Department of Energy
Albuquerque Operations Office
Waste Isolation Pilot Plant Project Office
P. O. Box 3090
Carlsbad, New Mexico 88221

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Ms. Judith M. Espinosa, Secretary
New Mexico Environment Department
P.O. Box 26110
Santa Fe, NM 87502

Dear Secretary Espinosa:

The purpose of this memorandum is to transmit a copy of the final Annual Site Environmental Report (ASER) for the Waste Isolation Pilot Plant (WIPP) for calendar year 1990. This annual report is a requirement of Department of Energy Order 5400.1 and is intended to inform the general public of the general environmental conditions within the vicinity of the WIPP.

If you have any questions regarding this document, please contact Jerry Carr of my staff.

Sincerely

Arlen Hunt

Arlen Hunt
Project Manager

This is report on 30 day extension for language for generator site Bands

Enclosure

cc w/enclosure:
C&C File

cc w/o enclosure:
G. Gonzales, NMED
B. Garcia, NMED
K. Sisneros, NMED
P. McCasland, NMED/WIPP
J. Lytle, DOE-HQ
M. Frei, DOE-HQ
M. Goodis, DOE-HQ
M. Kleinrock, DOE-HQ
P. Ziemer, DOE-HQ
J. Arthur, DOE-AL
W. Harrell, DOE-AL
R. Wise, DOE-WPO
T. Reese, DOE-WPO
J. Mewhinney, DOE-WPO
T. Greenwood, DOE-WPO
J. Carr, DOE-WPO
J. Abbott, ASI-WPO
S. Jones, WID
L. Madl, WID
R. Farrell, WID

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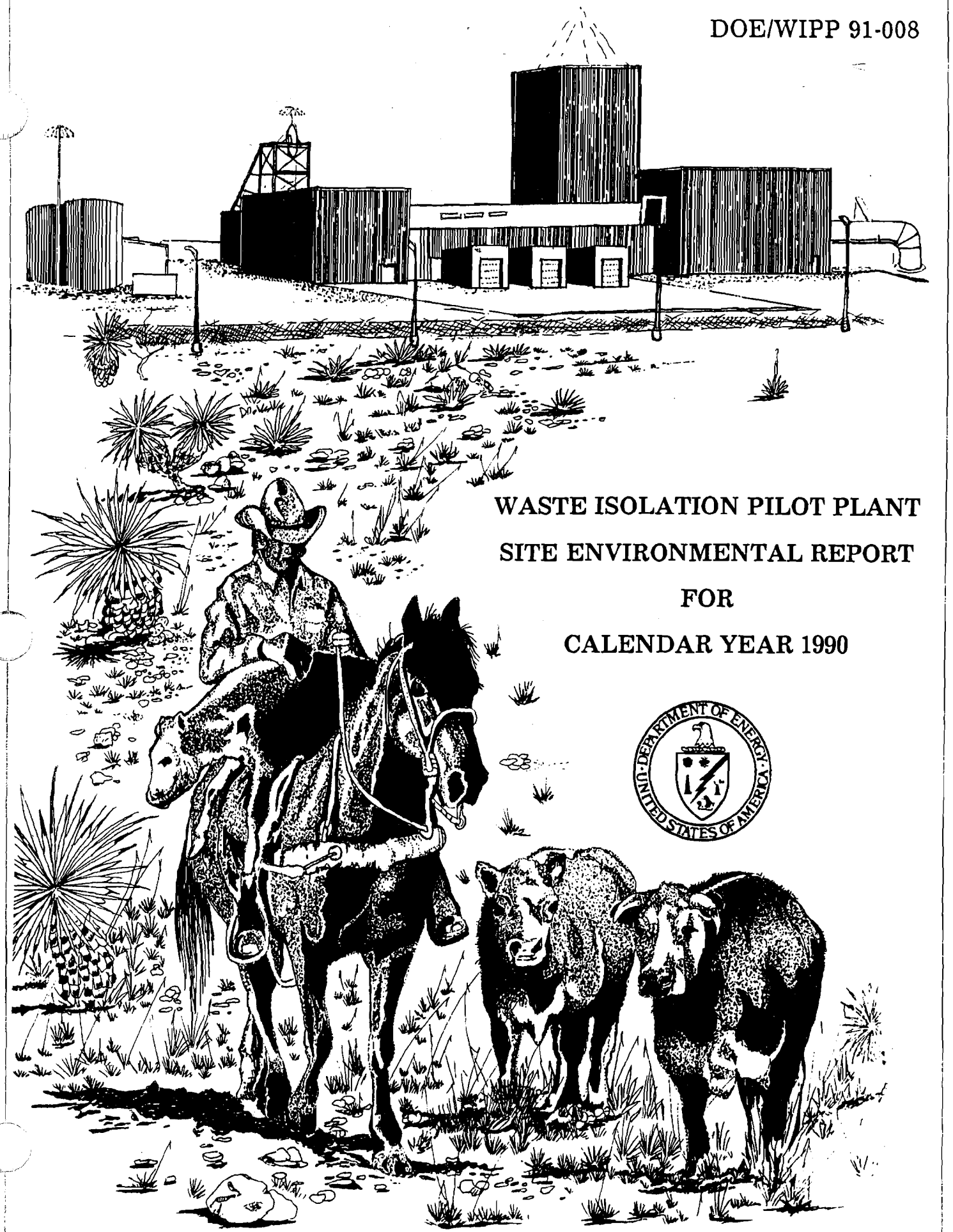

WASTE ISOLATION PILOT PLANT SITE ENVIRONMENTAL REPORT FOR CALENDAR YEAR 1990

This document is issued by Westinghouse Electric Corporation, Waste Isola
Division, as the Managing and Operating Contractor for the Department of Energ
Waste Isolation Pilot Plant, Carlsbad, New Mexico, 88221 .

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WASTE ISOLATION PILOT PLANT

SITE ENVIRONMENTAL REPORT

FOR CALENDAR YEAR 1990

Any comments or questions regarding this report should
be directed to the Project Manager,
U.S. Department of Energy
WIPP Project Office
P.O. Box 3090
Carlsbad, NM 88221

or to the Manager,
Environment, Safety and Health
Westinghouse Electric Corporation
P. O. Box 2078
Carlsbad, NM 88221

This report was prepared for the U.S. Department of Energy
by the Environmental Monitoring and the Environmental Analysis and
Compliance Sections of the Environment, Safety and Health Department
the Management and Operating Contractor
Westinghouse Electric Corporation, under Contract No. DE-AC04-86AL31950

PREFACE

This is the seventh Annual Site Environmental Report for the U.S. Department of Energy, Waste Isolation Pilot Plant (WIPP). The most significant addition to the 1990 report is the inclusion of the Annual Water Quality Data Report which addresses groundwater surveillance at the WIPP. The Water Quality Report was previously issued as a separate document. The combination of these two reports allow readers to have all environmental monitoring information consolidated together for an easy reference.

As you read this document you will notice the groundwater data in Chapter 7 is either presented in metric or English units. The equivalent units have not been shown. To assist the reader in reviewing Chapter 7, a conversion table from metric units to English units can be found as the last page in this report.

Additionally, it is anticipated that this will be the last Annual Site Environmental Report for the WIPP issued with the facility in a preoperational state. When the WIPP is operational, certain sections of this report will change to address the operational status. The significant changes will be in Chapter 5, Environmental Radiological Program Information.

The Secretary of Energy has made strong commitments for sound environmental management. The Management and Operating Contractor for the WIPP, Westinghouse Electric Corporation, completely supports the Secretary's commitments with a Total Quality attitude in the true spirit of environmental awareness.

To recognize the Department of Energy's concern for environmental awareness, this document has been printed on recycled paper. It is our intention that this be the beginning of a significant step for the WIPP in to use recycled products whenever possible, and when this is not possible, to use the least environmental degradable product available.

COVER ILLUSTRATION

This illustration depicts the coexistence of historic land used in southeastern New Mexico with modern day technology for the approaching 21st century. The U. S. Department of Energy is committed to preserving multiple land use for this area with sound environmental practices. (The illustration is by Bill Briggs, who is an electrical engineer at the WIPP.)

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ACRONYMS AND ABBREVIATIONS

AMS	Atmospheric Monitoring Station
AMSL	Above Mean Sea Level
ANOVA	Analysis of Variance
ASER	Annual Site Environmental Report
BLM	U. S. Bureau of Land Management
Bq	Becquerel
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act (also known as Superfund)
CFM	Cubic Feet per Minute
CH-TRU	Contact Handled Transuranic Waste
CT-1	Control 1
CT-2	Control 2
CWA	Clean Water Act
CY	Calendar Year
DOE	U.S. Department of Energy
DOE-EML	U.S. Department of Energy Environmental Measurements Laboratory
DOT	U. S. Department of Transportation
EC	Electrical Conductivity
EEG	Environmental Evaluation Group
EID	New Mexico Environmental Improvement Division
EMP	Ecological Monitoring Program
EPA	U. S. Environmental Protection Agency
FEIS	Final Environmental Impact Statement
FDA	Fluorescardiacetate Hydrolysis Assay
FSAR	Final Safety Analysis Report
FT	Feet
FWPCA	Federal Water Pollution Control Act

ACRONYMS AND ABBREVIATIONS

GOCO	Government-Owened, Contractor Operated
HEPA	High Efficiency Particulate Air (filter)
HPIC	High Pressure Ionization Chamber
ITAS	International Technologies Analytical Services Laboratory
MOU	Memorandum of Understanding
MPS	Meters Per Second
NA	Not Applicable
NCRP	National Council on Radiation Protection and Measurement
NEPA	National Environmental Policy Act
NES	Nonradiological Environmental Surveillance
NESHAPs	National Emmissions Standards for Hazardous Air Pollutants
NMGF	New Mexico Department of Game of Fish
NMSA	New Mexico Statutes Act
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution discharge Elimination System
NRC	Nuclear Regulatory Commission
NT	Not Tested
NW 2	Northwest 2
OEMP	Operational Environmental Monitoring Program
OP	Optical Density
PCB	Polychlorinated Biphenyls
PSD	Prevention of Significant Deterioration
QA	Quality Assurance
QC	Quality Control
RBP	Radiological Baseline Program
RCRA	Resource Conservation and Recovery Act
RES	Radiological Environmental Surveillance
RH-TRU	Remote Handled Transuranic Waste

