Silver (Ag), total mg/kg	Antimony (Sb), total mg/kg	Iron (Fe), total mg/kg	Lead (Pb), total mg/kg
SD022	02/22/89	16.5	11.4 U	8.6	2.3 U	13.7 U	7920	NR
SD022	02/22/89	10.0 U	50.0 U	25.0 U	10.0 U	60.0 U	100 U	NR
SD021	02/22/89	19.5	17.9 U	14.3	6.8	21.4 U	10600	NR
SD020	02/22/89	2.4 U	11.8 U	5.9 U	2.4 U	14.1 U	1040	NR
SD023	02/21/89	10.8	14.1 U	7.1 U	2.8 U	17.0 U	9110	NR
SD004	02/21/89	30.4	33.4 U	22.0	6.7 U	40.1 U	15000	NR
SD004	02/21/89	11.0	12.3 U	7.7	2.5 U	14.8 U	6900	NR
SD016	02/23/89	3.5	12.8 U	6.4 U	2.6 U	15.4 U	2290	NR
SD017	02/23/89	3.6	12.5 U	6.2 U	2.5 U	15.0 U	2280	NR
SD018	02/23/89	15.3	32.4 U	16.2 U	6.5 U	38.8 U	7490	NR

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value

Total Metals Results for

Sediment Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Lithium (Li), total mg/kg	Magnesium (Mg), total mg/kg	Manganese (Mn), total mg/kg	Mercury (Hg), total mg/kg	Molybdenum (Mo), total mg/kg	Nickel (Ni), total mg/kg	Potassium (K), total mg/kg
SD022	02/22/89	22.8 U	1380	95.2	NR	22.8 U	9.9	1140 U
SD022	02/22/89	100 U	5000 U	15.0 U	NR	100 U	40.0 U	5000 U
SD021	02/22/89	35.7 U	2490	105	NR	35.7 U	14.3 U	1790 U
SD020	02/22/89	23.5 U	1180 U	9.0	NR	23.5 U	9.4 U	1180 U
SD023	02/21/89	28.3 U	1530	97.0	NR	28.3 U	14.2	1410 U
SD004	02/21/89	66.9 U	3340 U	303	NR	66.9 U	26.8 U	3340 U
SD004	02/21/89	24.7 U	1230 U	139	NR	24.7 U	9.9 U	1230 U
SD016	02/23/89	25.7 U	1280 U	139	NR	25.7 U	10.3 U	1280 U
SD017	02/23/89	25.0 U	1250 U	179	NR	25.0 U	10.0 U	1250 U
SD018	02/23/89	64.7 U	3240 U	57.3	NR	64.7 U	25.9 U	3240 U

NR = Analyte not reported
U = Analyzed but not detected
• = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Total Metals Results for

Sediment Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Sodium (Na), total mg/kg	Selenium (Se), total mg/kg	Strontium (Sr), total mg/kg	Thallium (Tl), total mg/kg	Tin (Sn), Total mg/kg	Vanadium (V), total mg/kg	Zinc (Zn), total mg/kg
SD022	02/22/89	1140 U	NR	25.2	NR	22.8 U	13.4	35.7
SD022	02/22/89	5000 U	NR	100 U	NR	100 U	50.0 U	20.0 U
SD021	02/22/89	1790 U	NR	175	NR	35.7 U	17.9 U	43.2
SD020	02/22/89	1180 U	NR	23.5 U	NR	23.5 U	11.8 U	6.5
SD023	02/21/89	1410 U	NR	28.3 U	NR	28.3 U	20.6	22.8
SD004	02/21/89	3340 U	NR	66.9 U	NR	66.9 U	33.4 U	70.3
SD004	02/21/89	1230 U	NR	24.7 U	NR	24.7 U	12.9	26.0
SD016	02/23/89	1280 U	NR	25.7 U	NR	25.7 U	12.8 U	8.7
SD017	02/23/89	1250 U	NR	25.0 U	NR	25.0 U	12.5 U	9.3
SD018	02/23/89	3240 U	NR	74.2	NR	64.7 U	32.4 U	37.2

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Total Metals Results for

Sediment Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Aluminum (Al), total mg/kg	Arsenic (As), total mg/kg	Barium (Ba), total mg/kg	Beryllium (Be), total mg/kg	Cadmium (Cd), total mg/kg	Calcium (Ca), total mg/kg	Cesium (Cs), total mg/kg
SD019	02/23/89	21600	NR	140 U	3.5 U	3.5 U	9220	702 U

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value

Total Metals Results for

Sediment Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Chromium (Cr), total mg/kg	Cobalt (Co), total mg/kg	Copper (Cu), total mg/kg	Silver (Ag), total mg/kg	Antimony (Sb), total mg/kg	Iron (Fe), total mg/kg	Lead (Pb), total mg/kg
SD019	02/23/89	22.5	35.1 U	20.2	7.0 U	42.1 U	22500	NR

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value

Total Metals Results for

Sediment Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Lithium (Li), total mg/kg	Magnesium (Mg), total mg/kg	Manganese (Mn), total mg/kg	Mercury (Hg), total mg/kg	Molybdenum (Mo), total mg/kg	Nickel (Ni), total mg/kg	Potassium (K), total mg/kg
SD019	02/23/89	70.2 U	4110	180	NR	70.2 U	29.9	3510 U

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value

Total Metals Results for

Sediment Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Sodium (Na), total mg/kg	Selenium (Se), total mg/kg	Strontium (Sr), total mg/kg	Thallium (Tl), total mg/kg	Tin (Sn), Total mg/kg	Vanadium (V), total mg/kg	Zinc (Zn), total mg/kg
SD019	02/23/89	3510 U	NR	70.2 U	NR	70.2 U	50.2	48.3

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

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Sediment Inorganic Results

For Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Total Dissolved Solids NA	Chloride MG/KG	Nitrate+ Nitrite-Nitrogen MG/KG	Sulfate MG/KG	HCO3- MG/KG
SD022	02/22/89	NR	NR	2.1 U	NR	NR
SD022	02/22/89	INSUFFICIENT SAMPLE FOR INORGANIC ANALYSIS				
SD021	02/22/89	NR	NR	2.7 U	NR	NR
SD020	02/22/89	NR	NR	1.4 U	NR	NR
SD023	02/21/89	NR	NR	1.4 U	NR	NR
SD004	02/21/89	NR	NR	1.3 U	NR	NR
SD004	02/21/89	NR	NR	1.3 U	NR	NR
SD016	02/23/89	NR	NR	1.4 U	NR	NR
SD017	02/23/89	NR	NR	1.4 U	NR	NR
SD018	02/23/89	NR	NR	2.9 U	NR	NR

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Sediment Inorganic Results

For Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	CO3= MG/KG	pH pH Unit	Total Organic Carbon MG/KG	Fluoride MG/KG	Sulfide MG/KG
SD022	02/22/89	NR	7.7	NR	NR	NR
SD022	02/22/89	INSUFFICIENT SAMPLE FOR INORGANIC ANALYSIS				
SD021	02/22/89	NR	7.9	NR	NR	NR
SD020	02/22/89	NR	7.7	NR	NR	NR
SD023	02/21/89	NR	6.1	NR	NR	NR
SD004	02/21/89	NR	7.0	NR	NR	NR
SD004	02/21/89	NR	7.2	NR	NR	NR
SD016	02/23/89	NR	7.3	NR	NR	NR
SD017	02/23/89	NR	7.3	NR	NR	NR
SD018	02/23/89	NR	6.9	NR	NR	NR

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Sediment Inorganic Results

For Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Cyanide, Total MG/KG	Hexavalent Chromium (Cr+6) NA	Specific Conductance NA	Suspended Solids NA	Turbidity NA
SD022	02/22/89	NR	NR	NR	NR	NR
SD022	02/22/89	INSUFFICIENT SAMPLE FOR INORGANIC ANALYSIS				
SD021	02/22/89	NR	NR	NR	NR	NR
SD020	02/22/89	NR	NR	NR	NR	NR
SD023	02/21/89	NR	NR	NR	NR	NR
SD004	02/21/89	NR	NR	NR	NR	NR
SD004	02/21/89	NR	NR	NR	NR	NR
SD016	02/23/89	NR	NR	NR	NR	NR
SD017	02/23/89	NR	NR	NR	NR	NR
SD018	02/23/89	NR	NR	NR	NR	NR

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Sediment Inorganic Results

For Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Solids %	Oil and Grease MG/KG	Ignitability Degrees F.	Phosphate MG/KG
SD022	02/22/89	47.9	NR	NR	NR
SD022	02/22/89	INSUFFICIENT SAMPLE FOR INORGANIC ANALYSIS			
SD021	02/22/89	36.9	NR	NR	NR
SD020	02/22/89	72.3	NR	NR	NR
SD023	02/21/89	70.5	NR	NR	NR
SD004	02/21/89	79.8	NR	NR	NR
SD004	02/21/89	75.7	NR	NR	NR
SD016	02/23/89	70.0	NR	NR	NR
SD017	02/23/89	70.2	NR	NR	NR
SD018	02/23/89	34.8	NR	NR	NR

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Sediment Inorganic Results

For Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Total Dissolved Solids NA	Chloride MG/KG	Nitrate+ Nitrite-Nitrogen MG/KG	Sulfate MG/KG	HCO3- MG/KG
SD019	02/23/89	NR	NR	1.8 U	NR	NR

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Sediment Inorganic Results

For Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	CO3= MG/KG	pH pH Unit	Total Organic Carbon MG/KG	Fluoride MG/KG	Sulfide MG/KG
SD019	02/23/89	NR	7.0	NR	NR	NR

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Sediment Inorganic Results

For Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Cyanide, Total MG/KG	Hexavalent Chromium (Cr+6) NA	Specific Conductance NA	Suspended Solids NA	Turbidity NA
SD019	02/23/89	NR	NR	NR	NR	NR

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Sediment Inorganic Results

For Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Solids %	Oil and Grease MG/KG	Ignitability Degrees F.	Phosphate MG/KG
SD019	02/23/89	57.1	NR	NR	NR

Notes: NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

RADIONUCLIDES

Sediment Total Radiochemistry Results

for Stations at Rocky Flats Plant

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Gross Alpha pCi/g	Gross Beta pCi/g	Uranium 233, 234 pCi/g	Uranium 235 pCi/g
SD022	02/22/89	13 ± 13	25 ± 6	0.6 ± 0.1	0.0 ± 0.1
SD022	02/22/89	0 ± 1	-1 ± 2	0.1 ± 0.1	0.0 ± 0.1
SD021	02/22/89	24 ± 15	24 ± 6	1.2 ± 0.1	0.0 ± 0.1
SD020	02/22/89	4 ± 12	20 ± 6	0.5 ± 0.1	0.0 ± 0.1
SD023	02/21/89	40 ± 15	31 ± 6	1.2 ± 0.2	0.1 ± 0.1
SD004	02/21/89	25 ± 13	35 ± 6	1.1 ± 0.3	0.0 ± 0.1
SD004	02/21/89	48 ± 16	33 ± 6	1.0 ± 0.2	0.1 ± 0.1
SD016	02/23/89	20 ± 13	39 ± 6	0.5 ± 0.2	0.0 ± 0.1
SD017	02/23/89	31 ± 15	40 ± 7	0.5 ± 0.1	0.1 ± 0.1
SD018	02/23/89	35 ± 14	23 ± 6	0.7 ± 0.2	0.0 ± 0.1
SD019	02/23/89	39 ± 15	29 ± 6	0.9 ± 0.2	0.1 ± 0.1

Notes: NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Sediment Total Radiochemistry Results

for Stations at Rocky Flats Plant

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Uranium 238 pCi/g	Strontium 89,90 pCi/g	Plutonium 239 pCi/g	Americium 241 pCi/g
SD022	02/22/89	0.5 ± 0.1	0.1 ± 0.5	0.01 ± 0.02	0.00 ± 0.02
SD022	02/22/89	0.0 ± 0.1	0.3 ± 0.4	0.02 ± 0.03	-0.01 ± 0.03
SD021	02/22/89	1.1 ± 0.1	0.8 ± 0.7	0.08 ± 0.02	0.00 ± 0.02
SD020	02/22/89	0.4 ± 0.1	-0.1 ± 0.4	0.00 ± 0.02	-0.01 ± 0.02
SD023	02/21/89	1.3 ± 0.2	0.3 ± 0.7	0.01 ± 0.02	-0.01 ± 0.02
SD004	02/21/89	1.0 ± 0.2	0.6 ± 0.9	0.00 ± 0.02	0.01 ± 0.03
SD004	02/21/89	1.0 ± 0.2	0.0 ± 0.8	0.00 ± 0.02	-0.01 ± 0.02
SD016	02/23/89	0.6 ± 0.2	-0.2 ± 0.6	0.00 ± 0.02	-0.01 ± 0.02
SD017	02/23/89	0.5 ± 0.1	-0.6 ± 0.7	0.01 ± 0.02	-0.01 ± 0.02
SD018	02/23/89	0.5 ± 0.2	-0.2 ± 0.6	0.03 ± 0.02	0.02 ± 0.04
SD019	02/23/89	1.1 ± 0.2	0.4 ± 0.7	0.04 ± 0.03	0.00 ± 0.02

Notes: NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Sediment Total Radiochemistry Results

for Stations at Rocky Flats Plant

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Cesium 137 pCi/g	Tritium pCi/ml
SD022	02/22/89	0.0 ± 0.1	0.15 ± 0.14
SD022	02/22/89	-0.1 ± 0.6	240 ± 150
SD021	02/22/89	0.4 ± 0.1	0.32 ± 0.15
SD020	02/22/89	0.0 ± 0.1	0.31 ± 0.15
SD023	02/21/89	0.0 ± 0.1	0.22 ± 0.15
SD004	02/21/89	0.0 ± 0.1	0.20 ± 0.15
SD004	02/21/89	0.0 ± 0.1	0.09 ± 0.14
SD016	02/23/89	0.0 ± 0.1	0.13 ± 0.14
SD017	02/23/89	0.0 ± 0.1	0.20 ± 0.14
SD018	02/23/89	0.4 ± 0.1	0.12 ± 0.14
SD019	02/23/89	1.4 ± 0.1	0.18 ± 0.14

Notes: NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

APPENDIX H

DATA VALIDATION PACKAGES

COLOG ... COLORADO WELL LOGGING
1999 BROKER COURT, COLORADO 80905
PHONE (303) 578-0575 FAX (719) 473-0200

SONIC WAVEFORM

WELL: 38-89BR

PROJECT: ROCKY FLATS (BACKGROUND) DATE: 13 APRIL 1989
CLIENT: ROY F. WESTON COLOG ID NO.
LOCATION: ROCKY FLATS NORTHWEST PO 73045 EXCTING STREET 2000
STATE: COLORADO COUNTY: JEFFERSON ELEV: 5920 A FL DETH REF: GROUND
SERVICE DISTC
DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO
DISTANCE TO 1ST HOLE: COLOG ID: 2241314

Run No.	Bit Size	BIT RECORD To	From/Wgt/Tbg	To	CASING RECORD Size/Wgt/Tbg	From	To
1	7.875	24.0 FLS	50		6.5/8"	GRD	24.0 FLS
2							
3							
4							

HOLE MEDIUM: ARG SURF - SLW WATER (6.4' - 10) DRILL METHOD: MUD ROTARY CORE
MUD TYPE: Natural mud plus clean water TIME SINCE DRIL: 4 d
VISCOSITY: SAMPLE NOT RECEIVED AVAILABLE Res. ... at ... Deg.

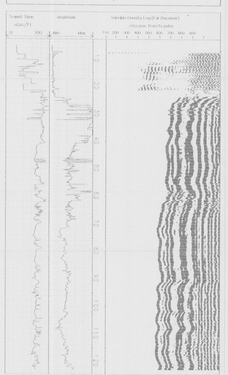
SONIC DATA

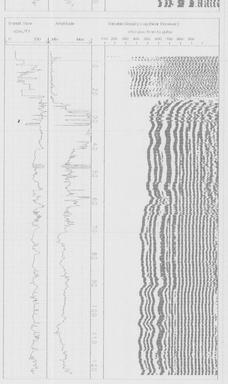
INSTRUMENTATION: ESSO MV SUPRG SERIES-III GRF/FIREK: 245 / 3 ft
LOGGING ENGINEER: MR. ROBERT CROWDER MR. DAMIEL LUCSOV
CLOSE REF: MR. JAMES F. MINNICK / MR. STEVEN MR. DAN FRIDMAN / ERIKSON
OTHER SERVICES: WESTERN, GAMMA, CALIPER, G. GAMMA ELECTRICS, TEMP, PS, HRS

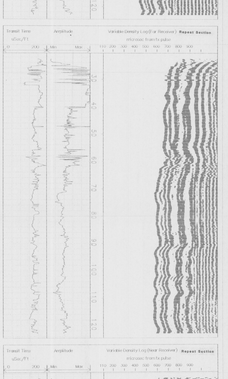
CASING DATA

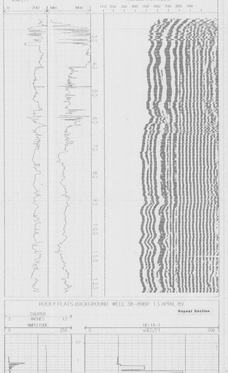
Size	Wgt	Grade	Conn	Top	Bottom	Hole Size	Type	Cmt Vol	Cmt Top	Cmt Bot	Cmt Type	Cmt Wgt	Cmt Yld
6.5/8"		GRD		GRD	24.0	7.875							
CONC		GUN	GUN	GUN	GUN		CONC	GUN	GUN	GUN		GUN	GUN
GRADE		BH	BHN	BHN	BH							GUN	GUN

CALIBRATION FOR GAMMA
SOURCE: FILE NAME:
PROJECT: ROCKY FLATS (BACKGROUND) ENGINEER:
DATE:
APPRO ENG COMPLETED 13 APR 89 - 0000
FIELD: 20 MINUTES PRIOR TO LOGGING ON
13 APR 89

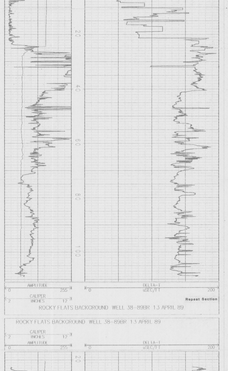




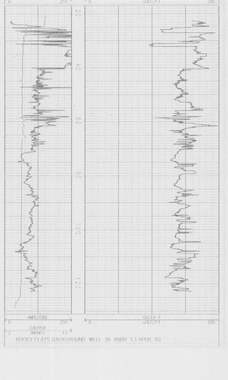




ROCKY FLATS (BACKGROUND) WELL 38-89BR 13 APRIL 89



ROCKY FLATS (BACKGROUND) WELL 38-89BR 13 APRIL 89



ROCKY FLATS (BACKGROUND) WELL 38-89BR 13 APRIL 89

COLOG dba COLORADO WELL LOGGING
1012 8th ST. GOLDEN, COLORADO 80401
PHONE: (303) 279-0571 TELEX: 45-0286

SONIC WAVEFORM
CALIPER
WELL: 35-89BR

PROJECT: ROCKY FLATS BACKGROUND
CLIENT: ROF F. WESTON, INC.
LOCATION: ROCKY FLATS NORTHING:491804.5000 EASTING:2442736.59
STATE: COLORADO COUNTY: JEFFERSON ELEV. 5655.00 DEF:14.00F GROUND

DATE: 4 APRIL 1989
COLOG ID NO:

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO
CUSTOMER TO: 218 FEET COLOG TO: 218 FEET

HOLE NO.	BIT SIZE	BIT RECORD From	To	CASING RECORD Size/Wgt/Thk.	From	To
1	4"	SURFACE	TD	8 5/8"	SURF	SURFACE
2						
3						
4						

HOLE MEDIUM: AIR SURF. - 9.07 WATER 9.07 - TD DRILL METHOD: MUD ROTARY CORE
MUD TYPE: TIME SINCE CIRC:
VISCOSITY: SAMPLE NOT WEIGHT: AVAILABLE lbs/ gal Deg

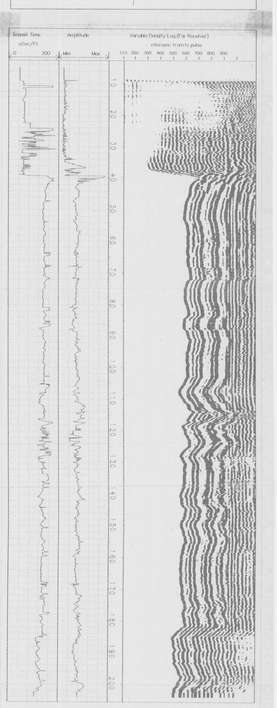
GENERAL DATA
INSTRUMENTATION: ESAD MT, SOPRO, SONICS INT. UNIT/TRUCK: 245 / 19
LOGGING ENGINEER: MR. ROBERT CROWDER, MR. JAMES L DOCICO
CLIENT REP.: MR. RON MILLER - WESTON, MR. TIM DEGRAW - EG&G
OTHER SERVICES: NEUTRON, GAMMA, CALIPER, G-GAMMA, ELECTRICS, TEMP., FL-RES.

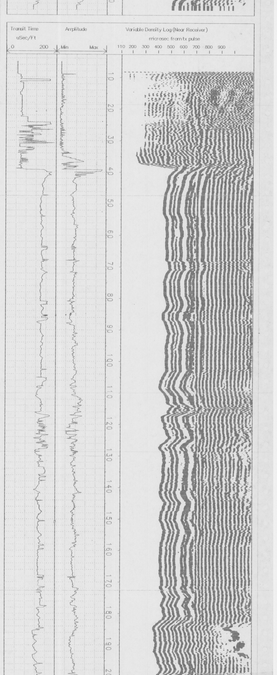
LOGGING DATA

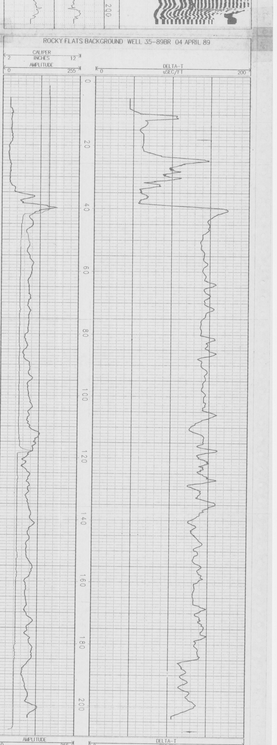
TOOL STRING	MAX DIAM.	MAX. SURF. TEMP.	CASING SHOE DEPTH	DATE TIME	CALIBRATION BEFORE		AFTER		SONICS		SONICS		SONICS	
					TIME	DATE	TIME	DATE	TIME	DATE	TIME	DATE	TIME	DATE
SONIC	3	125F	1575	1	1									
CALIPER	4	90F	8.08	1	1	1	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1	1	1	1	1

CALIBRATION FACTOR(S)
BOXTAL FILE NAME(S): 90SUPL.SMS,90SUPL.PLP,2050SMC.MPP
CALIBRATION
LOGGING COMPLETED 2 MAR 89 - 1005
FALLED 30 MINUTES PRIOR TO LOGGING ON
4 APR 89

Repeat section not available.







COLOG INC d.b.a. COLORADO WELL LOGGING
1019 8th ST. GOLDEN, COLORADO 80401
PHONE: (303) 279-0171 TELEX: 45-0286

SONIC WAVEFORM

WELL: 32-89BR

PROJECT: ROCKY FLATS BACKGROUND   DATE: 3 MARCH 1989
CLIENT: ROY F. WESTON, INC.   COLOG ID NO:
LOCATION: ROCKY FLATS   NORTHING: 42792.3657   EASTING: 21944.1858
STATE: COLORADO   COUNTY: JEFFERSON   ELEV: 5946.2   DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO
CUSTOMER TD: 204 FEET   COLOG TD: 197 FEET

RUN	BIT RECORD			CASING RECORD		
NO.	Bit Size	From	To	Size/Wgt/Thk.	From	To
1	9"	40 FEET	TD	8"	SURF	40 FEET
2	4 1/2"	40 FEET	TD			
3						
4						

HOLE MEDIUM: AIR: SURF - 10' WATER: 10' - TD   DRILL METHOD: MUD ROTARY CORE
MUD TYPE: NATURAL   TIME SINCE CIRC: 1 DAY *
VISCOSITY: SAMPLE NOT   WEIGHT: AVAILIBLE   Rm: at   Deg

GENERAL DATA

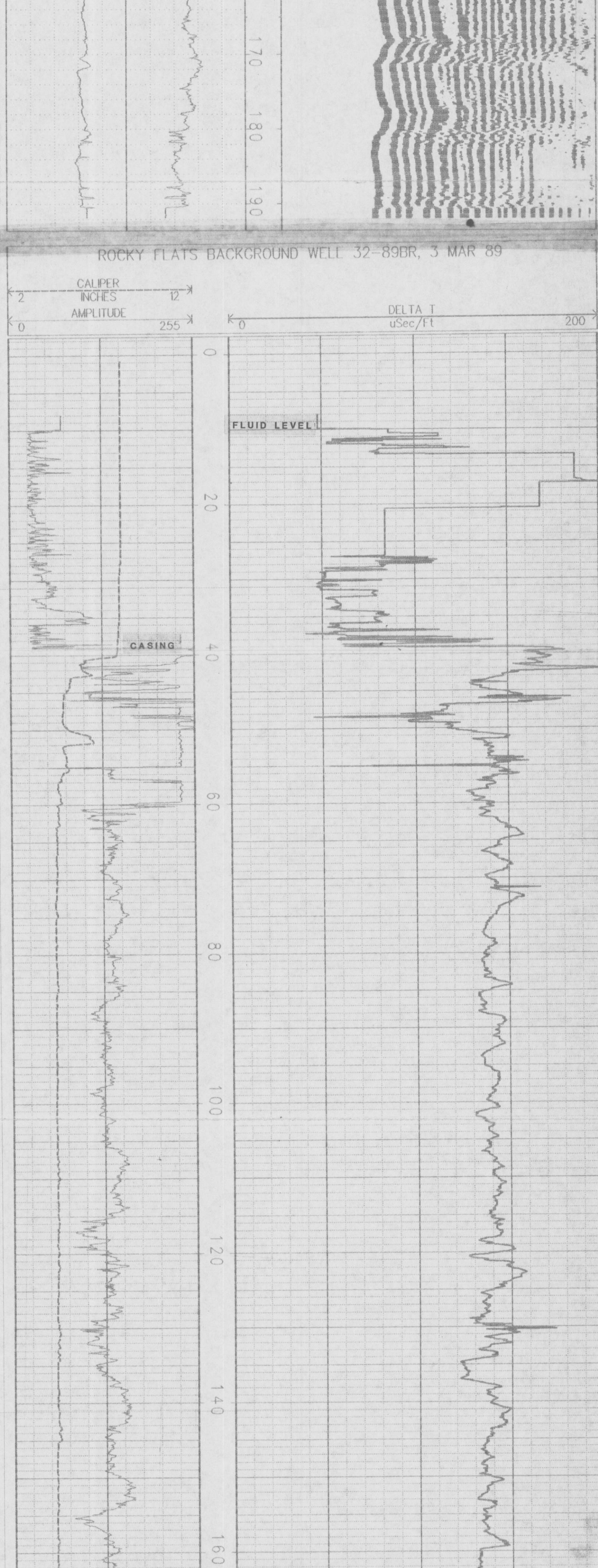
INSTRUMENTATION: EG&G MT. SOPRIS SERIES III   UNIT/TRUCK: 245 / 19
LOGGING ENGINEER: MR. ROBERT CROWDER, MR. THOMAS STAATZ
CLIENT REP: MR. DICK TREAT - CHEN, MR. TRAVIS CANON - EBASCO
OTHER SERVICES: N-N,CALIPER, G, G-G, SP, 16, 64, IP, GUARD, EM, TEMP.

LOGGING DATA

LOG FUNCTION	RUN NO.	EQUIPMENT MODEL	PROBE S.N.	UPHOLE S.N.	LOGGING DIG INT FEET	SPEED FT./MIN	DETECTOR TYPE	SPACING Tx-Rx FEET	Rx-Rx FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	INT. FEET
SONIC	3	CLPL	1275	771	0.1	6	CERAMIC	3 FT	1 FT			194'	10'	184'

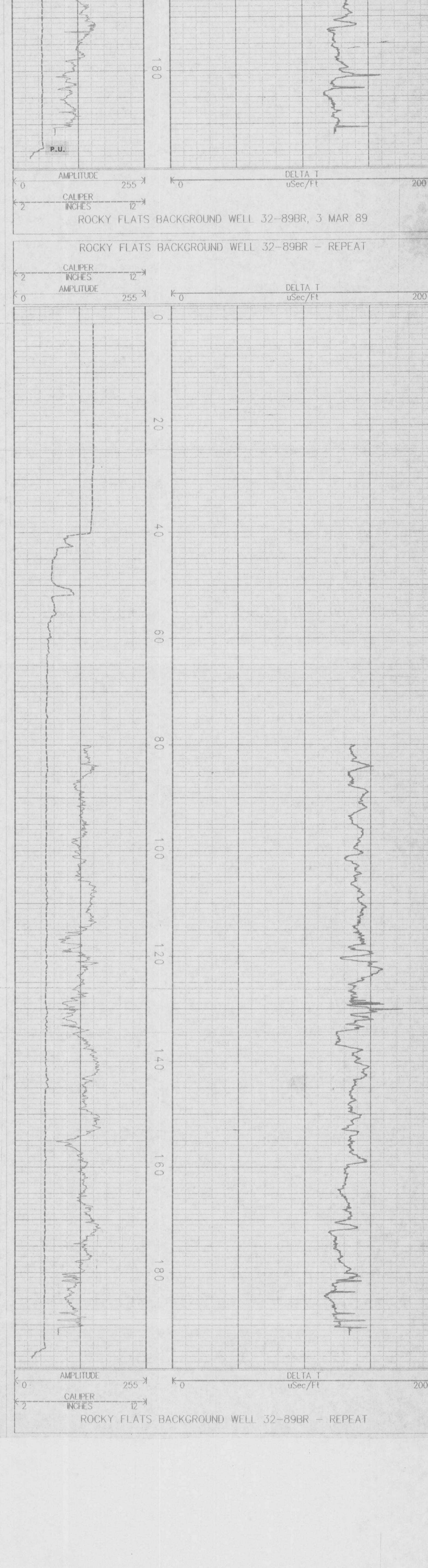
CALIBRATION FACTOR(S):
DIGITAL FILE NAME(S): 32CLPL.SW0, 32CLPL.SW1, 32VDL.HDP
REMARKS:
* DRILLING COMPLETED 2 MAR 89.
RODS PULLED 30 MINUTES PRIOR TO LOGGING ON 3 MAR 89.
SNOWING, WINDY 11 DEGREES F CAUSED IMMEDIATE CABLE ICING AS IT CAME OUT OF THE HOLE.
REPEAT SECTION RUN FROM 192' TO 80'

ROCKY FLATS BACKGROUND WELL 32-89BR, 3 MAR 89



ROCKY FLATS BACKGROUND WELL 32-89BR, 3 MAR 89

ROCKY FLATS BACKGROUND WELL 32-89BR - REPEAT



ROCKY FLATS BACKGROUND WELL 32-89BR - REPEAT

COLOG

COLORADO WELL LOGGING
P.O. BOX 1129 GRAND JUNCTION, COLORADO 81502
PHONE (303) 242-0971 TELEX NO. 46-59161

SONIC WAVEFORM
WELL 34-ERBR

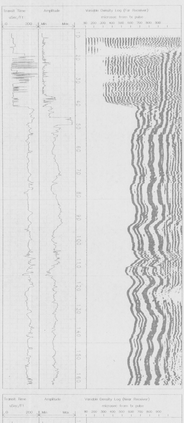
PROJECT: ROCKY FLATS BACKGROUND
COUNTY OR STATE: JEFFERSON, CO.
LOCATION: ROCKY FLATS - JEFFERSON, JEFFERSON
STATE: COLORADO
DRILLING CONTRACTOR: ROCKY MOUNTAIN
LOCATION: 10 TH EAST - 10 TH SOUTH
DATE: 12 MARCH 1989
COLORADO, CO. USA
EXISTING CONDITIONS
DATE: 19MAR89 DEPTH: 807.00FEET
DRILLING DATA

BIT	BIT SIZE	DEPTH	CASING	DEPTH	BIT RECORD			CASING RECORD		
NO.		IN	SIZE	IN	SIZE	MFG.	TYPE	SIZE	WT.	GRADE
1	8 3/4"	807	7	807	8 3/4"			7"	23	
2										
3										

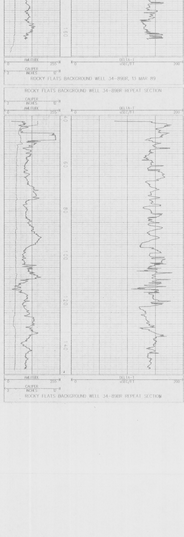
MUD: MEDIUM AND TURB. - 8" BARREL OF - 70
MUD WEIGHT: 8.7 LBS/GAL
VISCOSITY: 38 CSEC
FINAL METHANE MAX INSTANT & CON.
MAX. INST. CHG. 2 DEPTH - 0 PPM
MAX. CONT. CHG. 2 DEPTH - 0 PPM
OPERATING DATA
INSTRUMENTATION: FIELD NO. CSPRO - SERIAL # 0
LOGGING ENGINEER: MR. ROBERT CHEMPER / MR. THOMAS STEWART
LOGGING UNIT: CSPRO - SERIAL # 0 / CSPRO - SERIAL # 0
CLEAR DEPTHS: 0 TO 0 / 0 TO 0 MAX TEMP: 20 DEG. FAHRENHEIT

CURVE TITLE	SCALE	SAMPLE RATE	SAMPLE TYPE	SAMPLE TIME	PRESS. CORR.	PRESS. TYPE	SAMPLE TYPE	SAMPLE TIME	PRESS. CORR.	PRESS. TYPE
SONIC	200	1	SONIC	1	NONE		SONIC	1	NONE	

COMMENTS:
DIGITAL DATA SAMPLED ON 0.5 FOR SONIC
PRESSURE CORRECTED TO MEAN SEA LEVEL
PRESSURE DATA: 0 MEASURED FROM KB LEVEL
SONIC REPEAT SECTION RUN FROM 800 TO 807
TOP OF SAND FOR



ROCKY FLATS BACKGROUND WELL 34-ERBR, 12 MAY 89



ROCKY FLATS BACKGROUND WELL 34-ERBR, 12 MAY 89

ROCKY FLATS BACKGROUND WELL 34-ERBR REPEAT SECTION

ROCKY FLATS BACKGROUND WELL 34-ERBR REPEAT SECTION

COLOGS COLORADO WELL LOGGING
PO BOX 1 GRAND JUNCTION COLORADO 81502
PHONE (303) 276-0671 TELEX 45-0598

SONIC WAVEFORM
WELL 33-8SBR

PROJECT ROCKY FLATS - SBRCROSSRAD
DATE FEBRUARY 16 1989

CLIENT ROY F. WESTON, INC.
LOGGING NO.

LOCATION ROCKY FLATS - BETWEEN 4229-4847 - EXISTING 12835 SAND
ELEV. GROUND
COUNTY JEFFERSON
ELEV. DATUM DEPTH REF. GL

DRILLING CONTRACTOR NORDLY MECHANICAL DRILLING, COLORADO
DATE/TIME TO FIELD 17 COLOGS TO NO LOGS

BIT	DIA. (IN.)	CASING RECORD					
		SIZE	WT.	GRADE	TOP	BOTTOM	CEMENT

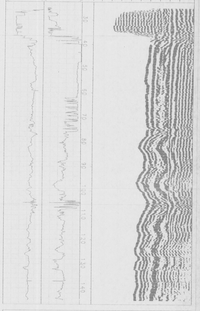
MUD RECORD				
TYPE	WEIGHT	VISCOSITY	PH	FLUID LOSS

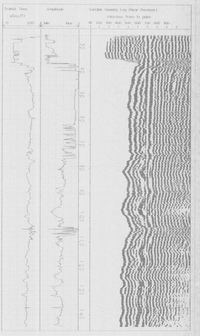
MUD TYPE NATURAL
SPEED, METERS PER MINUTE
TIME SINCE LAST CALIBRATION 1 HOURS
TEMPERATURE
DEGREES
Deg
DEGREES
Deg

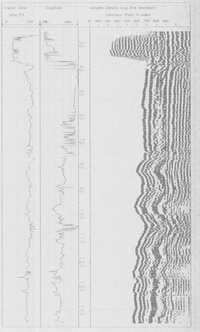
RECORDED BY
RECOMMENDATIONS
CLIENT REP. MR. FRANK BETHANCOURT (WESTON) MR. LARRY BERNS (DAMATCO)
TIMES SUPERVISOR 11:00 PM, CALL, CHANGE, 8:15 AM, OP. 8 PM TO 8AM, 7:15

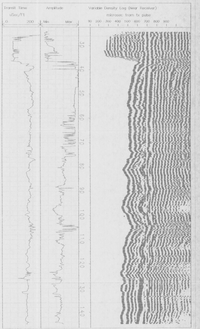
LOGGING DATA																							
FIELD PRINTS		TIME	TIME	CALIBRATION		LOGGING		FIELD		FIELD		FIELD		FIELD		FIELD		FIELD		FIELD		FIELD	
		STARTED	FINISHED	BEFORE	AFTER	SPEED		GAIN		GAIN		GAIN		GAIN		GAIN		GAIN		GAIN		GAIN	
FILM NO.	DATE																						

REMARKS
DATA FOR SONICS LOGS BELOW WAVEFORMS, CALIPER, GAMMA
RAYS
Video recorded

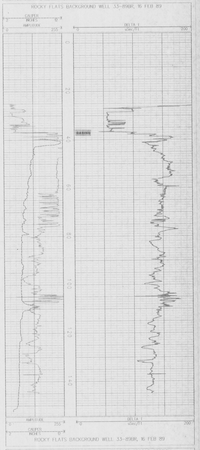




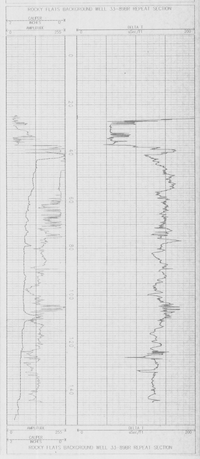




ROCKY FLATS BACKGROUND WELL 33-8SBR, 16 FEB 89



ROCKY FLATS BACKGROUND WELL 33-8SBR, 16 FEB 89



ROCKY FLATS BACKGROUND WELL 33-8SBR REPEAT SECTION

COLOG INC

d.b.a. COLORADO WELL LOGGING
1019 8th ST. GOLDEN, COLORADO 80401
PHONE: (303) 279-0171 TELEX: 45-0286

G-GAMMA, NEUTRON, GAMMA, CALIPER
WELL: 33-89BR

PROJECT: ROCKY FLATS – BACKGROUND
DATE: FEBRUARY 16 1989
CLIENT: ROY F. WESTON, INC.
COLOG ID NO:
LOCATION: ROCKY FLATS NORTHING: 43211.4667 EASTING: 22635.7846
STATE: COLORADO COUNTY: JEFFERSON ELEV: 5935.8 DEPTH REF: GL

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING, GOLDEN, CO
CUSTOMER TD: 159.8 FT COLOG ID:

RUN NO.	Bit Size	BIT RECORD From	To	CASING RECORD Size/Wgt/Thk	From	To
1	9"	SURF.	38 FT.	8" ID	SURF.	37.35 FT
2	4"	38 FT.	TD			
3						
4						

HOLE MEDIUM: NAT. MUD SURF.-TD DRILL METHOD: MUD ROTARY
MUD TYPE: NATURAL TIME SINCE CIRC: LESS THAN 3 HOURS
VISCOSITY: WEIGHT: Rm: at Deg

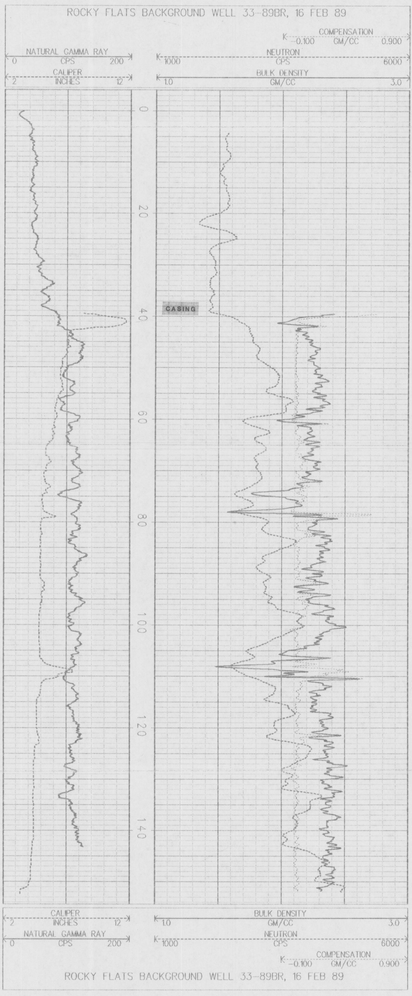
GENERAL DATA

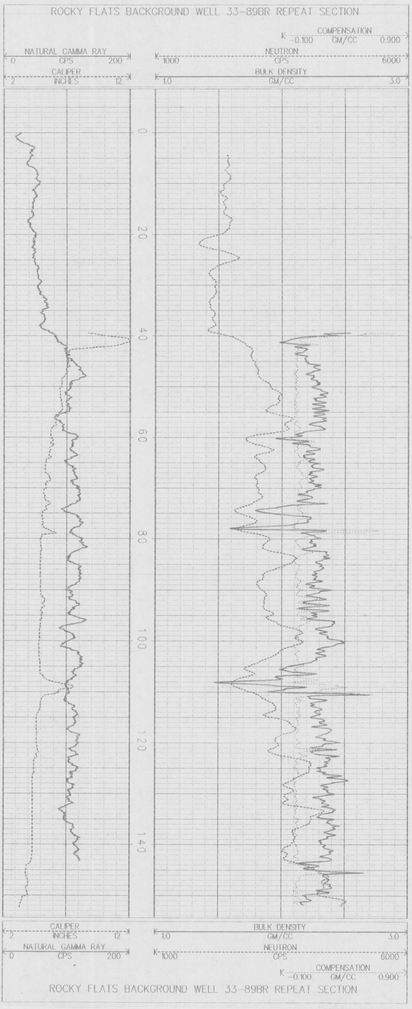
INSTRUMENTATION: EG&G MT. SOPRIS SERIES III UNIT/TRUCK: 19
LOGGING ENGINEER: ROBERT CROWDER, TOM STAATZ
CLIENT REP: MR. HANK BIENKOWSKI (WESTON), MR. LARRY IRONS (EBASCO)
OTHER SERVICES: T, FR, GUARD, SWF, 16-64", SP, IP, EM 39, DIP

LOGGING DATA

LOG FUNCTION	RUN NO.	EQUIPMENT MODEL	PREAMP S.N.	SUPERVIS S.N.	LOGGING DET. INT FEET	DEPTH FT/MIN	DETECTOR TYPE	SPACING Tr-Rx FEET	Rs-Rx FEET	SOURCE TYPE	SIZE CUBIC	LOGGED INTERVAL FROM	TO	INT. FEET
GAMMA	4	XAP	NSN	933	0.1	12	NaI					14.2	51.89	14.2+
NEUTRON	4	XAP	NSN	933	0.1	12	He3+	35 CM		Am24	3 CURI	1.1	51.89	1.1+
G-G DEN.	5	XAP	NSN	933	0.1	12	CsI	22 CM	13 CM	Cs137	100mC	15.2	38	19.1+
CALIPER	5	XAP	NSN	933	0.1	12						15.2	38	19.1+

CALIBRATION FACTOR(S):
DIGITAL FILE NAME(S): 33-89BR 33GRN3XM0, JXN, 33GGCJXN0, JXN, 33RADJIDP
REMARKS:
*Entire interval repeated





COLOG INC.

COLORADO WELL LOGGING

9701 W. 39th ST. GOLDEN, COLORADO 80401
PHONE: (303) 279-0371, TELEX: 45-0286

SONIC WAVEFORM

WELL: 36-89BR

PROJECT: ROCKY FLATS BACKGROUND
CLIENT: ROY F. WESTON, INC.
LOCATION: ROCKY FLATS NORTHING: 42344.5504 EASTING: 25360.6705
STATE: COLORADO COUNTY: JEFFERSON ELEV: 5826.5 DEPTH REF: GROUND

DATE: 23 MARCH 1989
COLOG ID NO:

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING – GOLDEN, COLORADO
CUSTOMER: TD: 107 FEET COLOG TD: 107 FEET

HOLE RECORD

Bit #	Bit Size	From	To
1	7"	0 FEET	50 FEET
2	4 1/2"	50 FEET	TD
3			
4			

CASING RECORD

Size/Wgt/Dia.	From	To
8"	SURF	50 FEET

HOLE MEDIUM: AIR, SURF. 7" WATER 7" TO
MUD TYPE: NATURAL, CLEAR WATER
VISCOSITY: SAMPLE NOT WEIGHT AVAILABLE

DRILL METHOD: MUD ROTARY, CORE
TIME SINCE CIRC: 1 DAY
Rm: at Deg

GENERAL DATA

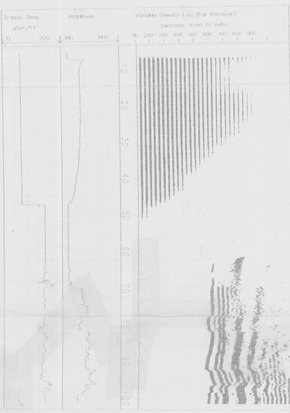
INSTRUMENTATION: COLOG MT. SONIC SERIES III
LOGGING ENGINEER: ROBERT CROMBIE, THOMAS STARTZ
CLIENT REP.: MR. BOB MILLER – MESSRS. MR. LARRY BORG – TRIANGO
OTHER SERVICES: HI-RESOLUTION GL, C-GL, SN, SS, SA, BI, QUAKE, TM, TEMP

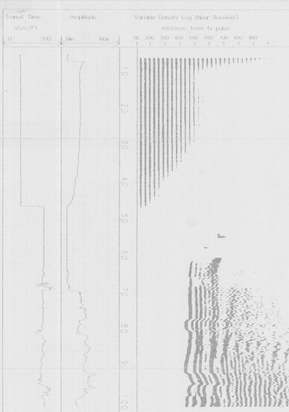
LOGGING DATA

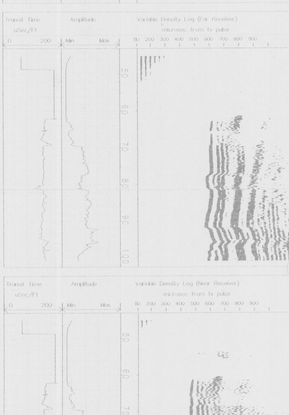
LOG CONDITION	CSG SIZE	MUD WGT	LOGGING MUD VISC	MAXIMUM TEMPERATURE DEG.	LOGGING METHOD	TIME FT/MIN	TC/SC FT/MIN	DEPTH FT/MIN	TIME	TIME OBS	DEPTH FROM	DEPTH TO	LOGGED INTERVAL FROM	LOGGED INTERVAL TO
SONIC	8"	8.4	40.0	57.0	1/1	8	1/1 SONIC	1/1	1/1		SURF		SURF	107

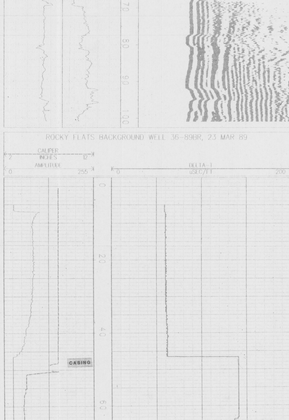
CALIBRATION (FACTORS):
DIGITAL: FILE NAME(S): 36SP1.DAT, 36SP2.DAT, 36SP3.DAT, 36SP4.DAT, 36SP5.DAT, 36SP6.DAT
REMARKS:
- DRILLING COMPLETED 23 MAR 89.
- HOLE FILLED 30 MINUTES PRIOR TO LOGGING.
- 24-23 MAR 89.

REPEAT SECTION RUN FROM 107' TO 50'

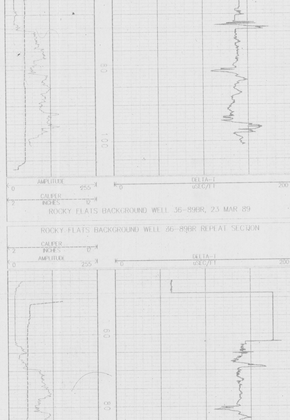








ROCKY FLATS BACKGROUND WELL 36-89BR, 23 MAR 89



ROCKY FLATS BACKGROUND WELL 36-89BR, 23 MAR 89

ROCKY FLATS BACKGROUND WELL 36-89BR REPEAT SECTION

ROCKY FLATS BACKGROUND WELL 36-89BR REPEAT SECTION

COLOG INC

1019 - 19th ST. GOLDEN, COLORADO 80401
PHONE: (303) 279-0575 TELEX: 45-0286

COLORADO WELL LOGGING

SONIC WAVEFORMS

WELL: 43-89BR

PROJECT: ROCKY FLATS BACKGROUND
CLIENT: ROY F. WESTON
LOCATION: ROCKY FLATS NORTHING:3381.6625 EASTING:1934.7555
STATE: COLORADO COUNTY: JEFFERSON ELEV: 5945.4' DEPTH REF: GROUND

DATE: 25 APRIL 1989
COLOG ID NO:

SCHEDULE DATA

DRILLING CONTRACTOR: BEVILES BROTHERS DRILLING - GOLDEN, COLORADO
CUSTOMER ID: 100 FEET COLOG ID: 98 FEET

RUN NO.	BIT SIZE	BIT RECORD From	To	CASING RECORD Size/Wgt/Thk	From	To
1	6"	36.0 FEET	TD	5 1/4"	SURF	36.0 FEET
2						
3						
4						

HOLE MEDIUM: AIR; SURF - 10.0' WATER; 10.0' - TD DRILL METHOD: MUD ROTARY; CORE
MUD TYPE: Natural mud plus clear water TIME SINCE CIRC: •
VISCOSITY: SAMPLE NOT WEIGHT: AVAILBLE Bbls of Deg

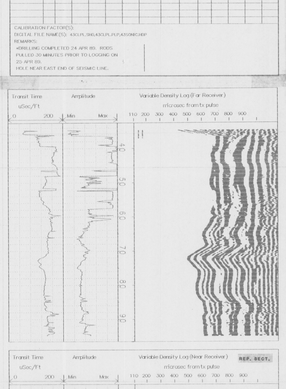
GENERAL DATA

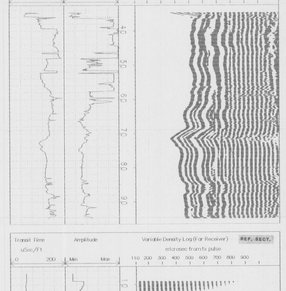
INSTRUMENTATION: COLOG MC SERIES; SERIES III UNIT/TRUCK: 245 / 19
LOGGING ENGINEER: MR. ROBERT CRONKER, MR. JAMES LOCOCO
CLIENT REP.: MR. ROY L. THIEN - WESTON; MR. TRAVIS CANON - EG&G/CO
OTHER SERVICES: NEUTRON, GAMMA, CALIPER, G-GAMMA, ELECTRICS, TEMP., FL-RES.

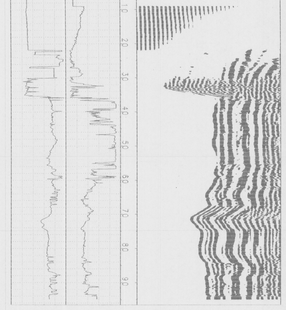
LOGGING DATA

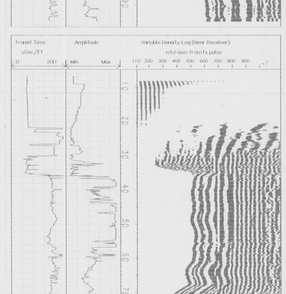
LOG FUNCTION	SCAN NO.	MODE	CURRENT (MA)	DEVIATION (DEG)	LOGGING SPEED (FT/MIN)	TIME CONSTANT (SEC)	DEAD TIME (MICROSEC)	SONIC TYPE	SONIC Tra-Rec (FEET)	SONIC Rec-Rec (FEET)	GAMMA TYPE	GAMMA SCAL CONS	LOGGED INTERVAL FROM (FT)	TO (FT)
SONIC	1	DAS	0.125	75	0.5	1	0	SONIC	2.0	1.0			36	98
CALIPER	1	HRT	NONE	NO	0.5	1	0						SURF	98

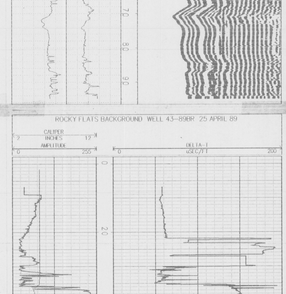
CALIBRATION FACTORS:
DIGITAL FILE NAME(S): 43CLPL,SHL43CLPL,FLFLATSONICHP
REMARKS:
•DRILLING COMPLETED 24 APR 89; RIDS
PULLED 30 MINUTES PRIOR TO LOGGING ON
25 APR 89.
HOLE NEAR EAST END OF SEISMIC LINE.

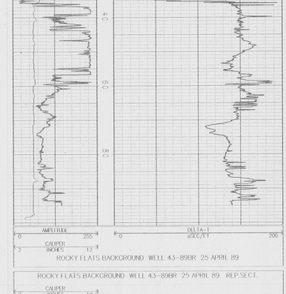












COLOG INC

dba COLORADO WELL LOGGING
109 B 8th ST. GOLDEN, COLORADO 80401
PHONE: (303) 279-2171 TELEX: 45-0268

CALIPER, TEMP.
FLUID RESISTIVITY
WELL: 37-89BR

PROJECT: ROCKY FLATS BACKGROUND
DATE: 12 MAY 1989
CLIENT: ROY F. WESTON
COLOG ID NO:
LOCATION: ROCKY FLATS NORTHING:39 700.5730 EASTING:23 03.3803
STATE: COLORADO COUNTY: JEFFERSON ELEV: 5838' DEPTH REF: GROUND

— BOREHOLE DATA —

DRILLING CONTRACTOR: BOWLES BROTHERS DRILLING — GOLDEN, COLORADO
CUSTOMER ID: 641 FEET COLOG TD: 641 FEET

BIT RECORD:

RUN NO.	Bit Size	From	To	Size/Wgt/Title	From	To
1	8 3/4"	SURFACE	TD	7"	SURF	SURFACE
2						
3						
4						

CASING RECORD

HOLE MEDIUM: AIR SURF. — 31.0' WATER: 31.0' — TD
DRILL METHOD: CNV/IN CORE/ROTARY
MUD TYPE: Natural mud plus clear water
TIME SINCE CIRC: +
VISCOSITY: SAMPLE NO3 WEIGHT: AVAILABLE
lbs/ gal Deg

— GENERAL DATA —

INSTRUMENTATION: EG&G MO. SONDES: SERIES III
UNIT/TRUCK: 245 / 19
LOGGING ENGINEER: MR. JAMES LOCICO
CLIENT REP: MS. JANET MARKS — WESTON, MR. TIM DEIGNAN — EG&G
OTHER SERVICES: WESTERN GAMMA, ELECTRIC, C-GAMMA, FM, SONIC

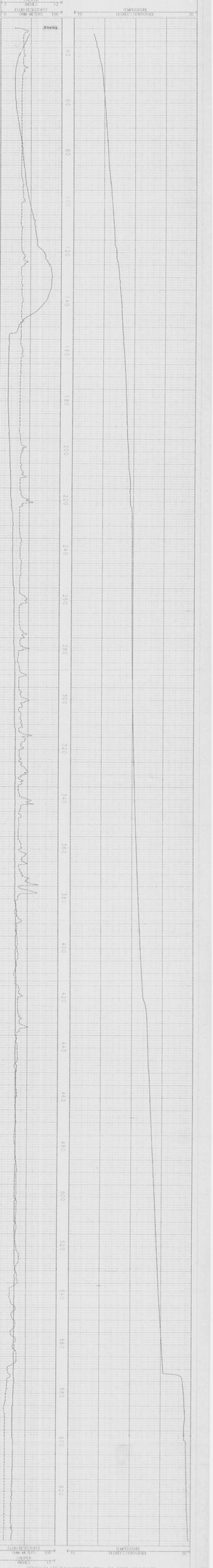
LOGGING DATA

LOG FUNCTION	RUN NO.	CALIBRATION MODEL	CALIBRATION SERIAL NO.	CALIBRATION DATE	LOGGING SPEED FEET/MIN	DATE	TIME	SENSOR TYPE	SENSOR TO BIT FEET	SENSOR TO GROUND FEET	SOURCE TYPE	SOURCE STRENGTH	LOGGED INTERVAL FROM	TO	BIT SIZE
CALIPER	1	SPT	3024	5/11	31	12							641'	31'	8 3/4"
TEMPERATURE	1	MGT	107	7/88	31	12							641'	31'	8 3/4"
FLUID RES.	1	MFT	107	7/88	31	12							22'	641'	8 3/4"

CALIBRATION RECORD:
DIGITAL FILE NAME(S): 37MLF1.DL, 37MLF1.FLF, 37MLF1.DAT
REMARKS:
•DRILLING COMPLETED 10 MAY 89 - 8000
PULLED 13 MINUTES PRIOR TO LOGGING ON 11 MAY 89.

NOTE THE HOLE WAS OPEN 14 HOURS BEFORE THIS RUN. DRILLER ADDED FRESH WATER TO HOLE 1/2 HOUR BEFORE THIS RUN.

ROCKY FLATS BACKGROUND WELL 37-89BR 12 MAY 89



COLOG INC

dba COLORADO WELL LOGGING
1019 8th ST. GOLDEN, COLORADO 80401
PHONE: (303) 279-0171 TELEX: 45-0286

NEUTRON, G-GAMMA
GAMMA, CALIPER
WELL: 32-89BR

PROJECT: ROCKY FLATS BACKGROUND
CLIENT: ROY F. WESTON, INC.
LOCATION: ROCKY FLATS NORTHING: 42792.3657 EASTING: 21944.1858
STATE: COLORADO COUNTY: JEFFERSON ELEV: 5946.2 DEPTH REF: GROUND

DATE: 3 MARCH 1989
COLOG ID NO:

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO
CUSTOMER TD: 204 FEET COLOG TD: 197 FEET

RUN NO.	BIT RECORD Bit Size	From	To	CASING RECORD Size/Wgt/Thk.	From	To
1	7"	40 FEET	TD	8"	SURF	40 FEET
2	4 1/2"	40 FEET	TD			
3						
4						

HOLE MEDIUM: AIR: SURF - 10' WATER: 10' - TD DRILL METHOD: MUD ROTARY CORE
MUD TYPE: NATURAL TIME SINCE CIRC: 1 DAY +
VISCOSITY: SAMPLE: NOT WEIGHT: AVAILIBLE Rm: at Deg

GENERAL DATA

INSTRUMENTATION: EG&G MT. SOPRIS SERIES III UNIT/TRUCK: 245 / 19
LOGGING ENGINEER: MR. ROBERT CROWDER, MR. THOMAS STAATZ
CLIENT REP: MR. DICK TREAT - CHEN, MR. TRAVIS CANON - EBASCO
OTHER SERVICES: SONICEM, TEMP., SP, IP, 16, 64, GUARD

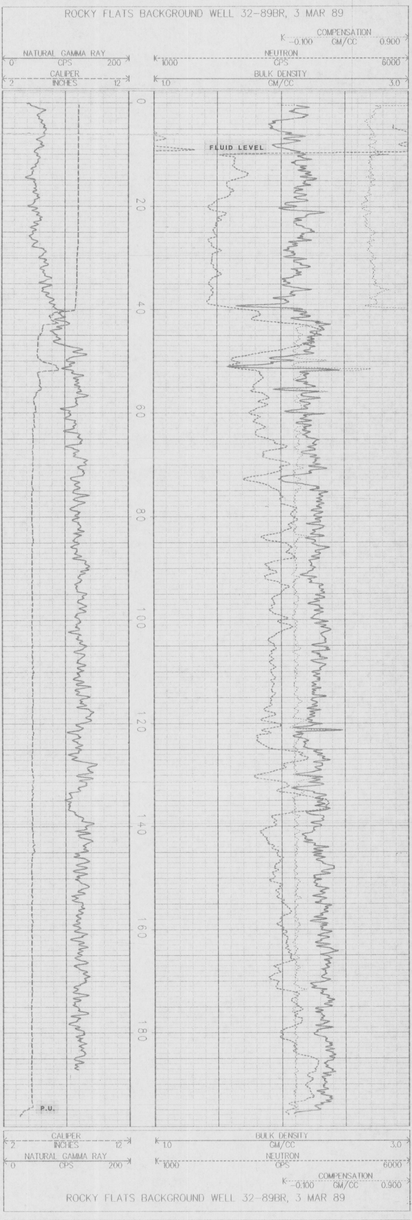
LOGGING DATA

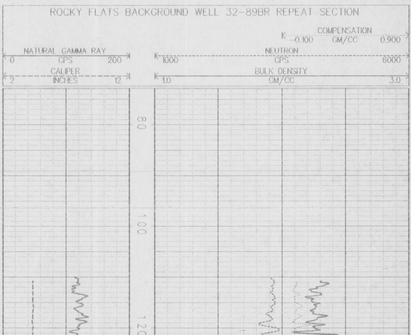
LOG FUNCTION	RUN NO.	EQUIPMENT MODEL	PROBE SIN.	BUNKER SIN.	DIC INT FEET	LOGGING SPEED FT/MIN	DETECTOR TYPE	SPACING Tx-Rx FEET	Rc-Rc FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	INT. FEET
GAMMA	4	09"	NGN	9.53	0.1	12	Nal					197'	SURF	197'
CALIPER	5	24"	NGN	9.53	0.1	12						196'	SURF	196'
NEUTRON	4	09"	1735	9.53	0.1	12	He3			Am241	3 CL	196'	10'	186'
GAMMA GAMMA	4	11"	NGN	9.53	0.1	12	Nal	20 Cm	15 Cm	CS137	1 Ci	196'	SURF	196'

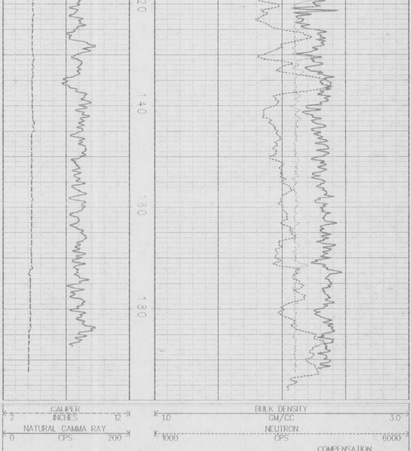
CALIBRATION FACTOR(S):
DIGITAL FILE NAME(S): 32BDNSGL.PXX, 32BDRGS4.PYX, 32BDNLPLP, 32BDNLPLP, 32BDNLHDP

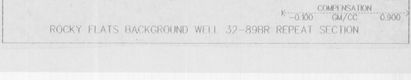
REMARKS:
* DRILLING COMPLETED 2 MAR 89.
RODS PULLED 30 MINUTES PRIOR TO LOGGING ON 3 MAR 89.
SNOWING, WINDY. 11 DEGREES F CAUSED IMMEDIATE CABLE ICING AS IT CAME OUT OF THE HOLE.

REPEAT SECTION RUN FROM 195' TO 110'









COLOG INC.

d.b.a. COLORADO WELL LOGGING
1019 8th ST. GOLDEN, COLORADO 80401
PHONE: (303) 279-0171 TELEX: 45-0286

SP, IP, 16&64 RES
GUARD, EM-39, CAL
WELL: 34-89BR

PROJECT: ROCKY FLATS BACKGROUND — DATE: 13 MARCH 1989
CLIENT: ROY F. WESTON, INC. — COLOG ID NO:
LOCATION: ROCKY FLATS — NORTHING: 4,3740.50,3.3 — EASTING: 2,3469.0744
STATE: COLORADO — COUNTY: JEFFERSON — ELEV: 5920.9 — DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS
CUSTOMER TD: 170 FEET COLOG TD: 168 FEET

RUN NO.	BIT RECORD: BIT Size	From	To	CASING RECORD: Size/Wgt/Thk.	From	To
1	9"	SURF	42 FEET	8"	SURF	42 FEET
2	4 1/2"	42 FEET	TD			
3						
4						

HOLE MEDIUM: AIR: SURF - TF WATER: TF - TD — DRILL METHOD: MUD ROTARY & CORE
MUD TYPE: NATURAL — TIME SINCE CIRC: 3 DAYS +
VISCOSITY: NO SAMPLE — WEIGHT: AVAILBLE — Rmc at Deg

GENERAL DATA

INSTRUMENTATION: CG&G MT. SOPRIS SERIES III — UNIT/TRUCK: 245 / 19
LOGGING ENGINEER: MR. ROBERT CROWDER / MR. THOMAS STAATZ
CLIENT REP: MR. DICK TREAT - CHEN, MR. TIM DOGNAN - EG&G&S.CO
OTHER SERVICES: N-N, G, G-G, SONIC, TEMP*, FLUID RESISTIVITY

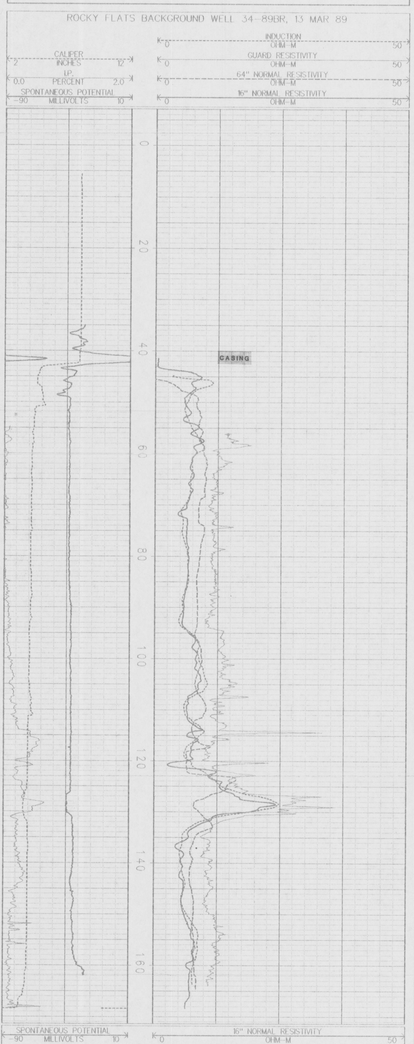
LOGGING DATA

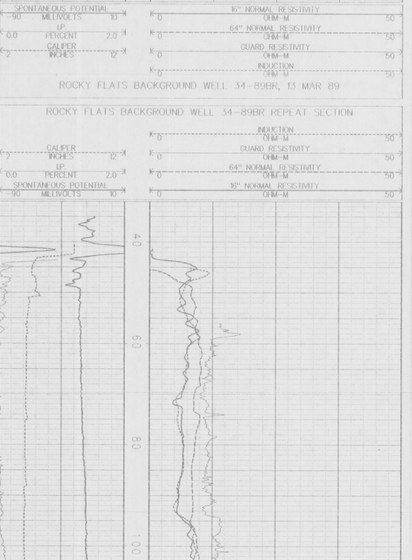
LOG FUNCTION	RUN NO.	EQUIPMENT: MODEL	PROBE SN.	VEHICLE SN.	LOGGING INT FEET	SPEED F/MIN	DETECTOR TYPE	SPACING: 16-64 FEET	64-16 FEET	SOURCE TYPE	SIZE CURR	LOGGED INTERVAL: FROM	TO	INT. FEET
S.P.	2	R.P.	975	417	0.1	12						162'	42'	122'
I.P.	2	R.P.	975	417	0.1	12						168'	58'	110'
16&64" RES.	2	R.P.	975	417	0.1	12						168'	42'	126'
GUARD RES.	4	M.P.	M.M.	933	0.1	12						164'	56'	108'
INDUCTION	7	EM39	0550	0550	0.2	10						164'	42'	142'

CALIBRATION FACTOR(s):
DIGITAL FILE NAME(S): 34RLP.PUN, 34RLPR.PUN, 34RLP.RUP, 34RLPR.RUP, 34ELECHDP
REMARKS:
* FINISHED DRILLING 10 MAR 89 (FRIDAY).
PULLED RODS 30 MINUTES PRIOR TO LOGGING ON 13 MAR 89.

REPEAT SECTION RUN FROM 160' TO 35'.

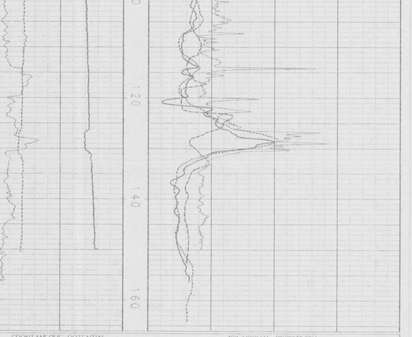
ROCKY FLATS BACKGROUND WELL 34-89BR, 13 MAR 89

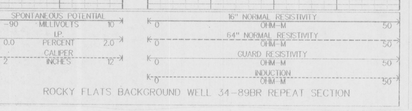




ROCKY FLATS BACKGROUND WELL 34-89BR, 13 MAR 89

ROCKY FLATS BACKGROUND WELL 34-89BR REPEAT SECTION





ROCKY FLATS BACKGROUND WELL 34-89BR REPEAT SECTION

COLOG INC. d/b/a COLORADO WELL LOGGING
1019 8th ST. GOLDEN, COLORADO 80401
PHONE: (303) 279-0171 TELEX: 45-0286

POROSITY LOGS

WELL: 34-89BR

PROJECT: ROCKY FLATS BACKGROUND
DATE: 13 MARCH 1989
CLIENT: ROY F. WESTON, INC.
COLOG ID NO:
LOCATION: ROCKY FLATS NORTHING: 43740.8033 EASTING: 23469.0744
STATE: COLORADO COUNTY: JEFFERSON ELEV: 5920.9 DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS
CUSTOMER TD: 170 FEET COLOG TD: 168 FEET

RUN NO.	BIT RECORD Bit Size	From	To	CASING RECORD Size/Wgt/Thk.	From	To
1	9"	SURFACE	42 FEET	8"	SURF	42 FEET
2	4 1/2"	42 FEET	TD			
3						
4						

HOLE MEDIUM: AIR: SURF – TT WATER: TT – TD DRILL METHOD: MUD ROTARY & CORE
MUD TYPE: NATURAL TIME SINCE CIRC: 3 DAYS +
VISCOSITY: NO SAMPLE WEIGHT: AVAILIBLE Rmc at Deg

GENERAL DATA

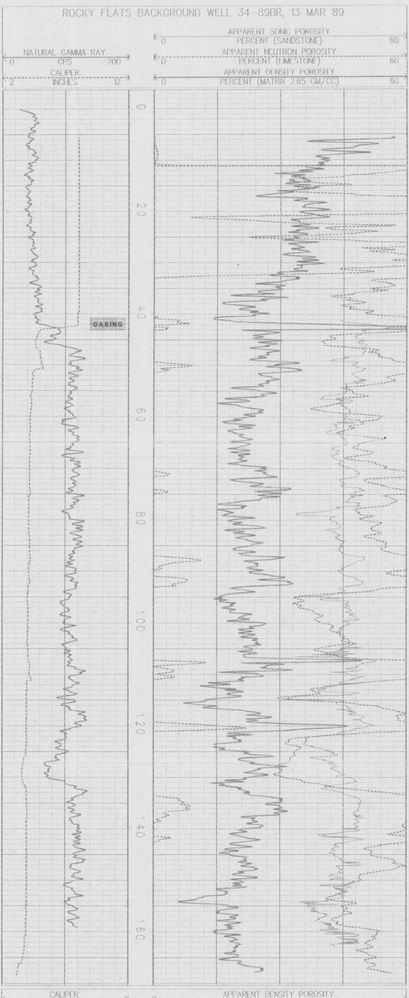
INSTRUMENTATION: EG&G MT. SOPRIS SERIES III UNIT/TRUCK: 245 / 19
LOGGING ENGINEER: MR. ROBERT CROWDER / MR. THOMAS STAATZ
CLIENT REP: MR. DICK TREAT – CHEN, MR. TIM DEIGNAN – EBASCO
OTHER SERVICES: EM, TEMP, SP, ID, 16, 64, GUARD

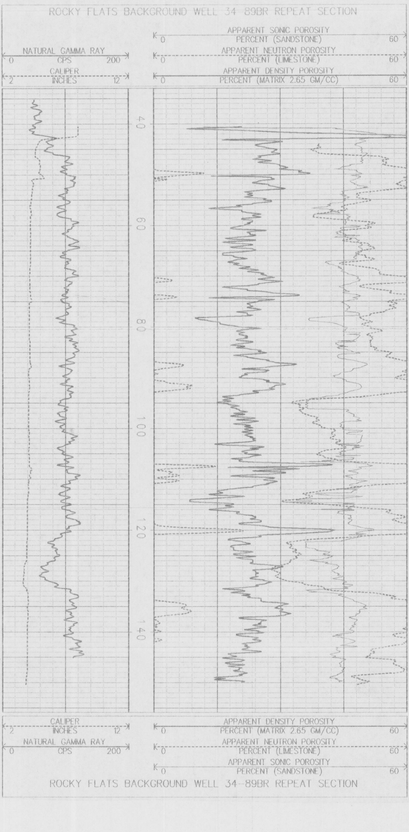
LOGGING DATA

LOG FUNCTION	RUN NO.	MODEL	EQUIPMENT PROBE S.N.	TEMPROBE S.N.	LOGGING INT FEET	OPERATION VEL/MIN	DETECTOR TYPE	SPACING TC-SP FEET	TC-IR FEET	SOURCE TYPE	SZE CURE	LOGGED INTERVAL FROM	TO	INT FEET
GAMMA	4	EPS	NGN	9.53	0.1	12	Nal					169'	53.89	169'
CALIPER	6	HPP	NGN	9.53	0.1	12						169'	0'	169'
SONIC	3	GLPL	9275	771	0.1	6	CERAMIC	3 FT	1 FT			169'	0'	154'
NEUTRON	14	DPI	1235	9.53	0.1	12	He3			Am241	3 Ci	169'	4'	164'
GAMMA-GAMMA	1	HPP	NGN	9.53	0.1	12	Nal Scin	20 Cm	35 Cm	Cs137	.3 Ci	169'	0'	169'

CALIBRATION FACTOR(S):
DIGITAL FILE NAME(S): 34PGRUNN, 34PRBUNN, 34PGRDUP, 34PRBDUP, 34PGRJNP
REMARKS:
* FINISHED DRILLING 10 MAR 89 (FRIDAY).
PULLED RODS 30 MINUTES PRIOR TO LOGGING ON 13 MAR 89.

REPEAT SECTION RUN FROM 159' TO 35'.





COLOG INC.

d.b.a. COLORADO WELL LOGGING
1019 8th ST. GOLDEN, COLORADO 80401
PHONE: (303) 279-0171 TELEX: 45-0286

POROSITY LOGS

WELL: 33-89BR

PROJECT: ROCKY FLATS - BACKGROUND
CLIENT: ROY F. WESTON, INC.
LOCATION: ROCKY FLATS NORTHING: 4321.4667 EASTING: 2263.7846
STATE: COLORADO COUNTY: JEFFERSON ELEV: 5935.8 DEPTH REF: GL

DATE: FEBRUARY 16 1989
COLOG ID NO:

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING, GOLDEN, CO
CUSTOMER ID: 159.8 FT COLOG TD: 112 FEET

RUN NO.	BIT RECORD Bit Size	From	To	CASING RECORD Size/Wgt/Thk	From	To
1.	9"	SURF.	38 FT.	8" ID	SURF.	37.35 FT
2.	4"	38 FT.	TD			
3						
4.						

HOLE MEDIUM: NAT. MUD SURF.-TD
MUD TYPE: NATURAL, CLEAR WATER
VISCOSITY: WEIGHT:

DRILL METHOD: MUD ROTARY
TIME SINCE CIRC: LESS THAN 3 HOURS
Rm: at Deg

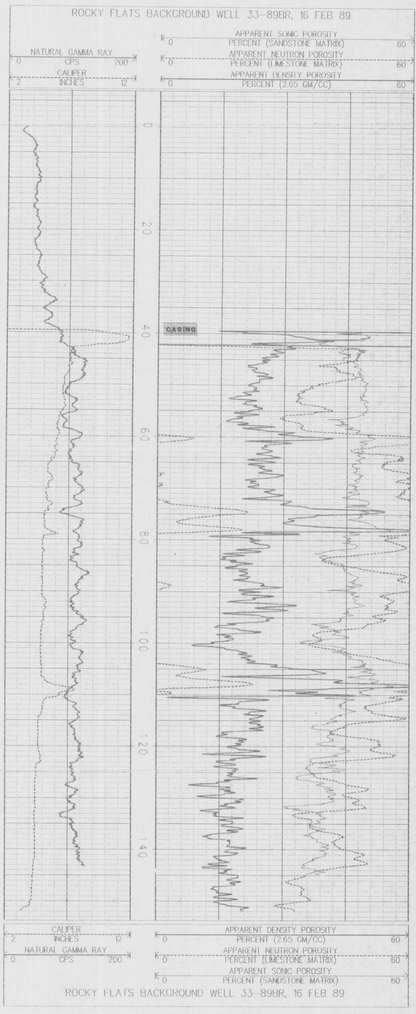
GENERAL DATA

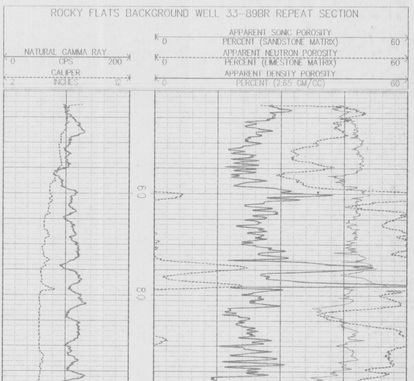
INSTRUMENTATION: EG&G MT SOPRS SERIES III UNIT/TRUCK: 19
LOGGING ENGINEER: ROBERT CROWDER, TOM STAATZ
CLIENT REP: MR. HANK BRINKOWSKI (WESTON), MR. LARRY IRONS (FERASCO)
OTHER SERVICES: T, FR, GUARD, SWF, 16-64", SP, IP, EM 39

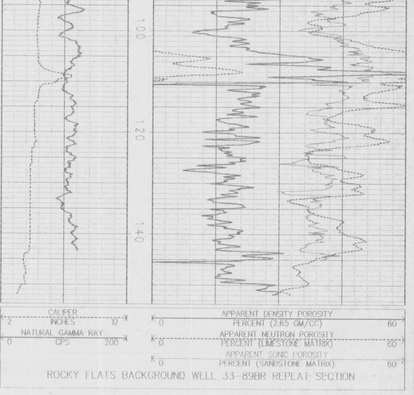
LOGGING DATA

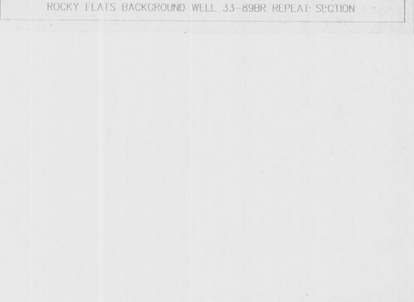
LOG FUNCTION	RUN NO.	MODEL	EQUIPMENT PROBE S.N.	TUNNEL S.N.	LOGGING SPEED FT/MIN	DETECTOR TYPE	SPACING Tx-Rx FEET	Rx-Rx FEET	SOURCE TYPE	STRENGTH CURIES	LOGGED INTERVAL FROM	TO	INT FEET
GAMMA	4	XAP	MSN	933	0.1	12	NaI				14.2	51.89	142+
NEUTRON	4	XAP	MSN	933	0.1	12	He3+	35 CM		Am24	2 CUR	10.1	SURF	151+
G-G DEN.	5	XAP	MSN	933	0.1	12	CsI	22 CM	13 CM	Cs137	100mC	15.2	38	114+
CALIPER	5	XAP	MSN	933	0.1	12					15.2	38	114+
SONIC	4	CLPL	14165	771	0.1	6	CERAMIC	18"	12"	9270	14.7	25'	127'

CALIBRATION FACTOR(S):
DIGITAL FILE NAME(S): 33PORJPTN/RILPTN, 33PORJPLP/RILPLP, 33PORJHDP
REMARKS:
*Entire interval repeated









COLOG INC

d.b.a. COLORADO WELL LOGGING
1019 8th ST. GOLDEN, COLORADO 80401
PHONE: (303) 279-0171 TELEX: 45-0286

POROSITY LOGS

WELL: 32-89BR

PROJECT: ROCKY FLATS BACKGROUND — DATE: 3 MARCH 1989

CLIENT: ROY F. WESTON, INC. — COLOG ID NO:

LOCATION: ROCKY FLATS NORTHING: 42792.3657 EASTING: 21944.1858

STATE: COLORADO COUNTY: JEFFERSON ELEV: 5946.2 DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLE'S BROTHERS DRILLING - GOLDEN, COLORADO

CUSTOMER TD: 204 FEET COLOG TD: 197 FEET

RUN NO.	BIT RECORD Bit Size	From	To	CASING RECORD Size/Wgt/Thk	From	To
1	9"	40 FEET	TD	8"	SURF	40 FEET
2	4 1/2"	40 FEET	TD			
3						
4						

HOLE MEDIUM: AIR; SURF - 10' WATER: 10' - TD DRILL METHOD: MUD ROTARY CORE

MUD TYPE: NATURAL TIME SINCE CIRC: 1 DAY +

VISCOSITY: SAMPLE NOT WEIGHT: AVAILBLE Rm: at Deg

GENERAL DATA

INSTRUMENTATION: EG&G MT. SOPRIS SERIES III UNIT/TRUCK: 245 / 19

LOGGING ENGINEER: MR. ROBERT CROWDER, MR. THOMAS STAATZ

CLIENT REP: MR. DICK TREAT - CHEN, MR. TRAVIS CANON - EBASCO

OTHER SERVICES: TEMP., EM, SP, 16, 64, 8", GUARD, F-R

LOGGING DATA

LOG FUNCTION	RUN NO.	MODEL	EQUIPMENT PROBE S.N.	PRBOLE S.N.	DIC	LOGGING INTERVAL FEET	FT/MIN	DETECTOR TYPE	SPACING Det-Rec FEET	Rec-Rec FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	UNIT FEET
GAMMA	4	EPF	HGN	933	0.1	12	Nal						199'	SURF	199'
CALIPER	5	HPF	HSN	933	0.1	12							197'	SURF	197'
SONIC	3	CPL	1275	771	0.1	6	CERAMIC	3 FT	1 FT				194'	10'	194'
NEUTRON	4	GPF	1735	933	0.1	12	He3			Am24	3 Ci.		196'	10'	196'
GAMMA GAMMA	5	HPF	HGN	933	0.1	12	Nal	20 Cm	.35 Cm	Cs137	.1 Ci		199'	SURF	199'

CALIBRATION FACTOR(S):

DIGITAL FILE NAME(S): 32S-PRPLP, 32S-PRBPLP, 32S-PORLP, 32S-PRBPLP, 32PORLHP

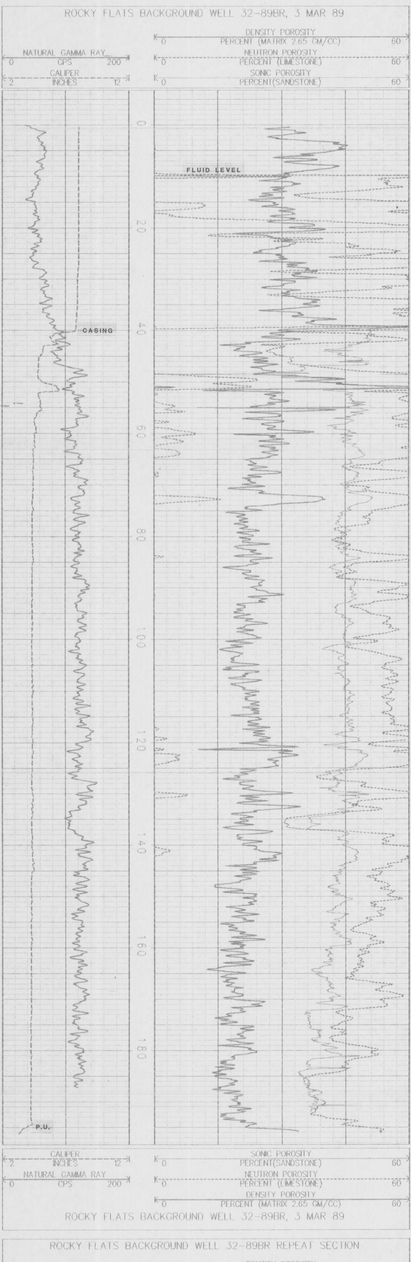
REMARKS:

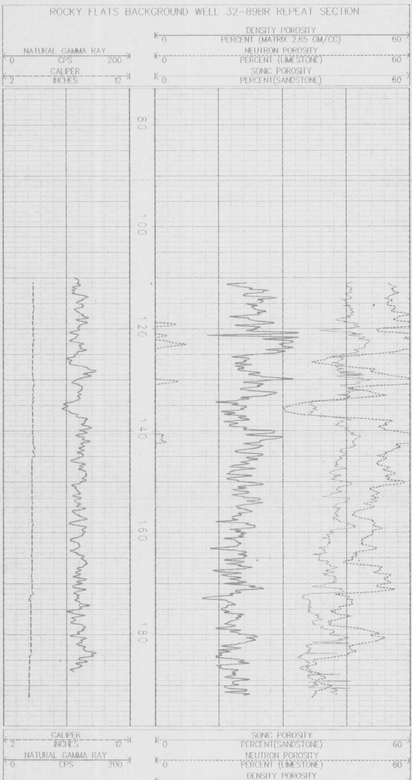
+ DRILLING COMPLETED 2 MAR 89.