ACRONYMS AND ABBREVIATIONS

SARA	Superfund Amendments and Reauthorization Act
SE-2	Southeast 2
SEIS	Supplement Environmental Impact Statement
SNL	Sandia National Laboratories
SNK	Student-Newman-Keuls
TDS	Total Dissolved Solids
TLD	Thermoluminescent Dosimeters
TOC	Top of Casing
TRU	Transuranic Waste
TSP	Total Suspended Particles
UST	Underground Storage Tank
VOCs	Volatile Organic Compounds
WAESD	Westinghouse Advanced Energy Systems Division
WIPP	Waste Isolation Pilot Plant
WPO	WIPP Project Office
WQA	Water Quality Act
WQSP	Water Quality Sampling Program

CHAPTER 1

EXECUTIVE SUMMARY

The U. S. Department of Energy (DOE) Waste Isolation Pilot Plant (WIPP) Operational Environmental Monitoring Plan (OEMP) monitors a comprehensive set of parameters in order to detect any potential environmental impacts and establish baselines.for future quantitative environmental impact evaluations. Surface water and groundwater, soil, and biotics are measured for background radiation. Nonradiological environmental monitoring activities include meteorological, air quality, soil properties, and the status of the local biological community. Ecological studies focus on the immediate area surrounding the site with emphasis on the salt storage pile, whereas baseline radiological surveillance covers a broader geographic area including nearby ranches, villages, and cities.

Since the WIPP is still in a preoperational state, no waste has been received; therefore, certain elements required by Order DOE 5400.1 are not presented in this report. For example, no discussion of radionuclide emissions with subsequent doses to the public is included. With the WIPP in a preoperational state, discussions of radioactivity for specific radionuclides released as effluents are not included.

Additionally it is important to state to the reader of this document that a summarization of the radiological and nonradiological data baselines for the preoperational phase of the WIPP are being compiled and will be presented in a summarized form once completed. It is anticipated these data summarizes will be completed in 1991.

1.1 COMPLIANCE SUMMARY

In 1990, the WIPP complied with applicable federal and state environmental regulations. The WIPP project maintains active permits from the Bureau of Land Management (BLM) and an Environmental Improvement Division (EID) permit for open burning.

Additionally, the DOE has notified the EID of hazardous waste activities associated with the management of site-generated hazardous waste. The WIPP has a hazardous waste management program in place which is in compliance with Resource Conservation and Recovery Act (RCRA) requirements. The WIPP submitted RCRA Part A in January and Part B in February, 1991. Also during the year, WIPP submitted the required Emergency and Hazardous Chemical Inventory Report. This report was submitted to satisfy the requirements of Section 312 of Title III for the Superfund Amendments and Reauthorization Act (SARA).

On November 14, 1990, the U. S. Environmental Protection Agency (EPA), through publication in the Federal Register granted a Conditional No-Migration Determination for the DOE WIPP (EPA, 1990). This determination granted DOE's request for a variance from land disposal restrictions under the RCRA during a ten year period covering the five year WIPP Test Phase. This variance had been requested by the DOE through submittal of the No-Migration Variance Petition and its subsequent revision in March 1990 (DOE, 1990a).

To satisfy National Environmental Policy Act (NEPA) requirements, the DOE developed a Final Supplement Environmental Impact Statement (SEIS) which was issued in January 1990 (DOE, 1990b). This document covered both new information obtained since the original Final Environmental Impact Statement (FEIS) was issued in October 1980, and newly proposed activities, such as the Test Phase activities. On June 22, 1990, the Record of Decision for the SEIS was published in the Federal Register (DOE, 1990c).

A technical data package was prepared in 1990 to demonstrate compliance with 40 CFR 61, S National Emissions Standard for Hazardous Air Pollutants (NESHAPs). The data package doses to the public to be well below the 0.1 mrem limit at which a formal application must be subm The data package further documented the design of the airborne effluent monitoring system used a WIPP.

The WIPP Waste Minimization and Pollution Prevention Awareness Plan has been drafted and is currently being revised to incorporate comments. The final plan will be submitted to DOE WIPP Project Office (WPO) in June of 1991.

In September 1990, during a pressure test of petroleum product storage tanks, a leak was indicated associated piping above the unleaded fuel tank. The EID and the EPA Region IV offices were prc notified of a potential leak and the unleaded fuel tank drained. A remedial investigation was perfo

1.2 ENVIRONMENTAL PROGRAM INFORMATION

The effort to establish environmental baseline conditions at the WIPP site before arrival of waste h been ongoing since 1975. These studies are continuing to characterize the local environment both radiologically and nonradiologically until the WIPP is operational. Once the WIPP is operational, programs will transition into the operational phase and pertinent data collection will continue thro the life of the project.

1.2.1 Operational Environmental Monitoring Program

The WIPP OEMP lists schedules and guidelines for monitoring a comprehensive set of parameters in order to detect and quantify any present or potential environmental impacts. Nonradiological portions of the program focus on the immediate area surrounding t, whereas radiological surveillance generally covers a broader geographic area inclu ar ranches, villages and cities. Environmental monitoring will continue at the site during proje operations and through decommissioning activities. The sampling activities will continue to performed at the established monitoring locations which are unchanged from earlier Annua Environmental Reports (ASERs).

1.2.2 Significant Environmental Activities

This section addresses significant environmental activities which occurred during 1990.

- **Raptor Research Program**

In calendar year (CY) 1990, 80 raptor nests and 31 Chihuahuan raven nests were monitored Reproductive success was poor, especially for Chihuahuan ravens. The trend remains cons with proceeding years of low nest success rates. The poor success continues to correlate wi numbers of prey species which are beginning to recover from three previous years of below normal precipitation in the area.

- **Reclamation of Disturbed Lands**

No reclamation activities, other than monitoring, are reportable for CY 1990. Reclamation techniques and experimental parameters from the 1988 and 1989 reclamation activities are currently being addressed in a thesis entitled "Examination of Native Plants and Tillage for Reclamation of Caliche, Dune Soil, and Salt-Impacted Soil in the Los Medanos of New Me The study is being conducted by a graduate student of New Mexico State University and fu by the DOE.

Monitoring of reclamation plots consisted of photographing all caliche roads, drill pads, borrow pits, batch plants, and the Brinderson landfill. Total land area photographed was approximately 19.6ha. (49 acres). Photographs were taken during September and October.

1.3 ENVIRONMENTAL RADIOLOGICAL PROGRAM INFORMATION

The following subsections present monitoring topics for the subprograms of the OEMP. These programs are consistent with Draft Order DOE 5400.6, Requirements for Radiological Effluent Monitoring and Environmental Surveillance for U.S. DOE Operations.

With the WIPP status being preoperational it is not required by Order DOE 5400.1, that annual radiological analysis of samples be performed once the required radiological baseline has been established. However, to further substantiate the data baseline, certain radiological sampling programs have continued with the samples being archived for future analysis, if conditions warrant further data.

As specifically outlined in the OEMP, five subprograms are being conducted to document the background levels of possible radionuclide pathways leading from the WIPP to man.

1.3.1 Airborne Particulate and Effluent Monitoring

Sampling airborne aerosol particulates was initiated in 1985 and is an important subprogram of the OEMP. The Final Safety Analysis Report (FSAR) (DOE, 1990) identifies the atmosphere pathway as the only credible release pathway resulting in a potential dose to the public. Continuous particulate aerosol samplers operate at eight locations, three within the Zone II boundary, four at local ranches and communities, and one as a sample control site.

The continuous aerosol samplers presently being utilized maintain a regulated flow rate of approximately 950 milliliters per second (two cubic feet per minute) of air through a 47-millimeter 1.9 inch) fiber filter for particulate collection. Particulate filters were collected weekly at all locations in 1990. The collected filters were counted at the Environmental Counting Laboratory at the WIPP, where gross alpha and gross beta counts of each filter were calculated yielding weekly counts and a quarterly average for each location. Table 5-1 of Chapter 5 of this document lists the quarterly alpha and beta concentrations for each sampling location.

1.3.2 Soil Sampling

Soil samples were collected in December 1990 at seven locations. A template insert allows the collection of samples at three depths at each location: (1) surface samples, 0-2 cm (0-0.8 in), (2) intermediate sample 2-5 cm (0.8-2.0 in) and (3) deep sample, 5-10 centimeters (2.0-3.9 in). Every sample was a composite of 10 randomly located subsamples, each collected within a 10 by 10 centimeter (3.9 by 3.9 inches) stainless steel template. Soil samples collected during 1990 were archived as the required number of samples had already been collected to establish the soil radiological baseline.

1.3.3 Groundwater

Groundwater surveillance continued routinely throughout CY 1990 with 18 wells sampled. All samples collected were archived for future analysis. Should curcumstances warrent analysis, the radiological groundwater collected in 1990 can then be analyzed.

1.3.4 Surface Water and Sediment Sampling

Surface water and sediment samples were not collected in CY 1990. As with soil sampling, (background measurements have been established, annual collections of surface water and sediments is not required. However, periodic samples of surface water and sediments will b collected prior to the operational phase of the WIPP to further substantiate the background radiological data for the surface.

1.3.5 Beef, Game Animals, and Aquatic Fish Samples

In CY 1990, game animals (quail, rabbits) and fish were collected as directed in the OEMP, samples were not collected in 1990. The biotics collected were processed and archived for f radiological analysis.

1.4 NONRADIOLOGICAL MONITORING INFORMATION

Nonradiological Environmental Surveillance (NES) was conducted by the Regulatory and Envi· nental Program department. As of February, 1991 this department was reorganized and f envir ıental monitoring will be under the direction of the Environment, Safety, and Health depar.ıent.

This program was preceded by the WIPP Biology Program (1975-1982), which combined scientific technical expertise from six universities. These universities developed an extensive baseline of information describing the major components of the Los Medanos ecosystem prior to the initiatio WIPP construction activities.

1.4.1 Meteorology

The WIPP NES includes a meteorological station that provides support for various progran the WIPP. The primary function of this station is to generate data to aid in modeling atmos conditions for Radiological Environmental Surveillance (RES). The meteorological statior records standard meteorological measurements of wind speed, wind direction, and temper 3, 10, and 40 meters (10, 32, and 130 ft), respectively, with dew point and precipitation mon at ground level. These parameters are continuously measured and the data are stored as re data.

The annual precipitation at the WIPP for 1990 was 41 cm (15.97 in), which is above the ave this area by 10 cm (3.97 in). The precipitation for 1990 was 62 percent greater than that rec for 1989. This precipitation increase has helped to alleviate the drought effects on the ecos of the area.

In CY 1990 the winds in the WIPP area were consistent with previous wind direction data v winds from the southeast being predominate.

1.4.2 Environmental Photography

Aerial photographs of the WIPP site have been taken semiannually from 1982 until 1989, d the winter and summer seasons. In 1990, the decision was made to take aerial photograph annually during the peak growing season, late August through September. Any vegetative due to WIPP activities will be best identified during this time of year. These photographs document surface disturbance, development, and reclamation activities at the WIPP and surrounding BLM Lands.

Surface photography has been conducted semiannually at seven ecological study plots since 1984. These photographs are used to document surface impacts at the study plots examined, and found to show very little surface impact.

1.4.3 Air Quality Monitoring

Seven classes of pollutant gases are monitored at the WIPP site on a continuous basis: sulfur dioxide (SO_2), carbon monoxide (CO), ozone (O_3), hydrogen sulfide (H_2S), and oxides of nitrogen (NO_x). In addition, weekly measurements of Total Suspended Particulates (TSP) are made from the particulates collected by the low-volume continuous air sampler at the far-field air sampling location.

The ambient gas monitors are extremely sensitive instruments that require semiannual recertification by a factory engineer. Other than typical replacement of worn parts, the ambient gas analyzers required no significant maintenance actions.

The data generated by the analyzers was at the lower limit of detection which was below the New Mexico State standard.

1.4.4 Surface Water and Sediment Quality Monitoring

During CY 1990, no surface water or sediment quality monitoring was conducted since a baseline has been established. Preoperational monitoring to establish a baseline began in 1985 and continued through 1988 with samples collected annually. It is currently proposed that surface water and sediment quality monitoring will be conducted biennially until the WIPP is operational.

1.4.5 Groundwater

Groundwater surveillance continued routinely throughout CY 1990 with 18 wells sampled for water quality. Twelve wells were sampled for the fifth time, three wells were sampled for the fourth time, two wells were sampled for the third time and one well was sampled for the secondtime. Groundwater Level Surveillance took place utilizing 57 separate well bores, six of which were equipped with production inflated packers to allow surveillance of more than one production zone through the same well bore. Groundwater level measurements of the Culebra dolomite were taken at 46 locations and measurements of the Magenta dolomite were taken at 11 locations. The remaining measurements were taken in a formation of lesser interest.

1.4.6 Wildlife Population Monitoring

Population density measurements of birds and small nocturnal mammals are preformed annually to assess the effects of WIPP activities on wildlife populations.

- Bird Densities

In 1990 species numbers varied from previous years' data. This disparity can be attributed to below normal precipitation from the winter of 1989 into early spring of 1990.

Overall, species distribution patterns between WIPP transits and Control transits remain relatively constant with the most significant species diversity occurring near the facility. More abundant food, most notably insects and greater habitat diversity, probably account for the increase in numbers of the WIPP transits compared to those of the controls. Insect dependant species such as Flycatchers and King birds were the prominent species on the increase near the facility.

- **Small Nocturnal Mammal Population Densities**

In 1990, Ord's kangaroo rats remained the most common species encountered. Severa Kangaroo rats were recaptured 70 to 90 meters from their original capture location, wi average recapture ventured 30 to 50 meters from their original capture location. Gras mice were the next most common species encountered. Other species encountered in were plains wood rats, white-footed mice, deer mice, and silky pocket mice. Only one cotton rat was encountered

1.4.7 Surface and Subsurface Soil

During CY 1990, the quarterly sampling of the surface soil as well as the annual deep s conducted during the second quarter. The subsurface soil is collected at two depths, 3 centimeters (11.8 to 17.7 inches) and 75 centimeters (23.6 to 29.5 inches), in the soil pr However, with the WIPP being in a preoperational state during 1990, and with an adec baseline established concerning soil properties at the WIPP. No analysis was perform soil samples collected. The soil samples collected will be archived pending future anal conditions indicate additional soil analysis is warranted.

With the established baseline data, continuing the quarterly soil analysis was not requi OEMP. However with the anticipation of the WIPP becoming operational in 1991 the analysis of soil samples will once again commence as directed by the OEMP.

1.4.8 Vegetation Monitoring

The CY 1989 vegetation monitoring data showed a decline in several parameters with i proximity to the salt piles, indicating a detrimental effect of these storage pile ecosystem. However, the 1990 data do not show such an effect. The total cov in were relatively uniform over all distances from the piles. The densities of annuals and richness were also relatively uniform across all plots. A pattern observed in the 1989 d also seen in the 1990 data is an increase in shrub cover with increasing proximity to the an approximately equal decrease in perennial grass cover. The responses of these plot rainfall in later years will reveal whether this pattern is reflecting the start of a significa in the structure of the plant community or whether it is only a short-term effect caused short-term weather conditions.

Of greatest significance in the 1990 vegetation monitoring data, was the observation th drought conditions of this year have had a uniform effect on vegetation in all plots. A effect resulting from salt-induced physiological stress near the salt piles was not obser

1.5 QUALITY ASSURANCE

This document adheres to policies set forth by federal QA regulations including: ASME NQ Quality Assurance Program Requirements for Nuclear Facilities, (ASME, 1989) and EPA, QAMS-005/80, Interim Guidelines and Specifications for Preparing Quality Assurnce Projec (EPA, 1980), fulfills the requirements of the QA plan specified in DOE Orders 5400.1 (DOE 5400.3 (DOE, 1988e), 5700.6B (DOE, 1986c) and draft DOE 5400.6 (DOE, 1988f).

CHAPTER 2

INTRODUCTION

This is the WIPP Site Environmental Report for CY 1990. The WIPP site is located in southeastern New Mexico. The WIPP is a government owned and contractor operated facility. The WIPP project is operated by Westinghouse Electric Corporation for the DOE. The purpose of the WIPP is to provide a research and development facility to demonstrate the safe disposal of transuranic (TRU) wastes generated by the defense activities of the U.S. Government. This document is prepared in accordance with the guidance contained in Order DOE 5400.1, General Environmental Protection Program Requirements (DOE, 1988a); Order DOE 5400.5, Radiation Protection of the Public and the Environment; and DOE/WIPP 90-050, Environmental Protection Implementation Plan for the Waste Isolation Pilot Plant, which requires DOE facilities to submit an ASER to the Office of Operational Safety. This report provides a comprehensive description of environmental activities at the WIPP during calendar year 1990.

The WIPP facility will not receive waste until all concerns affecting opening the WIPP are addressed to the satisfaction of the Secretary of Energy. Therefore, this report describes the status of the preoperational activities of the RES program, which are outlined in the Radiological Baseline Program (RBP) for the WIPP (WTSD-TME-057). Since the WIPP is in a preoperational state, meaning no defense facility waste contaminated with radionuclides has been shipped to the WIPP, certain elements of Order DOE 5400.1 are not presented in this report.

In March 1989, the monitoring activities of the RBP and the Ecological Monitoring Program (EMP) were combined into the OEMP. This program is described in the Operational Environmental Monitoring Plan for the Waste Isolation Pilot Plant (DOE/WIPP 88-025). This plan defines the scope and extent of the WIPP effluent and environmental monitoring programs during the operational life of the facility. It also discusses the quality assurance and quality control programs which ensure that samples collected and the resulting analytical data are representative of actual conditions at the WIPP site. The OEMP is the guidance document under which all of the environmental monitoring programs follow. Its purpose is to ensure that all appropriate sampling efforts are inplace to establish the amount and type of naturally occurring radiation in the WIPP area before the WIPP is operational. Then to provide a database for comparisons between preoperational and operational environmental conditions once the WIPP is operating as a waste repository for low level radioactive waste.

The OEMP was prepared in accordance with the guidance contained in Order DOE 5400.1 and draft Order 5400.5, Radiation Protection of the Public and the Environment (DOE, 1988b), which was subsequently issued as Order DOE 5400.5 in February, 1990. This plan also responds to the requirements and guidelines presented in draft Order DOE 5400.6, Radiological Effluent Monitoring and Environmental Surveillance for U.S. DOE Operations (DOE, 1988c). Since waste has not been received and WIPP is still in a preoperational state, certain elements of Order DOE 5400.1 are not presented in this report. For example, no discussion of radionuclide emissions with subsequent of doses to the public is included.