RODS PULLED 30 MINUTES PRIOR TO LOGGING ON 3 MAR 89.

SNOWING, WINDY 11 DEGREES F CAUSED IMMEDIATE CABLE ICING AS IT CAME OUT OF THE HOLE.

REPEAT SECTION RUN FROM 192' TO 110'





COLOG INC

d.b.a. COLORADO WELL LOGGING
1019 - 8th ST. GOLDEN, COLORADO 80401
PHONE: (303) 279-0171 TELEX: 45-0286

G-GAMMA, NEUTRON
GAMMA, CALIPER
WELL: 34-89BR

PROJECT: ROCKY FLATS BACKGROUND
DATE: 13 MARCH 1989
CLIENT: ROY F. WESTON, INC.
COLOG ID NO:
LOCATION: ROCKY FLATS NORTHING: 43740.8033 EASTING: 23469.0744
STATE: COLORADO COUNTY: JEFFERSON ELEV: 5920.9 DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO
CUSTOMER TD: 170 FEET COLOG TD: 168 FEET

RUN NO.	BIT RECORD Bit Size	From	To	CASING RECORD Size/Wgt/Thk.	From	To
1	8"	SURFACE	42 FEET	8"	SURF	42 FEET
2	4 1/2"	42 FEET	TD			
3						
4						

HOLE MEDIUM: AIR: SURF - TF WATER: TF - TD DRILL METHOD: MUD ROTARY & CORE
MUD TYPE: NATURAL TIME SINCE CIRC: 3 DAYS +
VISCOSITY: NO SAMPLE WEIGHT: AVAILBLE Rm: at Deg

GENERAL DATA

INSTRUMENTATION: EG&G MT. SOFRIS SERIES III UNIT/TRUCK: 245 / 19
LOGGING ENGINEER: MR. ROBERT CROWDER / MR. THOMAS STAATZ
CLIENT REP: MR. DICK TRUAT - CHEN, MR. TIM DEIGNAN - EBASCO
OTHER SERVICES: EM, SONIC, TEMP, SP, #1, 16, 64, GUARD

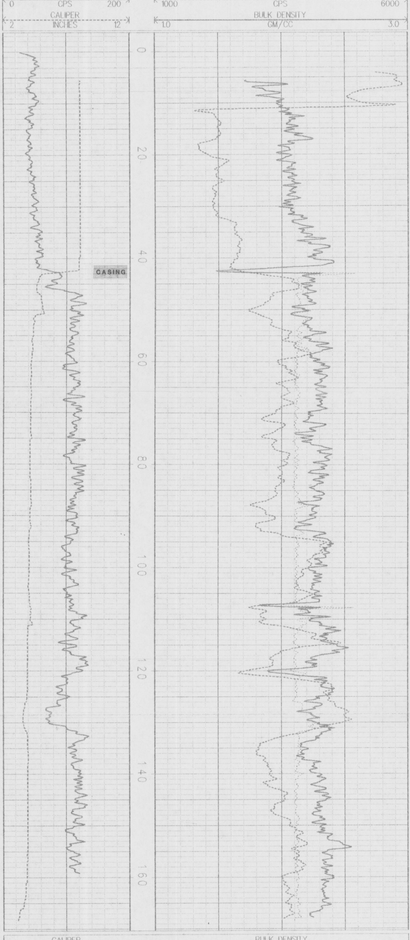
LOGGING DATA

LOG FUNCTION	RUN NO.	EQUIPMENT PROBE MODEL	PROBE S.N.	INPROBE S.N.	LOGGING INT FEET	LOGGING INT/SPEED FT./MIN.	DETECTOR TYPE	SPACING Tx-Rx FEET	Rx-Rx FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	BIT FEET
GAMMA	4	88FF	NGN	9.33	0.1	12	Nal					160'	SURF	160'
CALIPER	6	88FF	NGN	9.33	0.1	12						168'	6'	162'
NEUTRON	4	0FF	17.55	9.33	0.1	12	He3			Am241	.5 Ci.	168'	4'	164'
GAMMA-GAMMA	88FF	NGN	9.33	0.1	12	Nal	20 Cm	35 Cm	Cs137	.1 Ci.	168'	57'	163'

CALIBRATION FACTOR(S):
DIGITAL FILE NAME(S): 34PORGVN, 34RRRUPLN, 34PORDPLP, 34PRRDPLP, 34GENHDP
REMARKS:
* FINISHED DRILLING 10 MAR 89 (FRIDAY).
PULLED RODS 30 MINUTES PRIOR TO LOGGING ON 13 MAR 89.

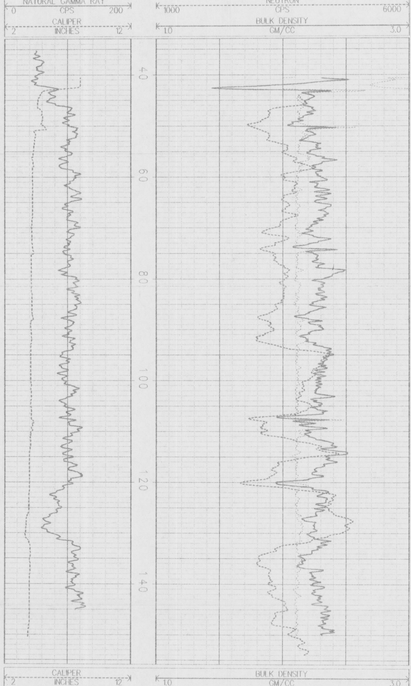
REPEAT SECTION RUN FROM 150' TO 35'.

ROCKY FLATS BACKGROUND WELL 34-89BR, 13 MAR 89



ROCKY FLATS BACKGROUND WELL 34-89BR, 13 MAR 89

ROCKY FLATS BACKGROUND WELL 34-89BR REPEAT SECTION



ROCKY FLATS BACKGROUND WELL 34-89BR REPEAT SECTION

COLOG INC. — COLORADO WELL LOGGING
1010 8th ST. GOLDEN, COLORADO 80401
PHONE (303) 279-0171 TELEX 45-0266

SP, IP, 16&64 RES
GUARD, INDUCTION
WELL: 32-89BR

PROJECT: ROCKY FLATS BACKGROUND
CLIENT: ROY F. WESTON, INC.
LOCATION: ROCKY FLATS NORTHING: 42797.3657 EASTING: 7444.8550
STATE: COLORADO COUNTY: JEFFERSON ELEV: 5946.3 DEPTH REF: GROUND

DATE: 3 MARCH 1989
COLOG ID NO.

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING COLORADO
CUSTOMER TD: 204 FEET COLOG TD: 197 FEET

RUN NO.	BIT RECORD Bit Size	From	To	CASING RECORD Size/wgt/Thd	From	To
1	9"	40 FEET	TD	8"	SURF	40 FEET
2	4 1/2"	40 FEET	TD			
3						
4						

HOLE: MEDIUM ABR SURF 10' WATER: 10' - TD DRILL METHOD: MUD ROTARY CORE
MUD TYPE: NATURAL TIME SINCE CIRC: 1 DAY +
VISCOSITY: SAMPLE NOT WEIGHT: AVAILABLE temp of Deg

GENERAL DATA

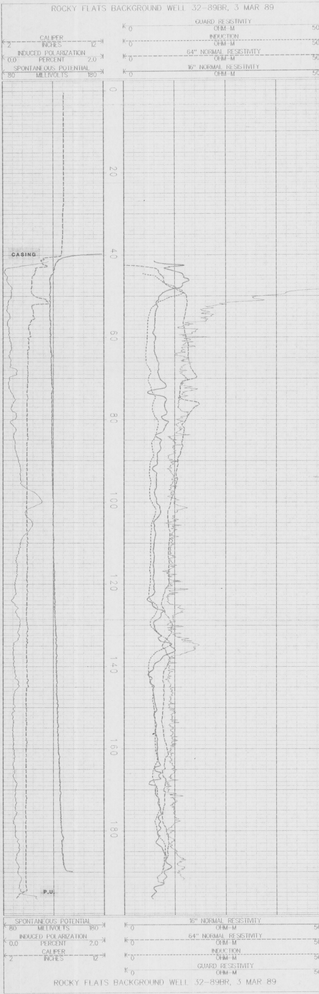
INSTRUMENTATION: EGAG MT. SOPRIS SERIES III UNIT/TRUCK: 245 / 19
LOGGING ENGINEER: MR. ROBERT CROWDER, MR. THOMAS STRATZ
CLIENT REP: MR. DICK TRIGAT CHEN, MR. TRAVIS CANON TRASCO
OTHER SERVICES: N-N GAMMA, SONIC TIME F. F.

LOGGING DATA

LOG FUNCTION	GAIN SW.	MODEL	LOGMATIC FROM	TO	DEPTH SCALE FEET	LOGGING RATE FEET/MIN	DETECTOR TYPE	TUBE TYPE	SPACING TO-RX FEET	SPACING TO-TX FEET	DIAMETER FIRST	DIAMETER CODE	LOGGED INTERVAL FROM	TO	FEET
S.P.	2	SLP	0	197	20.5	10							0'0"	40'	39.0'
I.P.	2	SLP	175	417	20.5	10							0'0"	49'	39.0'
N. & 64 RES.	4	SLP	175	417	20.5	10							0'0"	49'	39.0'
GUARD RES.	4	RW	NON	833	20.5	10							0'4"	50'	46.4'
INDUCTION	5	GM-39	0000	0000	20.5	10							0'0"	42'	39.0'

CALIBRATION FACTORS:
DIGITAL FILE NAME(S): 32BR.DAT, 32BR.SP, 32BR.IP, 32BR.N64, 32BR.GUARD, 32BR.IND
REMARKS:
+ DRILLING COMPLETED 2 MAR 89.
RODS PULLED 30 MINUTES PRIOR TO LOGGING ON 3 MAR 89.
SNOWING, WINDY 18 DEGREES F CAUSED IMMEDIATE CABLE ICING AS IT CAME OUT OF THE HOLE.
REPEAT SECTION RUN FROM 196' TO 40'

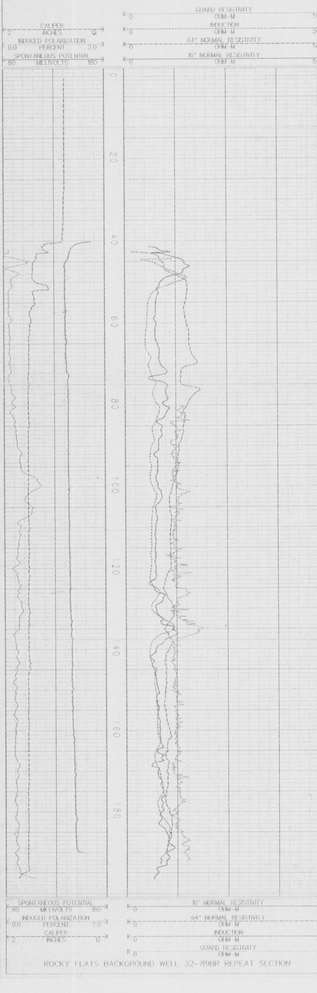
ROCKY FLATS BACKGROUND WELL 32-89BR, 3 MAR 89



SPONTANEOUS POTENTIAL
MILLIVOLTS 80 180
INDUCED POLARIZATION
PERCENT 0.0 2.0
CALIPER
INCHES 6 12
16" NORMAL RESISTIVITY
OHM-M 0 50
64" NORMAL RESISTIVITY
OHM-M 0 50
INDUCTION
OHM-M 0 50
GUARD RESISTIVITY
OHM-M 0 50

ROCKY FLATS BACKGROUND WELL 32-89BR, 3 MAR 89

ROCKY FLATS BACKGROUND WELL 32-89BR REPEAT SECTION



SPONTANEOUS POTENTIAL
MILLIVOLTS 80 180
INDUCED POLARIZATION
PERCENT 0.0 2.0
CALIPER
INCHES 6 12
16" NORMAL RESISTIVITY
OHM-M 0 50
64" NORMAL RESISTIVITY
OHM-M 0 50
INDUCTION
OHM-M 0 50
GUARD RESISTIVITY
OHM-M 0 50

ROCKY FLATS BACKGROUND WELL 32-89BR REPEAT SECTION

COLOG INC

d.b.a. COLORADO WELL LOGGING
1019 8th ST. GOLDEN, COLORADO 80401
PHONE: (303) 279-0171 TELEX: 45-0286

SP, IP, 16&64 RES
GUARD, INDUCTION
WELL: 41-89BR

PROJECT: ROCKY FLATS BACKGROUND
DATE: 19 APRIL 1989
CLIENT: ROY F. WESTON
COLOG ID NO:
LOCATION: ROCKY FLATS NORTHING:32799.2398 EASTING:26481.3343
STATE: COLORADO COUNTY: JEFFERSON ELEV: 5729.7 DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO
CUSTOMER TD: 109 FEET COLOG TD: 109 FEET

RUN NO.	BIT RECORD Bit Size	From	To	CASING RECORD Size/Wgt/Thk.	From	To
1	4 1/2"	50 FEET	TD	5 1/4"	SURF	50 FEET
2						
3						
4						

HOLE MEDIUM: AIR: SURF - 25.0' WATER: 25.0' - TD DRILL METHOD: MUD ROTARY CORE
MUD TYPE: Natural mud plus clear water TIME SINCE CIRC: *
VISCOSITY: SAMPLE NOT WEIGHT: AVAILIBLE lbs at Deg

GENERAL DATA

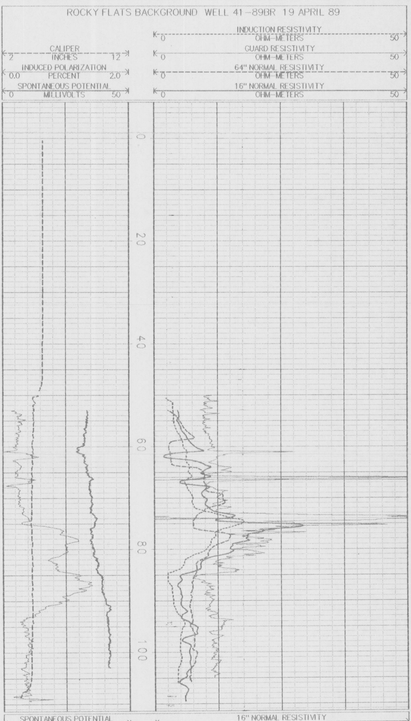
INSTRUMENTATION: EG&G MT. SOPRIS SERIES III UNIT/TRUCK: 245 / 19
LOGGING ENGINEER: MR. ROBERT CROWDER, MR. JAMES LOCOCO
CLIENT REP: MS. JANET MARKS - WESTON, MR. TIM DEIGNAN - EBASCO
OTHER SERVICES: NEUTRON, G-GAMMA,SONIC, GAMMA, TEMP., FLUID RES.

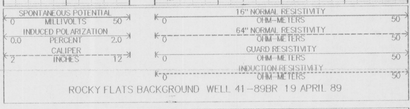
LOGGING DATA

LOG FUNCTION	RUN NO.	MODEL	EQUIPMENT PROBE S.N.	MAINFRAME S.N.	LOGGING SPEED FEET	DETECTOR TYPE	SPACING Tx-Rx FEET	Rx-Rx FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	TIME FEET
S.P.	2	RLP	975	417	0.1	12					103'	40'	63'
I.P.	2	RLP	975	417	0.1	12					109'	40'	69'
16 & 64 RES	2	RLP	975	417	0.1	12					109'	40'	69'
GUARD RES.	4	IPP	NSN	933	0.1	12					109'	40'	69'
INDUCTION	6	IEM-39	0550	0550	0.2	16					108'	SURF	108'

CALIBRATION FACTOR(S):
DIGITAL FILE NAME(S): 41R.P.FOG, 41ELEC.PUP, 41ELEC.HDP
REMARKS:
*DRILLING COMPLETED 18 APR 89. RODS PULLED 30 MINUTES PRIOR TO LOGGING ON 19 APR 89.

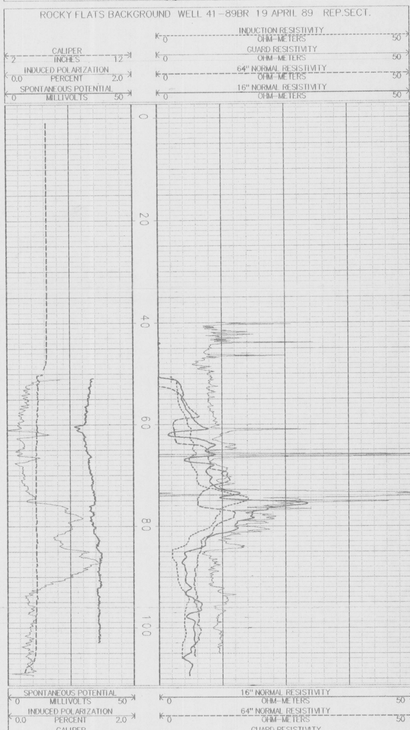
ROCKY FLATS BACKGROUND WELL 41-89BR 19 APRIL 89

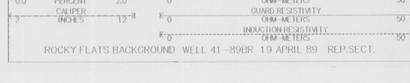




ROCKY FLATS BACKGROUND WELL 41-89BR 19 APRIL 89

ROCKY FLATS BACKGROUND WELL 41-89BR 19 APRIL 89 REP.SECT.





ROCKY FLATS BACKGROUND WELL 41-89BR 19 APRIL 89 REP.SECT.

COLOG INC

d.b.a. COLORADO WELL LOGGING
1019 8th ST. GOLDEN, COLORADO 80401
PHONE: (303) 279-0171 TELEX: 45-0286

SP, IP, 16&64 RES
GUARD, INDUCTION
WELL: 38-89BR

PROJECT: ROCKY FLATS BACKGROUND
DATE: 13 APRIL 1989
CLIENT: ROY F. WESTON
COLOG ID NO:
LOCATION: ROCKY FLATS NORTHING: 41797.9045 EASTING: 23567.2850
STATE: COLORADO COUNTY: JEFFERSON ELEV: 5901.4 FL DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO
CUSTOMER ID: 1.32 FEET COLOG ID: 129 FEET

RUN NO.	BIT RECORD: Bit Size	From	To	CASING RECORD: Size/Wgt/Thk.	From	To
1	4"	24 FEET	TD	8 5/8"	SURF	24 FEET
2						
3						
4						

HOLE MEDIUM: AIR: SURF - 8.4' WATER: 8.4'- TD
DRILL METHOD: MUD ROTARY CORE
MUD TYPE: Natural mud plus clear water
TIME SINCE CIRC: *
VISCOSITY: SAMPLE NOT WEIGHT: AVAILIBLE Rm at Deg

GENERAL DATA

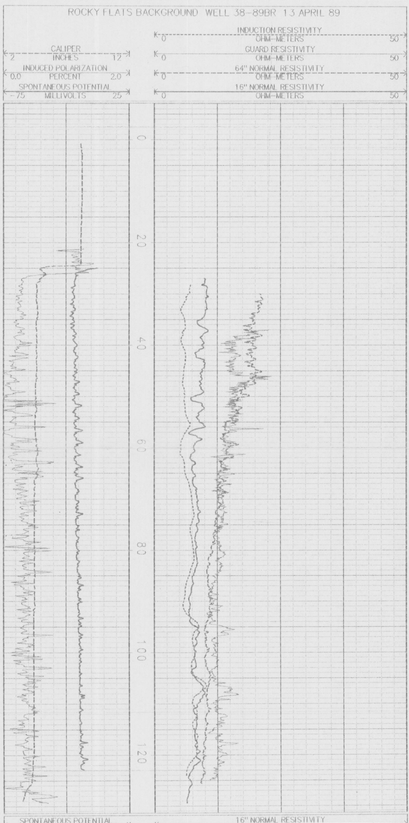
INSTRUMENTATION: EG&G MT. SOPRIS SERIES III
UNIT/TRUCK: 245 / 19
LOGGING ENGINEER: MR. ROBERT CROWDER, MR. JAMES LOCOCO
CLIENT REP: MS. JANE I MARKS - WESTON, MR. TIM DEGNAN - EBASCO
OTHER SERVICES: NEUTRON, G-GAMMA SONIC, GAMMA, TEMP, FLUID RES.

LOGGING DATA

LOG FUNCTION	RUN NO.	EQUIPMENT: MODEL	PROBE S.N.	WHEEL S.N.	LOGGING: ENCNT FEET	SPEED FT./MIN	DETECTOR TYPE	SPACING: T1-R1 FEET	R1-R2 FEET	SOURCE: TYPE	SIZE CURIES	LOGGED INTERVAL: FROM	TO	INT FEET
S.P.	2	9.P	975	417	0.1	12						12.9'	1.9'	108'
I.P.	2	R.P	975	417	0.1	12						12.9'	1.9'	114'
16 & 64 RES	2	R.P	975	417	0.1	12						12.6'	1.5'	111'
GUARD RES	4	RPF	NGM	953	0.1	12						12.5'	1.5'	90'
INDUCTION	6	IDM-39	0550	0550	0.2	10						12.6'	0.8'	126'

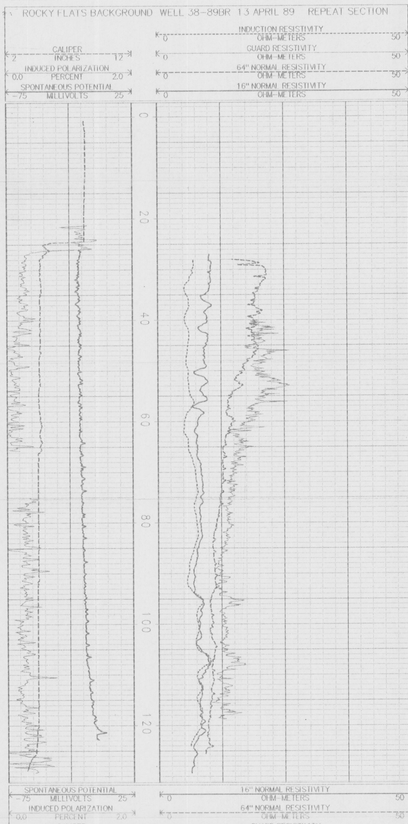
CALIBRATION FACTOR(S):
DIGITAL FILE NAME(S): 38BLP.DT61, 38LLG.CPLP, 38ELLG.HDP
REMARKS:
*DRILLING COMPLETED 12 APR 89. RODS PULLED 30 MINUTES PRIOR TO LOGGING ON 13 APR 89.

ROCKY FLATS BACKGROUND WELL 38-89BR 13 APRIL 89



ROCKY FLATS BACKGROUND WELL 38-89BR 13 APRIL 89

ROCKY FLATS BACKGROUND WELL 38-89BR 13 APRIL 89 REPEAT SECTION



ROCKY FLATS BACKGROUND WELL 38-89BR 13 APRIL 89 REPEAT SECTION

COLOG INC

d.b.a. COLORADO WELL LOGGING

1019 8th ST. GOLDEN, COLORADO 80401

PHONE: (303) 279-0171 TELEX: 45-0286

GAMMA, CALIPER
NEUTRON, G-GAMMA
WELL: 38-89BR

PROJECT: ROCKY FLATS BACKGROUND — DATE: 13 APRIL 1989

CLIENT: ROY F. WESTON — COLOG ID NO:

LOCATION: ROCKY FLATS: NORTHING: 41797.9045 EASTING: 23567.2850

STATE: COLORADO COUNTY: JEFFERSON ELEV: 5901.4 ft. DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING – GOLDEN, COLORADO

CUSTOMER TD: 132 FEET COLOG TD: 129 FEET

RUN NO.	BIT RECORD Bit Size	From	To	CASING RECORD Size/Wgt/Thk	From	To
1	4"	24 FEET	TD	8 5/8"	SURF	24 FEET
2						
3						
4						

HOLE MEDIUM: AIR: SURF – 8.4" WATER: 8.4"– TD DRILL METHOD: MUD ROTARY CORE

MUD TYPE: Natural mud plus clear water TIME SINCE CIRC: +

VISCOSITY: SAMPLE NOT WEIGHT: AVALIBLE Rm: at Deg

GENERAL DATA

INSTRUMENTATION: EG&G MT. SOPRIS SERIES III UNIT / TRUCK: 245 / 19

LOGGING ENGINEER: MR. ROBERT CROWDER, MR. JAMES LOCOCO

CLIENT REP: MS. JANET MARKS – WESTON, MR. TIM DEIGNAN – EBASCO

OTHER SERVICES: SONIC, ELECTRICS, EM, TEMP.

LOGGING DATA

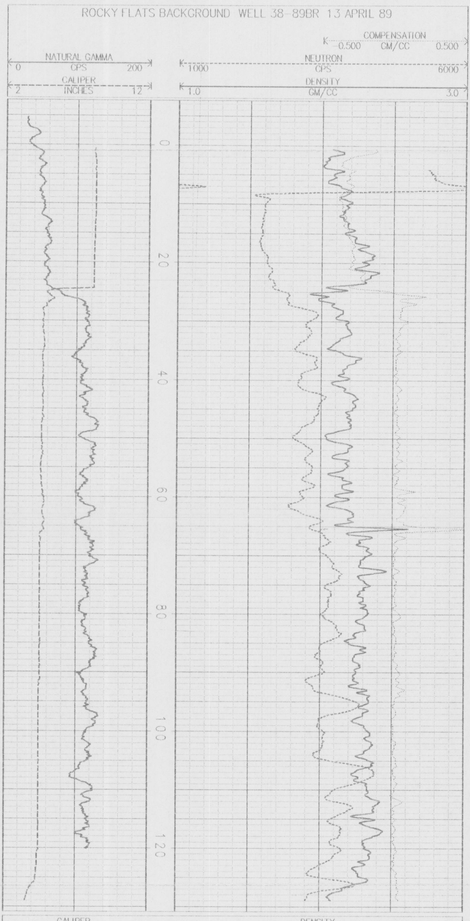
LOG FUNCTION	RUN NO.	EQUIPMENT MODEL	PROBE	SUPRBOLE S.N.	LOGGING DIG INT FEET	SPEED FT./MIN	DETECTOR TYPE	SPACING Tx-Rx FEET	Rx-Rx FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	INT. FEET
GAMMA	4	HPF	NSN	933	0.1	12	Nal					129'	SURF	129'
CALIPER	5	HPF	NSN	933	0.1	12						129'	SURF	129'
NEUTRON	4	DPT	1735	933	0.1	12	He3			Am241	3 Ci.	129'	SURF	129'
GAMMA GAMMA	5	HPF	NSN	933	0.1	12	Nal	20 Cm	15 Cm	Cs137	.1 Ci	129'	SURF	129'

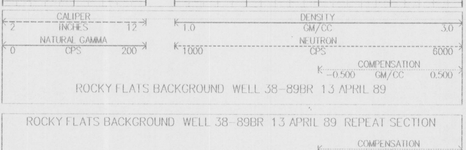
CALIBRATION FACTOR(S):

DIGITAL FILE NAME(S): 38G04.PYX, 35DENJDP, 35DENJPLP

REMARKS:

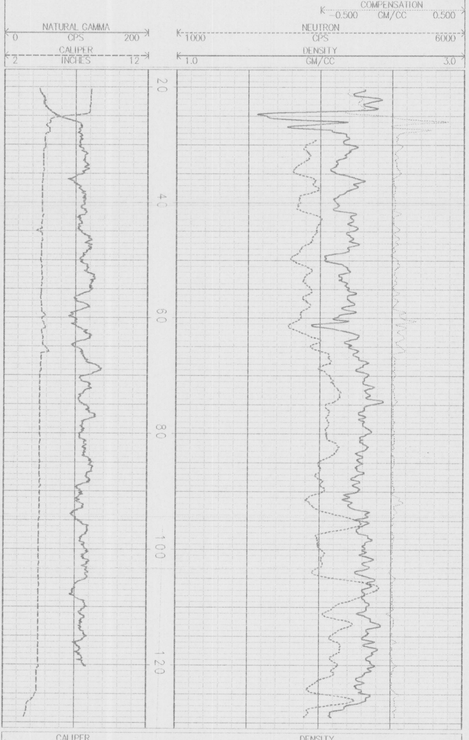
•DRILLING COMPLETED 12 APR 89. RODS PULLED 30 MINUTES PRIOR TO LOGGING ON 13 APR 89.

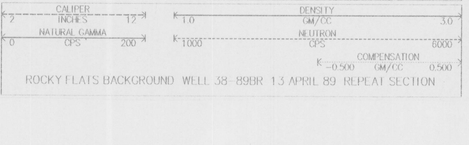




ROCKY FLATS BACKGROUND WELL 38-89BR 13 APRIL 89

ROCKY FLATS BACKGROUND WELL 38-89BR 13 APRIL 89 REPEAT SECTION





ROCKY FLATS BACKGROUND WELL 38-89BR 13 APRIL 89 REPEAT SECTION

COLOG INC.

COLORADO WELL LOGGING
1019 8th ST. GOLDEN, COLORADO 80401
PHONE: (303) 279-0171 TELEX: 45-0286

SONIC WAVEFORM CALIPER
WELL: 41-89BR

PROJECT: ROCKY FLATS BACKGROUND — DATE: 19 APRIL 1989

CLIENT: ROY F. WESTON — COLOG ID NO:

LOCATION: ROCKY FLATS: NORTHING:32799.2398 EASTING:26481.5343

STATE: COLORADO COUNTY: JEFFERSON ELEV: 5729.7 DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING – GOLDEN, COLORADO

CUSTOMER TD: 109 FEET COLOG TD: 109 FEET

RUN NO.	BIT RECORD Bit Size	From	To	CASING RECORD Size/Wgt/Tbs.	From	To
1	4 1/2"	50 FEET	TD	5 1/4"	SURF	50 FEET
2						
3						
4						

HOLE MEDIUM: AIR: SURF – 25.0' WATER: 25.0' – TD DRILL METHOD: MUD ROTARY CORE

MUD TYPE: Natural mud plus clear water TIME SINCE CIRC: +

VISCOSITY: SAMPLE NOT WEIGHT: AVAILIBLE Rm: at Deg

GENERAL DATA

INSTRUMENTATION: EG&G MT. SOPRIS SERIES III UNIT/TRUCK: 245 / 19

LOGGING ENGINEER: MR. ROBERT CROWDER, MR. JAMES LOCICO

CLIENT REP: MS. JANET MARKS – WESTON, MR. TIM DOTONAN – FEBASCO

OTHER SERVICES: NEUTRON, GAMMA, CALIPER, G–GAMMA, ELECTRICS, TEMP., FL–RES.

LOGGING DATA

LOG FUNCTION	RUN NO.	MODEL	COMMENT PROBE DIA.	SONDE DIA.	LOGGING SPEED FT/MIN	DETECTOR TYPE	SPACING Tx–Rx FEET	Rx–Rx FEET	SOURCE TYPE	SIZE CURIES	LOGGED INTERVAL FROM	TO	DEPTH FEET
SONIC	3	OLPL	1.275	2.71	63.	8.	CERAMIC	3 FT	1 FT		104'	SURF.	104'
CALIPER	4	MFP	4.06	5.53	63.	12.					109'	SURF.	109'

CALIBRATION FACTOR(S):

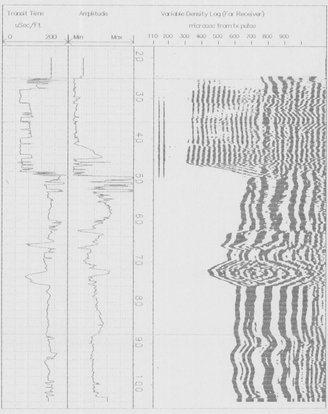
DIGITAL FILE NAME(S): 41OLPL3KGL41OLPLPL41SONCHRP

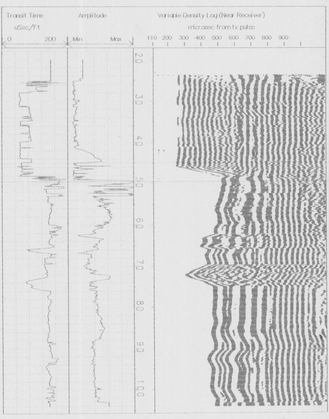
REMARKS:

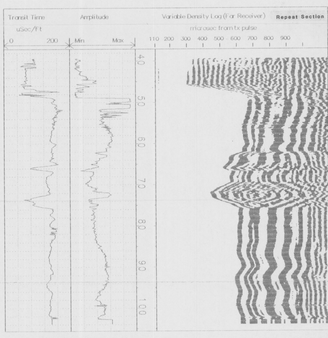
•DRILLING COMPLETED 18 APR 89. RODS

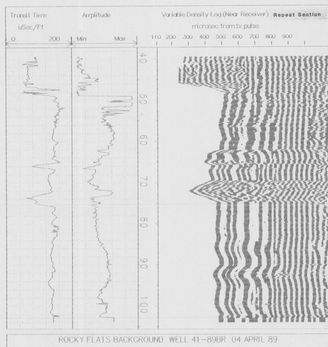
PULLED 30 MINUTES PRIOR TO LOGGING ON

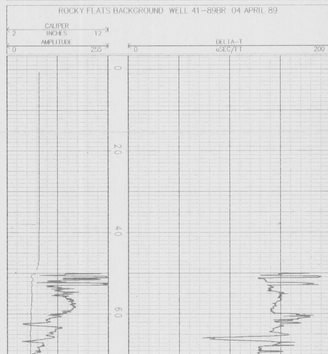
19 APR 89.











COLOG INC

d.b.a. COLORADO WELL LOGGING
1019 8th ST. GOLDEN, COLORADO 80401
PHONE: (303) 279-0171 TELEX: 45-0286

SP, 16" - 64" RES
GUARD RES., EM39
WELL: 33-89BR

PROJECT: ROCKY FLATS - BACKGROUND
CLIENT: ROY F. WESTON, INC.
DATE: 16 FEBRUARY 1989
COLOG ID NO:
LOCATION: ROCKY FLATS NORTHING: 43211.1667 EASTING: 22635.7846
STATE: COLORADO COUNTY: JEFFERSON ELEV: 5935.8 DEPTH REF: GL

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING, GOLDEN, CO
CUSTOMER TD: 159.8 FT COLOG TD: 112 FT.

RUN NO.	BIT RECORD Bit Size	From	To	CASING RECORD Size/Wgt/Thk.	From	To
1	9"	SURF.	38 FT.	8" ID	SURF.	37.35 FT
2	4"	38 FT.	TD			
3						
4						

HOLE MEDIUM: NAT. MUD SURF.-TD
DRILL METHOD: MUD ROTARY
MUD TYPE: NATURAL
TIME SINCE CIRC: LESS THAN 1 HOUR +
VISCOSITY: WEIGHT: Rm: at Deg

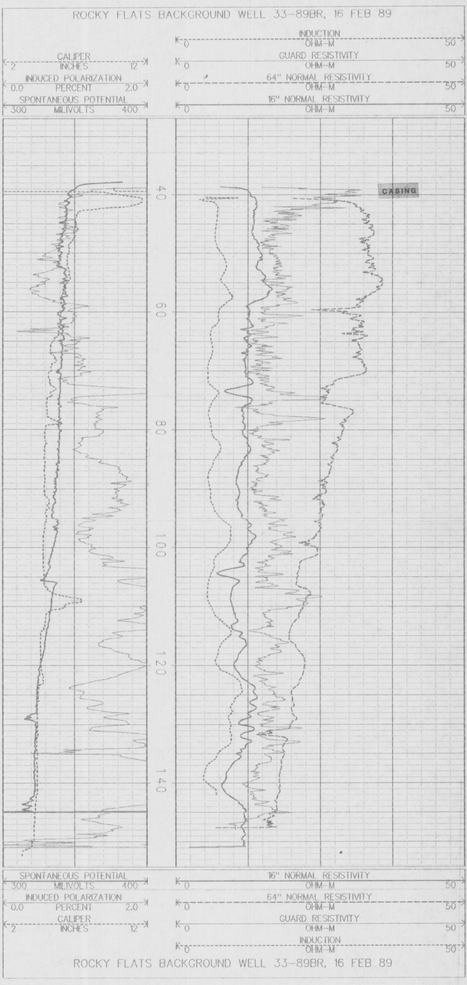
GENERAL DATA

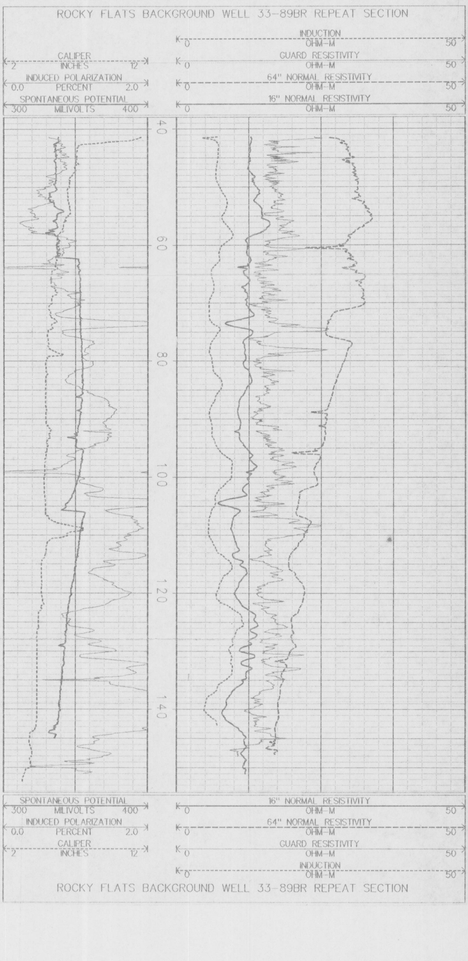
INSTRUMENTATION: EG&G MT. SOPRIS SERIES III UNIT/TRUCK: 19
LOGGING ENGINEER: ROBERT CROWDER, TOM STAATZ
CLIENT REP: MR. HANK BIENKOWSKI (WESTON), MR. LARRY IRONS (EBASCO)
OTHER SERVICES: G, GG DEN., CAL., N, SWF, DIP, T, FR

LOGGING DATA

LOG FUNCTION	RUN NO.	EQUIPMENT MODEL	PROBE S.N.	PUSHDOWN S.N.	LOGGING DIR.	INTERPRETED FT./MIN.	DETECTOR TYPE	SPACING Tx-Rx FEET	Rx-Rx FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	INT. FEET
SP	2	RLP	975	417	0.1	12						14.4	38	106+
16-64" RES.	2	RLP	975	417	0.1	12						15.0	38	112+
8"	2	RLP	975	417	0.1	12						15.1	38	113+
EM39-COND.	2	EM-39			0.2	10						14.2	38	104+
GUARD RES.	4	XAP	NSN	9.53	0.1	12						14.7	38	109+

CALIBRATION FACTOR(S):
DIGITAL FILE NAME(S): 33DLECT.PVN/R.PVN, 33DLECT.PLP/R.PLP 33DLECT.HDP
REMARKS:
+Entire interval repeated





COLOG INC

d.b.a. COLORADO WELL LOGGING

1019 8th ST. GOLDEN, COLORADO 80401

PHONE: (303) 279-0171 TELEX: 45-0286

TEMPERATURE
FLUID RESISTIVITY
WELL: 33-89BR

PROJECT: ROCKY FLATS - BACKGROUND DATE: FEBRUARY 16 1989

CLIENT: ROY F. WESTON, INC. COLOG ID NO:

LOCATION: ROCKY FLATS NORTHING: 43211.4667 EASTING: 22635.7846

STATE: COLORADO COUNTY: JEFFERSON ELEV: 5935.8 DEPTH REF: GL

BOREHOLE DATA

~~DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING, GOLDEN, CO~~

CUSTOMER TD: 159.8 FT COLOG TD:

RUN	BIT RECORD			CASING RECORD		
NO.	Bit Size	From	To	Size/Wgt/Thk.	From	To
1	9"	SURF.	38 FT.	8" ID	SURF.	37.35 FT
2	4"	38 FT.	TD			
3						
4						

HOLE MEDIUM: NAT. MUD SURF.-TD DRILL METHOD: MUD ROTARY

MUD TYPE: NATURAL TIME SINCE CIRC: LESS THAN 1 HOUR

VISCOSITY: WEIGHT: Rm: at Deg

GENERAL DATA

INSTRUMENTATION: EG&G MT. SOPRIS SERIES III UNIT/TRUCK: 19

LOGGING ENGINEER: ROBERT CROWDER, TOM STAATZ

CLIENT REP: MR. HANK BIENKOWSKI (WESTON), MR. LARRY IRONS (EBASCO)