2.1 DESCRIPTION OF THE WIPP PROJECT

Once designated as an operational facility by the DOE, TRU wastes will be transported from 10 generator sites around the United States to the WIPP. Initially, the waste will be transported from the Idaho National Engineering Laboratory and the Rocky Flats facility, in Colorado for the test phase. These waste materials are contaminated with alpha emitting radionuclides having atomic numbers greater than 92 and half lives longer than 20 years. Also to be classified as a transuranic (TRU) waste, the specific activity of these radionuclides in TRU waste must be higher than 100 nCi/g. General criteria defining the various categories of radioactive waste, including TRU waste, appear in Order DOE 5820.2A (DOE, 1988d). Isotopes of plutonium, americium, and curium will be the predominant radionuclides contaminating TRU waste shipped to the WIPP.

The TRU waste to be received from the 10 generator sites will be transported to the WIPP v tractor-trailor trucks. Each truck can haul up to three transuranic package transporter (TRU containing 14, 55 gallon drums or two standard waste boxes. The TRUPACT II is a durable, reuse container which has been approved by the Nuclear Regulatory Commission (NRC) to transport the contact-handled transuranic waste to the WIPP. (The NRC is the nationally recognized governing agency that regulates safe handling and proper safety concerns pertaining to radiation exposure to public and the environment).

Once these TRUPACT IIs have arrived at the WIPP and they are brought into the Waste Handling Building, waste containers will be removed from the TRUPACT II, placed on the waste handling h and lowered to the repository level of 655 m (2150 feet). Waste containers will then be removed fr hoist and emplaced in excavated storage rooms in the Salado formation, a thick sequence of salt be deposited approximately 250 million years ago (Permian Age). After filling a storage area, speciall designed seals and plugs will be placed in the excavated storage rooms and in the shafts. The plast self-healing nature of the salt formation will result in gradual creep closure, causing encapsulation isolation of the waste within the Salado formation. It is presently designated that the first five years WIPP operations will be a test phase period, during which time tests will be performed to support WIPP design and long-term isolation performance.

During site operations, the underground area will be ventilated by ambient air which enters the Air Intake Shaft, and the Salt Handling Shaft, the Waste Handling Shaft, and exits through the exhaust In the event of an underground accident involving radioactivity, exhaust air will be circulated at a reduced flow rate through the Exhaust Filter Building, which contains banks of high efficiency particulate air (HEPA) filters that remove potentially contaminated particulates. Exhaust ventilat from the Waste Handling Building is continuously HEPA filtered to the atmosphere, and air emiss are not expected to represent a significant effluent release point.

2.2 DESCRIPTION OF THE ENVIRONMENT

The WIPP site is located in Eddy county in southeastern New Mexico (Figure 2-1). The site is approximately 40 kilometers (26 miles) east-southeast of Carlsbad in an area known as Los Medan (the dunes), which is a sparsely inhabited plateau with little water and limited land uses. The land owned by the United States Department of Interior, BLM and is leased to permittees for grazing livestock. Other land uses in the general area include mining for potash; exploring for and/or extra oil and natural gas; recreational use such as hunting, trapping, birdwatching; and other uses as per by the BLM.

The WIPP site consists of 16 sections (6.48 ha) of Federal land in Township 22 South, Range 31 E Except for the 2.75 square kilometers (1 square mile) encompassing the facility (known as the DO Exclusive Use Area), surface land uses remain largely unchanged. Mining and drilling for purpos other than support of the WIPP project are restricted within this 16 section (6.48 ha) area.

The WIPP site is divided into zones as represented in Figure 2-1. Zone I, surrounded by a chain-l fence, includes all major surface facilities. The secured area boundary, bounded by a barbed wire includes other facilities associated with construction. Zone II indicates the maximum extent of underground development. The WIPP site boundary extends at least 1.6 kilometers (1 mile) beyo underground development and is defined on the surface by the 16 section (6.48 ha) land withdraw This boundary provides a functional barrier of intact salt between the underground region define Zone II and the accessible environment.

The approximate distribution of the local population in 1985 within 80 kilometers (50 miles) of the site is illustrated in Figure 2-2. The nearest residents to the site include eight individuals living at Mills Ranch, 5.8 kilometers (3.5 miles) south-southwest of the site, and 13 individuals liv the Ranch, 11.7 kilometers (7 miles) west-northwest of the site. Both neighboring ranches ha en,

will continue to be, monitored as part of the environmental monitoring program. Also, the International Minerals and Chemical Corporation potash mine plant site is located 15 kilometers (9 miles) west-northwest of the site. Detailed demographic summaries and projections are in the WIPP FEIS (DOE, 1980), SEIS (DOE, 1990), and the FSAR (DOE, 1990).

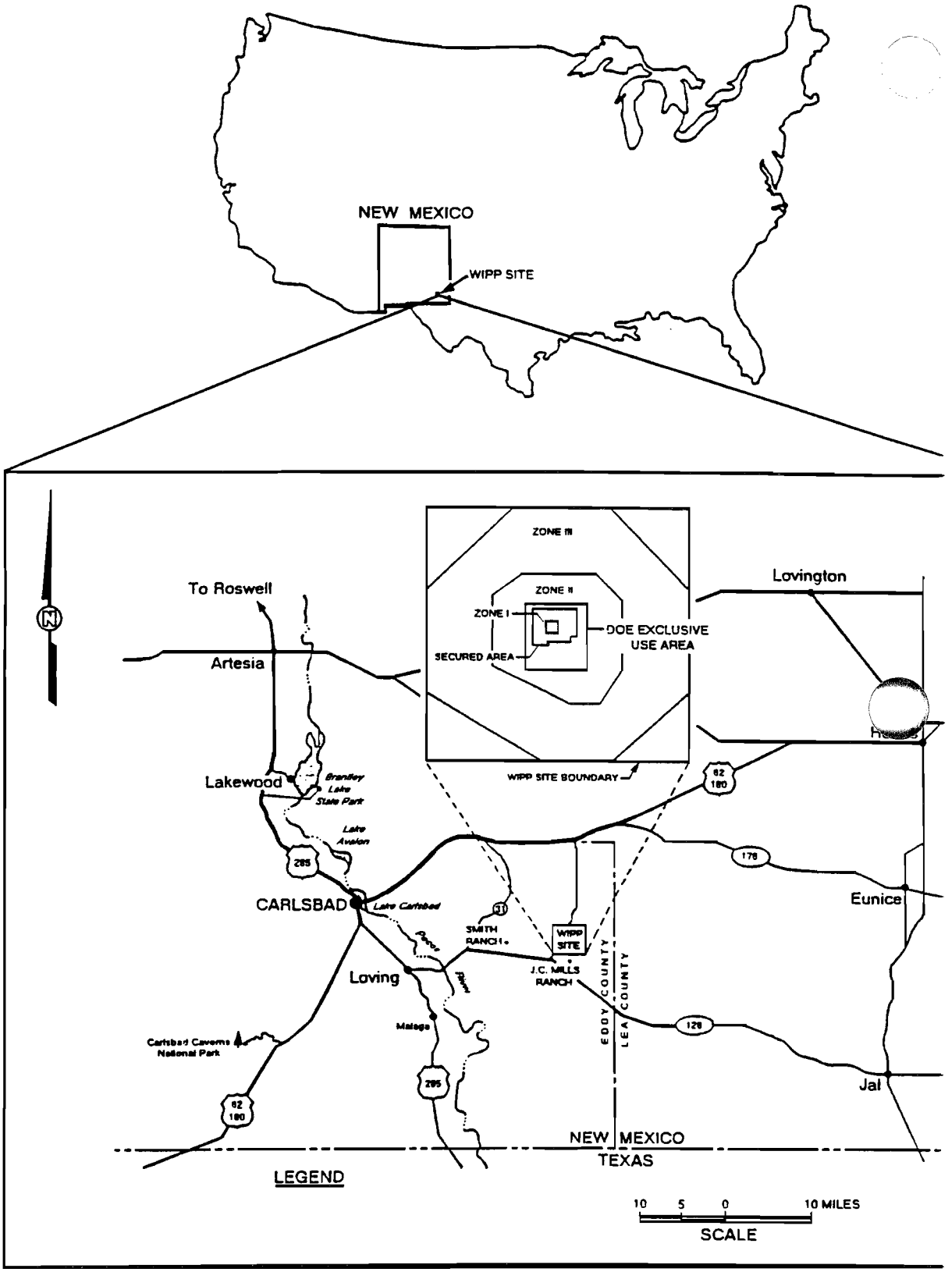

Figure 2-1
Location Of The WIPP Site

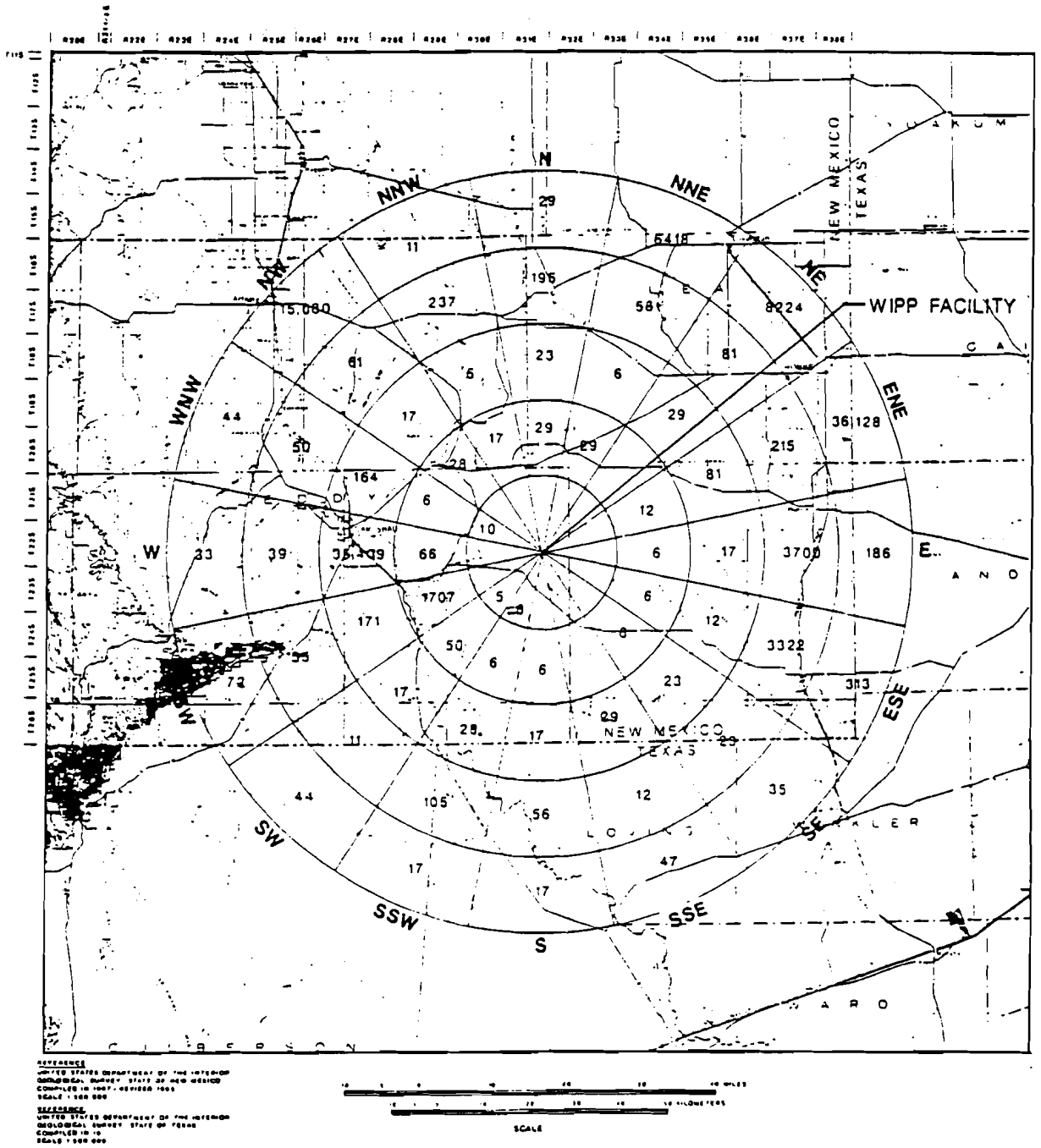

Figure 2-2
1985 Population Within 50 Miles
Of The WIPP Site

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CHAPTER 3

COMPLIANCE SUMMARY

The WIPP is required to comply with all applicable federal and state laws and regulations such as those specified in Order DOE 5400.1, General Environmental Protection Program (DOE, 1988a). Documentation of required federal and state permits, notifications, and approvals is maintained by the Environment, Safety and Health Department of the Management and Operating contractor. Regulatory requirements are implemented by incorporating them into facility plans and procedures.

Table 3-1 presents Compliance Status of Federal and New Mexico Statutes Applicable to the WIPP Project. Table 3-2 presents DOE Orders and Agreements Affecting the WIPP environmental program. Table 3-3 is a Summary Of Agreements Between the DOE and the State of New Mexico that affect the environmental program. Table 3-4 presents details concerning active environmental permits for the WIPP in 1990.

3.1 COMPLIANCE ASSESSMENT FOR CALENDAR YEAR 1990

In 1990, the WIPP complied with applicable federal and state environmental regulations. The WIPP project maintains 25 active permits from the BLM, the EID, the EPA, the New Mexico Department of Game and Fish, and the New Mexico Commissioner of Public Lands. It is also appropriate to note that the WIPP is in compliance with all applicable requirements of the Nuclear Waste Policy, Act of 1982 as implemented by the EPA through 40 CFR 191.

Additionally, the DOE has notified the EID of hazardous waste activities associated with the management of site-generated hazardous waste. The WIPP has a hazardous waste management program inplace which is in compliance with RCRA requirements. In accordance with RCRA requirements, storage areas are operated by written procedure and routine inspections of satellite accumulation areas are performed. WIPP will submit RCRA Parts A and B during the first two months of 1991. Also during the year, WIPP submitted the required Emergency and Hazardous Chemical Inventory Report. This report was submitted to satisfy the requirements of section 312 of Title III for the SARA.

On November 14, 1990, the Environmental Protection Agency, through publication in the Federal Register, granted a Conditional No-Migration Determination for the Department of Energy Waste Isolation Pilot Plant. This determination granted DOE's request for a variance from land disposal restrictions under the RCRA during a ten year period covering the five year WIPP Test Phase. This variance had been requested by the DOE through submittal of the No-Migration Variance Petition and its subsequent revision in March 1990 (DOE, 1990a). Conditions of the determination include:

- No waste other than that needed for testing
- A limitation on the volume of waste allowed during the Test Phase to one percent of the total WIPP capacity or approximately 8500 drum equivalents of waste
- All waste must be removed if long term acceptability of the site cannot be demonstrated
- All waste must be readily retrievable
- Annual written reports on performance assessment must be prepared
- A carbon adsorption unit for the control of volatile organic compounds (VOCs) must be in the discharge system of the bin scale test rooms and achieve a control efficiency for VOCs of at least 95 percent

- An Air Monitoring Plan must be implemented
- A characterization program for the test waste must be performed
- During 1990 the WIPP was in a preoperational phase, there was not a release at the WI which requires notification to Federal and State authorities. However, once, operation: release of regulated materials occurs all appropriate agencies will be notified as protoc mandates.

To satisfy National Environmental Policy Act requirements, the DOE developed a Final Supplement Environmental Impact Statement (FEIS) which was issued in January 1990. (DOE, 1990b) This docur covered both new information obtained since the original FEIS was issued in October 1980 and newly proposed activities, such as the Test Phase activities. Other changes included waste inventories, the transportation of waste to WIPP, and the management of transuranic waste containing hazardous cher constituents (i.e., "mixed" waste). On June 22, 1990, the Record of Decision for the SEIS was publishe the Federal Register. (DOE, 1990c)

A technical data package was prepared in 1990 to demonstrate compliance with 40 CFR 61, Subpart H NESHAPs. The data package estimated doses to the public to be well below the 0.1 mrem limit at whi formal application must be submitted. The data package further documented the design of the airborr effluent monitoring system used at WIPP.

A tightness test was conducted on the WIPP Underground Storage Tank (UST) systems utilized for th storage of petroleum products on September 28, 1990. The unleaded gasoline storage tank system fail test for tightness at the 25 inches above the tank's top, and passed the test at 6 inches above the tank's t This verified the presence of a leak in the associated piping. The EID and EPA Region VI US isi offices were notified. A report outlining corrective actions was issued per regulatory requiren n October 5, 1990 (to both agencies). An extension to the required 45 day subsurface investigatio as conducted on November 27, 1990. Samples collected during the investigation were submitted to a subcontracted laboratory for analyses. The analytical data generated were included in the subsurface investigation report submitted to both EID and EPA Region VI on December 19, 1990. EID responde that no further remediation actions were necessary. The planned upgrade of both UST systems is to b in August of 1991.

The unleaded fuel storage tank system will remain empty and out of service until completion of the aforementioned upgrade. Alternative unleaded fuel storage at the WIPP is to be provided through the of a 1000-gallon above-ground storage tank. This will occur once the diked containment system is constructed. Currently, unleaded fuel is acquired from off-site sources.

During CY 1990 the Waste Acceptance Certification Criteria Committee (WACCC) issued the draft entitled WACCC management program (WP 90-004) in December 1990. The WACCC is to ensure th waste coming to the WIPP follows all guidance and requirements as required by the NEPA, the FSAR the No-Migration Determination.

In June 1990 the WIPP Final Safety Analysis Report was approved by the DOE.

On July 25, 1990, the state of New Mexico received authority under the federal RCRA program to regu mixed wastes. In a letter dated August 27, 1990, the state of New Mexico notified the WIPP that the Pa RCRA permit application was due by January 22, 1991, and the Part B permit application by February 1991.

3.2 CURRENT ISSUES AND ACTIONS

The state of New Mexico was granted authorization to regulate mixed waste during 1990. Plans are being made to file RCRA Parts A & B permit applications during calendar year 1991.

The State of New Mexico and DOE have entered into an agreement which will allow the EID to monitor clean-up and on-going environmental activities at the WIPP.

This agreement comes from an initiative called for in April 1989 by a group of ten state governors with DOE nuclear facilities within or adjacent to their states.

Memorandum of Understanding (MOU) between DOE/WPO and BLM effective October 24, 1990 allows for an administrative land withdrawl between the DOE and the BLM for the 8746 acres which is outside the existing 1454 acres of the DOE exclusive use area. These remaining 8746 acres completes the 16 section land withdrawal.

In order to comply with the Clean Air Act (CAA), a NESHAPs a technical data package was prepared in 1990 and submitted to the DOE, EPA headquarters, and EPA Region VI offices in February 1991. Since non-reference methods are in use at WIPP to collect samples, an explanation of the design documentation, testing, and operation of the system has been prepared for the EPA.

Reclamation of abandoned caliche pits, roads, and well pads, which are required by Public Land Order 6403 and the associated MOU between the DOE and the BLM, is in progress. Land-Use Permit NM 067-LUP-237 for the construction landfill expired on February 9, 1990. Since the BLM no longer permits landfills, the landfill was closed and will be reclaimed in accordance with the permit conditions.

3.3 PERMITS

The status of required permits is tracked on a monthly basis, and permits are renewed as necessary to comply with the BLM, the EID, the NMGF, the New Mexico Commissioner of Public Lands, and the New Mexico Department of Finance and Administration Planning Division (Historic Preservation Bureau).