OTHER SERVICES: G, GG DEN., CAL., GUARD, N, SWF, 16-64", SP, IP, EM 39, DIP

LOGGING DATA

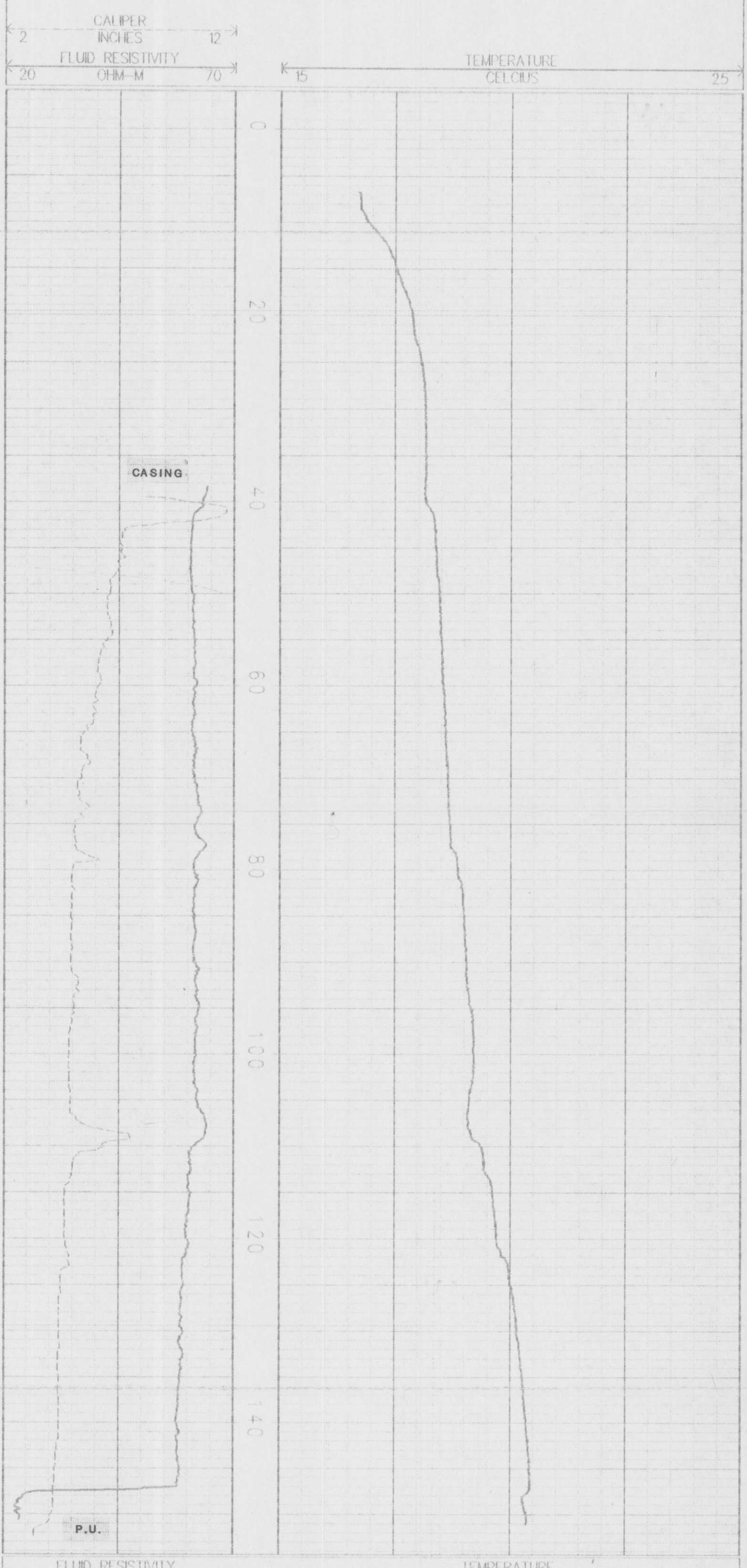
LOG FUNCTION	RUN NO.	EQUIPMENT MODEL	PROBE S.N.	UPHOLE S.N.	LOGGING DIG INT FEET	SPEED FT./MIN	DETECTOR TYPE	SPACING Tx-Rx FEET	Rx-Rx FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	INT. FEET
TEMPERATURE	1	MLP	917	506	0.1	12						SURF.	151	151
FLUID RES.	1	MLP	917	506	0.1	12						SURF.	151	151

CALIBRATION FACTOR(S):

DIGITAL FILE NAME(S): 33-89BR 33MLP.FCO 33MLP.HDP

REMARKS:

ROCKY FLATS BACKGROUND WELL 33-89BR, 16 FEB 89



ROCKY FLATS BACKGROUND WELL 33-89BR, 16 FEB 89

COLOG INC

d.b.a. COLORADO WELL LOGGING

1019 8th ST. GOLDEN, COLORADO 80401

PHONE: (303) 279-0171 TELEX: 45-0286

FLUID RESISTIVITY
TEMP., CALIPER
WELL: 32-89BR

PROJECT: ROCKY FLATS BACKGROUND — DATE: 3 MARCH 1989

CLIENT: ROY F. WESTON, INC. — COLOG ID NO:

LOCATION: ROCKY FLATS NORTHING: 42792.3657 EASTING: 21944.1858

STATE: COLORADO COUNTY: JEFFERSON ELEV: 5946.2 DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO

CUSTOMER TD: 204 FEET COLOG TD: 197 FEET

RUN	BIT RECORD			CASING RECORD		
NO.	Bit Size	From	To	Size/Wgt/Thk.	From	To
1	9"	40 FEET	TD	8"	SURF	40 FEET
2	4 1/2"	40 FEET	TD			
3						
4						

HOLE MEDIUM: AIR: SURF - 10' WATER: 10' - TD — DRILL METHOD: MUD ROTARY CORE

MUD TYPE: NATURAL — TIME SINCE CIRC: 1 DAY +

VISCOSITY: SAMPLE NOT WEIGHT: AVAILIBLE Rmt at Deg

GENERAL DATA

INSTRUMENTATION: EG&G MT. SOPRIS SERIES III — UNIT/TRUCK: 245 / 19

LOGGING ENGINEER: MR. ROBERT CROWDER, MR. THOMAS STAATZ

CLIENT REP: MR. DICK TREAT - CHEN, MR. TRAVIS CANON - EBASCO

OTHER SERVICES: N-N, G, G-G, SP, IP, 16, 64, EM, SONIC

LOGGING DATA

LOG FUNCTION	RUN NO.	EQUIPMENT MODEL	PROBE S.N.	UPHOLE S.N.	LOGGING DIG INT FEET	SPEED FT./MIN.	DETECTOR TYPE	SPACING Tx-Rx FEET	Rx-Rx FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	INT. FEET
CALIPER	5	HPF	NSN	933	0.1	12						196'	SURF	196'
TEMPERATURE	1	MLP	917	506	0.1	12						10'	196'	186'
FLUID RES.	1	MLP	917	506	0.1	12						10'	196'	186'

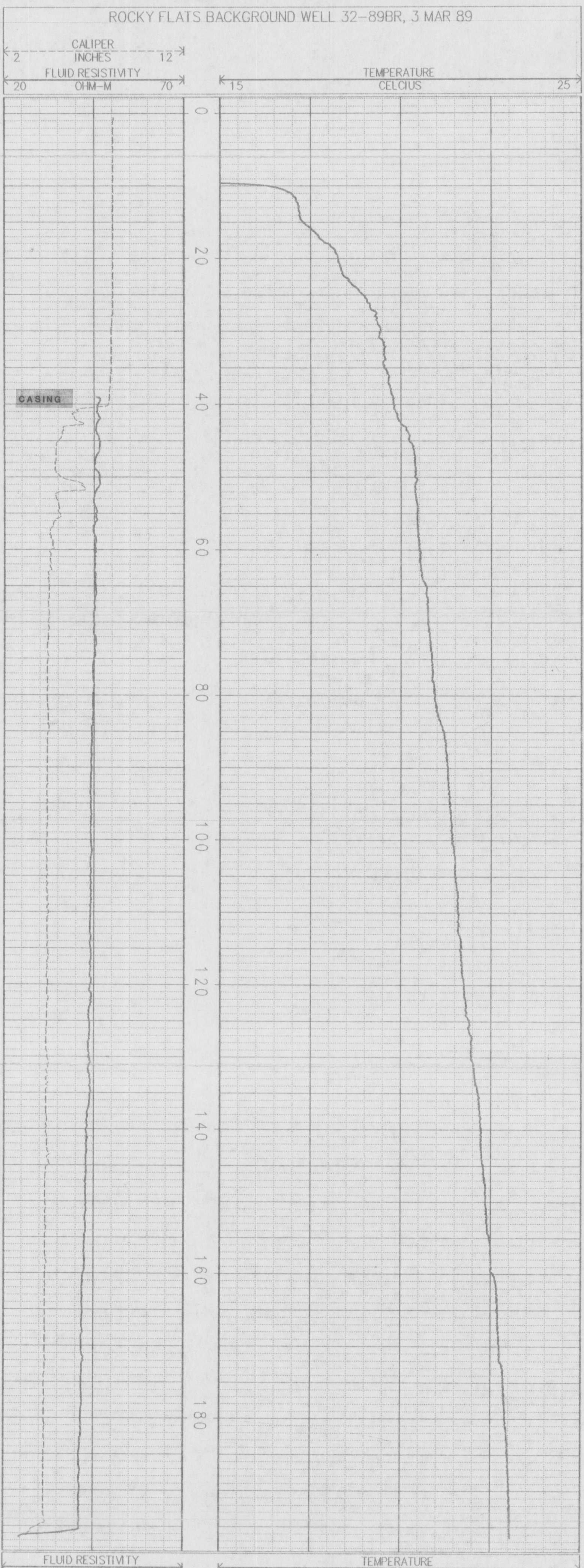
CALIBRATION FACTOR(S):

DIGITAL FILE NAME(S): 32MLP.FJ0, 32MLP.PLP, 32MLP.HDP

REMARKS:

+ DRILLING COMPLETED 2 MAR 89.
RODS PULLED 30 MINUTES PRIOR TO LOGGING ON 3 MAR 89.
SNOWING, WINDY 11 DEGREES F CAUSED IMMEDIATE CABLE ICING AS IT CAME OUT OF THE HOLE.

ROCKY FLATS BACKGROUND WELL 32-89BR, 3 MAR 89



ROCKY FLATS BACKGROUND WELL 32-89BR, 3 MAR 89

COLOG INC

a.k.a. COLORADO WELL LOGGING
1019 8th ST. GOLDEN, COLORADO 80401
PHONE: (303) 279-0171 TELEX: 45-0286

SONIC WAVEFORM

WELL: 41-89BRA

PROJECT: ROCKY FLATS BACKGROUND — DATE: 9 MARCH 1989

CLIENT: ROY F. WESTON, INC. — COLOG ID NO:

LOCATION: ROCKY FLATS NORTHING: 32801.6222 EASTING: 26472.0108

STATE: COLORADO COUNTY: JEFFERSON ELEV: 5729.8 DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO

CUSTOMER TD: 51.5 FT. COLOG TD: 50 FEET

RUN NO.	BIT RECORD Bit Size	From	To	CASING RECORD Size/Wgt/Thk.	From	To
1	6 1/4"	SURFACE	TD `	NONE		
2						
3						
4						

HOLE MEDIUM: WATER: SURFACE - TD — DRILL METHOD: AUGER

MUD TYPE: NONE — TIME SINCE CIRC: 1/4 HOUR

VISCOSITY: SAMPLE NOT WEIGHT: AVAILIBLE Rm: at Deg

GENERAL DATA

INSTRUMENTATION: EG&G MT. SOPRIS SERIES III — UNIT/TRUCK: 245 / 19

LOGGING ENGINEER: ROBERT CROWDER, THOMAS STAATZ

CLIENT REP: MR. KERRY Van ALLEN (WESTON),MR. IRONS, MR. DEIGNAN (EBASCO)

OTHER SERVICES: N-N,CALIPER, G, G-G, SP, 16, 64, GUARD, EM, TEMP.

LOGGING DATA

LOG FUNCTION	RUN NO.	EQUIPMENT MODEL	PROBE S.N.	DPROBE S.N.	LOGGING DIG INT FEET	SPEED FT./MIN.	DETECTOR TYPE	SPACING Tx-Rx FEET	Rx-Rx FEET	SOURCE TYPE	SIZE CURR	LOGGED INTERVAL FROM	TO	INT. FEET
SONIC	6	CLPL	1275	771	0.1	6	CERAMIC	3 FT	1 FT			42'	SURF	421

CALIBRATION FACTOR(S):

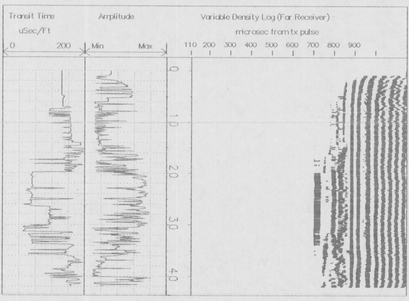
DIGITAL FILE NAME(S): 41ACLPL.SW5/4, 41ACLPL.S35/4, 41ACLPL.PLP/R,PLP 41AVOL.HDP

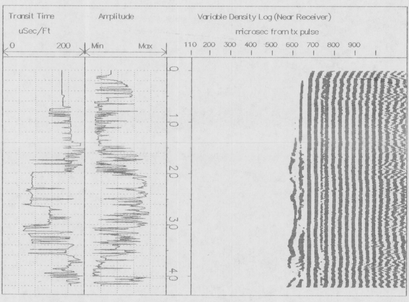
REMARKS:

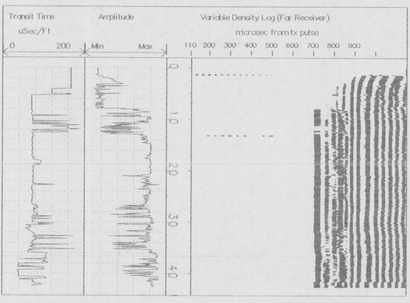
DRILLING COMPLETED 9 MAR 89.

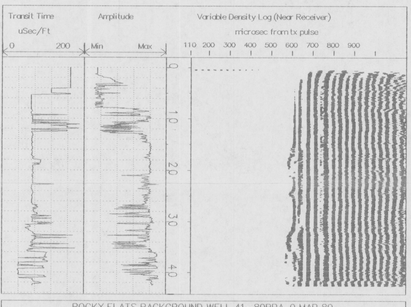
RODS PULLED 30 MINUTES PRIOR TO LOGGING ON 9 MAR 89.

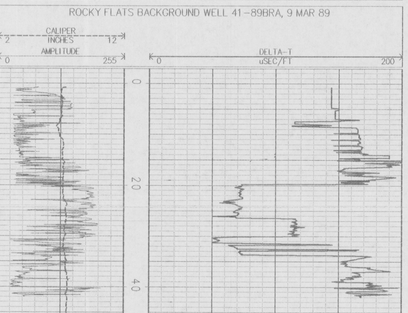
REPEAT SECTION RUN FROM 50 FEET TO SURFACE.

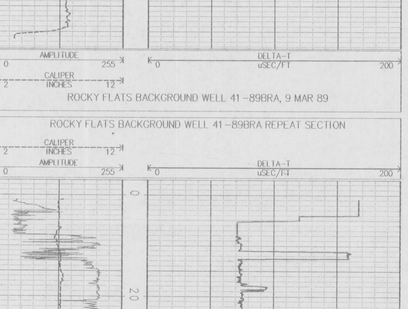












COLOG INC

d.b.a. COLORADO WELL LOGGING

1019 8th ST. GOLDEN, COLORADO 80401

PHONE: (303) 279-0171 TELEX: 45-0286

FLUID RESISTIVITY
TEMP., CALIPER
WELL: 34-89BR

PROJECT: ROCKY FLATS BACKGROUND — DATE: 13 MARCH 1989

CLIENT: ROY F. WESTON, INC. — COLOG ID NO:

LOCATION: ROCKY FLATS NORTHING: 43740.8033 EASTING: 23469.0744

STATE: COLORADO COUNTY: JEFFERSON ELEV: 5920.9 DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS

CUSTOMER TD: 170 FEET COLOG TD: 168 FEET

RUN	BIT RECORD			CASING RECORD		
NO.	Bit Size	From	To	Size/Wgt/Thk.	From	To
1	9"	SURFACE	42 FEET	8"	SURF	42 FEET
2	4 1/2"	42 FEET	TD			
3						
4						

HOLE MEDIUM: AIR: SURF - 11' WATER: 11' - TD — DRILL METHOD: MUD ROTARY & CORE

MUD TYPE: NATURAL — TIME SINCE CIRC: 3 DAYS *

VISCOSITY: NO SAMPLE WEIGHT: AVAILIBLE Rm: at Deg

GENERAL DATA

INSTRUMENTATION: EG&G MT. SOPRIS SERIES III — UNIT/TRUCK: 245 / 19

LOGGING ENGINEER: MR. ROBERT CROWDER / MR. THOMAS STAATZ

CLIENT REP: MR. DICK TREAT - CHEN, MR. TIM DEIGNAN - EBASCO

OTHER SERVICES: N-N, G, G-G, EM, SONIC, SP, IP, 16, 64, GUARD, CALIPER

LOGGING DATA

LOG FUNCTION	RUN NO.	EQUIPMENT MODEL	PROBE S.N.	UPHOLE S.N.	LOGGING DIG INT FEET	SPEED FT./MIN	DETECTOR TYPE	SPACING Tx-Rx FEET	Rx-Rx FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	INT. FEET
CALIPER	6	HPF	NSN	933	0.1	12						168'	5'	163'
TEMPERATURE	1	MLP	917	506	0.1	12						158'	SURF	158'
FLUID RES.	1	MLP	917	506	0.1	12						157'	11'	146'

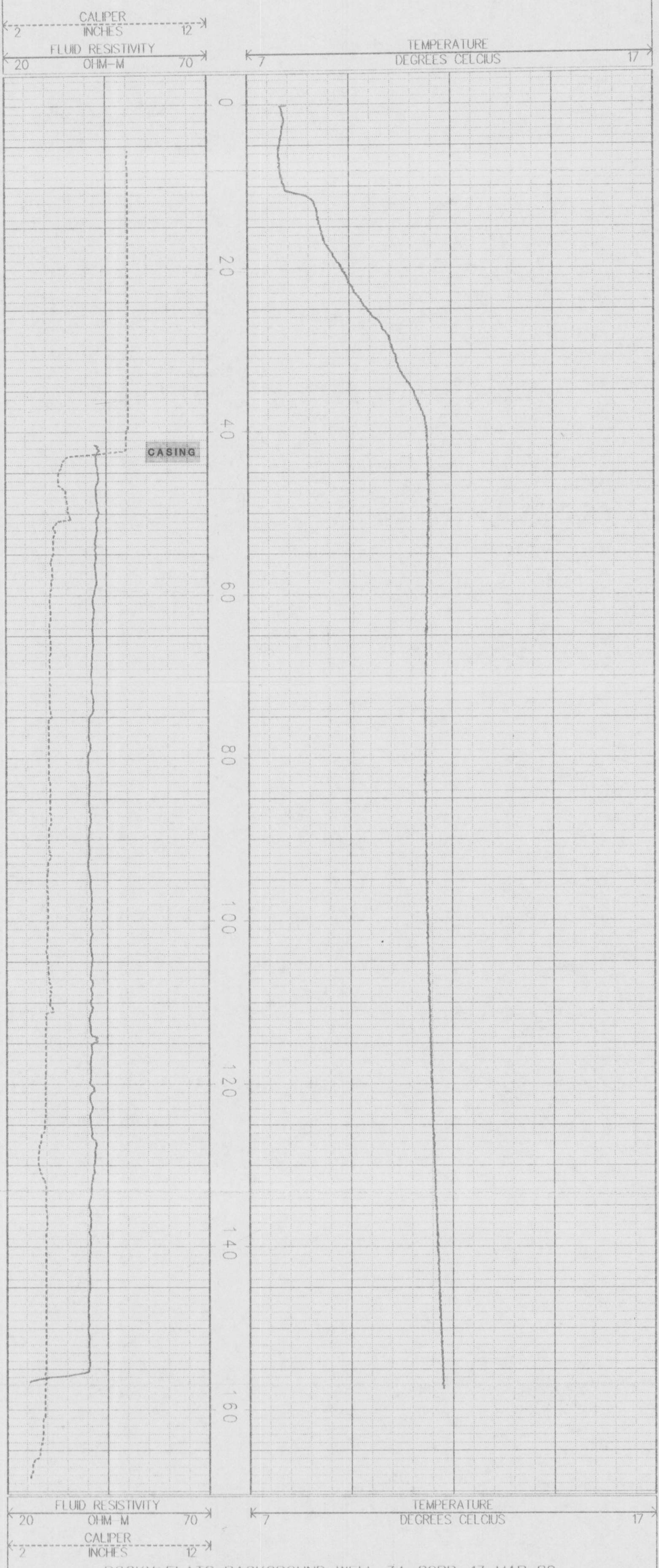
CALIBRATION FACTOR(S):

DIGITAL FILE NAME(S): 34MLP.FGO, 34MLP.PLP, 34MLP.HDP

REMARKS:

* FINISHED DRILLING 10 MAR 89 (FRIDAY). PULLED RODS 30 MINUTES PRIOR TO LOGGING ON 13 MAR 89.

ROCKY FLATS BACKGROUND WELL 34-89BR, 13 MAR 89



ROCKY FLATS BACKGROUND WELL 34-89BR, 13 MAR 89

COLOG INC

d.b.a. COLORADO WELL LOGGING

1019 8th ST. GOLDEN, COLORADO 80401

PHONE: (303) 279-0171 TELEX: 45-0286

POROSITY LOGS

WELL: 35-89BR

PROJECT: ROCKY FLATS BACKGROUND — DATE: 4 APRIL 1989

CLIENT: ROY F. WESTON — COLOG ID NO:

LOCATION: ROCKY FLATS NORTHING;41904.5920 EASTING;24227.9639

STATE: COLORADO COUNTY: JEFFERSON ELEV: 5877.6' DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO

CUSTOMER TD: 218 FEET COLOG TD: 208 FEET

RUN	BIT RECORD			CASING RECORD		
NO.	Bit Size	From	To	Size/Wgt/Thk.	From	To
1	4"	40 FEET	TD	8 5/8"	SURF	40 FEET
2						
3						
4						

HOLE MEDIUM: AIR: SURF - 9.0' WATER: 9.0'- TD — DRILL METHOD: MUD ROTARY CORE

MUD TYPE: — TIME SINCE CIRC:

VISCOSITY: SAMPLE NOT WEIGHT: AVAILIBLE Rmf at Deg

GENERAL DATA

INSTRUMENTATION: EG&G MT. SOPRIS SERIES III — UNIT/TRUCK: 245 / 19

LOGGING ENGINEER: MR. ROBERT CROWDER, MR. JAMES LOCOCO

CLIENT REP: MR. KEN MILLER - WESTON MR. TIM DEIGNAN - EBASCO

OTHER SERVICES: ELECTRICS, TEMP., EM

LOGGING DATA

LOG FUNCTION	RUN NO.	EQUIPMENT MODEL	PROBE S.N.	UPHOLE S.N.	LOGGING DIG INT FEET	SPEED FT./MIN.	DETECTOR TYPE	SPACING Tx-Rx FEET	Rx-Rx FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	INT. FEET
GAMMA	4	BPF	NSN	933	0.1	12	NaI					204'	SURF	204'
CALIPER	5	HPF	NSN	933	0.1	12						208'	SURF	208'
SONIC	3	CLPL	1275	771	0.1	6	CERAMIC	3 FT	1 FT			203'	SURF.	203'
NEUTRON	4	OPF	1735	933	0.1	12	He3			Am241	3 Ci.	204'	SURF.	204'
GAMMA GAMMA	5	HPF	NSN	933	0.1	12	NaI	20 Cm	35 Cm	CS137	.1 Ci	208'	SURF.	208'

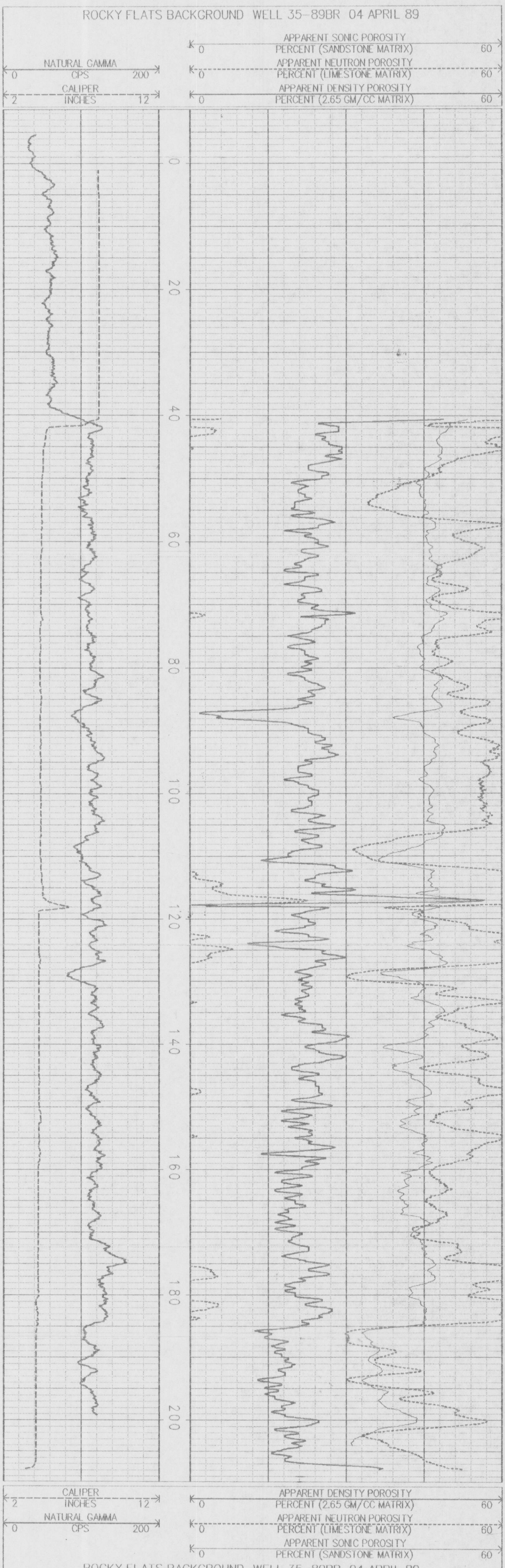
CALIBRATION FACTOR(S):

DIGITAL FILE NAME(S): 35POR.DET, 35POR.HDP, 35POR.PLP

REMARKS:

DRILLING COMPLETED 4 APR 89. RODS PULLED 30 MINUTES PRIOR TO LOGGING ON 4 APR 89.

ROCKY FLATS BACKGROUND WELL 35-89BR 04 APRIL 89



ROCKY FLATS BACKGROUND WELL 35-89BR 04 APRIL 89

COLOG INC d.b.a. COLORADO WELL LOGGING
1019 8th ST. GOLDEN, COLORADO 80401
PHONE: (303) 279-0171 TELEX: 45-0286

GAMMA, CALIPER
NEUTRON, G-GAMMA
WELL: 35-89BR

PROJECT: ROCKY FLATS BACKGROUND — DATE: 4 APRIL 1989
CLIENT: ROY F. WESTON, INC — COLOG ID NO:
LOCATION: ROCKY FLATS NORTHING:41904.5920 EASTING:24227.9639
STATE: COLORADO COUNTY: JEFFERSON ELEV: 5877.6' DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO
CUSTOMER TD: 218 FEET COLOG TD: 208 FEET

RUN	BIT RECORD			CASING RECORD		
NO.	Bit Size	From	To	Size/Wgt/Thk.	From	To
1	4"	40 FEET	TD	8 5/8"	SURF	40 FEET
2						
3						
4						

HOLE MEDIUM: AIR: SURF - 9.0' WATER: 9.0' - TD — DRILL METHOD: MUD ROTARY CORE
MUD TYPE: — TIME SINCE CIRC:
VISCOSITY: SAMPLE NOT WEIGHT: AVAILIBLE Rm: at Deg

GENERAL DATA

INSTRUMENTATION: EG&G MT. SOPRIS SERIES III — UNIT/TRUCK: 245 / 19
LOGGING ENGINEER: MR. ROBERT CROWDER, MR. JAMES LOCOCO
CLIENT REP: MR. KEN MILLER - WESTON MR. TIM DEIGNAN - EBASCO
OTHER SERVICES: SONIC, ELECTRICS, EM, TEMP.

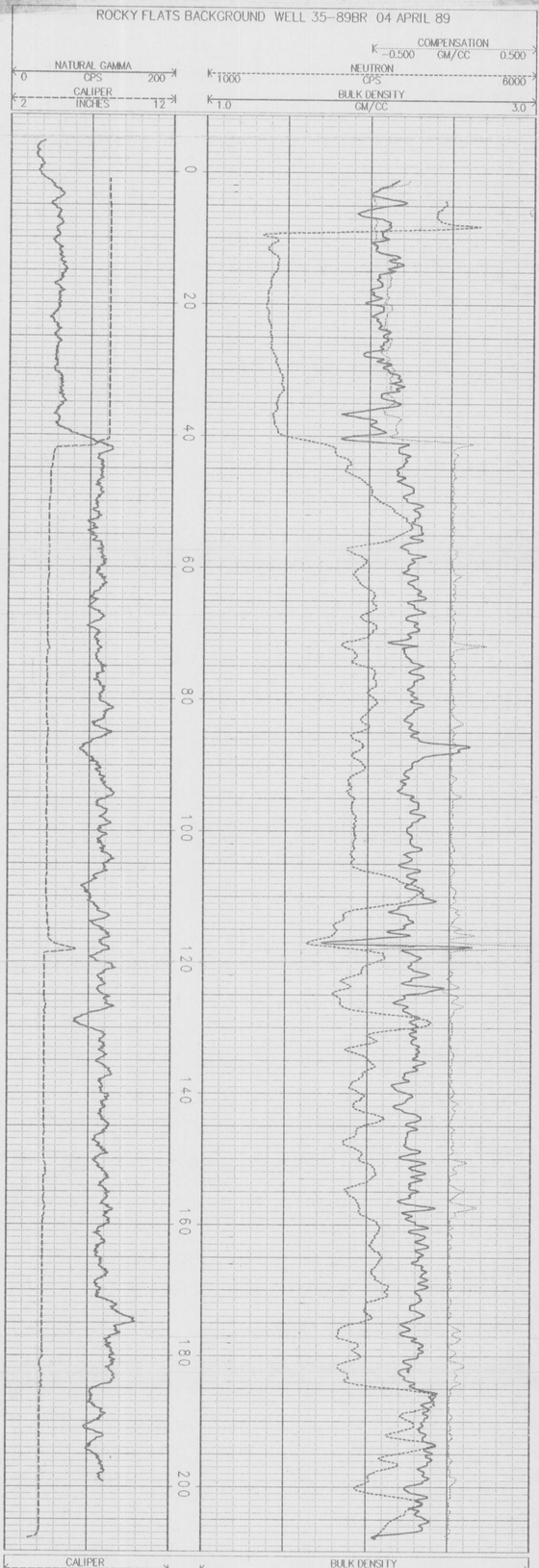
LOGGING DATA

LOG FUNCTION	RUN NO.	EQUIPMENT MODEL	PROBE S.N.	BOREHOLE S.N.	LOGGING DIG INT FEET	SPEED FT./MIN	DETECTOR TYPE	SPACING Tx-Rx FEET	Tx-Rx FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	INT. FEET
GAMMA	4	BPF	NSN	933	0.1	12	NaI					204'	SURF	204'
CALIPER	5	HPF	NSN	933	0.1	12						208'	SURF	208'
NEUTRON	4	OPF	1735	933	0.1	12	He3			Am241	3 Ci.	204'	SURF	204'
GAMMA GAMMA	5	HPF	NSN	933	0.1	12	NaI	20 Cm	15 Cm	CS137	1 Ci	208'	SURF	208'

CALIBRATION FACTOR(S):
DIGITAL FILE NAME(S): 35GG4.PXX, 35DENJIDP, 35GG4.PLP
REMARKS:
DRILLING COMPLETED 2 MAR 89. RODS
PULLED 30 MINUTES PRIOR TO LOGGING ON
4 APR 89.

Repeat sections not available.

ROCKY FLATS BACKGROUND WELL 35-89BR 04 APRIL 89



CALIPER
2 INCHES 12
NATURAL GAMMA
0 CPS 200
BULK DENSITY
1.0 GM/CC 3.0
NEUTRON
1000 CPS 6000
COMPENSATION
-0.500 GM/CC 0.500
ROCKY FLATS BACKGROUND WELL 35-89BR 04 APRIL 89

COLOG INC

d.b.a. COLORADO WELL LOGGING

1019 8th ST. GOLDEN, COLORADO 80401

PHONE: (303) 279-0171 TELEX: 45-0286

SP, IP, 16&64 RES
GUARD, INDUCTION
WELL: 35-89BR

PROJECT: ROCKY FLATS BACKGROUND — DATE: 4 APRIL 1989

CLIENT: ROY F. WESTON, INC. — COLOG ID NO:

LOCATION: ROCKY FLATS NORTHING:41904.5920 EASTING:24227.9639

STATE: COLORADO COUNTY: JEFFERSON ELEV: 5877.6' DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO

CUSTOMER TD: 218 FEET COLOG TD: 208 FEET

RUN	BIT RECORD			CASING RECORD		
NO.	Bit Size	From	To	Size/Wgt/Thk.	From	To
1	4"	40 FEET	TD	8 5/8"	SURF	40 FEET
2						
3						
4						

HOLE MEDIUM: AIR: SURF - 9.0' WATER: 9.0'- TD — DRILL METHOD: MUD ROTARY CORE

MUD TYPE: — TIME SINCE CIRC:

VISCOSITY: SAMPLE NOT WEIGHT: AVAILIBLE Rm at Deg

GENERAL DATA

INSTRUMENTATION: EG&G MT. SOPRIS SERIES III — UNIT/TRUCK: 245 / 19

LOGGING ENGINEER: MR. ROBERT CROWDER, MR. JAMES LOCOCO

CLIENT REP: MR. KEN MILLER - WESTON, MR. TIM DEIGNAN - EBASCO

OTHER SERVICES: NEUTRON, G-GAMMA,SONIC, GAMMA, TEMP., FLUID RES.

LOGGING DATA

LOG FUNCTION	RUN NO.	EQUIPMENT MODEL	PROBE S.N.	UPHOLE S.N.	LOGGING DIG INT FEET	SPEED FT./MIN.	DETECTOR TYPE	SPACING Tx-Rx FEET	Rx-Rx FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	INT. FEET
S.P.	2	RLP	975	417	0.1	12						211'	40'	161'
I.P.	2	RLP	975	417	0.1	12						211'	40'	161'
16 & 64 RES	2	RLP	975	417	0.1	12						211'	40'	161'
GUARD RES.	4	IPF	NSN	933	0.1	12						204'	40'	164'
INDUCTION	6	EM-39	0550	0550	0.2	10						207'	SURF	207'

CALIBRATION FACTOR(S):

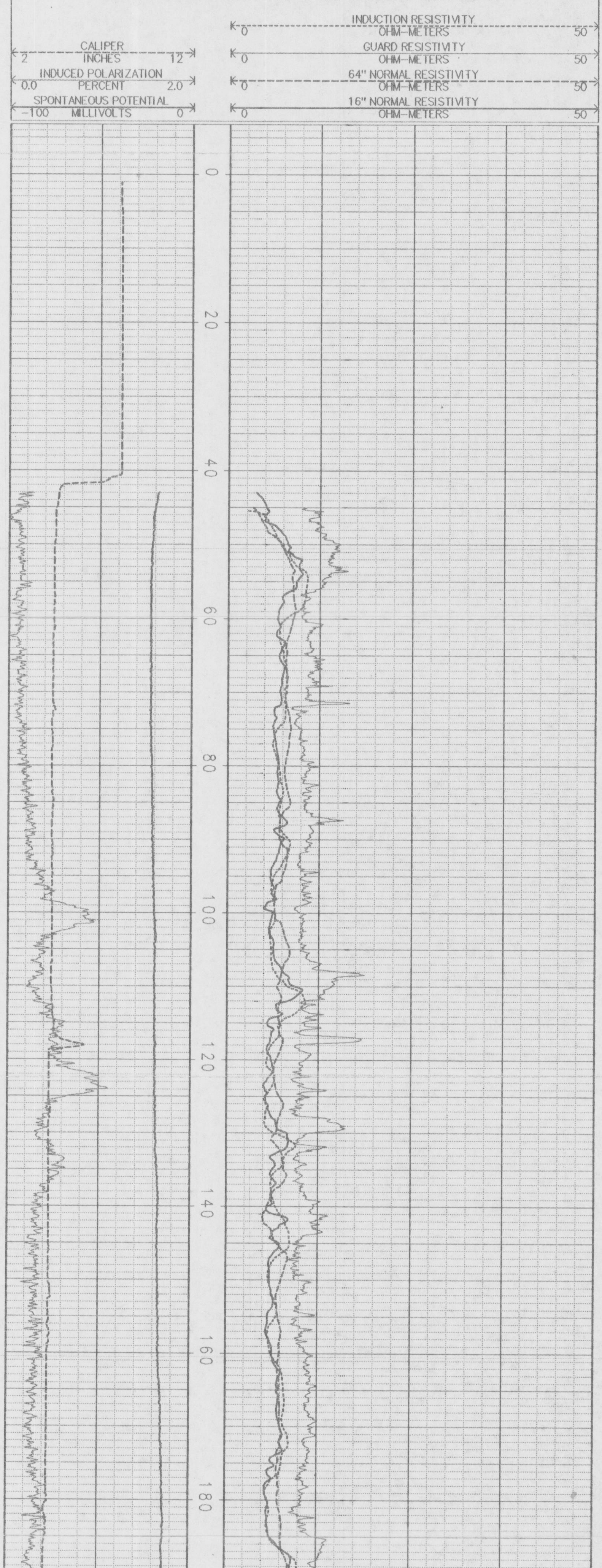
DIGITAL FILE NAME(S): 35RLP.FG3, 35RLP.PLP, 35RLPR.PLP, 35ELEC.HDP

REMARKS:

DRILLING COMPLETED 4 APR 89. RODS PULLED 30 MINUTES PRIOR TO LOGGING ON 4 APR 89.

Repeat sections not available.

ROCKY FLATS BACKGROUND WELL 35-89BR 04 APRIL 89



ROCKY FLATS BACKGROUND WELL 35-89BR 04 APRIL 89

COLOG INC

d.b.a. COLORADO WELL LOGGING

1019 8th ST. GOLDEN, COLORADO 80401

PHONE: (303) 279-0171 TELEX: 45-0286

CALIPER, TEMP.
FLUID RESISTIVITY
WELL: 35-89BR

PROJECT: ROCKY FLATS BACKGROUND — DATE: 4 APRIL 1989

CLIENT: ROY F. WESTON, INC — COLOG ID NO:

LOCATION: ROCKY FLATS NORTHING:41904.5920 EASTING:24227.9639

STATE: COLORADO COUNTY: JEFFERSON ELEV: DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO

CUSTOMER TD: 218 FEET COLOG TD: 208 FEET

RUN	BIT RECORD			CASING RECORD		
NO.	Bit Size	From	To	Size/Wgt/Thk.	From	To
1	4 1/2"	40 FEET	TD	8"	SURF	40 FEET
2						
3						
4						

HOLE MEDIUM: AIR: SURF - 9.0' WATER: 9.0'- TD — DRILL METHOD: MUD ROTARY CORE

MUD TYPE: — TIME SINCE CIRC:

VISCOSITY: SAMPLE NOT WEIGHT: AVAILIBLE Rmt at Deg

GENERAL DATA

INSTRUMENTATION: EG&G MT. SOPRIS SERIES III — UNIT/TRUCK: 245 / 19

LOGGING ENGINEER: MR. ROBERT CROWDER, MR. JAMES LOCOCO

CLIENT REP: MR. KEN MILLER - WESTON, MR. TIM DEIGNAN - EBASCO

OTHER SERVICES: NEUTRON, GAMMA, ELECTRIC, G-GAMMA, EM, SONIC

LOGGING DATA

LOG FUNCTION	RUN NO.	EQUIPMENT MODEL	PROBE S.N.	UPHOLE S.N.	LOGGING DIG INT FEET	SPEED FT./MIN.	DETECTOR TYPE	SPACING Tx-Rx FEET	Rx-Rx FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	INT. FEET
CALIPER	5	HPF	NSN	933	0.1	12						208'	SURF.	208'
TEMPERATURE	1	MLP	917	506	0.1	12						SURF.	208'	208'
FLUID RES.	1	MLP	917	506	0.1	12						SURF.	196'	196'

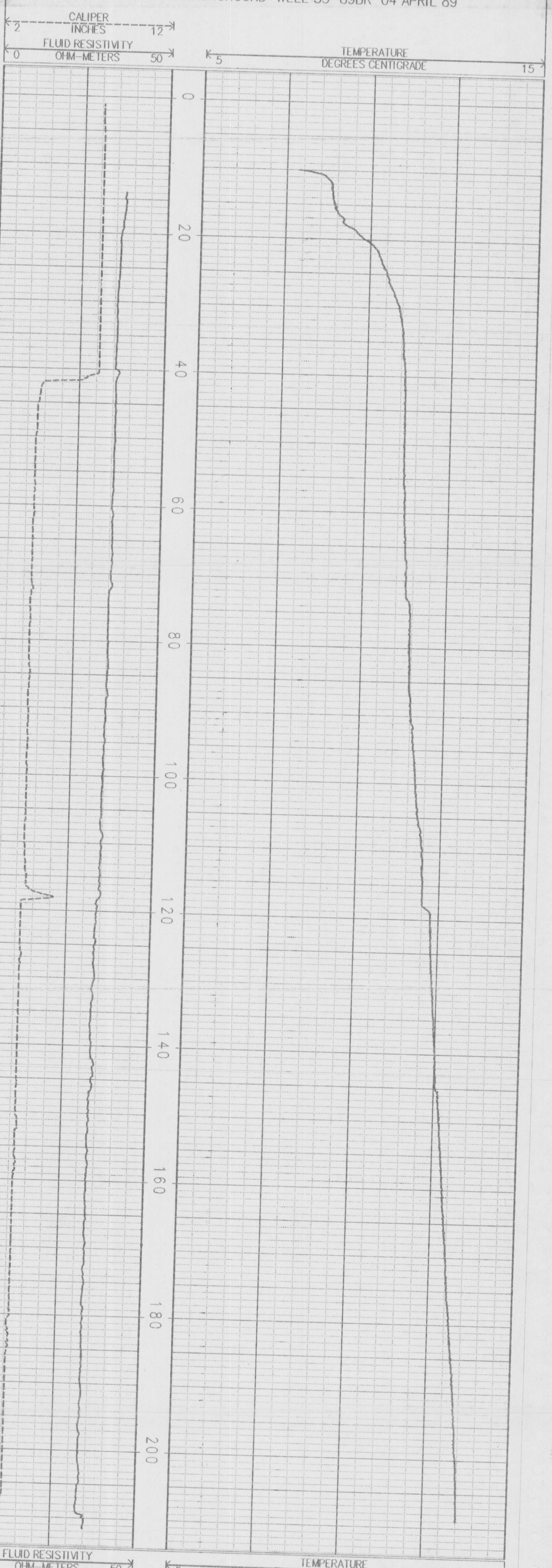
CALIBRATION FACTOR(S):

DIGITAL FILE NAME(S): 32MLP.FGO, 32MLP.PLP, 32MLP.HDP

REMARKS:

DRILLING COMPLETED 4 APR 89. RODS PULLED 30 MINUTES PRIOR TO LOGGING ON 4 APR 89.

ROCKY FLATS BACKGROUND WELL 35-89BR 04 APRIL 89



ROCKY FLATS BACKGROUND WELL 35-89BR 04 APRIL 89

COLOG INC

d.b.a. COLORADO WELL LOGGING
1019 8th ST. GOLDEN, COLORADO 80401
PHONE: (303) 279-0171 TELEX: 45-0286

POROSITY LOGS

WELL: 36-89BR

PROJECT: ROCKY FLATS BACKGROUND
DATE: 23 MARCH 1989
CLIENT: ROY F. WESTON, INC.
COLOG ID NO:
LOCATION: ROCKY FLATS NORTHING: 42344.5594 EASTING: 25382.0725
STATE: COLORADO COUNTY: JEFFERSON ELEV: 5826.9 DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO
CUSTOMER TD: 107 FEET COLOG TD: 107 FEET

RUN NO.	BIT RECORD Bit Size	From	To	CASING RECORD Size/Wgt/Thk	From	To
1	9"	50 FEET	TD	8"	SURF	50 FEET
2	4 1/2"	50 FEET	TD			
3						
4						

HOLE MEDIUM: AIR: SURF - 7' WATER: 7' - TD DRILL METHOD: MUD ROTARY CORE
MUD TYPE: NATURAL, CLEAR WATER TIME SINCE CIRC: 1 DAY +
VISCOSITY: SAMPLE NOT WEIGHT: AVAILIBLE Rm: at Deg

GENERAL DATA

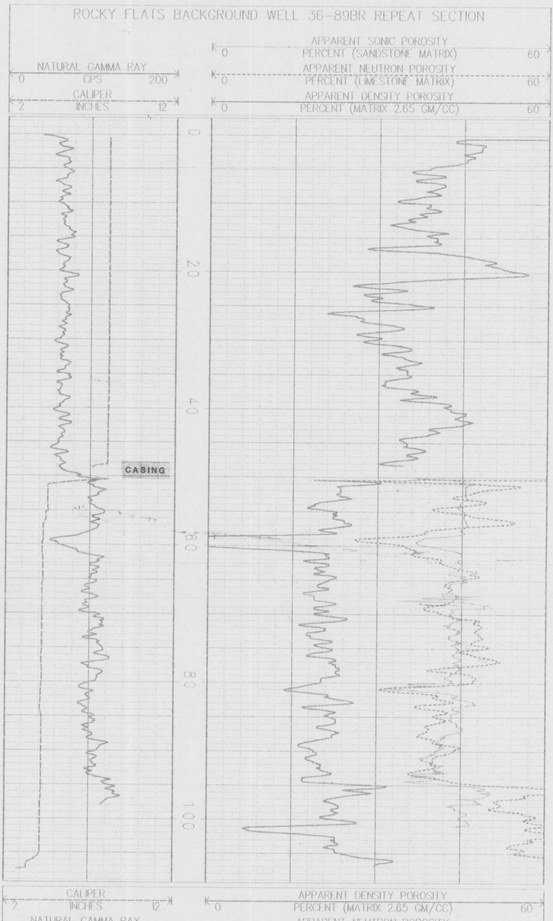
INSTRUMENTATION: EG&G MT. SOPRIS SERIES III UNIT/TRUCK: 245 / 19
LOGGING ENGINEER: ROBERT CROWDER, THOMAS STAATZ
CLIENT REP: MR. KEN MILLER - WESTON, MR. LARRY IRONS - EBASCO
OTHER SERVICES: TEMP., FM, SP, 16, 64, IP, GUARD, F-R

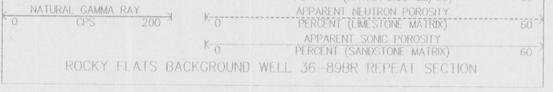
LOGGING DATA

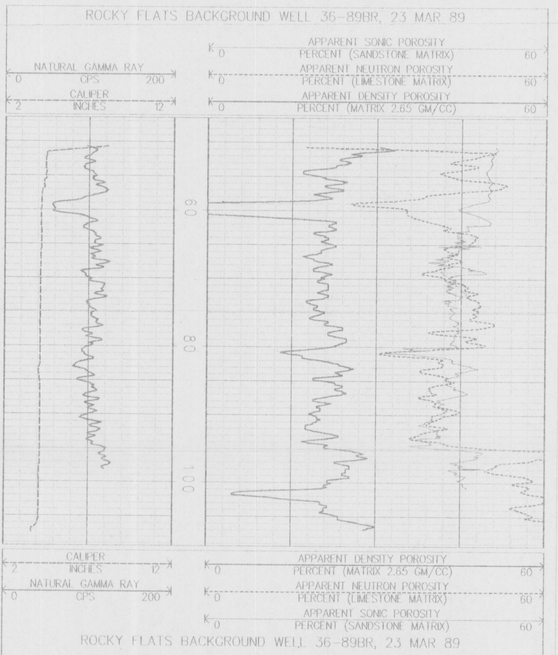
LOG FUNCTION	RUN NO.	EQUIPMENT MODEL	PROBE S.N.	UPHOLE S.N.	LOGGING ORG INTERVAL FEET	SPEED FT./MIN	DETECTOR TYPE	SPACING Tx-Rx FEET	Rx-Rx FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	INT. FEET
GAMMA	4	BPF	NSN	9.33	0.1	12	Nal					98'	SURF	98'
CALIPER	5	HPF	NSN	9.33	0.1	12						107'	SURF	107'
SONIC	3	CLPL	1275	771	0.1	6	CERAMIC	3 FT	1 FT			101'	SURF	101'
NEUTRON	4	OPF	1735	9.33	0.1	12	He3			Am241	3 Ci.	103'	6'	97'
GAMMA GAMMA	5	HPF	NSN	9.33	0.1	12	Nal	20 Cm	35 Cm	CS137	.1 Ci	107'	SURF	107'

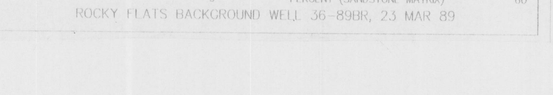
CALIBRATION FACTOR(S):
DIGITAL FILE NAME(S): 36DEN.PUN, 36DER.PTN, 36POR.PLP, 36PRR.PLP, 36PORJHDP
REMARKS:
* DRILLING COMPLETED 23 MAR 89.
RODS PULLED 30 MINUTES PRIOR TO LOGGING ON 23 MAR 89.

REPEAT SECTION RUN FROM 107' TO 50'.









COLOG INC

d.b.a. COLORADO WELL LOGGING

1019 8th ST. GOLDEN, COLORADO 80401

PHONE: (303) 279-0171 TELEX: 45-0286

CALIPER, TEMP.
FLUID RESISTIVITY
WELL: 38-89BR

PROJECT: ROCKY FLATS BACKGROUND — DATE: 13 APRIL 1989

CLIENT: ROY F. WESTON — COLOG ID NO:

LOCATION: ROCKY FLATS: NORTHING:41797.9045 EASTING:23567.2950

STATE: COLORADO COUNTY: JEFFERSON ELEV: 5901.4 ft. DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO

CUSTOMER TD: 132 FEET COLOG TD: 129 FEET

RUN	BIT RECORD			CASING RECORD		
NO.	Bit Size	From	To	Size/Wgt/Thk.	From	To
1	4"	24 FEET	TD	8 5/8"	SURF	24 FEET
2						
3						
4						

HOLE MEDIUM: AIR: SURF - 8.4' WATER: 8.4'- TD — DRILL METHOD: MUD ROTARY CORE

MUD TYPE: Natural mud plus clear water — TIME SINCE CIRC: *

VISCOSITY: SAMPLE NOT WEIGHT: AVAILIBLE Rmf at Deg

GENERAL DATA

INSTRUMENTATION: EG&G MT. SOPRIS SERIES III — UNIT/TRUCK: 245 / 19

LOGGING ENGINEER: MR. ROBERT CROWDER, MR. JAMES LOCOCO 2

CLIENT REP: MS. JANET MARKS - WESTON, MR. TIM DEIGNAN - EBASCO

OTHER SERVICES: NEUTRON, GAMMA, ELECTRIC, G-GAMMA, EM, SONIC

LOGGING DATA

LOG FUNCTION	RUN NO.	EQUIPMENT MODEL	PROBE S.N.	UPHOLE S.N.	LOGGING DIG INT FEET	SPEED FT./MIN.	DETECTOR TYPE	SPACING Tx-Rx FEET	Rx-Rx FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	INT. FEET
CALIPER	5	HPF	NSN	933	0.1	12						129'	SURF.	129'
TEMPERATURE	1	MLP	917	506	0.1	12						SURF.	129'	129'
FLUID RES.	1	MLP	917	506	0.1	12						SURF.	129'	129'

CALIBRATION FACTOR(S):

DIGITAL FILE NAME(S): 38MLP.FGO, 38MLP.PLP, 38MLP.HDP

REMARKS:

*DRILLING COMPLETED 12 APR 89. RODS PULLED 30 MINUTES PRIOR TO LOGGING ON 13 APR 89.

ROCKY FLATS BACKGROUND WELL 38-89BR 13 APRIL 89

ROCKY FLATS BACKGROUND WELL 38-89BR 13 APRIL 89

COLOG INC

d.b.a. COLORADO WELL LOGGING

1019 8th ST. GOLDEN, COLORADO 80401

PHONE: (303) 279-0171 TELEX: 45-0286

POROSITY LOGS

WELL: 38-89BR

PROJECT: ROCKY FLATS BACKGROUND

DATE: 13 APRIL 1989

CLIENT: ROY F. WESTON

COLOG ID NO:

LOCATION: ROCKY FLATS: NORTHING:41797.9045 EASTING:23567.2850

STATE: COLORADO COUNTY: JEFFERSON ELEV: 5901.4 ft. DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO

CUSTOMER TD: 132 FEET COLOG TD: 129 FEET

RUN	BIT RECORD			CASING RECORD		
NO.	Bit Size	From	To	Size/Wgt/Thk.	From	To
1	4"	24 FEET	TD	8 5/8"	SURF	24 FEET
2						
3						
4						

HOLE MEDIUM: AIR: SURF - 8.4' WATER: 8.4'- TD DRILL METHOD: MUD ROTARY CORE

MUD TYPE: Natural mud plus clear water TIME SINCE CIRC: *

VISCOSITY: SAMPLE NOT WEIGHT: AVAILIBLE Rmf at Deg

GENERAL DATA

INSTRUMENTATION: EG&G MT. SOPRIS SERIES III UNIT/TRUCK: 245 / 19

LOGGING ENGINEER: MR. ROBERT CROWDER, MR. JAMES LOCOCO

CLIENT REP: MS. JANET MARKS - WESTON, MR. TIM DEIGNAN - EBASCO

OTHER SERVICES: ELECTRICS, TEMP., EM

LOGGING DATA

LOG FUNCTION	RUN NO.	EQUIPMENT			LOGGING		DETECTOR	SPACING		SOURCE		LOGGED INTERVAL		
		MODEL	PROBE S.N.	UPHOLE S.N.	DIG INT FEET	SPEED FT./MIN.	TYPE	Tx-Rx FEET	Rx-Rx FEET	TYPE	SIZE CURIE	FROM	TO	INT. FEET
CALIPER	5	HPF	NSN	933	0.1	12						129'	SURF	129'
SONIC	3	CLPL	1275	771	0.1	6	CERAMIC	3 FT	1 FT	Pizo		123'	SURF.	123'
NEUTRON	4	OPF	1735	933	0.1	12	He3			Am241	3 Ci.	129'	SURF.	129'
GAMMA GAMMA	5	HPF	NSN	933	0.1	12	NaI	20 Cm	35 Cm	CS137	.1 Ci	129'	SURF.	129'

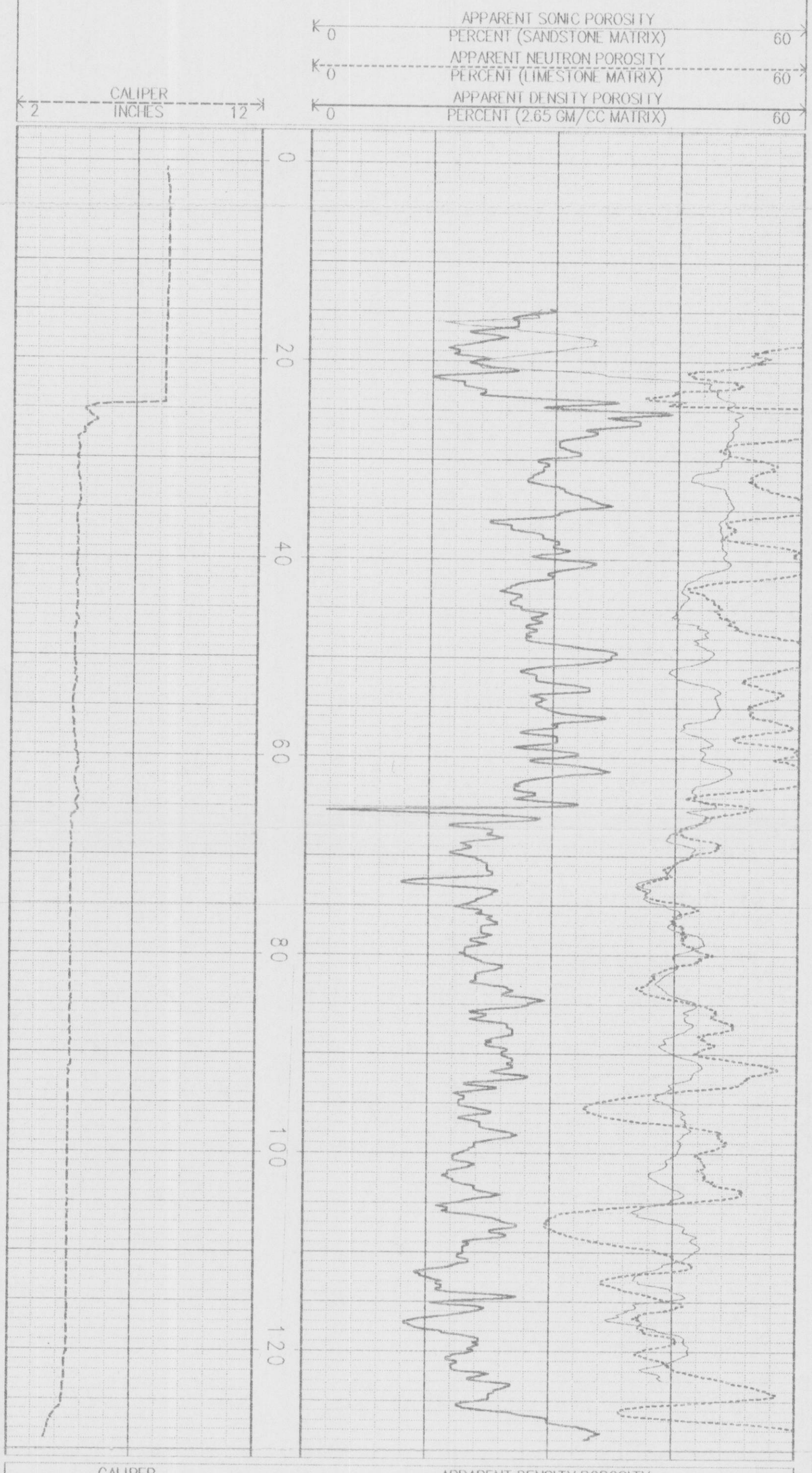
CALIBRATION FACTOR(S):

DIGITAL FILE NAME(S): 38POR.DBT, 38POR.HDP, 38POR.PLP

REMARKS:

*DRILLING COMPLETED 12 APR 89. RODS PULLED 30 MINUTES PRIOR TO LOGGING ON 13 APR 89.

ROCKY FLATS BACKGROUND WELL 38-89BR 13 APRIL 89



ROCKY FLATS BACKGROUND WELL 38-89BR 13 APRIL 89

COLOG INC

d.b.a. COLORADO WELL LOGGING

1019 8th ST. GOLDEN, COLORADO 80401

PHONE: (303) 279-0171 TELEX: 45-0286

SP, IP, 16&64 RES
GUARD, INDUCTION
WELL: 36-89BR

PROJECT: ROCKY FLATS BACKGROUND — DATE: 23 MARCH 1989

CLIENT: ROY F. WESTON, INC. — COLOG ID NO:

LOCATION: ROCKY FLATS NORTHING: 42344.5594 EASTING: 25382.0725

STATE: COLORADO COUNTY: JEFFERSON ELEV: 5826.9 DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO

CUSTOMER TD: 107 FEET COLOG TD: 107 FEET

RUN	BIT RECORD			CASING RECORD		
NO.	Bit Size	From	To	Size/Wgt/Thk.	From	To
1	9"	50 FEET	TD	8"	SURF	50 FEET
2	4 1/2"	50 FEET	TD			
3						
4						

HOLE MEDIUM: AIR: SURF - 7' WATER: 7' - TD — DRILL METHOD: MUD ROTARY CORE

MUD TYPE: NATURAL, CLEAR WATER — TIME SINCE CIRC: 1 DAY *

VISCOSITY: SAMPLE NOT WEIGHT: AVAILIBLE — Rm: at Deg

GENERAL DATA

INSTRUMENTATION: EG&G MT. SOPRIS SERIES III — UNIT/TRUCK: 245 / 19

LOGGING ENGINEER: ROBERT CROWDER, THOMAS STAATZ

CLIENT REP: MR. KEN MILLER - WESTON, MR. LARRY IRONS - EBASCO

OTHER SERVICES: N-N G-G, G, SONIC, TEMP., F-R

LOGGING DATA

LOG FUNCTION	RUN NO.	EQUIPMENT MODEL	PROBE S.N.	UPHOLE S.N.	LOGGING DIG INT FEET	SPEED FT./MIN	DETECTOR TYPE	SPACING Tx-Rx FEET	Rx-Rx FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	INT. FEET
S.P.	2	RLP	975	417	0.1	12						100'	50'	50'
I.P.	2	RLP	975	417	0.1	12						106'	50'	56'
16 & 64 RES	2	RLP	975	417	0.1	12						106'	50'	56'
GUARD RES.	4	IPF	NSN	933	0.1	12						100'	50'	50'
INDUCTION	6	EM-39	0550	0550	0.2	10						102'	50'	52'

CALIBRATION FACTOR(S):

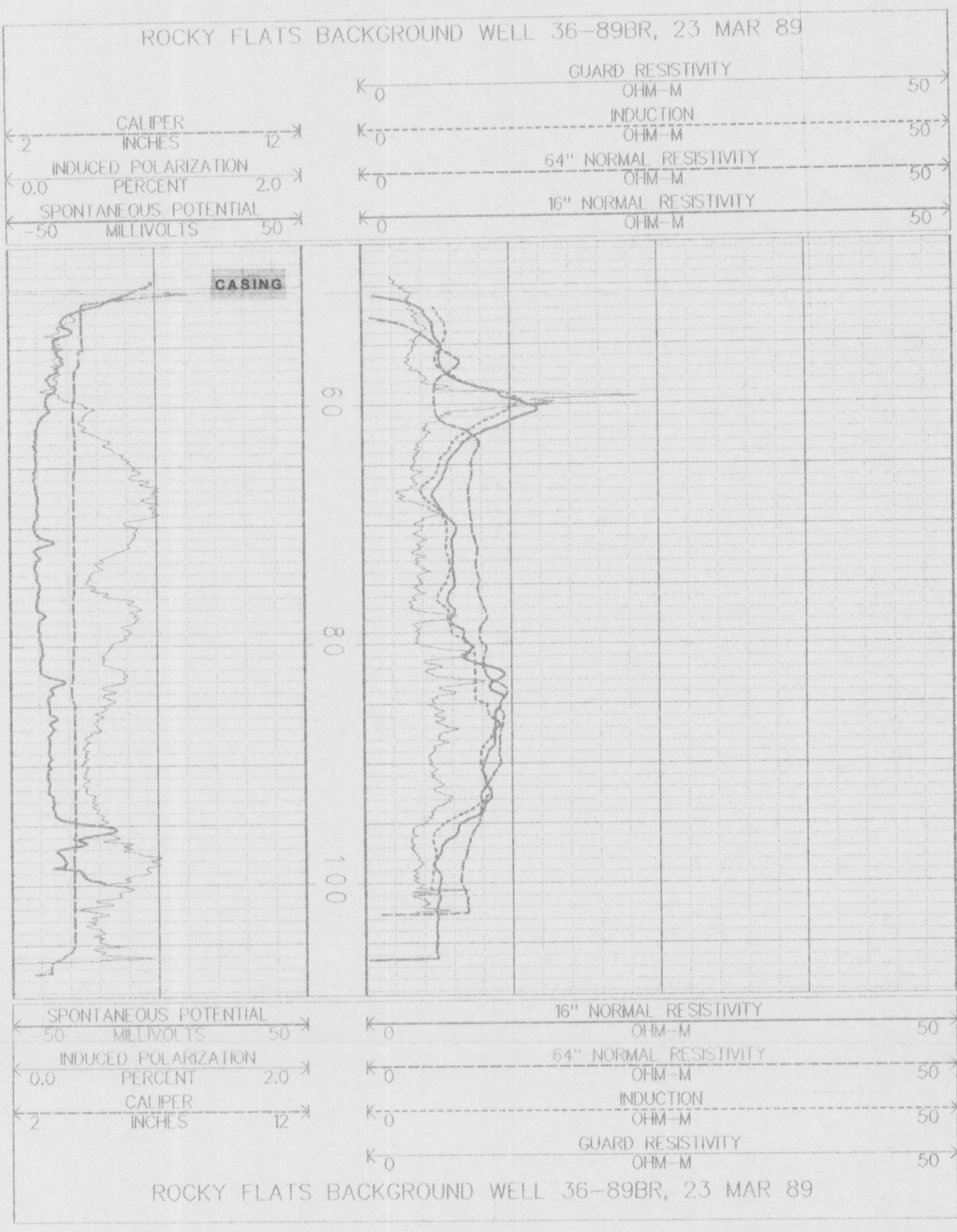
DIGITAL FILE NAME(S): 36RLP.FH0, 36RLP.FG1, 36RLP.PLP, 36RLPR.PLP, 36ELEC.HDP

REMARKS:

* DRILLING COMPLETED 23 MAR 89.
RODS PULLED 30 MINUTES PRIOR TO LOGGING ON 23 MAR 89.

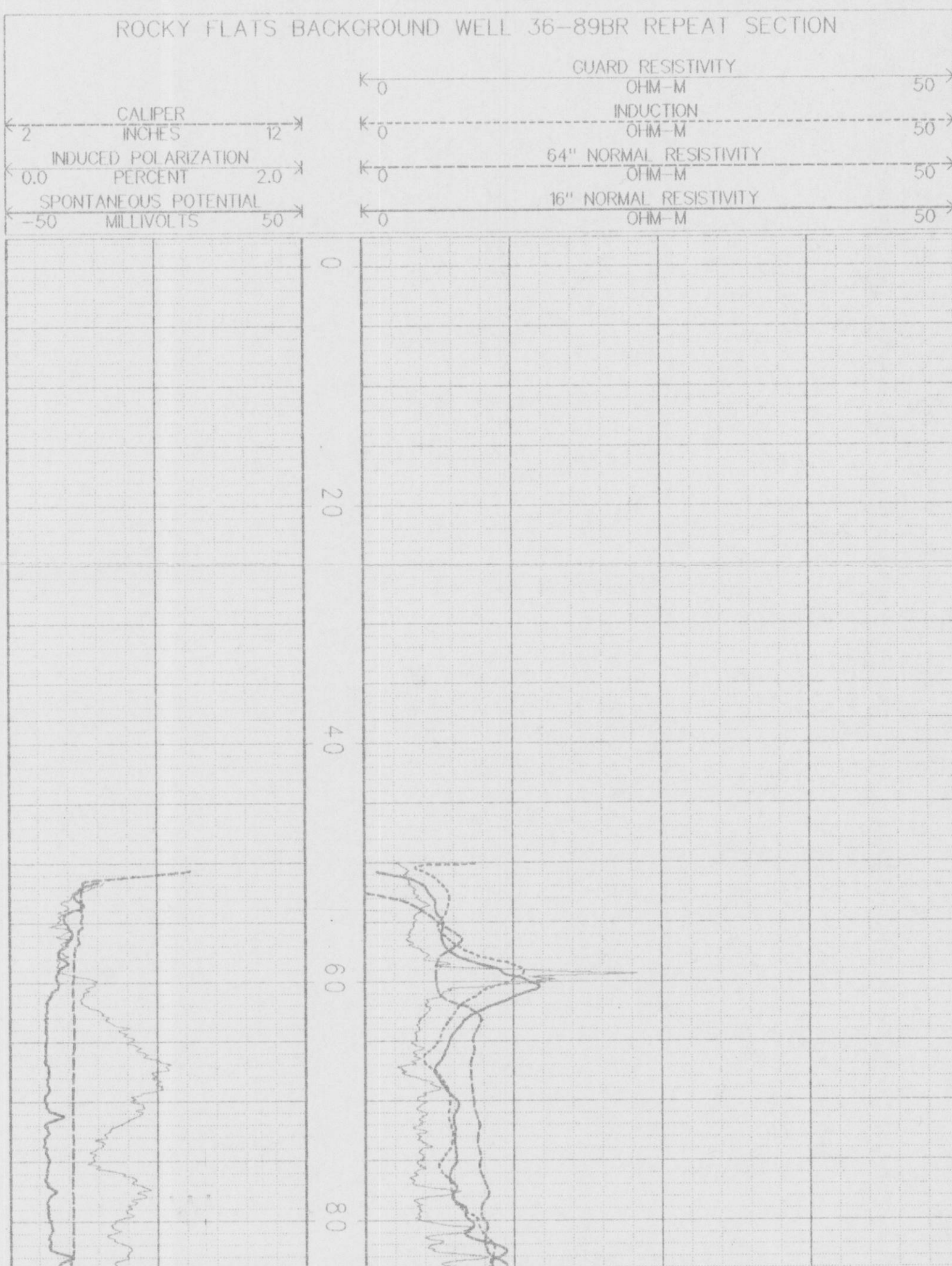
REPEAT SECTION RUN FROM 107' TO 50'

ROCKY FLATS BACKGROUND WELL 36-89BR, 23 MAR 89



ROCKY FLATS BACKGROUND WELL 36-89BR, 23 MAR 89

ROCKY FLATS BACKGROUND WELL 36-89BR REPEAT SECTION



ROCKY FLATS BACKGROUND WELL 36-89BR REPEAT SECTION

COLOG INC

d.b.a. COLORADO WELL LOGGING

1019 8th ST. GOLDEN, COLORADO 80401

PHONE: (303) 279-0171 TELEX: 45-0286

NEUTRON, G-GAMMA
GAMMA, CALIPER
WELL: 36-89BR

PROJECT: ROCKY FLATS BACKGROUND

DATE: 23 MARCH 1989

CLIENT: ROY F. WESTON, INC.

COLOG ID NO:

LOCATION: ROCKY FLATS NORTHING: 42344.5594 EASTING: 25382.0725

STATE: COLORADO COUNTY: JEFFERSON ELEV: 5826.9 DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO

CUSTOMER TD: 107 FEET COLOG TD: 107 FEET

RUN	BIT RECORD			CASING RECORD		
NO.	Bit Size	From	To	Size/Wgt/Thk.	From	To
1	9"	50 FEET	TD	8"	SURF	50 FEET
2	4 1/2"	50 FEET	TD			
3						
4						

HOLE MEDIUM: AIR: SURF - 7' WATER: 7' - TD DRILL METHOD: MUD ROTARY CORE

MUD TYPE: NATURAL, CLEAR WATER TIME SINCE CIRC: 1 DAY *

VISCOSITY: SAMPLE NOT WEIGHT: AVAILIBLE Rm: at Deg

GENERAL DATA

INSTRUMENTATION: EG&G MT. SOPRIS SERIES III UNIT/TRUCK: 245 / 19

LOGGING ENGINEER: ROBERT CROWDER, THOMAS STAATZ

CLIENT REP: MR. KEN MILLER - WESTON, MR. LARRY IRONS - EBASCO

OTHER SERVICES: SONIC,EM, TEMP., SP, IP, 16, 64, GUARD

LOGGING DATA

LOG FUNCTION	RUN NO.	EQUIPMENT MODEL	PROBE S.N.	UPHOLE S.N.	LOGGING DIG INT FEET	SPEED FT./MIN	DETECTOR TYPE	SPACING Tx-Rx FEET	Rx-Rx FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	INT. FEET
GAMMA	4	BPF	NSN	933	0.1	12	NaI					98'	SURF	98'
CALIPER	5	HPF	NSN	933	0.1	12						107'	SURF	107'
NEUTRON	4	OPF	1735	933	0.1	12	He3			Am24	3 Ci.	103'	6'	97'
GAMMA GAMMA	5	HPF	NSN	933	0.1	12	NaI	20 Cm	15 Cm	CS137	.1 Ci	107'	SURF	107'

CALIBRATION FACTOR(S):

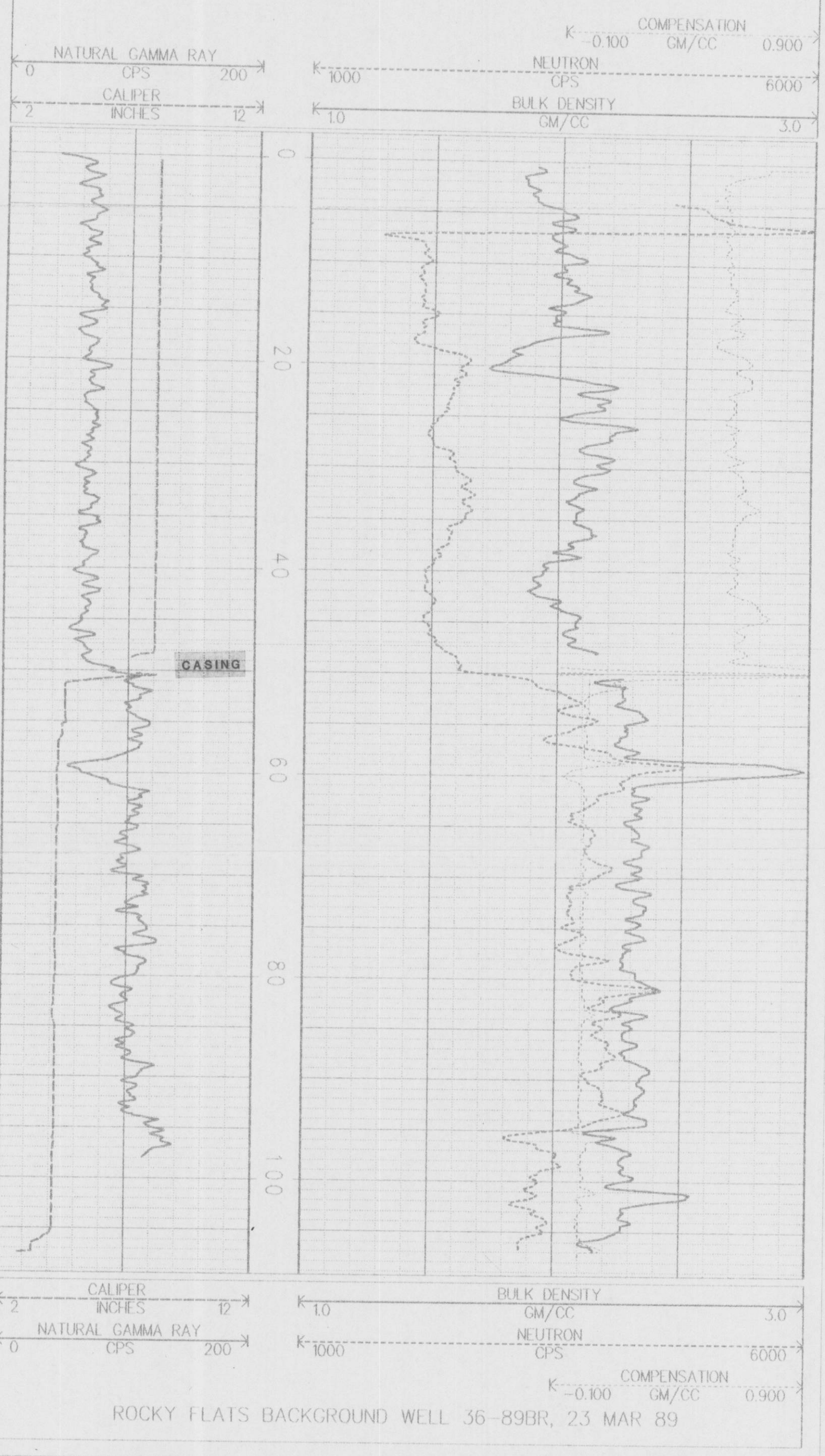
DIGITAL FILE NAME(S): 36DEN.PUN, 36DER.PTN, 32DEN.PLP, 32DER.PLP, 32DEN.HDP

REMARKS:

* DRILLING COMPLETED 23 MAR 89.
RODS PULLED 30 MINUTES PRIOR TO LOGGING ON 23 MAR 89.

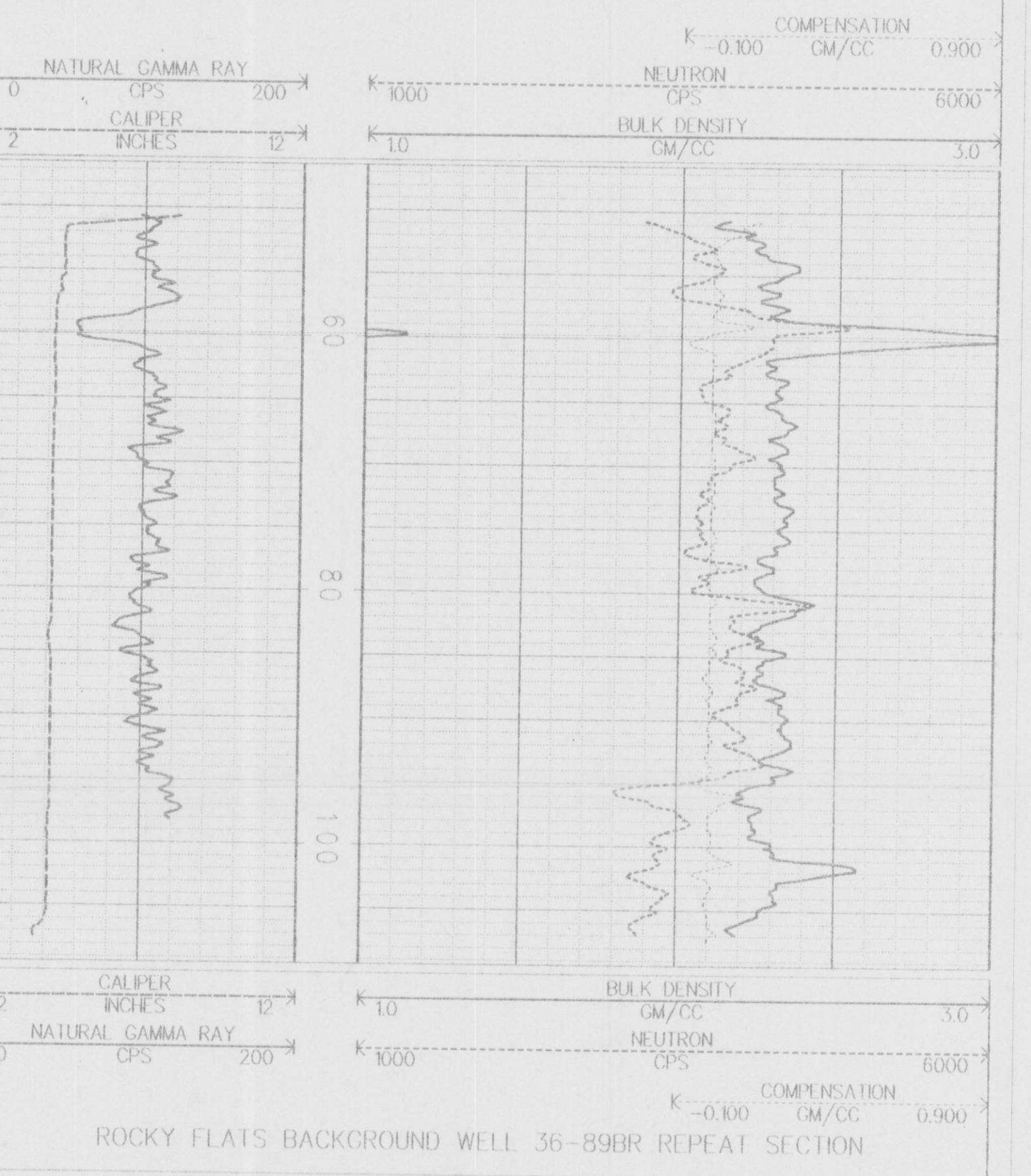
REPEAT SECTION RUN FROM 107' TO 50'.

ROCKY FLATS BACKGROUND WELL 36-89BR, 23 MAR 89



ROCKY FLATS BACKGROUND WELL 36-89BR, 23 MAR 89

ROCKY FLATS BACKGROUND WELL 36-89BR REPEAT SECTION



ROCKY FLATS BACKGROUND WELL 36-89BR REPEAT SECTION

COLOG INC d.b.a. COLORADO WELL LOGGING
1019 8th ST. GOLDEN, COLORADO 80401
PHONE: (303) 279-0171 TELEX: 45-0286

GAMMA, CALIPER
NEUTRON, G-GAMMA
WELL: 43-89BR

PROJECT: ROCKY FLATS BACKGROUND — DATE: 25 APRIL 1989
CLIENT: ROY F. WESTON — COLOG ID NO:
LOCATION: ROCKY FLATS NORTHING:33819.6221 EASTING:19347.7575
STATE: COLORADO COUNTY: JEFFERSON ELEV: 5965.6' DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO
CUSTOMER TD: 100 FEET COLOG TD: 99 FEET

RUN NO.	BIT RECORD Bit Size	From	To	CASING RECORD Size/Wgt/Thk.	From	To
1	4"	36.5 FEET	TD	5 1/4"	SURF	36.5 FEET
2						
3						
4						

HOLE MEDIUM: AIR: SURF - 10.0' WATER: 10.0' - TD DRILL METHOD: MUD ROTARY CORE
MUD TYPE: Natural mud plus clear water TIME SINCE CIRC: *:
VISCOSITY: SAMPLE NOT WEIGHT: AVAILIBLE Rmt at Deg

GENERAL DATA

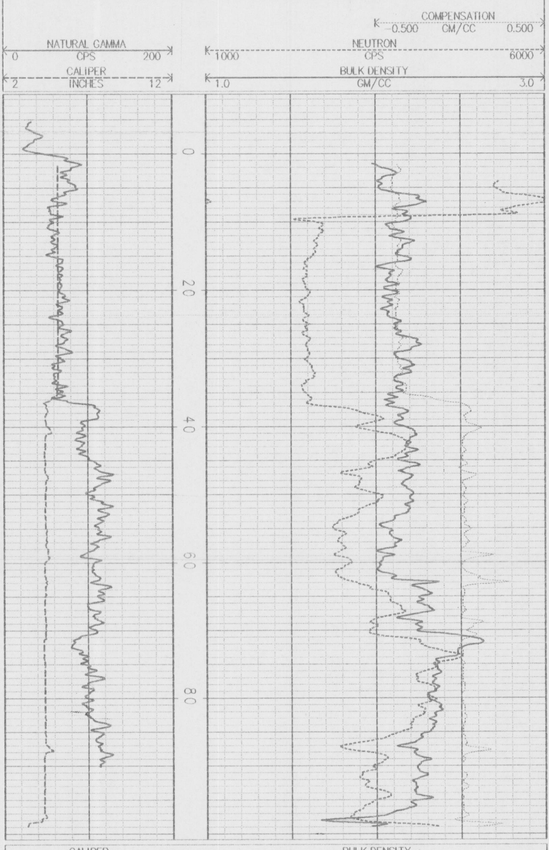
INSTRUMENTATION: EG&G MT. SOPRIS SERIES III UNIT/TRUCK: 245 / 19
LOGGING ENGINEER: MR. ROBERT CROWDER, MR. JAMES LOCOCO
CLIENT REP: MR. ROY I. THUN - WESTON MR. TRAVIS CANON - EBASCO
OTHER SERVICES: SONIC, ELECTRICS, EM, TEMP.

LOGGING DATA

LOG FUNCTION	RUN NO.	EQUIPMENT MODEL	PROBE S.N.	SUPHOLE S.N.	LOGGING DIG INT FEET	SPEED FT./MIN	DETECTOR TYPE	SPACING Tx-Rx FEET	Rx-Rx FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	INT. FEET
GAMMA	4	BPF	NSN	933	0.1	12	NaI					94'	SURF	94'
CALIPER	5	HPF	NSN	933	0.1	12						99'	SURF	99'
NEUTRON	4	OPF	1735	933	0.1	12	He3			Am241	3 Ci.	99'	4'	95'
GAMMA GAMMA	5	HPF	NSN	933	0.1	12	NaI	20 Cm	15 Cm	CS137	.1 Ci	99'	SURF	99'

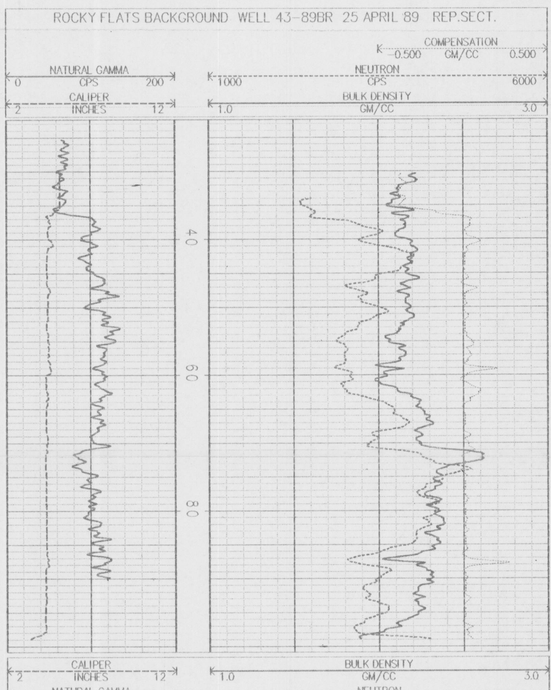
CALIBRATION FACTOR(S):
DIGITAL FILE NAME(S): 43GG4.PYX, 41DEN.HDP, 43GG4.PLP
REMARKS:
*DRILLING COMPLETED 24 APR 89. RODS PULLED 30 MINUTES PRIOR TO LOGGING ON 25 APR 89.
HOLE NEAR EAST END OF SEISMIC LINE.