The WIPP held 13 active permits from the BLM in 1990. These permits are primarily land-use, free-use, and right-of-way permits. There were no noncompliance for BLM-administered permits in 1990.

The WIPP holds two New Mexico EID permits, one for open burning, and the other for the food or drink purveyor permit for the WIPP cafeteria. These permits are renewed annually.

3.4 COMPLIANCE SUMMARY UPDATE FOR JANUARY - MARCH 1991

This section addresses the first quarter of 1991 Compliance issues at the WIPP and their status.

3.4.1 COMPLIANCE STATUS FOR JANUARY-MARCH 1991

During the period January-March 1991, compliance was maintained for applicable EPA regulations (i.e., RCRA, SARA, the Clean Water Act (CWA), and the CAA.

Compliance with all BLM and state of New Mexico permits and regulations was also maintained during this period.

Significant environmental compliance actions in the period January-March 1991 are

- The RCRA Part A application was hand-delivered to the EID on January 22, 1991. A second copy was delivered to the EPA Region VI office in Dallas, Texas, on the same The RCRA Part B application was delivered to the same agencies at the end of Febru 1991.

- RCRA Implementation: In February 1989, the Governor of New Mexico signed legisl which authorized the EID to regulate mixed waste at the WIPP. In August, 1990, the Environmental Protection Agency delegated RCRA mixed waste authority to the State New Mexico. Accordingly, both hazardous waste generated at the WIPP and mixed w generated at other sites and transported to the WIPP are now subject to RCRA requirements.

- DOE is currently working with EID and the Environmental Protection Agency to deve waste characterization plan which satisfies both the requirements of the No-Migration Variance and the RCRA waste management facility characterization requirements.

- The WID prepared and shipped hazardous wastes from the WIPP site on two occasion during the first quarter of 1991. A 30 day extension to the 90 day period allotted by regulation for shipping hazardous wastes off-site was applied for and received from the regulator. The WIPP has maintained compliance with the RCRA requirements as it a to hazardous waste generator activities. All reporting requirements applicable to facili regulated under RCRA were submitted as required.

- WID submitted Section 312 TIER II reports to DOE/WPO on February 15, 1991 and other Federal, State and Local Agencies as required by the SARA Title III.

- During the first quarter of 1991, the WIPP was in a preoperational phase, there was no release at the WIPP which requires notification to Federal and State authorities. How once operational if a release of regulated materials occurs all appropriate agencies will notifeid as protocol mandates.

3.4.2 CURRENT ISSUES AND ACTIONS

In order to comply with the CAA, a NESHAPs a technical data package was prepared in 1 and submitted to the DOE, EPA headquarters, and EPA Region VI offices in February 19 Since non-reference methods are in use at WIPP to collect samples, an explanation of the d documentation, testing, and operation of the system has been prepared for the EPA.

3.4.3 PERMITS

The applicable environmental requirements, permits, and the respective permit status for t quarter of 1991 are listed in Table 3-5, Environmental Permit Matrix for January - March 1 The status of required permits is tracked on a monthly basis, and they are renewed as neces comply with the BLM, the EID, the New Mexico Department of Game and Fish, the New M Commissioner of Public Lands, and the New Mexico Department of Finance and Administ Planning Division (Historic Preservation Bureau).

The WIPP currently holds 10 active permits from the BLM for the first quarter of 1991. Th permits are primarily land-use, free-use, and right-of-way permits. This number has been r down from 13 in 1990. There were no noncompliance for BLM-administered perm 19 The WIPP was granted an additional permit in January 1991, by the New Mexico D ne Game and Fish for banding protected raptor species.

Table 3-1

COMPLIANCE STATUS OF FEDERAL AND NEW MEXICO STATUTES APPLICABLE TO THE WIPP PROJECT

NAME OF STATUTE	CITATION	ANNOTATION
Clean Air Act	42 U.S.C. §§ 7401 et seq.	Establishes a national regulatory strategy to protect and enhance the nation's air resources. Regulates "criteria" pollutants such as particulates, SO_2, CO, NO_2, ozone, photochemical oxidants, and lead.
New Mexico Environmental Improvement Act	§§ 74-1-1 through 74-1-10 NMSA (1978)	Creates the Environmental Improvement Division with authority to regulate water supply, water pollution, liquid and solid waste, air quality, noise, low-level radioactive waste disposal, and sanitation.
New Mexico Air Quality Control Act	§§ 74-2-1 through 74-2-155 NMSA (1978)	Establishes a State regulatory strategy patterned after the Federal Clean Air Act. (Gives New Mexico primary jurisdiction for air quality regulations.)
Clean Water Act	33 U.S.C. §§ 1251 et seq.	Establishes a national regulatory strategy to restore and maintain the chemical, physical, and biological integrity of the nation's waters.
New Mexico Water Quality Act	§§ 74-6-1 through 74-6-13 NMSA (1978)	Establishes a State regulatory strategy patterned after the Federal Clean Water Act. (Gives the State "primacy" for water quality control regulation.)
National Historic Preservation Act of 1966	16 U.S. C. §§ 470 et seq.	Establishes the National Register of Historic Places and requires Federal agencies to consider the effect of any Federal undertaking on sites, structures, or objects included in the National Register.
New Mexico Cultural Properties Act	§§ 18-6-1 through 18-6-17 NMSA (1978)	Establishes a committee to review proposals for preservation of cultural properties. Requires permits for excavation of archeological sites. Establishes the State Historic Division and the State Historic Preservation Officer (SHPO).
Endangered Species of 1973	16 U.S.C. §§ 1531 et seq.	Authorizes determination of threatened and endangered plant and animal species and provides for Federal, State, and local conservation programs.
National Environmental Policy Act	42 U.S.C. 4321 et seq. (1970)	Establishes a broad national policy to encourage productive and enjoyable harmony between persons and their environment and to ensure that consideration is given to environmental values and factors in Federal decision making.
New Mexico Wildlife Conservation Act	§§ 17-2-37 through 178-2-46 NMSA (1978)	Empowers the State Game and Fish Commission to list endangered species, promulgate regulations, and enter into cooperative agreements with the U.S. Fish and Wildlife Service to protect such species.
Federal Land Policy and Management Act	16 U.S.C. §§ 1701 et seq.	Authorizes "administrative" public land withdrawals by the Secretary of Interior for a period not to exceed 20 years. Also authorizes exchanges of Federal for State or private lands where the "public interest will be well served." Applies to BLM lands.

Table 3-1
(continued)

COMPLIANCE STATUS OF FEDERAL AND NEW MEXICO STATUTES APPLICABLE TO THE WIPP PROJECT

NAME OF STATUTE	CITATION	ANNOTATION
Department of Energy National Security and Military Applications of Nuclear Energy Authorization Act of 1980	Public Law (PL) 96-540 and PL 96-164; 42 U.S.C. §§ 7272 and 7273	Authorizes construction of the WIPP as a DOE defense R&D facility exempted from NRC regulation. Mandates DOE consultation and cooperation with the State of New Mexico.
New Mexico Emergency Management Act	§§ 74-3-1 through 74-3-16 NMSA (1978)	Provides for development of a comprehensive statewide hazardous materials emergency management plan covering hazardous and radioactive materials. Establishes a Hazardous Materials Safety Board.
New Mexico Radioactive Materials Act	§§ 74-4A-2 through 74-4A-14 NMSA (1978)	Establishes the Radioactive Waste Consultation Task Force, empowered to negotiate for the state with the federal government regarding federal facilities for disposal of high-level radioactive waste, transuranic waste, and low-level radioactive waste.
Hazardous Materials Transportation Act of 1976	49 U.S.C. §§ 1801 et seq.	Establishes authority of the Department of Transportation to uniformly regulate the transportation of hazardous materials which pose risks to life and property.
Resource Conservation and Recovery Act (RCRA)	PL 94-580 and amended by PL 95-609, PL 96-463, PL 96-482, PL 96-510, PL 97-272, PL 97-375, PL 98-48, PL 98-371, PL 98-616, PL 99-339, and PL 99-499	Provides cradle-to-grave regulation over hazardous waste. The DOE and the EPA have determined that radioactive mixed waste are regulated under both the Resource Conservation and Recovery Act and the Atomic Energy Act.
New Mexico Hazardous Waste Management Regulations	§§ 74-4-1 through 74-4-13 (1977, 1981, 1983, 1987, 1989)	Implements Hazardous Waste Management Program for the State of New Mexico.
Atomic Energy Act	42 U.S.C. 2201/AEA 161	Requires the USEPA to promulgate generally applicable standards for the protection of the public and the environment with regards to radiation.
Safe Drinking Water Act	42 U.S.C. 300/SDWA 1412	Regulates the protection of primary drinking waters with regard to radionuclides.
Fe[illegible]nsecticide, Fu[illegible]e, and Rodenticide Act (FIFRA)	40 CFR 162 Parts 150-189	Regulate the [illegible]ation, use, application, experimental use, restrictions, penalities, cert[illegible]d applicators, i[illegible]xport, research, and monitoring of all chemicals under the FIFRA[illegible]

Table 3-2

DOE ORDERS AND AGREEMENTS AFFECTING THE WIPP ENVIRONMENTAL PROGRAM

ORDER NO.	DATE	TITLE	ANNOTATION
DOE 5400.1	11/09/88	General Environmental Protection Program	Establishes environmental protection program requirements, authorities, and responsibilities for DOE operations for ensuring compliance with Federal and State environmental protection laws and regulations, Federal executive orders, and internal department policies.
DOE 5400.2A	01/31/89	Environmental Compliance Issue Coordination	Establishes DOE requirements for coordination of significant environmental compliance issues.
DOE 5400.3	02/22/89	Hazardous and Radioactive Mixed Waste Program	Establishes DOE hazardous and radioactive mixed waste policies and requirements for RCRA compliance.
DOE 5400.4	10/06/89	Comprehensive Environmental Response, Compensation, and Liability Act Requirements	Establishes basic requirements for implementation of the superfund at DOE facilities
DOE 5400.5	02/08/90	Radiation Protection of the Public and the Environment	Establishes standards and requirements for operations of the DOE and DOE contractors with respect to protection of the public and the environment against undue risk from radiation.
DOE 5440.1D	04/09/85	National Environmental Policy Act	Establishes DOE policy for implementation of the National Environmental Policy Act of 1969 (PL 91-190).
DOE 5480.1B	09/23/86	Environmental Protection, Safety, and Health Protection Program for DOE Operations	Establishes an overall framework of program requirements for safety, environmental, and health protection, including criteria for radiation exposure and radioactive releases for operating facilities and sites.
DOE 5480.3	09/23/86	Safety Requirements for the Packaging of Fissile and Other Radioactive Materials	Establishes requirements for packaging and transportation of radioactive materials for DOE facilities.
DOE 5484.1	10\17\90	Environmental Protection, Safety, and Health Protection Information Reporting Requirements	Establishes requirements and procedures for reporting information having environmental protection, safety, or health significance for DOE operations.
AL 5484.1	08/23/82	Environmental Protection, Safety and Health Protection Information Reporting Requirements	Albuquerque Operations Office implementation of 5484.1.