ROCKY FLATS BACKGROUND WELL 43-89BR 25 APRIL 89



ROCKY FLATS BACKGROUND WELL 43-89BR 25 APRIL 89

ROCKY FLATS BACKGROUND WELL 43-89BR 25 APRIL 89 REP.SECT.



ROCKY FLATS BACKGROUND WELL 43-89BR 25 APRIL 89 REP.SECT.

COLOG INC

d.b.a. COLORADO WELL LOGGING

1019 8th ST. GOLDEN, COLORADO 80401

PHONE: (303) 279-0171 TELEX: 45-0286

NEUTRON, G-GAMMA
GAMMA, CALIPER
WELL: 41-89BRA

PROJECT: ROCKY FLATS BACKGROUND — DATE: 9 MARCH 1989

CLIENT: ROY F. WESTON, INC. — COLOG ID NO:

LOCATION: ROCKY FLATS NORTHING:32801.6222 EASTING:26472.0108

STATE: COLORADO COUNTY: JEFFERSON ELEV: 5729.8 DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO

CUSTOMER TD: 51.5 FT. COLOG TD: 51 FEET

RUN	BIT RECORD			CASING RECORD		
NO.	Bit Size	From	To	Size/Wgt/Thk.	From	To
1	6 1/4"	SURFACE	TD	NONE		
2						
3						
4						

HOLE MEDIUM: WATER: SURFACE - TD — DRILL METHOD: AUGER

MUD TYPE: NONE — TIME SINCE CIRC: 1/4 HOUR

VISCOSITY: SAMPLE NOT WEIGHT: AVAILIBLE Rmt at Deg

GENERAL DATA

INSTRUMENTATION: EG&G MT. SOPRIS SERIES III — UNIT/TRUCK: 245 / 19

LOGGING ENGINEER: ROBERT CROWDER, THOMAS STAATZ

CLIENT REP: MR. KERRY Van ALLEN - WESTON, MR. IRONS, MR. DEIGNAN -EBASCO

OTHER SERVICES: SONIC,EM, TEMP., SP, 16, 64, GUARD

LOGGING DATA

LOG FUNCTION	RUN NO.	EQUIPMENT MODEL	PROBE S.N.	UPHOLE S.N.	LOGGING DIG INT FEET	SPEED FT./MIN.	DETECTOR TYPE	SPACING Tx-Rx FEET	Rx-Rx FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	INT. FEET
GAMMA	2	BPF	NSN	933	0.1	12	NaI					43'	SURF	43'
CALIPER	3	HPF	NSN	933	0.1	12						51'	SURF	51'
NEUTRON	2	OPF	1735	933	0.1	12	He3			Am241	3 Ci.	50'	SURF	50'
GAMMA GAMMA	3	HPF	NSN	933	0.1	12	NaI	20 Cm	15 Cm	CS137	.1 Ci	51'	SURF	51'

CALIBRATION FACTOR(S):

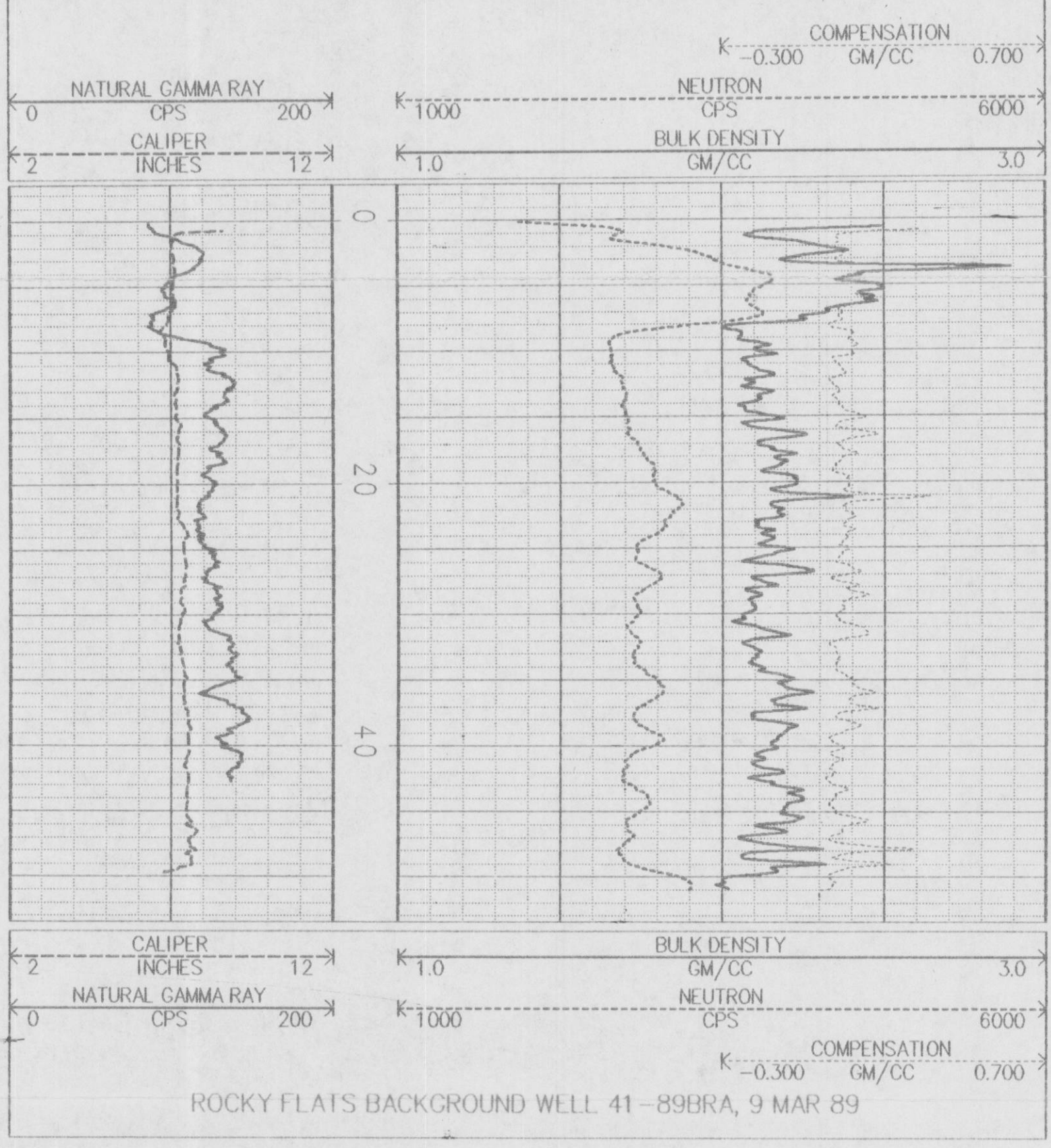
DIGITAL FILE NAME(S): 41APOR.PTN, 41APRR.PTN, 41ADEN.PLP, 41ADER.PLP, 41ADEN.HDP

REMARKS:

DRILLING COMPLETED 9 MAR 89.
RODS PULLED 30 MINUTES PRIOR TO LOGGING ON 9 MAR 89.

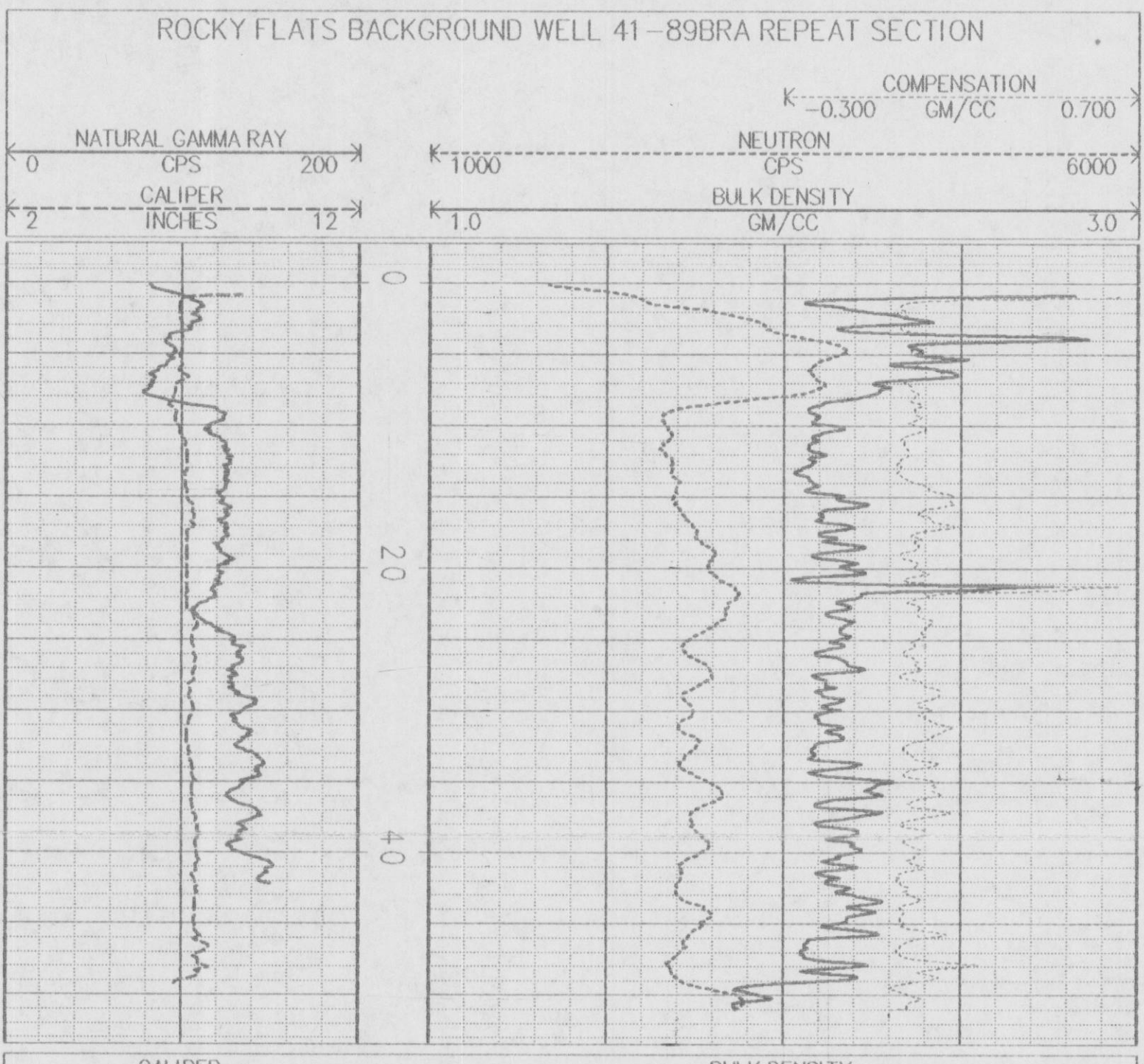
REPEAT SECTION RUN FROM 50 FEET TO SURFACE.

ROCKY FLATS BACKGROUND WELL 41-89BRA, 9 MAR 89



ROCKY FLATS BACKGROUND WELL 41-89BRA, 9 MAR 89

ROCKY FLATS BACKGROUND WELL 41-89BRA REPEAT SECTION



ROCKY FLATS BACKGROUND WELL 41-89BRA REPEAT SECTION

COLOG INC

d.b.a. COLORADO WELL LOGGING

1019 8th ST. GOLDEN, COLORADO 80401

PHONE: (303) 279-0171 TELEX: 45-0286

GAMMA, CALIPER
NEUTRON, G-GAMMA
WELL: 41-89BR

PROJECT: ROCKY FLATS BACKGROUND — DATE: 19 APRIL 1989

CLIENT: ROY F. WESTON — COLOG ID NO:

LOCATION: ROCKY FLATS: NORTHING:32799.2398 EASTING:26481.3343

STATE: COLORADO COUNTY: JEFFERSON ELEV: 5729.7 DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO

CUSTOMER TD: 109 FEET COLOG TD: 109 FEET

RUN	BIT RECORD			CASING RECORD		
NO.	Bit Size	From	To	Size/Wgt/Thk.	From	To
1	4 1/2"	50 FEET	TD	5 1/4"	SURF	50 FEET
2						
3						
4						

HOLE MEDIUM: AIR: SURF - 25.0' WATER: 25.0'- TD — DRILL METHOD: MUD ROTARY CORE

MUD TYPE: Natural mud plus clear water — TIME SINCE CIRC: *

VISCOSITY: SAMPLE NOT WEIGHT: AVAILIBLE Rmf at Deg

GENERAL DATA

INSTRUMENTATION: EG&G MT. SOPRIS SERIES III — UNIT/TRUCK: 245 / 19

LOGGING ENGINEER: MR. ROBERT CROWDER, MR. JAMES LOCOCO

CLIENT REP: MS. JANET MARKS - WESTON MR. TIM DEIGNAN - EBASCO

OTHER SERVICES: SONIC, ELECTRICS, EM, TEMP.

LOGGING DATA

LOG FUNCTION	RUN NO.	EQUIPMENT MODEL	PROBE S.N.	UPHOLE S.N.	LOGGING DIG INT FEET	SPEED FT./MIN.	DETECTOR TYPE	SPACING Tx-Rx FEET	Rx-Rx FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	INT. FEET
GAMMA	4	BPF	NSN	933	0.1	12	NaI					101'	SURF	101'
CALIPER	5	HPF	NSN	933	0.1	12						109'	SURF	109'
NEUTRON	4	OPF	1735	933	0.1	12	He3			Am241	3 Ci.	109'	SURF	109'
GAMMA GAMMA	5	HPF	NSN	933	0.1	12	NaI	20 Cm	15 Cm	CS137	.1 Ci	109'	SURF	109'

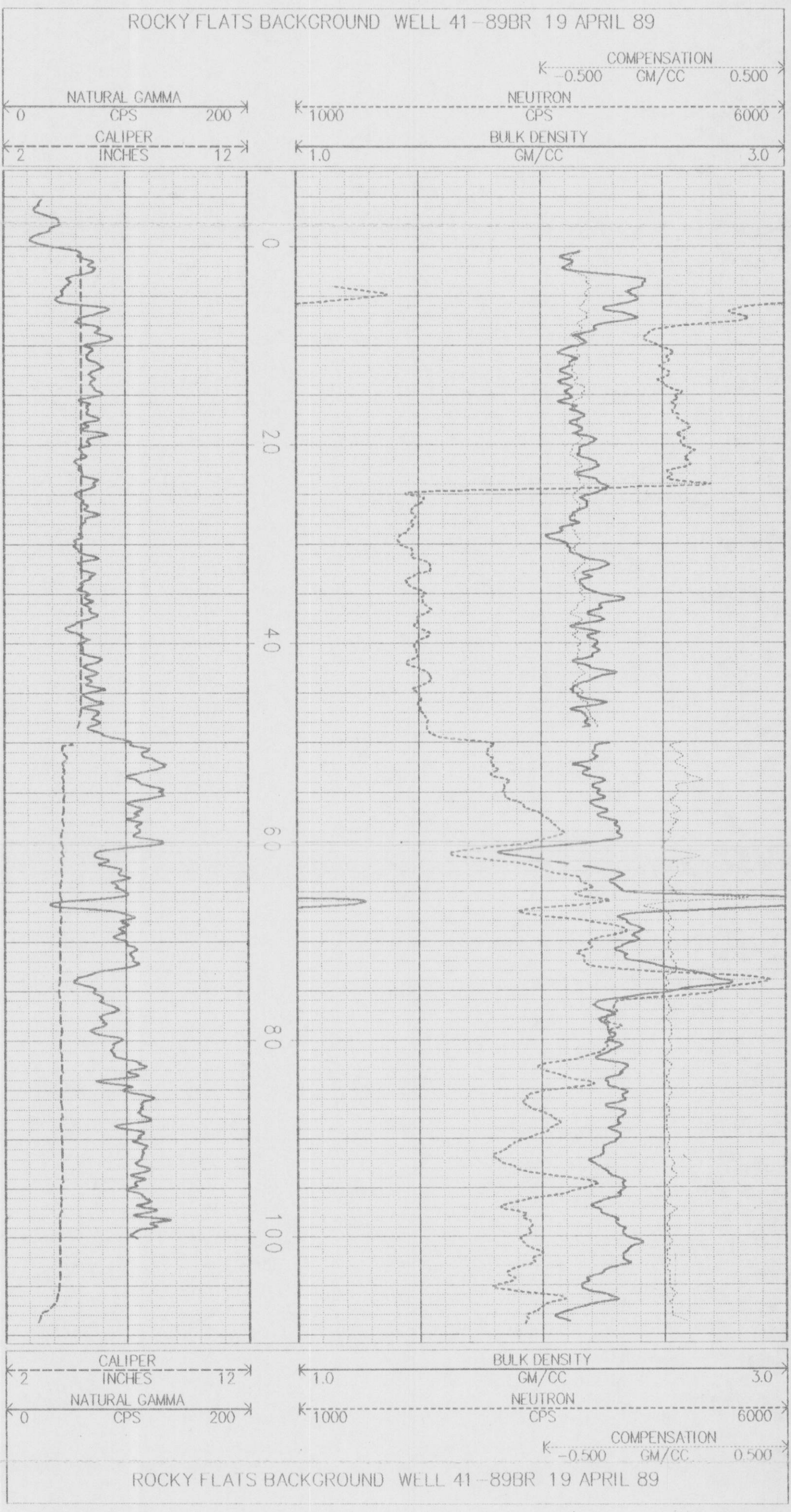
CALIBRATION FACTOR(S):

DIGITAL FILE NAME(S): 41GG4.PYX, 41DEN.HDP, 41GG4.PLP

REMARKS:

*DRILLING COMPLETED 18 MAR 89. RODS PULLED 30 MINUTES PRIOR TO LOGGING ON 19 APR 89.

ROCKY FLATS BACKGROUND WELL 41-89BR 19 APRIL 89



ROCKY FLATS BACKGROUND WELL 41-89BR 19 APRIL 89

COLOG INC

d.b.a. COLORADO WELL LOGGING

1019 8th ST. GOLDEN, COLORADO 80401

PHONE: (303) 279-0171 TELEX: 45-0286

POROSITY LOGS

WELL: 41-89BR

PROJECT: ROCKY FLATS BACKGROUND

DATE: 19 APRIL 1989

CLIENT: ROY F. WESTON

COLOG ID NO:

LOCATION: ROCKY FLATS NORTHING;32799.2398 EASTING;26481.3343

STATE: COLORADO COUNTY: JEFFERSON ELEV: 5729.7 DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO

CUSTOMER TD: 109 FEET COLOG TD: 109 FEET

RUN	BIT RECORD			CASING RECORD		
NO.	Bit Size	From	To	Size/Wgt/Thk.	From	To
1	4 1/2"	50 FEET	TD	5 1/4"	SURF	50 FEET
2						
3						
4						

HOLE MEDIUM: AIR: SURF - 25.0' WATER: 25.0'- TD DRILL METHOD: MUD ROTARY CORE

MUD TYPE: Natural mud plus clear water TIME SINCE CIRC: *

VISCOSITY: SAMPLE NOT WEIGHT: AVAILIBLE Rmt at Deg

GENERAL DATA

INSTRUMENTATION: EG&G MT. SOPRIS SERIES III UNIT/TRUCK: 245 / 19

LOGGING ENGINEER: MR. ROBERT CROWDER, MR. JAMES LOCOCO

CLIENT REP: MS. JANET MARKS - WESTON MR. TIM DEIGNAN - EBASCO

OTHER SERVICES: ELECTRICS, TEMP., EM

LOGGING DATA

LOG FUNCTION	RUN NO.	EQUIPMENT MODEL	PROBE S.N.	UPHOLE S.N.	LOGGING DIG INT FEET	SPEED FT./MIN.	DETECTOR TYPE	SPACING Tx-Rx FEET	Rx-Rx FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	INT. FEET
GAMMA	4	BPF	NSN	933	0.1	12	NaI					101'	SURF	101'
CALIPER	5	HPF	NSN	933	0.1	12						109'	SURF	109'
SONIC	3	CLPL	1275	771	0.1	6	CERAMIC	3 FT	1 FT			104'	SURF.	104'
NEUTRON	4	OPF	1735	933	0.1	12	He3			Am241	3 Ci.	109'	SURF.	109'
GAMMA GAMMA	5	HPF	NSN	933	0.1	12	NaI	20 Cm	35 Cm	CS137	.1 Ci	109'	SURF.	109'

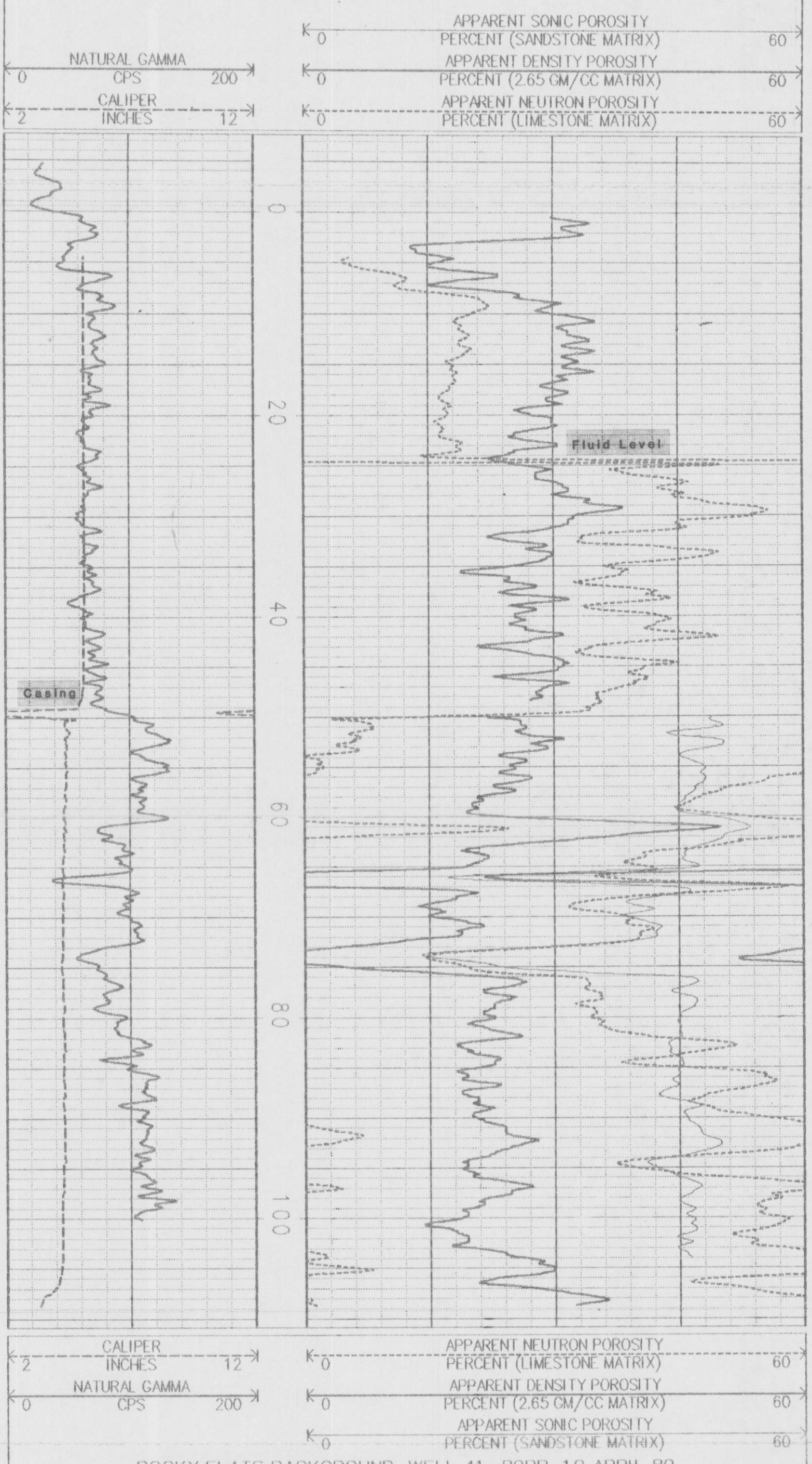
CALIBRATION FACTOR(S):

DIGITAL FILE NAME(S): 41POR.PTN, 41POR.HDP, 41POR.PLP

REMARKS:

*DRILLING COMPLETED 18 APR 89. RODS PULLED 30 MINUTES PRIOR TO LOGGING ON 19 APR 89.

ROCKY FLATS BACKGROUND WELL 41-89BR 19 APRIL 89



ROCKY FLATS BACKGROUND WELL 41-89BR 19 APRIL 89

COLOG INC

d.b.a. COLORADO WELL LOGGING

1019 8th ST. GOLDEN, COLORADO 80401

PHONE: (303) 279-0171 TELEX: 45-0286

SP, IP, 16&64 RES
GUARD, INDUCTION
WELL: 43-89BR

PROJECT: ROCKY FLATS BACKGROUND — DATE: 25 APRIL 1989

CLIENT: ROY F. WESTON — COLOG ID NO:

LOCATION: ROCKY FLATS NORTHING;33819.6221 EASTING;19347.7575

STATE: COLORADO COUNTY: JEFFERSON ELEV: 5965.6' DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO

CUSTOMER TD: 109 FEET COLOG TD: 109 FEET

RUN	BIT RECORD			CASING RECORD		
NO.	Bit Size	From	To	Size/Wgt/Thk.	From	To
1	4"	36.5 FEET	TD	5 1/4"	SURF	36.5 FEET
2						
3						
4						

HOLE MEDIUM: AIR: SURF - 10.0' WATER: 10.0'- TD — DRILL METHOD: MUD ROTARY CORE

MUD TYPE: Natural mud plus clear water — TIME SINCE CIRC: *

VISCOSITY: SAMPLE NOT WEIGHT: AVAILIBLE Rmf at Deg

GENERAL DATA

INSTRUMENTATION: EG&G MT. SOPRIS SERIES III — UNIT/TRUCK: 245 / 19

LOGGING ENGINEER: MR. ROBERT CROWDER, MR. JAMES LOCOCO

CLIENT REP: MR. ROY I THUN - WESTON, MR. TRAVIS CANON - EBASCO

OTHER SERVICES: NEUTRON, G-GAMMA,SONIC, GAMMA, TEMP., FLUID RES.

LOGGING DATA

LOG FUNCTION	RUN NO.	EQUIPMENT MODEL	PROBE S.N.	UPHOLE S.N.	LOGGING DIG INT FEET	SPEED FT./MIN	DETECTOR TYPE	SPACING Tx*Rx FEET	Rx-Rx FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	INT. FEET
S.P.	2	RLP	975	417	0.1	12						99'	30'	69'
I.P.	2	RLP	975	417	0.1	12						99'	30'	69'
16 & 64 RES	2	RLP	975	417	0.1	12						99'	30'	69'
GUARD RES.	4	IPF	NSN	933	0.1	12						99'	30'	69'
INDUCTION	6	EM-39	0550	0550	0.2	10						99'	SURF	69'

CALIBRATION FACTOR(S):

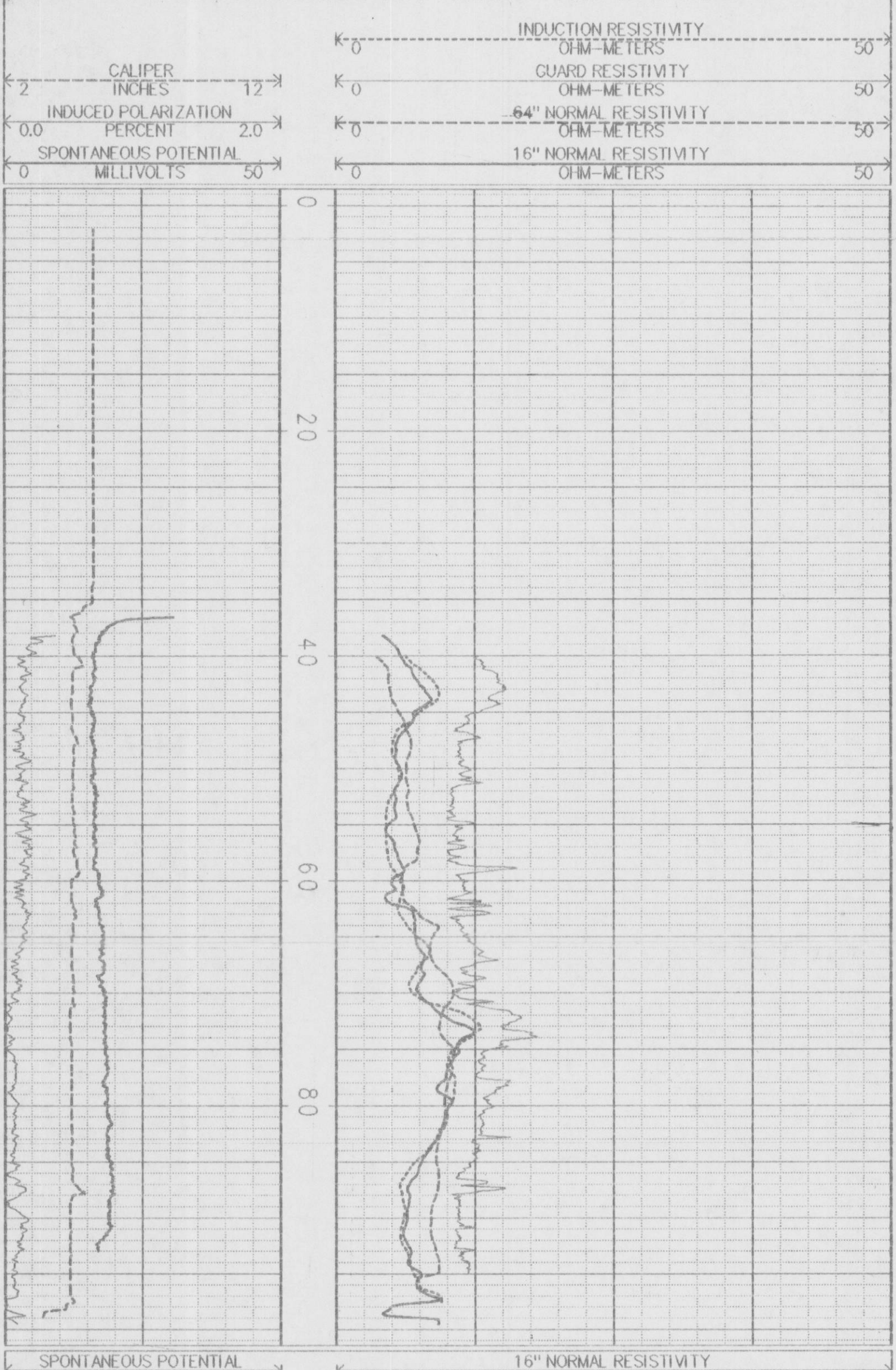
DIGITAL FILE NAME(S): 43RLP.FF0, 43ELEC.PLP, 43ELEC.HDP

REMARKS:

*DRILLING COMPLETED 18 APR 89. RODS PULLED 30 MINUTES PRIOR TO LOGGING ON 19 APR 89.

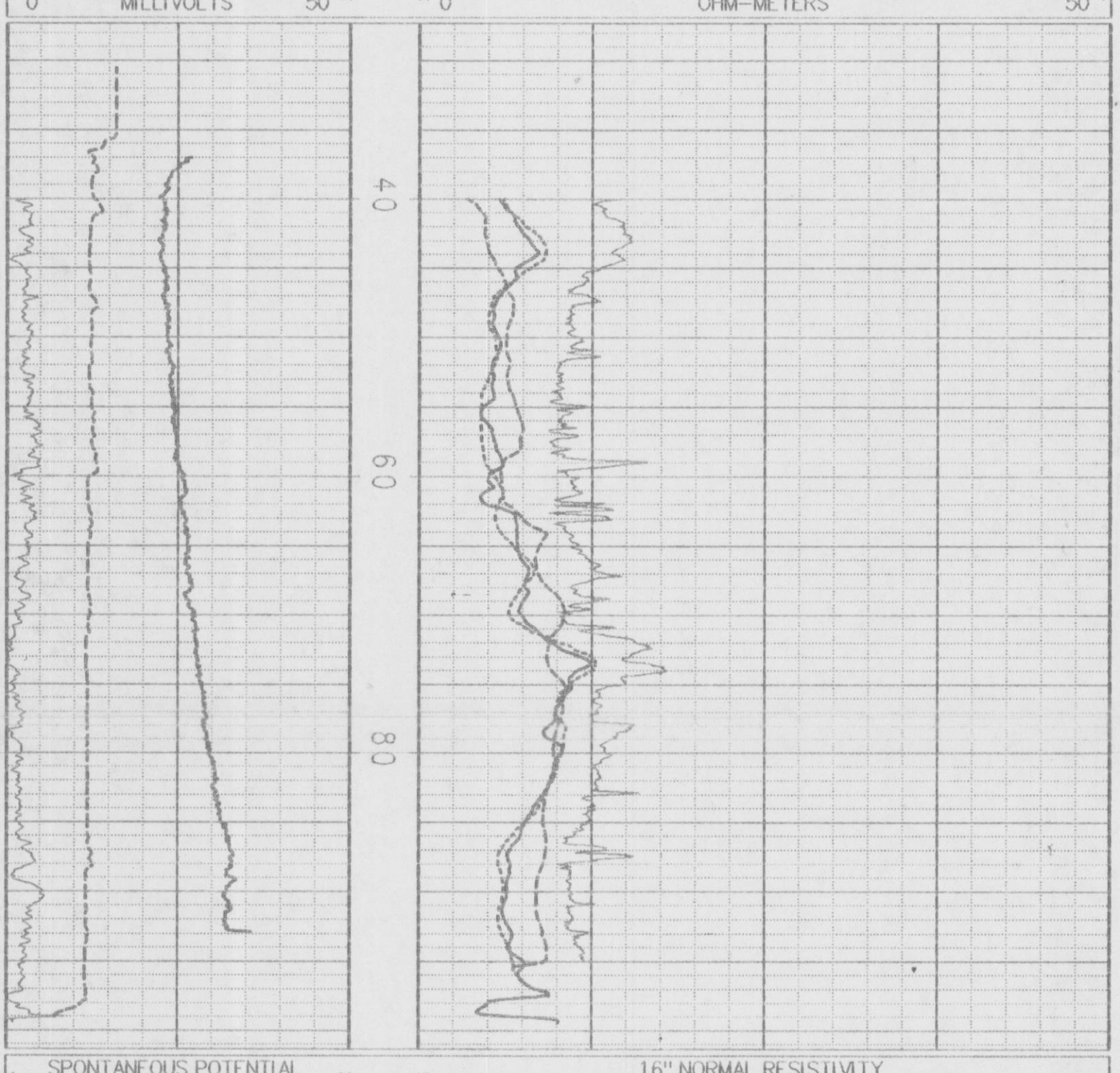
HOLE NEAR EAST END OF SEISMIC LINE.

ROCKY FLATS BACKGROUND WELL 43-89BR 25 APRIL 89



ROCKY FLATS BACKGROUND WELL 43-89BR 25 APRIL 89

ROCKY FLATS BACKGROUND WELL 43-89BR 25 APRIL 89 REP.SECT.



ROCKY FLATS BACKGROUND WELL 43-89BR 25 APRIL 89 REP.SECT.

COLOG INC

d.b.a. COLORADO WELL LOGGING

1019 8th ST. GOLDEN, COLORADO 80401

PHONE: (303) 279-0171 TELEX: 45-0286

SP, 16 & 64 RES.
GUARD, INDUCTION
WELL: 41-89BRA

PROJECT: ROCKY FLATS BACKGROUND — DATE: 9 MARCH 1989

CLIENT: ROY F. WESTON, INC. — COLOG ID NO:

LOCATION: ROCKY FLATS NORTHING: 32801.6222 EASTING: 26472.0108

STATE: COLORADO COUNTY: JEFFERSON ELEV: 5729.8 DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO

CUSTOMER TD: 51.5 FT. COLOG TD: 51 FEET

RUN	BIT RECORD			CASING RECORD		
NO.	Bit Size	From	To	Size/Wgt/Thk.	From	To
1	6 1/2"	SURF	TD	NONE		
2						
3						
4						

HOLE MEDIUM: WATER: SURFACE - TD — DRILL METHOD: AUGER

MUD TYPE: NATURAL — TIME SINCE CIRC: 1/4 HOUR

VISCOSITY: SAMPLE NOT WEIGHT: AVAILIBLE Rmt at Deg

GENERAL DATA

INSTRUMENTATION: EG&G MT. SOPRIS SERIES III — UNIT/TRUCK: 245 / 19

LOGGING ENGINEER: ROBERT CROWDER, THOMAS STAATZ

CLIENT REP: MR. KERRY Van ALLEN (WESTON),MR. IRONS, MR. DEIGNAN (EBASCO)

OTHER SERVICES: N-N G-G, G, SONIC, TEMP., F-R

LOGGING DATA

LOG FUNCTION	RUN NO.	EQUIPMENT MODEL	PROBE S.N.	UPHOLE S.N.	LOGGING DIG INT FEET	SPEED FT./MIN.	DETECTOR TYPE	SPACING Tx-Rx FEET	Rx-Rx FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	INT. FEET
S.P.	1	RLP	975	417	0.1	12						44'	SURF	44'
16" RES.	1	RLP	975	417	0.1	12						50'	SURF	50'
64" RES.	1	RLP	975	417	0.1	12						47'	SURF	47'
GUARD RES.	2	IPF	NSN	933	0.1	12						47'	SURF	47'
INDUCTION	7	EM-39	0550	0550	0.2	10						44'	SURF	44'

CALIBRATION FACTOR(S):

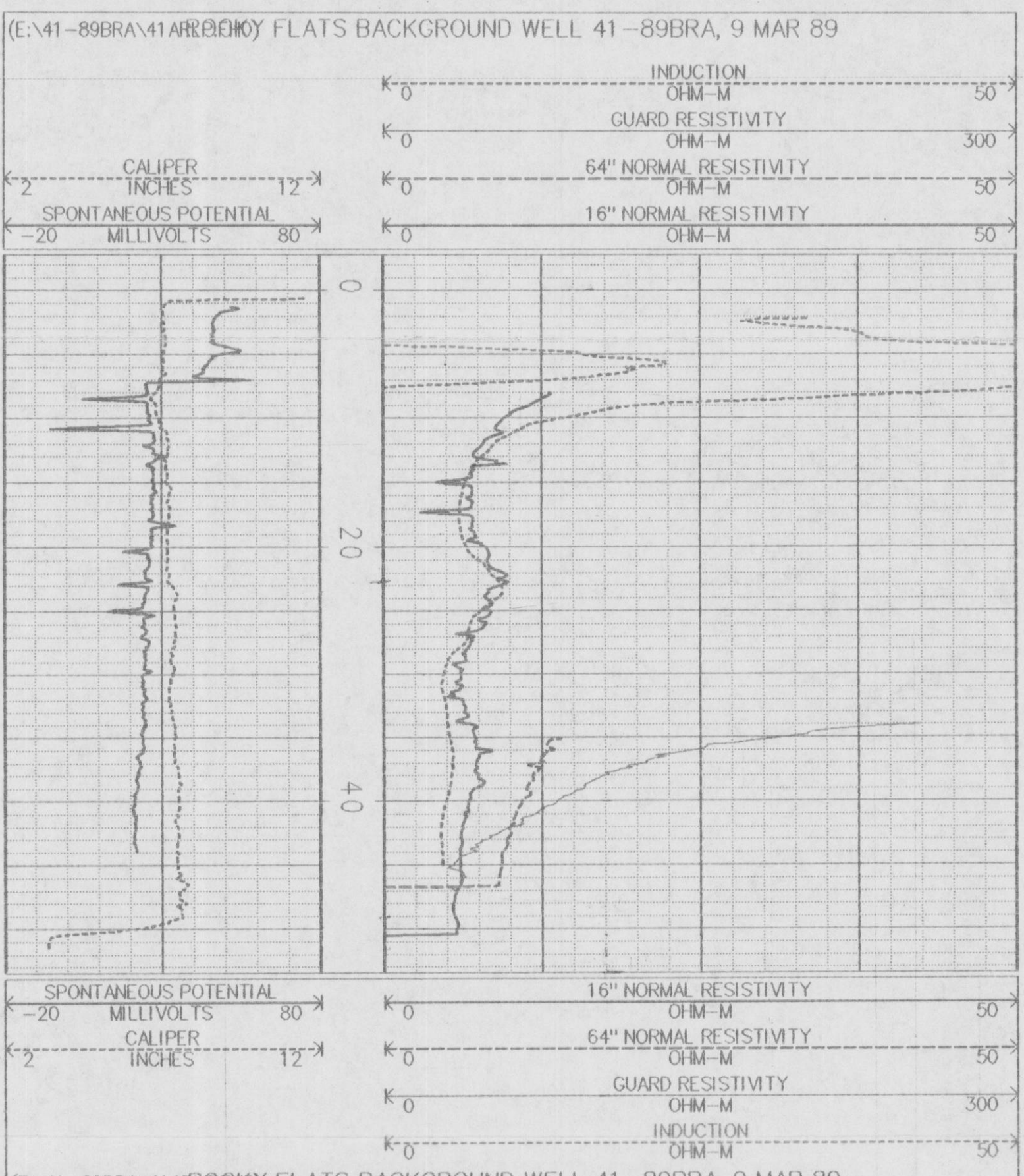
DIGITAL FILE NAME(S): 41ARLP.FH0, 41ARLP.FH1, 41ARLP.PLP, 41ARLPR.PLP, 41AELEC.HDP

REMARKS:

DRILLING COMPLETED 9 MAR 89.
AUGER PULLED 30 MINUTES PRIOR TO LOGGING ON 9 MAR 89.

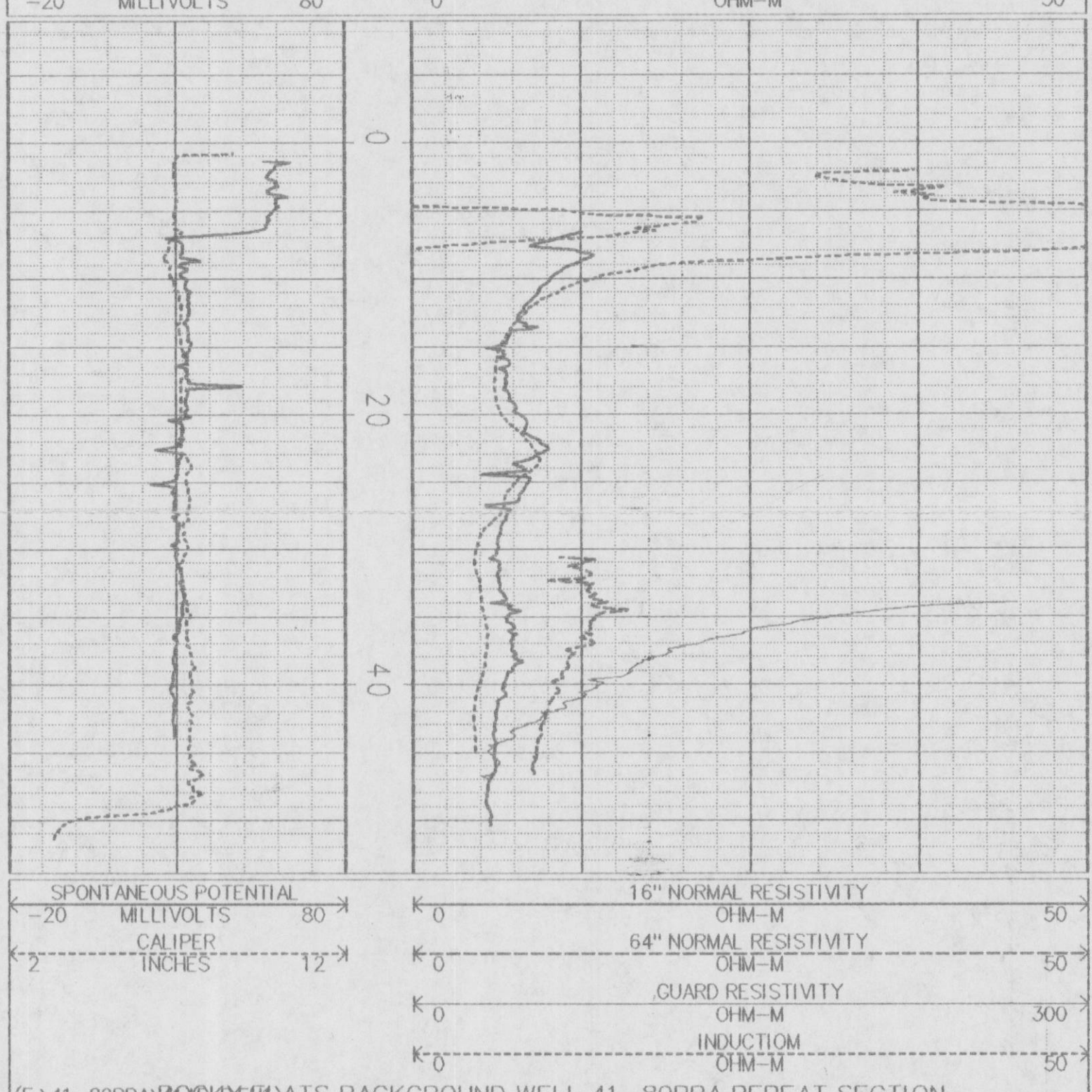
REPEAT SECTION RUN FROM 50 FEET TO SURFACE.

(E:\41-89BRA\41ARLP.FH0) ROCKY FLATS BACKGROUND WELL 41-89BRA, 9 MAR 89



(E:\41-89BRA\41ARLP.FH0) ROCKY FLATS BACKGROUND WELL 41-89BRA, 9 MAR 89

(E:\41-89BRA\41ARLP.FH1) ROCKY FLATS BACKGROUND WELL 41-89BRA REPEAT SECTION



(E:\41-89BRA\41ARLP.FH1) ROCKY FLATS BACKGROUND WELL 41-89BRA REPEAT SECTION

COLOG INC

d.b.a. COLORADO WELL LOGGING

1019 8th ST. GOLDEN, COLORADO 80401

PHONE: (303) 279-0171 TELEX: 45-0286

CALIPER, TEMP.
FLUID RESISTIVITY
WELL: 43-89BR

PROJECT: ROCKY FLATS BACKGROUND — DATE: 25 APRIL 1989

CLIENT: ROY F. WESTON — COLOG ID NO:

LOCATION: ROCKY FLATS NORTHING;33819.6221 EASTING;19347.7575

STATE: COLORADO COUNTY: JEFFERSON ELEV: 5965.6' DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING -- GOLDEN, COLORADO

CUSTOMER TD: 100 FEET COLOG TD: 99 FEET

RUN	BIT RECORD			CASING RECORD		
NO.	Bit Size	From	To	Size/Wgt/Thk.	From	To
1	4"	36.5 FEET	TD	5 1/4"	SURF	36.5 FEET
2						
3						
4						

HOLE MEDIUM: AIR: SURF -- 10.0' WATER: 10.0'-- TD — DRILL METHOD: CONVECTION CORE/ROT

MUD TYPE: Natural mud plus clear water — TIME SINCE CIRC: *

VISCOSITY: SAMPLE NOT WEIGHT: AVAILIBLE Rmf at Deg

GENERAL DATA

INSTRUMENTATION: EG&G MT. SOPRIS SERIES III — UNIT/TRUCK: 245 / 19

LOGGING ENGINEER: MR. ROBERT CROWDER, MR. JAMES LOCOCO

CLIENT REP: MR. ROY I. THUN -- WESTON, MR. TRAVIS CANON -- EBASCO

OTHER SERVICES: NEUTRON, GAMMA, ELECTRIC, G-GAMMA, EM, SONIC

LOGGING DATA

LOG FUNCTION	RUN NO.	EQUIPMENT MODEL	PROBE S.N.	UPHOLE S.N.	LOGGING DIG INT FEET	SPEED FT./MIN.	DETECTOR TYPE	SPACING Tx-Rx FEET	Rx-Rx FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	INT. FEET
CALIPER	5	HPF	NSN	933	0.1	12						99'	SURF.	99'
TEMPERATURE	1	MLP	917	506	0.1	12						SURF.	99'	99'
FLUID RES.	1	MLP	917	506	0.1	12						SURF.	99'	99'

CALIBRATION FACTOR(S):

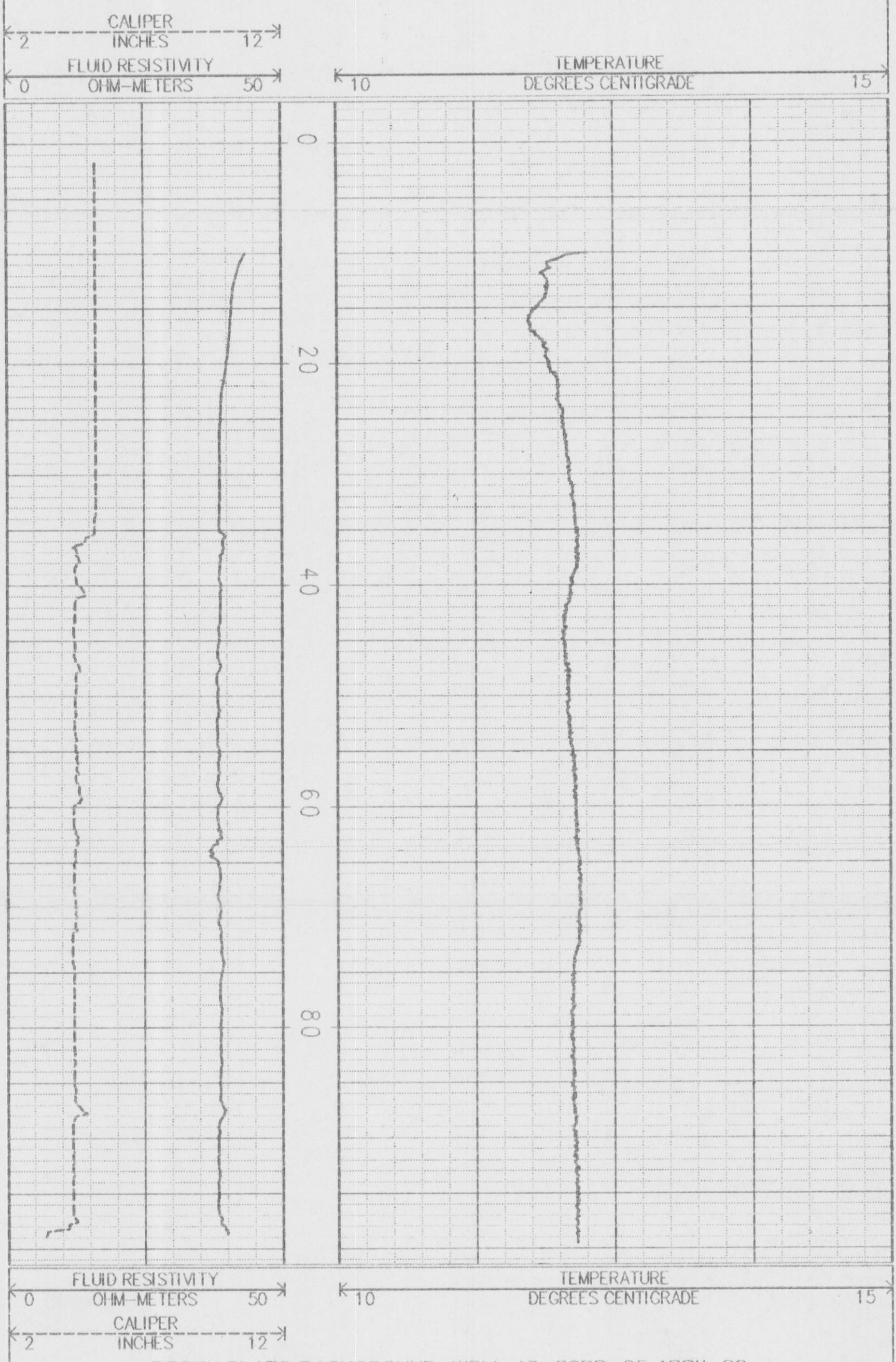
DIGITAL FILE NAME(S): 43MLP.FF0, 43MLP.PLP, 43MLP.HDP

REMARKS:

*DRILLING COMPLETED 24 APR 89. RODS PULLED 15 MINUTES PRIOR TO LOGGING ON 26 APR 89.

HOLE NEAR EAST END OF SEISMIC LINE.

ROCKY FLATS BACKGROUND WELL 43-89BR 25 APRIL 89



ROCKY FLATS BACKGROUND WELL 43-89BR 25 APRIL 89

COLOG INC

d.b.a. COLORADO WELL LOGGING

1019 8th ST. GOLDEN, COLORADO 80401

PHONE: (303) 279-0171 TELEX: 45-0286

CALIPER, TEMP.
FLUID RESISTIVITY
WELL: 41-89BR

PROJECT: ROCKY FLATS BACKGROUND — DATE: 19 APRIL 1989

CLIENT: ROY F. WESTON — COLOG ID NO:

LOCATION: ROCKY FLATS NORTHING;32799.2398 EASTING;26481.3343

STATE: COLORADO COUNTY: JEFFERSON ELEV: 5729.7 DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO

CUSTOMER TD: 109 FEET COLOG TD: 109 FEET

RUN	BIT RECORD			CASING RECORD		
NO.	Bit Size	From	To	Size/Wgt/Thk.	From	To
1	4 1/2"	40 FEET	TD	5 1/4"	SURF	50 FEET
2						
3						
4						

HOLE MEDIUM: AIR: SURF - 25.0' WATER: 25.0'- TD — DRILL METHOD: MUD ROTARY CORE

MUD TYPE: Natural mud plus clear water — TIME SINCE CIRC: *

VISCOSITY: SAMPLE NOT WEIGHT: AVAILIBLE Rmt at Deg

GENERAL DATA

INSTRUMENTATION: EG&G MT. SOPRIS SERIES III — UNIT/TRUCK: 245 / 19

LOGGING ENGINEER: MR. ROBERT CROWDER, MR. JAMES LOCOCO

CLIENT REP: MS. JANET MARKS - WESTON, MR. TIM DEIGNAN - EBASCO

OTHER SERVICES: NEUTRON, GAMMA, ELECTRIC, G-GAMMA, EM, SONIC

LOGGING DATA

LOG FUNCTION	RUN NO.	EQUIPMENT MODEL	PROBE S.N.	UPHOLE S.N.	LOGGING DIG INT FEET	SPEED FT./MIN.	DETECTOR TYPE	SPACING Tx-Rx FEET	Rx-Rx FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	INT. FEET
CALIPER	5	HPF	NSN	933	0.1	12						109'	SURF.	109'
TEMPERATURE	1	MLP	917	506	0.1	12						SURF.	108'	108'
FLUID RES.	1	MLP	917	506	0.1	12						SURF.	109'	109'

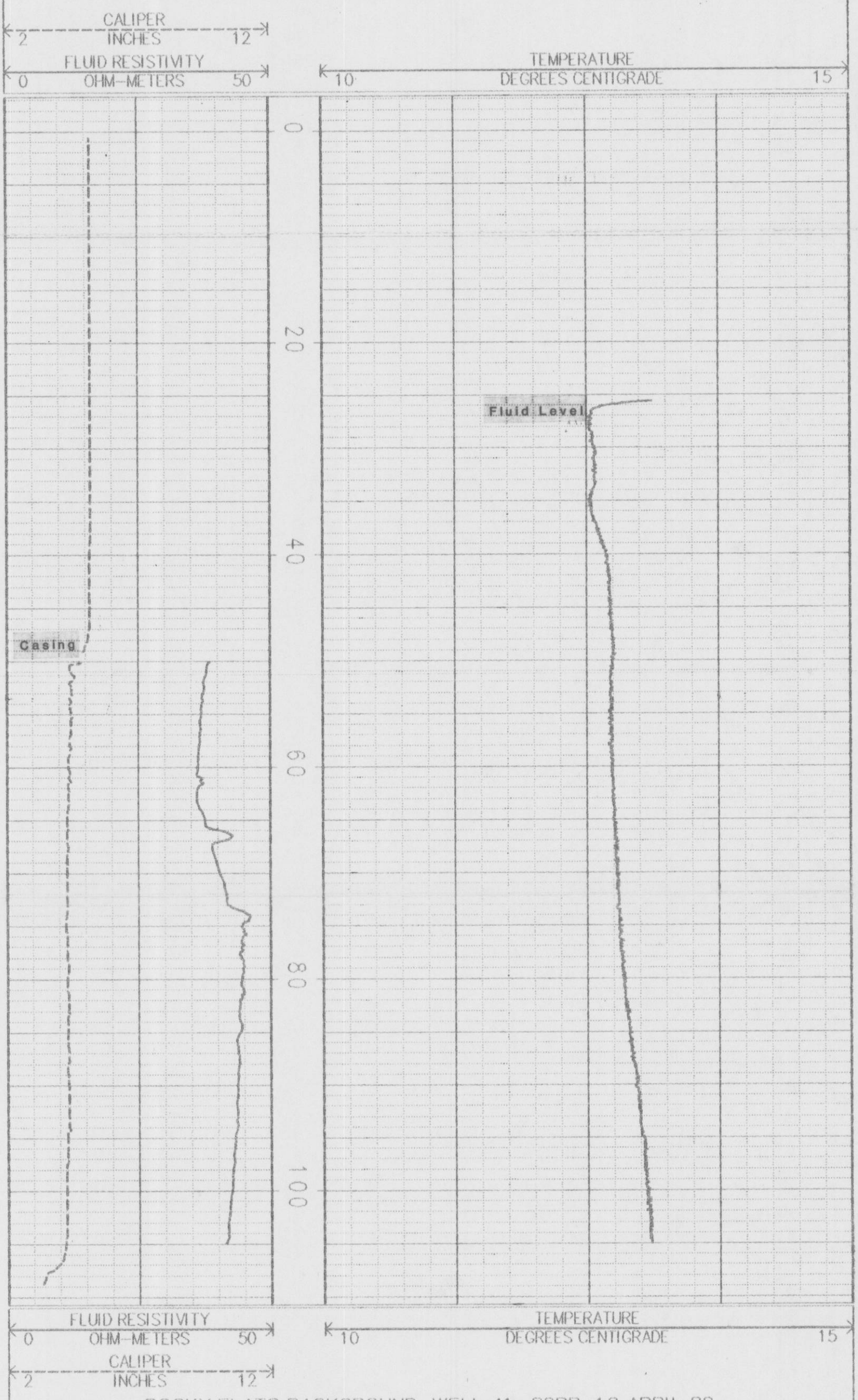
CALIBRATION FACTOR(S):

DIGITAL FILE NAME(S): 41MLP.FH0, 41MLP.PLP, 41MLP.HDP

REMARKS:

*DRILLING COMPLETED 18 APR 89. RODS PULLED 15 MINUTES PRIOR TO LOGGING ON 19 APR 89.

ROCKY FLATS BACKGROUND WELL 41-89BR 19 APRIL 89



ROCKY FLATS BACKGROUND WELL 41-89BR 19 APRIL 89

COLOG INC

d.b.a. COLORADO WELL LOGGING

1019 8th ST. GOLDEN, COLORADO 80401

PHONE: (303) 279-0171 TELEX: 45-0286

FLUID RESISTIVITY TEMP., CALIPER

WELL: 41-89BRA

PROJECT: ROCKY FLATS BACKGROUND

DATE: 9 MARCH 1989

CLIENT: ROY F. WESTON, INC.

COLOG ID NO:

LOCATION: ROCKY FLATS NORTHING: 32801.6222 EASTING: 26472.0108

STATE: COLORADO COUNTY: JEFFERSON ELEV: 5729.8 DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO

CUSTOMER TD: 51.5 FT. COLOG TD: 51 FEET

RUN	BIT RECORD			CASING RECORD		
NO.	Bit Size	From	To	Size/Wgt/Thk.	From	To
1	6 1/2"	SURF	TD	NONE		
2						
3						
4						

HOLE MEDIUM: WATER: SURFACE - TD

DRILL METHOD: AUGER

MUD TYPE: NONE

TIME SINCE CIRC: 1/4 HOUR

VISCOSITY: SAMPLE NOT WEIGHT: AVAILIBLE Rmt at Deg

GENERAL DATA

INSTRUMENTATION: EG&G MT. SOPRIS SERIES III

UNIT/TRUCK: 245 / 19

LOGGING ENGINEER: ROBERT CROWDER, THOMAS STAATZ

CLIENT REP: MR. KERRY Van ALLEN - WESTON, MR. IRONS, MR. DEIGNAN -EBASCO

OTHER SERVICES: N-N, G, G-G, SP, 16, 64, EM, SONIC

LOGGING DATA

LOG FUNCTION	RUN NO.	EQUIPMENT			LOGGING		DETECTOR	SPACING		SOURCE		LOGGED INTERVAL		
		MODEL	PROBE S.N.	UPHOLE S.N.	DIG INT FEET	SPEED FT./MIN.	TYPE	Tx-Rx FEET	Rx-Rx FEET	TYPE	SIZE CURIE	FROM	TO	INT. FEET
CALIPER	3	HPF	NSN	933	0.1	12						45'	SURF	45'
TEMPERATURE	5	MLP	917	506	0.1	12						SURF	48'	48'
FLUID RES.	5	MLP	917	506	0.1	12						SURF	48'	48'

CALIBRATION FACTOR(S):

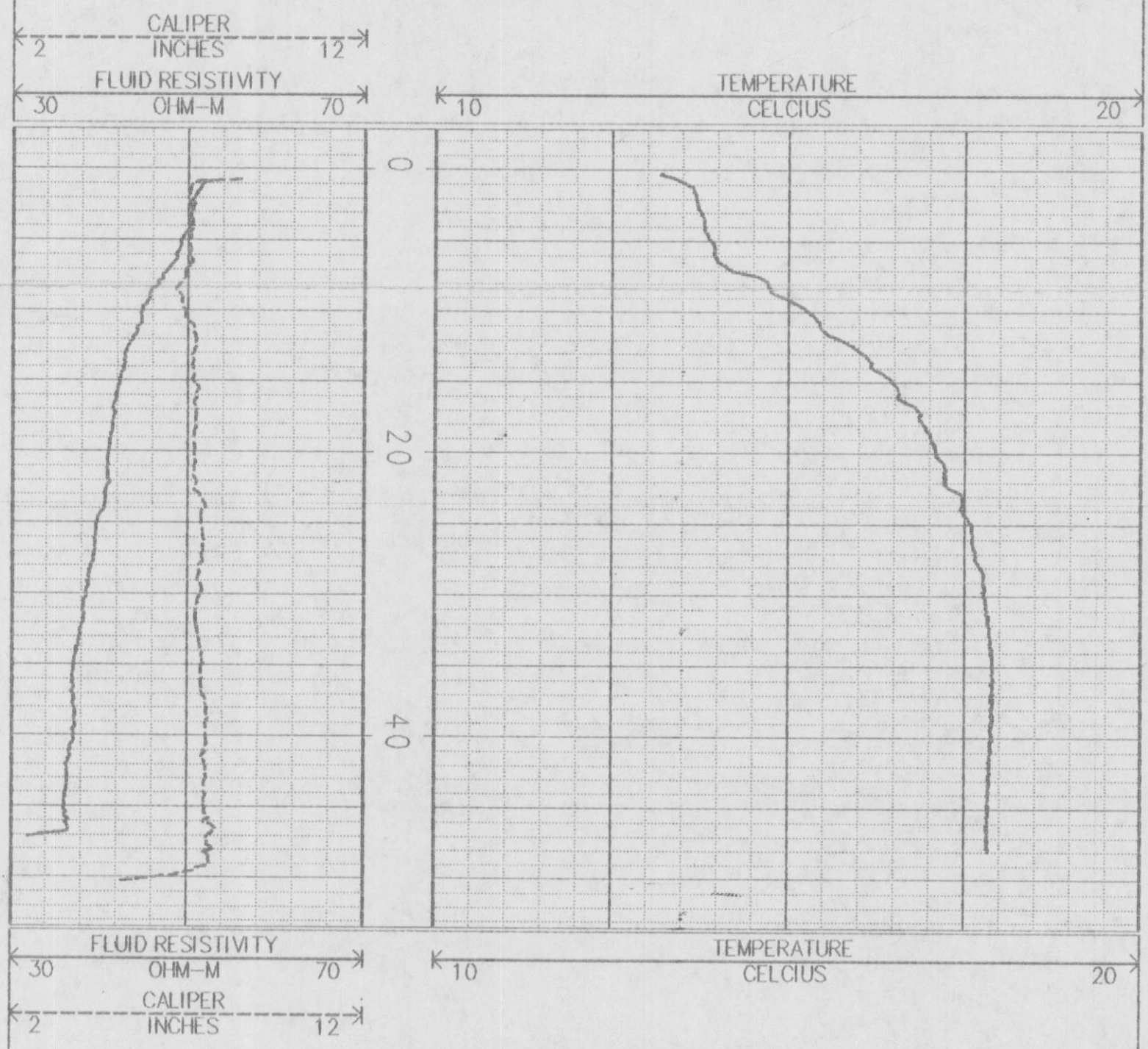
DIGITAL FILE NAME(S): 41AMLP.FHO, 41AMLP.PLP, 41AMLP.HDP

REMARKS:

DRILLING COMPLETED 9 MAR 89.

AUGER PULLED 30 MINUTES PRIOR TO LOGGING ON 9 MAR 89.

ROCKY FLATS BACKGROUND WELL 41-89BRA, 9 MAR 89



ROCKY FLATS BACKGROUND WELL 41-89BRA, 9 MAR 89

COLOG INC

d.b.a. COLORADO WELL LOGGING

1019 8th ST. GOLDEN, COLORADO 80401

PHONE: (303) 279-0171 TELEX: 45-0286

FLUID RESISTIVITY
TEMP., CALIPER
WELL: 36--89BR

PROJECT: ROCKY FLATS BACKGROUND — DATE: 23 MARCH 1989

CLIENT: ROY F. WESTON, INC. — COLOG ID NO:

LOCATION: ROCKY FLATS NORTHING: 42344.5594 EASTING: 25382.0725

STATE: COLORADO COUNTY: JEFFERSON ELEV: 5826.9 DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO

CUSTOMER TD: 107 FEET COLOG TD: 107 FEET

RUN	BIT RECORD			CASING RECORD		
NO.	Bit Size	From	To	Size/Wgt/Thk.	From	To
1	9"	50 FEET	TD	8"	SURF	50 FEET
2	4 1/2"	50 FEET	TD			
3						
4						

HOLE MEDIUM: AIR: SURF - 7' WATER: 7' - TD DRILL METHOD: MUD ROTARY CORE

MUD TYPE: NATURAL,CLEAR WATER TIME SINCE CIRC: 1 DAY +

VISCOSITY: SAMPLE NOT WEIGHT: AVAILIBLE Rm: at Deg

GENERAL DATA

INSTRUMENTATION: EG&G MT. SOPRIS SERIES III UNIT/TRUCK: 245 / 19

LOGGING ENGINEER: ROBERT CROWDER, THOMAS STAATZ

CLIENT REP: MR. KEN MILLER - WESTON, MR. LARRY IRONS - EBASCO

OTHER SERVICES: N-N, G, G-G, SP, IP, 16, 64, EM, SONIC

LOGGING DATA

LOG FUNCTION	RUN NO.	EQUIPMENT MODEL	PROBE S.N.	UPHOLE S.N.	LOGGING DIG INT FEET	SPEED FT./MIN	DETECTOR TYPE	SPACING Tx-Rx FEET	Rx-Rx FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	INT. FEET
CALIPER	5	HPF	NSN	933	0.1	12						107'	SURF	107'
TEMPERATURE	1	MLP	917	506	0.1	12						SURF	107'	107'
FLUID RES.	1	MLP	917	506	0.1	12						SURF	107'	107'

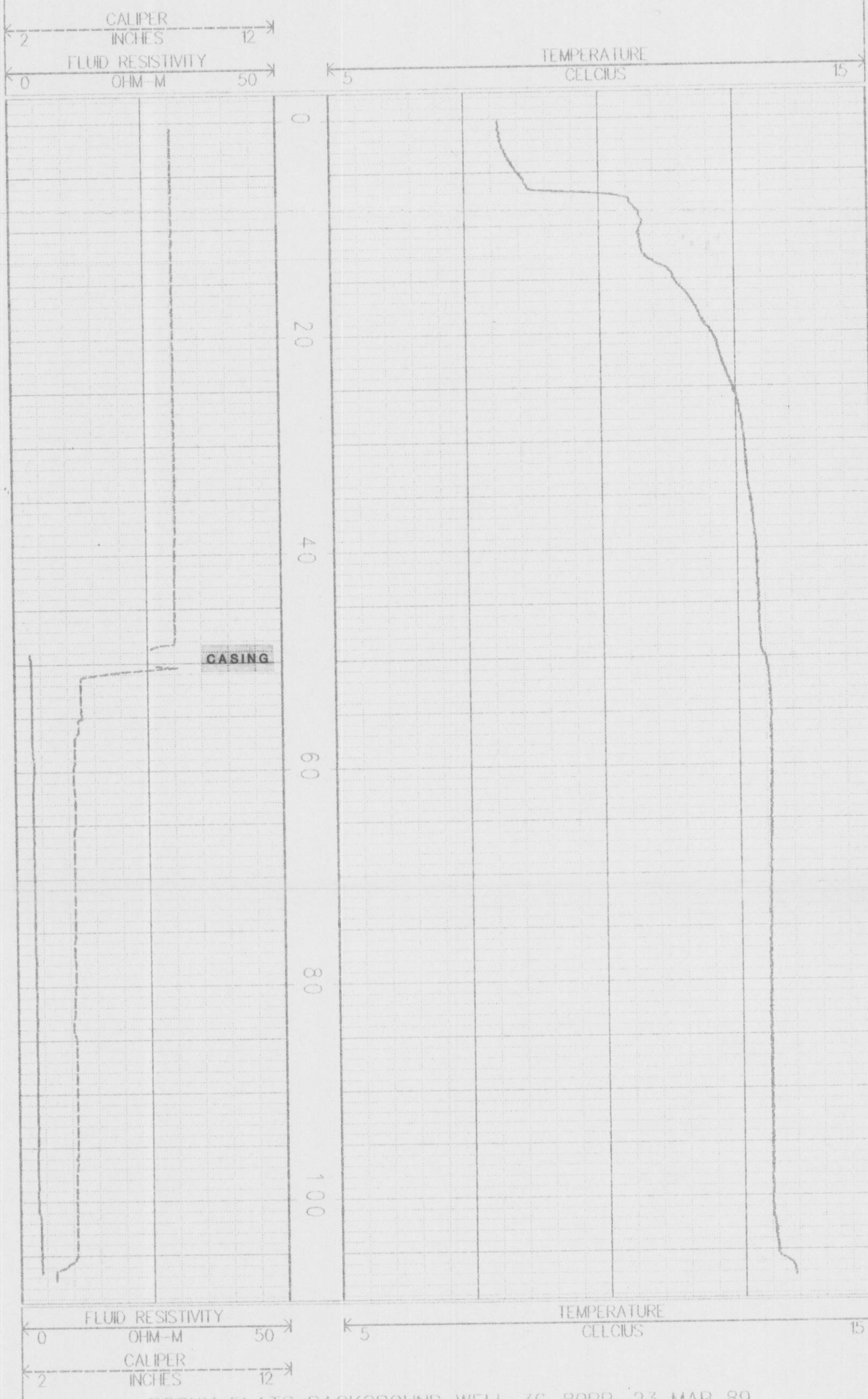
CALIBRATION FACTOR(S):

DIGITAL FILE NAME(S): 36MLP.FGO, 36MLP.PLP, 36MLP.HDP

REMARKS:

* DRILLING COMPLETED 22 MAR 89.
RODS PULLED 30 MINUTES PRIOR TO LOGGING ON 23 MAR 89.

ROCKY FLATS BACKGROUND WELL 36-89BR, 23 MAR 89



ROCKY FLATS BACKGROUND WELL 36-89BR, 23 MAR 89

COLOG INC

d.b.a. COLORADO WELL LOGGING

1019 8th ST. GOLDEN, COLORADO 80401

PHONE: (303) 279-0171 TELEX: 45-0286

POROSITY LOGS

WELL: 41-89BRA

PROJECT: ROCKY FLATS BACKGROUND

DATE: 9 MARCH 1989

CLIENT: ROY F. WESTON, INC.

COLOG ID NO:

LOCATION: ROCKY FLATS NORTHING: 32801.6222 EASTING: 26472.0108

STATE: COLORADO COUNTY: JEFFERSON ELEV: 5729.8 DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO

CUSTOMER TD: 51.5 FT. COLOG TD: 50 FEET

RUN	BIT RECORD			CASING RECORD		
NO.	Bit Size	From	To	Size/Wgt/Thk.	From	To
1	6 1/4"	SURFACE	TD	NONE		
2						
3						
4						

HOLE MEDIUM: WATER: SURFACE - TD

DRILL METHOD: AUGER

MUD TYPE: NONE

TIME SINCE CIRC: 1/4 HOUR

VISCOSITY: SAMPLE NOT WEIGHT: AVAILIBLE Rm at Deg

GENERAL DATA

INSTRUMENTATION: EG&G MT. SOPRIS SERIES III

UNIT/TRUCK: 245 / 19

LOGGING ENGINEER: ROBERT CROWDER, THOMAS STAATZ

CLIENT REP: MR. KERRY Van ALLEN - WESTON, MR. IRONS, MR. DEIGNAN -EBASCO

OTHER SERVICES: TEMP., EM, SP, 16, 64, GUARD, F-R

LOGGING DATA

LOG FUNCTION	RUN NO.	EQUIPMENT MODEL	PROBE S.N.	UPHOLE S.N.	LOGGING DIG INT FEET	SPEED FT./MIN.	DETECTOR TYPE	SPACING Tx-Rx FEET	Rx-Rx FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	INT. FEET
GAMMA	2	BPF	NSN	933	0.1	12	NaI					43'	SURF	43'
CALIPER	3	HPF	NSN	933	0.1	12						51'	SURF	51'
SONIC	6	CLPL	1275	771	0.1	6	CERAMIC	3 FT	1 FT			42'	SURF	42'
NEUTRON	2	OPF	1735	933	0.1	12	He3			Am241	3 Ci.	50'	SURF	50'
GAMMA GAMMA	3	HPF	NSN	933	0.1	12	NaI	20 Cm	35 Cm	CS137	.1 Ci	51'	SURF	51'

CALIBRATION FACTOR(S):

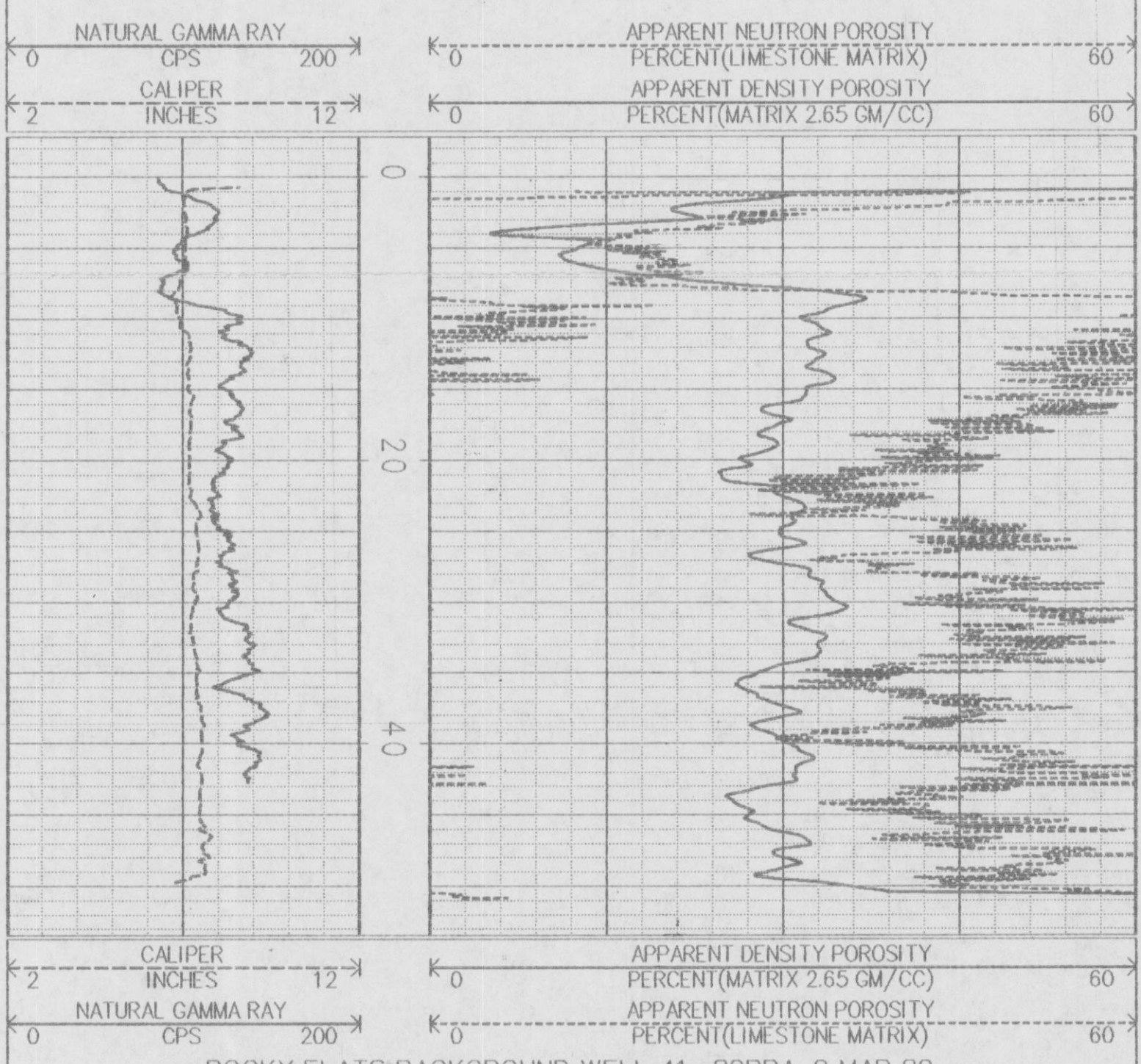
DIGITAL FILE NAME(S): 41APOR.PTN, 41APRR.PTN, 41APOR.PLP, 41APRR.PLP, 41APOR.HDP

REMARKS:

DRILLING COMPLETED 9 MAR 89.
RODS PULLED 30 MINUTES PRIOR TO LOGGING ON 9 MAR 89.

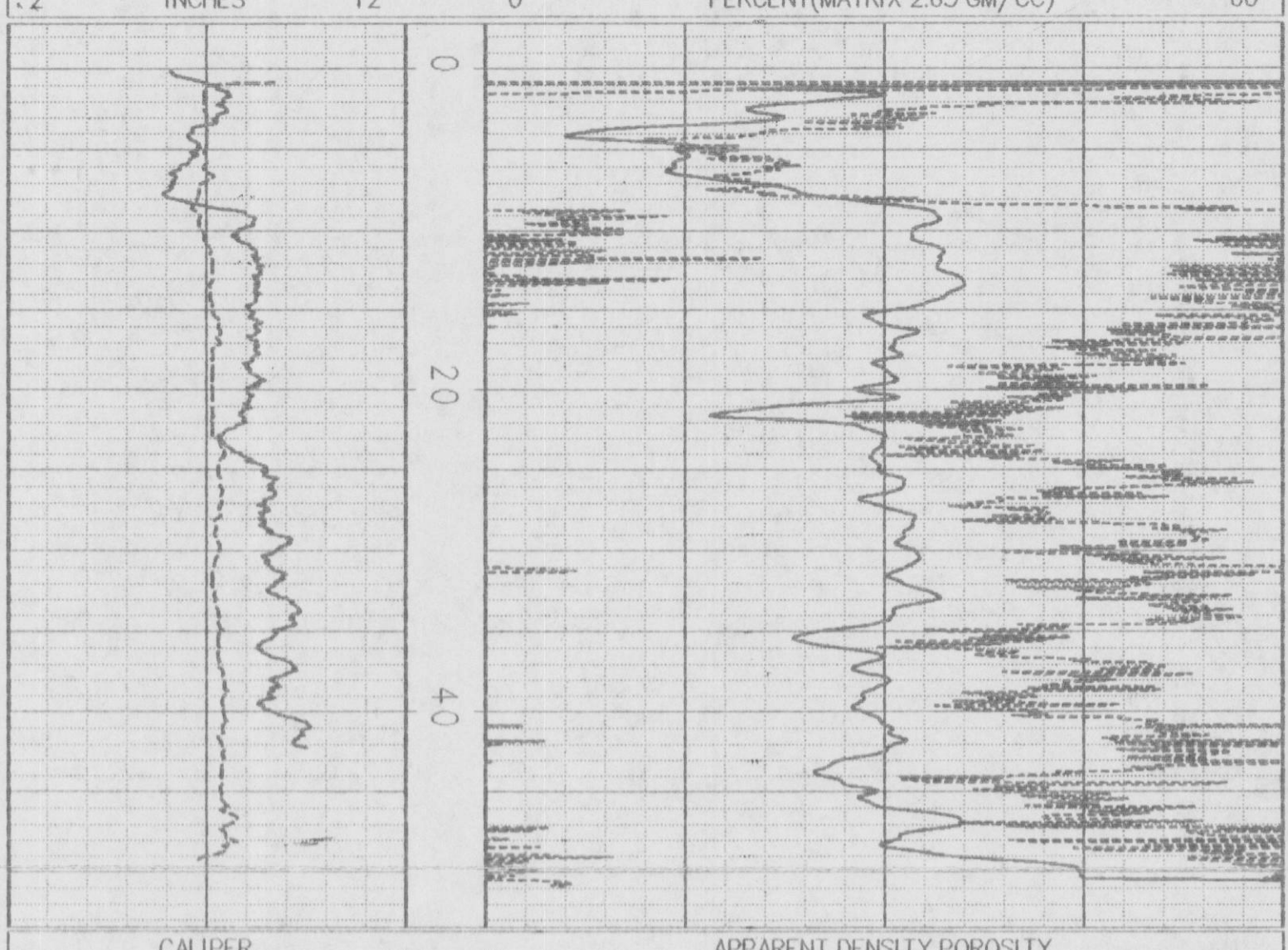
REPEAT SECTION RUN FROM 50 FEET TO SURFACE.