Table 3-2
(Continued)

DOE ORDERS AND AGREEMENTS AFFECTING THE WIPP ENVIRONM PROGRAM

ORDERS

ORDER NO.	DATE	TITLE	ANNOTATION
DOE 5481.1B AL 5481.1B	09/23/86 01/27/88	Safety Analysis and Review System	To establish uniform req ments for the preparatio review of safety analyses operations which include fication of hazards, their or control, assessment of and documented manage authorization of the oper
DOE 5482.1A	08/13/81	Environmental, Safety and Health Appraisal Program	To establish the Environ mental Protection, Safet and Health (ES&H) appraisal program for th
DOE 5500.3	08/13/81	Emergency Planning, Preparedness, and Response for Operations	To establish requiremen development of DOE sit emergency plans and pro radiological emergencies in existing or planned D actors and nonreactor n facilities. Furthermore, that comprehensive eme actions are planned, coo and implemented to resp tively to the on- d sequences of a ic gency at these a vides for appro coo between DOE and off-si to ensure the protection personnel, public health and the environment.
DOE 5700.6B	09/23/86	Quality Assurance	To provide DOE policy, principles, and assign res for establishing, implem maintaining programs o actions to ensure quality in DOE programs.
DOE 5820.2A	09/26/88	Radioactive Waste Management	Establishes policies and guidelines by which DO ages radioactive waste, byproducts, and radioac contaminated surplus fa
DOE 5480.4	05/15/84	Environmental Protection, Safety, and Health Protection	To specify and provide ments for the applicatio mandatory Environmen tection, Safety, and Hea (ES&H) standards appl to all DOE and DOE co operations; to provide a reference ES&H standa and references ES&H s
DOE 6430.1A	04/06/89	General Design Criteria	To provide general desi criteria for use in the ac DOE facilities and to es responsibilities and aut development and maint criteria.

Table 3-3

SUMMARY OF AGREEMENTS BETWEEN DOE AND THE STATE OF NEW MEXICO THAT AFFECT THE ENVIRONMENTAL PROGRAM

Stipulated Agreement. This agreement, approved by the U.S. District Court when it stayed (held in abeyance) proceedings in the lawsuit against the DOE by the State, was executed on July 1, 1981. The eight-page agreement ensures that a binding, enforceable "consultation and cooperation" agreement will be entered into by the DOE and the State and that the DOE will make a "good faith effort" to resolve certain State off-site concerns (which are covered in the Supplemental Stipulated Agreement). The Stipulated Agreement also addresses a number of additional studies and experiments to be conducted by the DOE for the Site Preliminary Design Validation (SPDV) phase of the WIPP.

Agreement for Consultation and Cooperation. Usually referred to as the "C&C Agreement," this agreement is contained in Appendix A to the Stipulated Agreement. It affirms the intent of the Secretary of Energy to consult and cooperate with New Mexico with respect to State public health and safety concerns.

Working Agreement for Consultation and Cooperation. This agreement, Appendix B to the Stipulated Agreement, identifies in Article IV over 60 "key events" and "milestones" in the construction and operation of the WIPP that must be reviewed by the State before they are commenced. Many environmental items are included. (Article IV of the Working Agreement was revised on April 8, 1983.)

Supplemental Stipulated Agreement Resolving Certain State Off-Site Concerns Over WIPP. This agreement, dated December 27, 1982, addresses five State concerns including the need for State "verification" of the WIPP operational environmental monitoring program. The concerns addressed are: State liability (for a nuclear incident), emergency response preparedness, transportation monitoring of the WIPP waste, WIPP environmental monitoring by the State, and upgrading of State highways.

First Modification to the Agreement for Consultation and Cooperation. Signed November 30, 1984, wherein the DOE and the State agreed to address certain concerns of the State regarding: (1) the specific mission of the WIPP, (2) a demonstration of retrievably prior to waste emplacement, (3) post-closure control and responsibility, (4) completion of certain additional scientific testing and reports, (5) compliance with applicable Federal regulatory standards for waste repositories, and (6) a program for encouraging and reporting upon the hiring of New Mexico residents at the WIPP.

Second Modification to the Agreement for Consultation and Cooperation. Signed August 4, 1987, wherein the DOE and the state agree to address certain concerns of the state regarding: (1) surface and subsurface mining and drilling after closure of the WIPP site, (2) the disposal of salt tailings at the WIPP site, and (3) compliance with Environmental Protection Agency (EPA), Department of Transportation (DOT), and Nuclear Regulatory Commission (NRC) regulations.

1988 Modification to the Working Agreement of the Consultation and Cooperation Agreement Between the Department of Energy and the State of New Mexico on the Waste Isolation Pilot Plant. Signed March 1988, this modification deleted the sorbing tracer test from the list of required reports and substituted additional tests. In addition, the State is allowed to operate a fixed air sampler in the mine ventilation effluent air stream.

Memorandum of Understanding between United States Department of Energy WIPP Project Office and United States Department of the Interior Rosell District, Bureau of Land Management This memorandum effective October 26, 1990 allows for an administration land withdrawl between the U.S. DOE the BLM for the BLM for the 8746 acres outside 1454 acres of the DOE exclusive use acarage. This remaining 8746 acres completes the 16 section land withdrawl.

Table 3-4
1990 Active Environmental Permits

GRANTING AGENCY	TYPE OF PERMIT/ APPROVAL	PERMIT NUMBER	DATE GRANTED	DATE EXPIRATION	PERMIT STATUS	PERMIT CONDITIONS	ACTION REQUIRED	COMMENTS
DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT	APPROVAL TO DRILL 2 NEW TEST WELLS ON EXISTING PADS AT P-1 AND P-2.	NA	9/18/86	NA	ACTIVE			
NEW MEXICO ENVIRONMENTAL IMROVEMENT DIVISION	OPEN BURNING PERMIT TO TRAIN FIRE CONTROL CREWS.	NA	01/23/90	01/23/91	ACTIVE			
NEW MEXICO ENVIRONMENTAL IMPROVEMENT DIVISION	FOOD OR DRINK PURVEYOR PERMIT FOR CAFETERIA.	4CA08CARRS184A	10/10/86	NA	ACTIVE			RENEWED ANNUALLY
NEW MEXICO DEPARTMENT OF GAME AND FISH	PERMIT TO COLLECT BIO-LOGICAL SAMPLES.	1894	01/08/90	12/31/90	ACTIVE	LIMIT OF 25 QUAIL AND 50 CATFISH		
NEW MEXICO DEPARTMENT OF GAME AND FISH	CONCURRENCE THAT CONSTRUCTION OF WIPP WILL HAVE NO SIGNIFICANT ADVERSE IMPACT UPON THREATENED OR ENDANGERED SPECIES.	NA	4/7/80	NA	ACTIVE			LETTER TRANSMITTED TO UPDATE CONSULTATION WITH REGARD TO RECENT AMENDMENTS TO STATE ENDANGERED SPECIES LIST(COPY NEEDED FOR PERMIT FILE).
NEW MEXICO COMMISSIONER OF PUBLIC LANDS	RIGHT-OF-WAY FOR HIGH VOLUME AIR SAMPLER. (16,35,29)	RW-22789	10/03/85	10/3/2020	ACTIVE	$500 ANNUAL FEE.		
NEW MEXICO DEPARTMENT OF FINANCE AND ADMINISTRATION PLANNING DIVISION HISTORIC PRESERVATION BUREAU	CONCURRENCE THAT THE ARCHAEO-LOGICAL RESOURCES PROTECTION PLAN PREPARED BY THE DOE IS ADEQUATE TO MITIGATE ANY ADVERSE IMPACTS UPON CULTURAL RESOURCES RESULT-	NA	7/25/83	NA	ACTIVE	NA	NA	

Table
1990 Active Environmental Permits
(continued)