ROCKY FLATS BACKGROUND WELL 41-89BRA, 9 MAR 89



ROCKY FLATS BACKGROUND WELL 41-89BRA, 9 MAR 89

ROCKY FLATS BACKGROUND WELL 41-89BRA REPEAT SECTION



ROCKY FLATS BACKGROUND WELL 41-89BRA REPEAT SECTION

COLOG INC

d.b.a. COLORADO WELL LOGGING

1019 8th ST. GOLDEN, COLORADO 80401

PHONE: (303) 279-0171 TELEX: 45-0286

POROSITY LOGS

WELL: 43-89BR

PROJECT: ROCKY FLATS BACKGROUND — DATE: 25 APRIL 1989

CLIENT: ROY F. WESTON — COLOG ID NO:

LOCATION: ROCKY FLATS NORTHING;33819.6221 EASTING;19347.7575

STATE: COLORADO COUNTY: JEFFERSON ELEV: 5965.6' DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO

CUSTOMER TD: 109 FEET COLOG TD: 109 FEET

RUN	BIT RECORD			CASING RECORD		
NO.	Bit Size	From	To	Size/Wgt/Thk.	From	To
1	4"	36.5 FEET	TD	5 1/4"	SURF	36.5 FEET
2						
3						
4						

HOLE MEDIUM: AIR: SURF - 10.0' WATER: 10.0' - TD — DRILL METHOD: MUD ROTARY CORE

MUD TYPE: Natural mud plus clear water — TIME SINCE CIRC: *

VISCOSITY: SAMPLE NOT WEIGHT: AVAILIBLE Rm: at Deg

GENERAL DATA

INSTRUMENTATION: EG&G MT. SOPRIS SERIES III — UNIT/TRUCK: 245 / 19

LOGGING ENGINEER: MR. ROBERT CROWDER, MR. JAMES LOCOCO — 2

CLIENT REP: MR. ROY I. THUN - WESTON, MR. TRAVIS CANON - EBASCO

OTHER SERVICES: ELECTRICS, TEMP., EM

LOGGING DATA

LOG FUNCTION	RUN NO.	EQUIPMENT MODEL	PROBE S.N.	UPHOLE S.N.	LOGGING DIG INT FEET	SPEED FT./MIN.	DETECTOR TYPE	SPACING Tx-Rx FEET	Rx-Rx FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	INT. FEET
GAMMA	4	BPF	NSN	933	0.1	12	NaI					94'	SURF	94'
CALIPER	5	HPF	NSN	933	0.1	12						99'	SURF	99'
SONIC	3	CLPL	1275	771	0.1	6	CERAMIC	3 FT	1 FT			95'	5'	90'
NEUTRON	4	OPF	1735	933	0.1	12	He3			Am241	3 Ci.	99'	SURF.	99'
GAMMA GAMMA	5	HPF	NSN	933	0.1	12	NaI	20 Cm	35 Cm	CS137	.1 Ci	99'	SURF.	99'

CALIBRATION FACTOR(S):

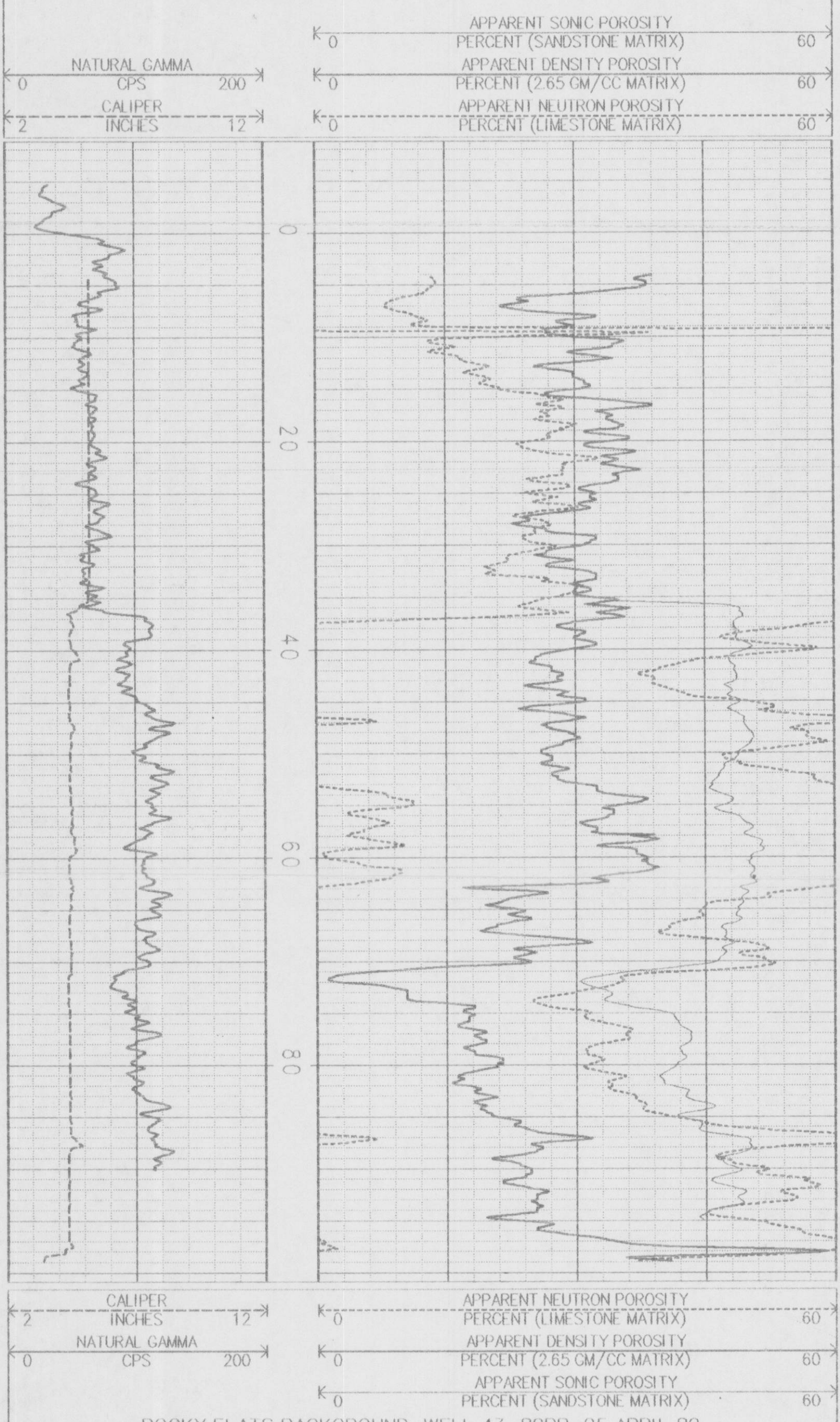
DIGITAL FILE NAME(S): 43POR.PSN, 43POR.HDP, 43POR.PLP

REMARKS:

*DRILLING COMPLETED 24 APR 89. RODS PULLED 30 MINUTES PRIOR TO LOGGING ON 25 APR 89.

HOLE NEAR EAST END OF SEISMIC LINE

ROCKY FLATS BACKGROUND WELL 43-89BR 25 APRIL 89



ROCKY FLATS BACKGROUND WELL 43-89BR 25 APRIL 89

COLOG INC

d.b.a. COLORADO WELL LOGGING

1019 8th ST. GOLDEN, COLORADO 80401

PHONE: (303) 279-0171 TELEX: 45-0286

POROSITY LOGS

WELL: 43-89BR

PROJECT: ROCKY FLATS BACKGROUND — DATE: 25 APRIL 1989

CLIENT: ROY F. WESTON — COLOG ID NO:

LOCATION: ROCKY FLATS NORTHING;33819.6221 EASTING;19347.7575

STATE: COLORADO COUNTY: JEFFERSON ELEV: 5965.6' DEPTH REF: GROUND

BOREHOLE DATA

DRILLING CONTRACTOR: BOYLES BROTHERS DRILLING - GOLDEN, COLORADO

CUSTOMER TD: 109 FEET COLOG TD: 109 FEET

RUN	BIT RECORD			CASING RECORD		
NO.	Bit Size	From	To	Size/Wgt/Thk.	From	To
1	4"	36.5 FEET	TD	5 1/4"	SURF	36.5 FEET
2						
3						
4						

HOLE MEDIUM: AIR: SURF - 10.0' WATER: 10.0' - TD — DRILL METHOD: MUD ROTARY CORE

MUD TYPE: Natural mud plus clear water — TIME SINCE CIRC: *

VISCOSITY: SAMPLE NOT WEIGHT: AVAILIBLE Rm: at Deg

GENERAL DATA

INSTRUMENTATION: EG&G MT. SOPRIS SERIES III — UNIT/TRUCK: 245 / 19

LOGGING ENGINEER: MR. ROBERT CROWDER, MR. JAMES LOCOCO — 2

CLIENT REP: MR. ROY I. THUN - WESTON, MR. TRAVIS CANON - EBASCO

OTHER SERVICES: ELECTRICS, TEMP., EM

LOGGING DATA

LOG FUNCTION	RUN NO.	EQUIPMENT MODEL	PROBE S.N.	UPHOLE S.N.	LOGGING DIG INT FEET	SPEED FT./MIN.	DETECTOR TYPE	SPACING Tx-Rx FEET	Rx-Rx FEET	SOURCE TYPE	SIZE CURIE	LOGGED INTERVAL FROM	TO	INT. FEET
GAMMA	4	BPF	NSN	933	0.1	12	NaI					94'	SURF	94'
CALIPER	5	HPF	NSN	933	0.1	12						99'	SURF	99'
SONIC	3	CLPL	1275	771	0.1	6	CERAMIC	3 FT	1 FT			95'	5'	90'
NEUTRON	4	OPF	1735	933	0.1	12	He3			Am241	3 Ci.	99'	SURF.	99'
GAMMA GAMMA	5	HPF	NSN	933	0.1	12	NaI	20 Cm	35 Cm	CS137	.1 Ci	99'	SURF.	99'

CALIBRATION FACTOR(S):

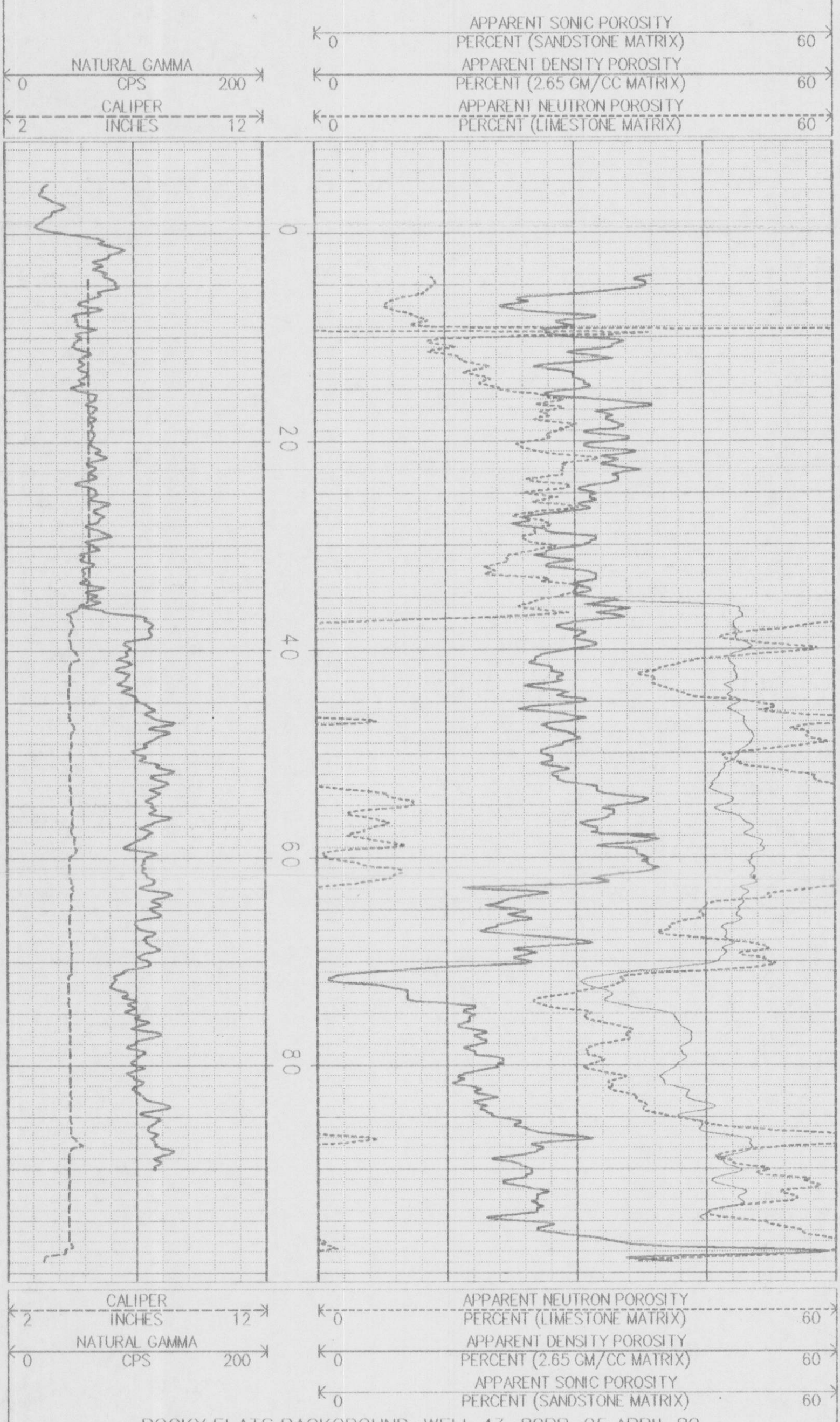
DIGITAL FILE NAME(S): 43POR.PSN, 43POR.HDP, 43POR.PLP

REMARKS:

*DRILLING COMPLETED 24 APR 89. RODS PULLED 30 MINUTES PRIOR TO LOGGING ON 25 APR 89.

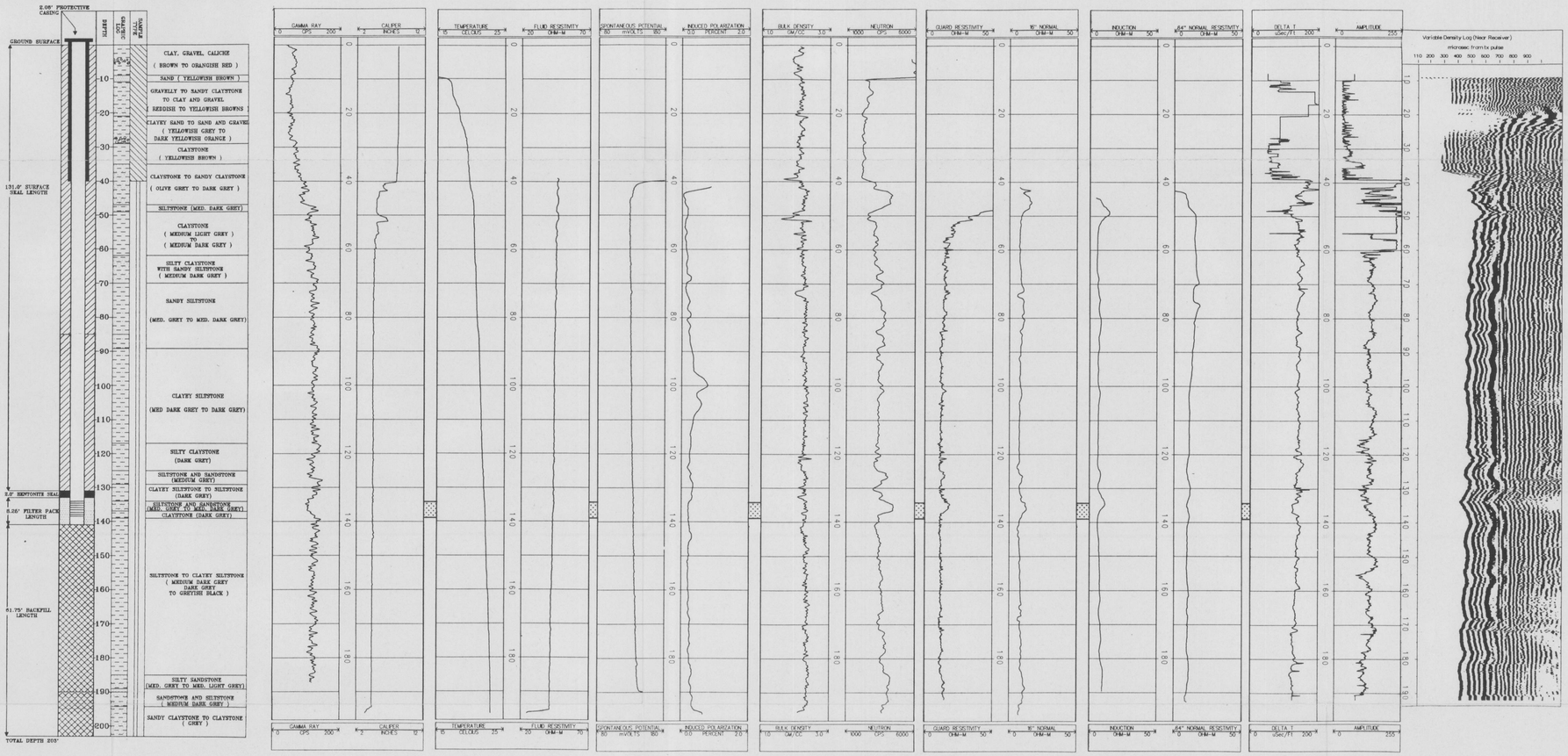
HOLE NEAR EAST END OF SEISMIC LINE

ROCKY FLATS BACKGROUND WELL 43-89BR 25 APRIL 89



ROCKY FLATS BACKGROUND WELL 43-89BR 25 APRIL 89

WELL NUMBER 32-89BR



SAMPLE METHODS

Continuous Drive Sampling

Rotary Core Sampling

NOTE

Screened Interval

WELL NO. 32-89BR

ROCKWELL INTERNATIONAL
ROCKY FLATS PLANT - GOLDEN, COLORADO

PLATE E-1

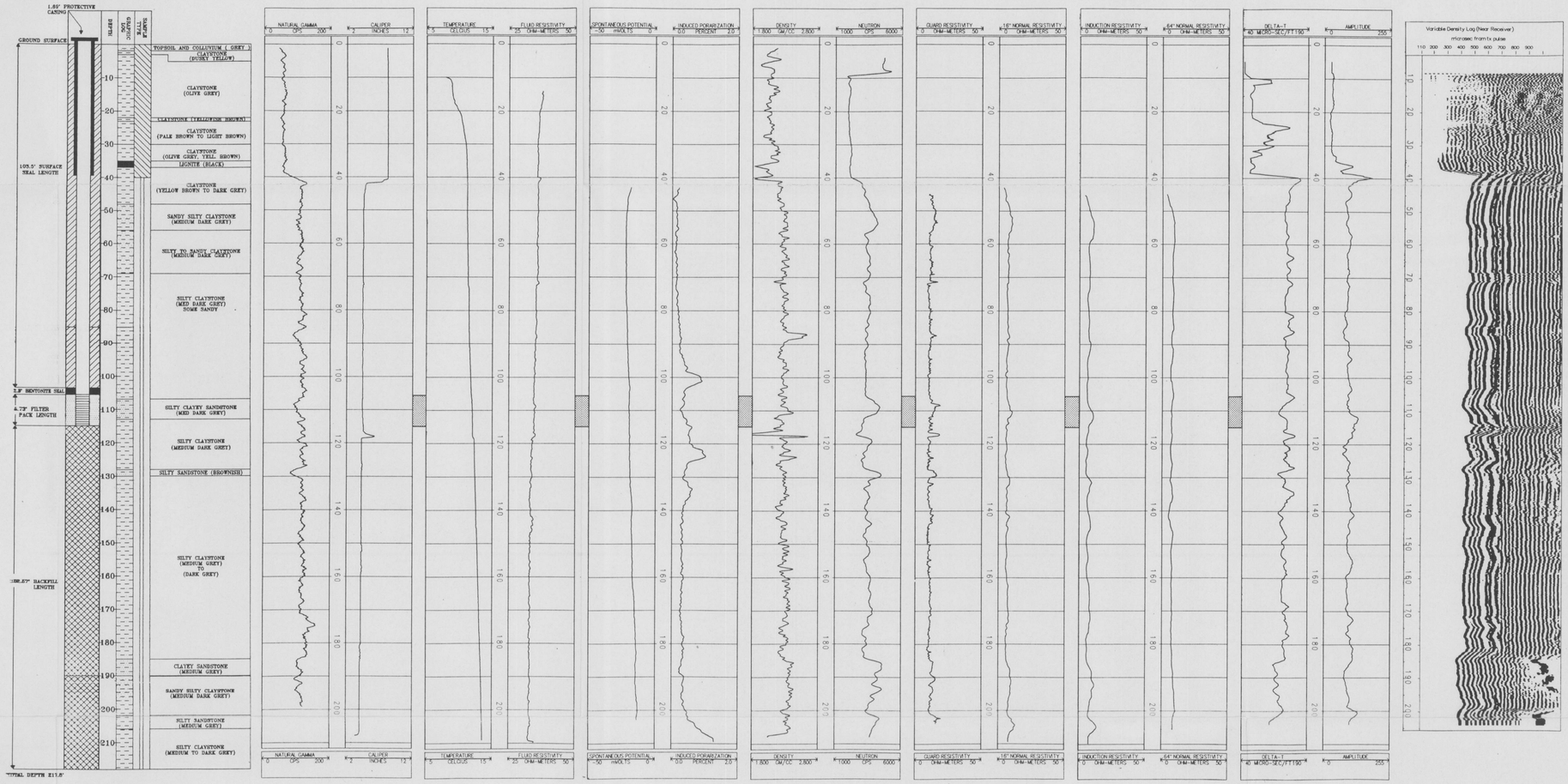
ENGINEERS: Roy F. Weston

Lakewood, Colorado

GROUND ELEV. - 5946.2'	DATE DRILLED
CASING ELEV. - 5948.28'	MARCH 3, 1989

COLOG INC.
Golden, Colorado

WELL NUMBER 35-89BR



SAMPLE METHODS

Continuous Drive Sampling

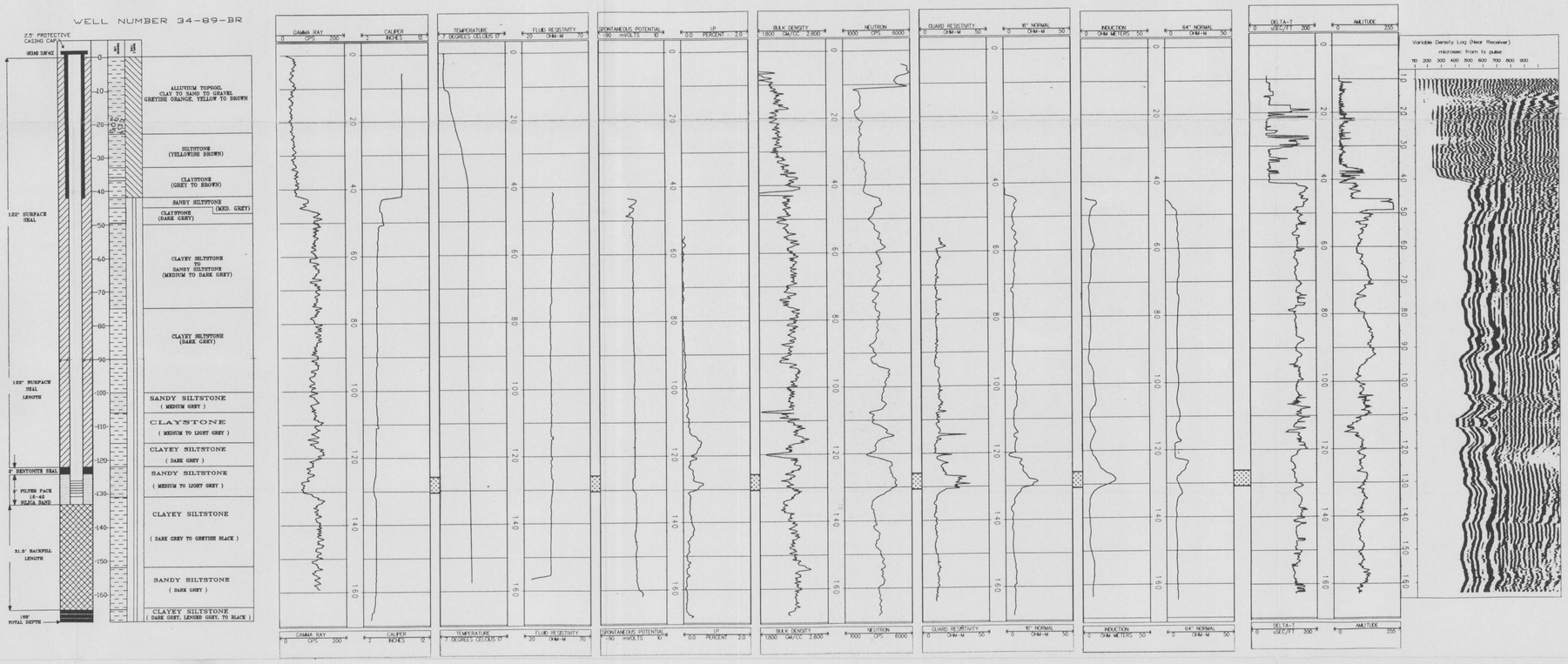
Rotary Core Sampling

NOTE

Screened Interval

WELL NO. 35-89BR	
ROCKWELL INTERNATIONAL ROCKY FLATS PLANT - GOLDEN, COLORADO PLATE E-4 ENGINEERS: Roy F. Weston Lakewood, Colorado	
GROUND ELEV. - 5877.6'	DATE DRILLED
CASING ELEV. - 5879.29'	APRIL 4, 1989
COLOG INC. Golden, Colorado	

WELL NUMBER 34-89-BR



SAMPLE METHODS

Continuous Drive Sampling

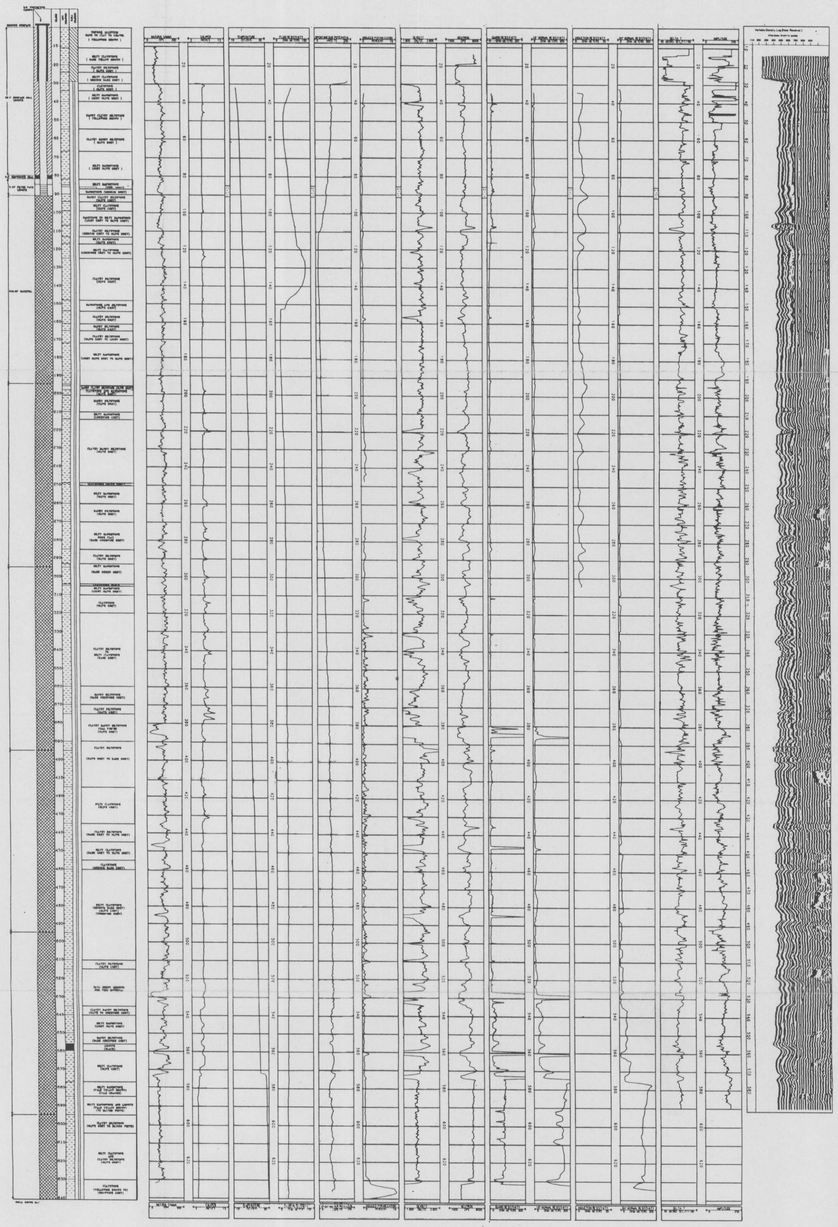
Rotary Core Sampling

NOTE

Screened Interval

WELL NO. 34-89BR	
ROCKWELL INTERNATIONAL ROCKY FLATS PLANT - GOLDEN, COLORADO PLATE E-3 ENGINEERS: Roy F. Weston Lakewood, Colorado	
GROUND ELEV. - 5920.9'	DATE DRILLED
CASING ELEV. - 5922.78'	MARCH 13, 1989
COLOG INC. Golden, Colorado	

WELL NUMBER 37-89BR



SAMPLE METHODS

Continuous Drive Sampling

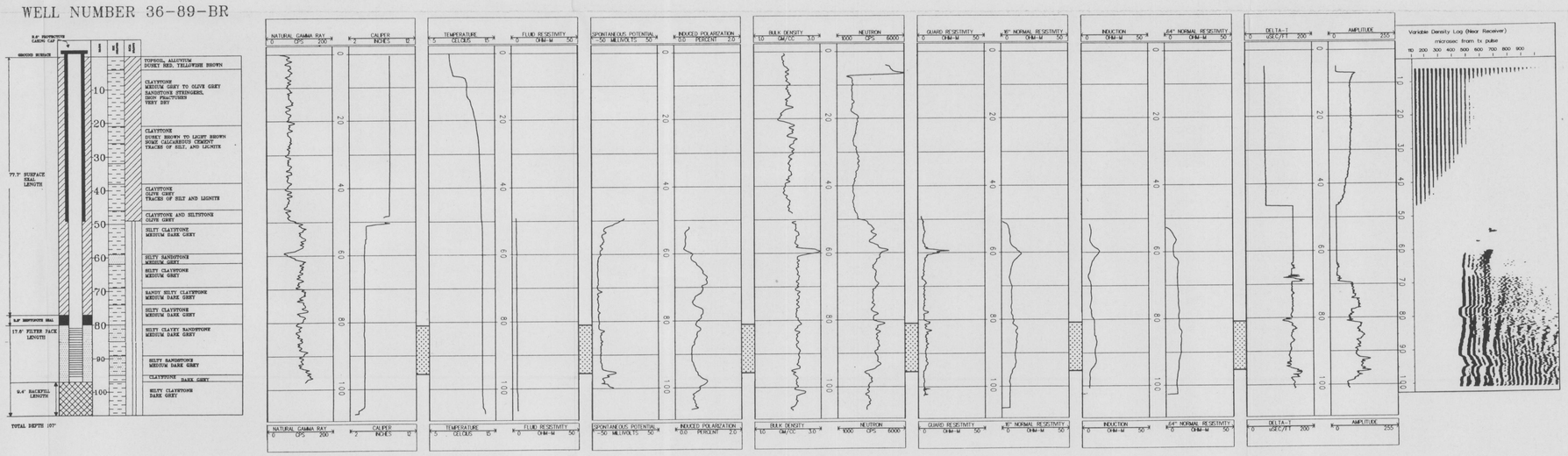
Rotary Core Sampling

NOTE

Screened Interval

WELL NO. 37-89BR	
ROCKWELL INTERNATIONAL ROCKY FLATS PLANT - GOLDEN, COLORADO PLATE E-6 ENGINEERS: Roy F. Weston Lakewood, Colorado	
GROUND ELEV. - 5832.3'	DATE DRILLED
CASING ELEV. - 5834.20'	MAY 12, 1989
COLOG INC. Golden, Colorado	

WELL NUMBER 36-89-BR



SAMPLE METHODS

Continuous Drive Sampling

Rotary Core Sampling

NOTE

Screened Interval

WELL NO. 36-89BR

ROCKWELL INTERNATIONAL
ROCKY FLATS PLANT - GOLDEN, COLORADO

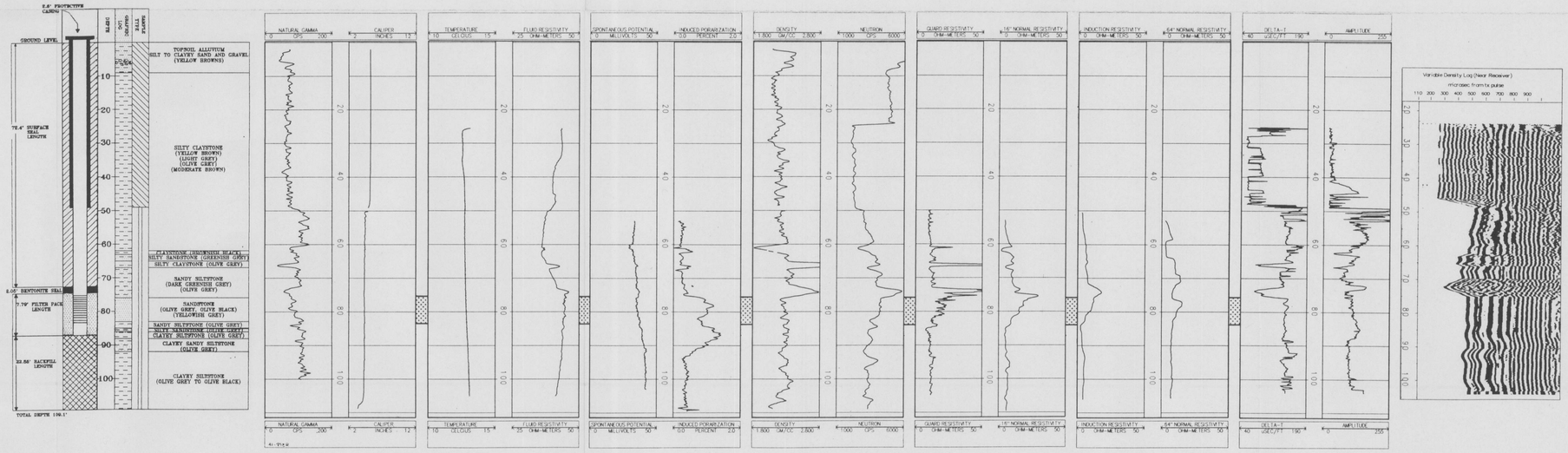
PLATE E-5

ENGINEERS: Roy F. Weston
Lakewood, Colorado

GROUND ELEV. - 5826.9'	DATE DRILLED
CASING ELEV. - 5828.86'	MARCH 23, 1989

COLOG INC.
Golden, Colorado

WELL NUMBER 41-89BR



SAMPLE METHODS

Continuous Drive Sampling

Rotary Core Sampling

NOTE

Screened Interval

WELL NO. 41-89BR

ROCKWELL INTERNATIONAL
ROCKY FLATS PLANT - GOLDEN, COLORADO

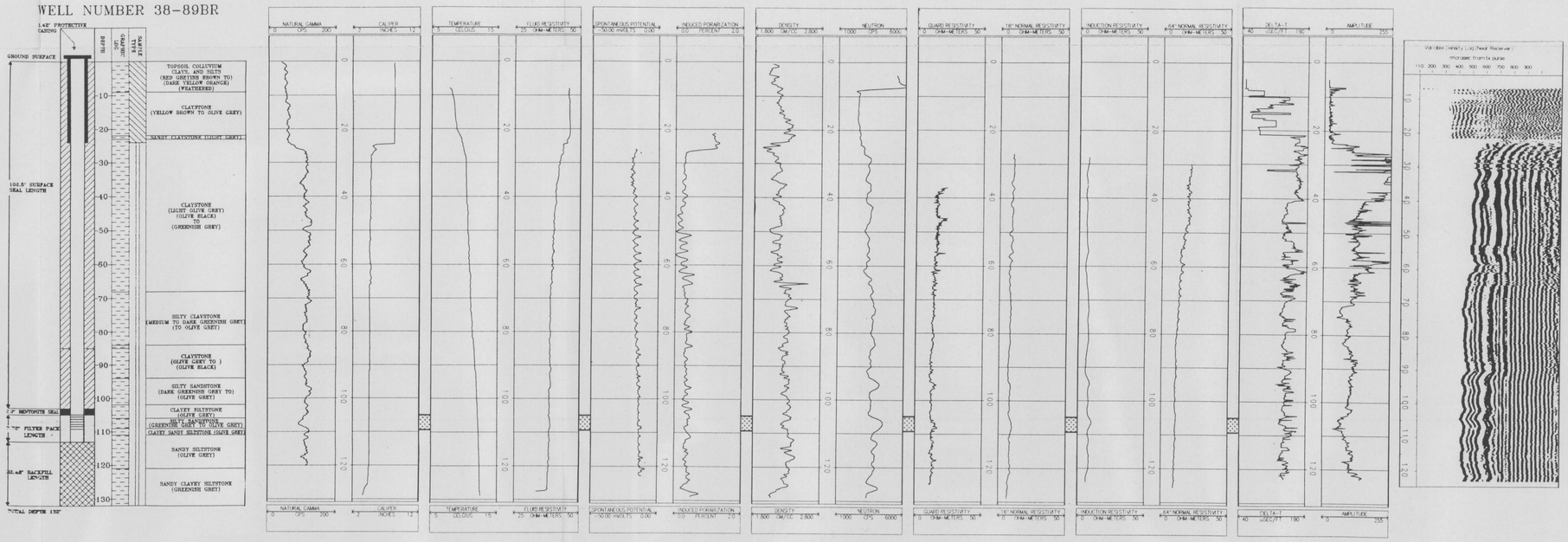
PLATE E-8

ENGINEERS: Roy F. Weston
Lakewood, Colorado

GROUND ELEV. - 5729.7'	DATE DRILLED
CASING ELEV. - 5731.82'	APRIL 19, 1989

COLOG INC.
Golden, Colorado

WELL NUMBER 38-89BR



SAMPLE METHODS

Continuous Drive Sampling

Rotary Core Sampling

NOTE

Screened Interval

WELL NO. 38-89BR

ROCKWELL INTERNATIONAL
ROCKY FLATS PLANT - GOLDEN, COLORADO

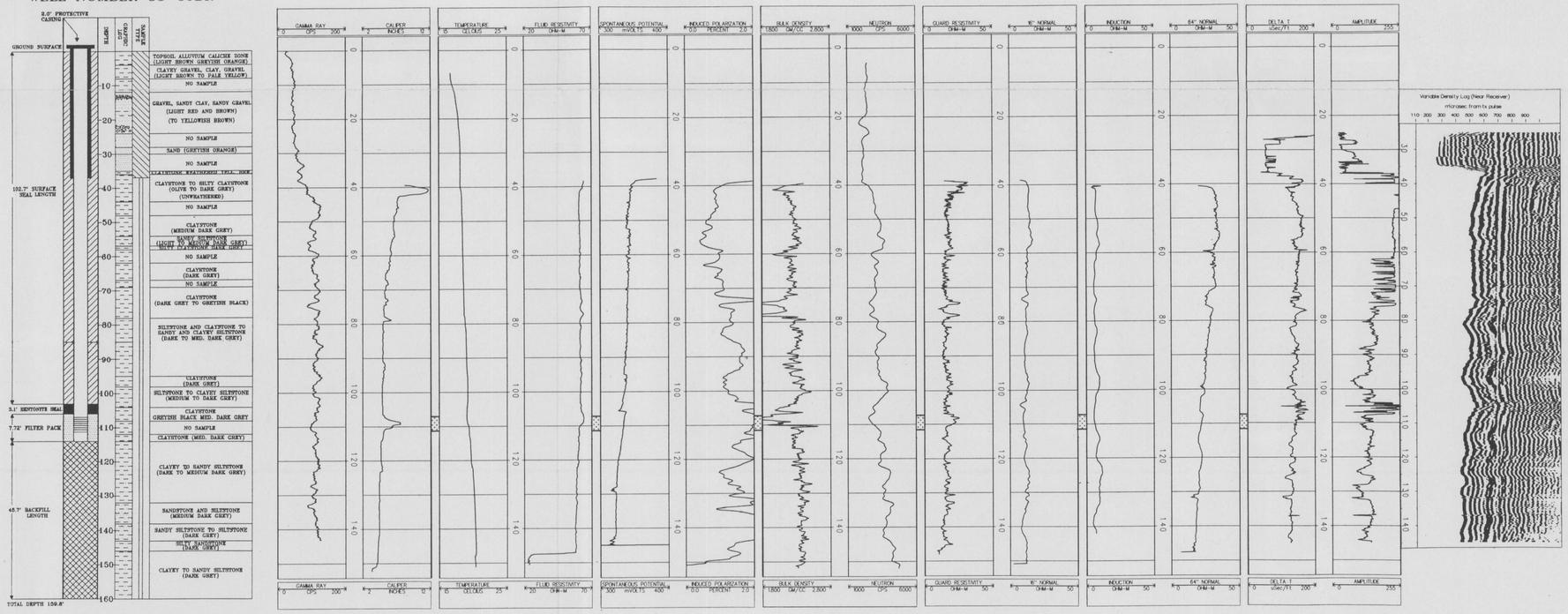
PLATE E-7

ENGINEERS: Roy F. Weston
Lakewood, Colorado

GROUND ELEV. - 5901.4'	DATE DRILLED
CASING ELEV. - 5902.82'	APRIL 13, 1989

COLOG INC.
Golden, Colorado

WELL NUMBER 33-89BR



SAMPLE METHODS

Continuous Drive Sampling

Rotary Core Sampling

NOTE

Screened Interval

WELL NO. 33-89BR

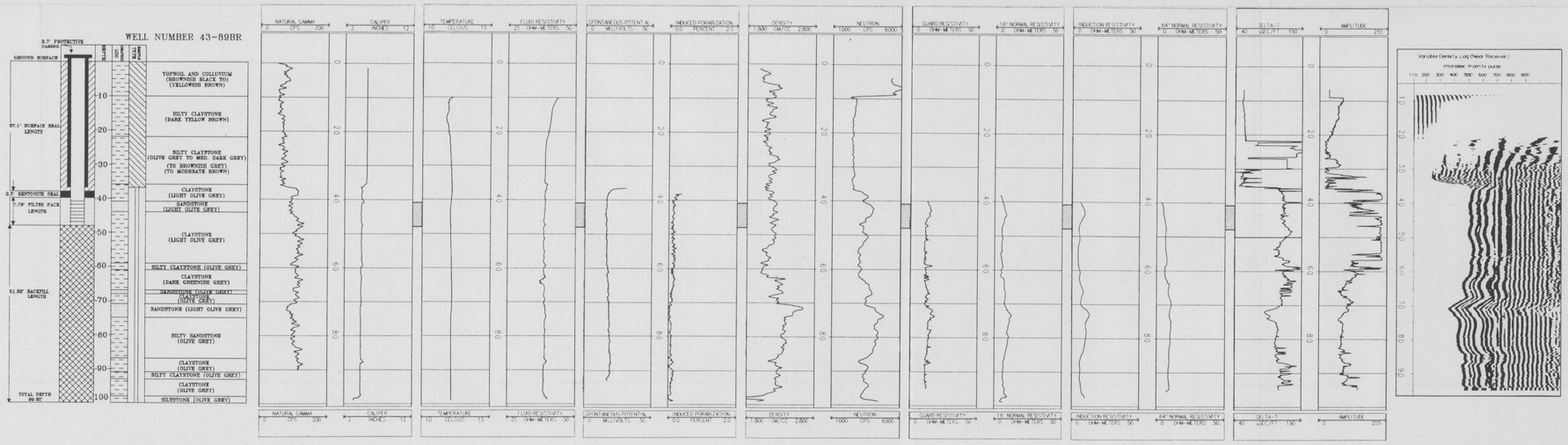
ROCKWELL INTERNATIONAL
ROCKY FLATS PLANT - GOLDEN, COLORADO

PLATE E-2

ENGINEERS: Roy F. Weston
Lakewood, Colorado

GROUND ELEV. - 5935.8'	DATE DRILLED
CASING ELEV. - 5937.69'	FEBRUARY 16, 1989

COLOG INC.
Golden, Colorado



SAMPLE METHODS

Continuous Drive Sampling

Rotary Core Sampling

NOTE

Screened Interval

WELL NO. 43-89BR

ROCKWELL INTERNATIONAL
ROCKY FLATS PLANT - GOLDEN, COLORADO

PLATE E-9

ENGINEERS: Roy F. Weston
Lakewood, Colorado

GROUND ELEV. - 5965.7'	DATE DRILLED
CASING ELEV. - 5967.47'	APRIL 25, 1989

COLOG INC.
Golden, Colorado