GRANTING AGENCY	TYPE OF PERMIT/ APPROVAL	PERMIT NUMBER	DATE GRANTED	DATE EXPIRATION	PERMIT STATUS	PERMIT CONDITIONS	ACTION REQUIRED	COMMENTS
U.S. ENVIRONMENTAL PROTECTION AGENCY	ACKNOWLEDGEMENT OF NOTIFICATION OF HAZARDOUS WASTE ACTIVITY (WIPP).	NM4890139088	1/88	NA	ACTIVE			BIENNIAL REPORT SUBMITTED 3/90
U.S. ENVIRONMENTAL PROTECTION AGENCY	NOTIFICATION OF PRESENCE OF 2 UNDERGROUND FUEL STORAGE TANKS AT WIPP.	NA	04/15/86	NA	ACTIVE		INVENTORY CONTROL	$200 ANNUAL FEE SUBMITTED 7/11/90. ANNUAL FEE DUE 7/91.
NEW MEXICO ENVIRONMENTAL IMPROVEMENT DIVISION	SUBMITTAL OF PART A RCRA PERMIT APPLICATION.		7/88	NA	ACTIVE		RESUBMIT BY 1/22/91	PART A RETURNED BY NM EID 12/89, TO BE RESUBMITTED WITHIN 6 MO. OF STATE AUTHORIZATION FOR MIXED WASTE. (7/25/90)
NEW MEXICO ENVIRONMENTAL IMPROVEMENT DIVISION	SUBMITTAL OF PART B RCRA PERMIT APPLICATION.	N/A					SUBMIT PERMIT APPLICATION BY 2/28/91	EID CALLED FOR PART B APPLICATION WITHIN 6 MO. OF REQUEST
U.S. ENVIRONMENTAL PROTECTION AGENCY	NESHAPS (RADIONUCLIDES).							DATA PACKAGE SUBMITTED TO THE DOE ON 11/07/90
DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT	RIGHT-OF-WAY FOR WATER PIPELINE.	NM53809	8/17/83	NA	ACTIVE			RIGHT-OF-WAY EXTENDED IN PERPETUITY, MODIFIED FOR CONSTRUCTION OF FENCE ALONG E AND W SIDES OF NORTH ACCESS ROAD.

Table 3-4
1990 Active Environmental Permits
(continued)

GRANTING AGENCY	TYPE OF PERMIT/ APPROVAL	PERMIT NUMBER	DATE GRANTED	DATE EXPIRATION	PERMIT STATUS	PERMIT CONDITIONS	ACTION REQUIRED	COMMENTS
DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT	RIGHT-OF-WAY FOR NORTH ACCESS ROAD. (20,32,33,06)	NM55676	8/24/83	NA	ACTIVE			RIGHT-OF-WAY EXTENDED IN PERPETUITY, MODIFIED FOR CONSTRUCTION OF FENCE ALONG E AND W SIDES OF NORTH ACCESS ROAD AND TO INSTALL OVERHEAD ELECTRIC LINE.
DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT	RIGHT-OF-WAY FOR RAILROAD.	NM55699	9/27/83	NA	ACTIVE			RIGHT-OF-WAY EXTENDED IN PERPETUITY.
DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT	RIGHT-OF-WAY FOR DOSIMETRY AND AEROSOL SAMPLING SITES. (22,31,20,07)	NM63136	7/3/86	NA	ACTIVE			
DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT	RIGHT-OF-WAY FOR SEVEN SUBSIDENCE MONUMENTS. (22,31,20,07) (22,31,21,05)	NM65801	11/7/86	NA	ACTIVE			
DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT	RIGHT-OF-WAY FOR AEROSOL SAMPLING SITE. (24,32,06,13)	NM77921	8/18/89	8/18/2019	ACTIVE			
DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGE[illegible]	RIGHT-OF-WAY FOR TEN RAPTOR NESTING PLATFORMS	NM82212	09/12/89	09/12/92	ACTIVE			REPLACES NM-060-LUP-235
DEPAR[illegible] OF THE INTERIOR, BUREAU OF LAND	RIGHT-OF-WAY FOR SURVEY MONUMENT	NM82245	12/13/89	12/13/2019	AC[illegible]			

DOE/WIPP

Table 3-4

1990 Active Environmental Permits
(continued)

GRANTING AGENCY	TYPE OF PERMIT/ APPROVAL	PERMIT NUMBER	DATE GRANTED	DATE EXPIRATION	PERMIT STATUS	PERMIT CONDITIONS	ACTION REQUIRED	COMMENTS
DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT	FREE USE PERMIT (21,32,33,05).	NM-060-FU9-7020	1/31/89	1/23/90	ACTIVE THROUGH 1/23/90	MAXIMUM EXCAVATION 28,000 CU YDS.		CALICHE USE REPORTS SUBMITTED 1/90
DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT	FREE USE PERMIT (23,30,01,07).	NM-060-FU9-7030	6/8/89	6/8/90	ACTIVE THROUGH 6/8/90	MAXIMUM EXCAVATION 4000 CU YDS.		CALICHE USE REPORTS SUBMITTED 1/90
DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT	LAND USE PERMIT TO DISPOSE OF CONSTRUCTION DEBRIS.	NM-067-LUP-237	2/9/87	2/9/90	ACTIVE THROUGH 2/9/90			LANDFILL CLOSED IN ACCORDANCE WITH PERMIT REQUIREMENTS. RECLAMATION REQUIRED.
DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT	RIGHT-OF-WAY FOR SECURITY FENCE INSTALATION.	NA	NA	NA	PENDING			PENDING BLM APPROVAL.
U.S. ENVIRONMENTAL PROTECTION AGENCY	ACKNOWLEDGEMENT OF NOTIFICATION OF HAZARDOUS WASTE ACTIVITY (TRUPACT).	NMD982283566	10/87	NA	INACTIVE	NA		ACTIVE GENERATOR STATUS: TERMINATE 3/90

Table 3-5
1991 Active Environmental Permits

GRANTING AGENCY	TYPE OF PERMIT/ APPROVAL	PERMIT NUMBER	DATE GRANTED	DATE EXPIRATION	PERMIT STATUS	PERMIT CONDITIONS	ACTION REQUIRED	COMMENTS
DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT	APPROVAL TO DRILL 2 NEW TEST WELLS ON EXISTING PADS AT P-1 AND P-2.	NA	9/18/86	NA	ACTIVE			
NEW MEXICO ENVIRONMENTAL IMROVEMENT DIVISION	OPEN BURNING PERMIT TO TRAIN FIRE CONTROL CREWS.	NA	03/08/91	03/08/92	ACTIVE			
NEW MEXICO ENVIRONMENTAL IMPROVEMENT DIVISION	FOOD OR DRINK PURVEYOR PERMIT FOR CAFETERIA.	4CA08CARRS184A	10/10/86	NA	ACTIVE			RENEWED ANNUALLY
NEW MEXICO DEPARTMENT OF GAME AND FISH	PERMIT TO COLLECT BIO-LOGICAL SAMPLES.	1894	01/25/91	12/31/91	ACTIVE	LIMIT OF 25 QUAIL AND 50 CATFISH		
NEW MEXICO DEPARTMENT OF GAME AND FISH	CONCURRENCE THAT CONSTRUCTION OF WIPP WILL HAVE NO SIGNIFICANT ADVERSE IMPACT UPON THREATENED OR ENDANGERED SPECIES.	NA	4/7/80	NA	ACTIVE			LETTER TRANSMITTED TO UPDATE CONSULTATION WITH REGARD TO RECENT AMENDMENTS TO STATE ENDANGERED SPECIES LIST(COPY NEEDED FOR PERMIT FILE).
NEW MEXICO DEPARTMENT OF GAME AND FISH	PROTECTED SPECIES PERMIT RAPTOR BANDING	1608	02/27/91	12/31/91	ACTIVE	NO FEDERALLY PROTECTED/ENDANG-ERED SPECIES MAY BE CAPTURED OR BANDED		
NEW MEXICO COMMISSIONER OF PUBLIC LANDS	RIGHT-OF-WAY FOR HIGH VOLUME AIR SAMPLER. (16,35,29)	RW-22789	10/03/85	10/3/2020	ACTIVE	$500 ANNUAL FEE.		

Table 3-5
1991 Active Environmental Permits
(continued)

GRANTING AGENCY	TYPE OF PERMIT/ APPROVAL	PERMIT NUMBER	DATE GRANTED	DATE EXPIRATION	PERMIT STATUS	PERMIT CONDITIONS	ACTION REQUIRED	COMMENTS
NEW MEXICO DEPARTMENT OF FINANCE AND ADMINISTRATION PLANNING DIVISION, HISTORIC PRESERVATION BUREAU	CONCURRENCE THAT THE ARCHAEO-LOGICAL RESOURCES PROTECTION PLAN PREPARED BY THE DOE IS ADEQUATE TO MITIGATE ANY ADVERSE IMPACTS UPON CULTURAL RESOURCES RESULT-ING FROM CON-STRUCTION OF THE FULL WIPP FACILITY.	NA	7/25/83	NA	ACTIVE	NA	NA	
U.S. ENVIRONMENTAL PROTECTION AGENCY	ACKNOWLEDGEMENT OF NOTIFICATION OF HAZARDOUS WASTE ACTIVITY (WIPP).	NM4890139088	1/88	NA	ACTIVE			BIENNIAL REPORT SUBMITTED 3/90
U.S. ENVIRONMENTAL PROTECTION AGENCY	NOTIFICATION OF PRESENCE OF 2 UNDERGROUND FUEL STORAGE TANKS AT WIPP.	NA	04/15/86	NA	ACTIVE		INVENTORY CONTROL	$200 ANNUAL FEE SUBMITTED 7/25/91. ANNUAL FEE DUE 7/92.
NEW MEXICO ENVIRONMENTAL IMPROVEMENT DIVISION	SUBMITTAL OF PART A RCRA PERMIT APPLICATION.		7/88	NA	ACTIVE		AWAITING APPROVAL	PART A WAS SUBMIT TED TO BOTH EID AND EPA REGION VI ON 1/22/91
NEW MEXICO ENVIRONMENTAL IMPROVEMENT DIVISION	SUBMITTAL OF PART B RCRA PERMIT APPLICATION.	N/A					UNTIL PERMIT IS ISSUED THE WIPP WILL OPERATE UNDER INTERIM STATUS	PART B WAS SUBMIT-TED TO EID ON 2/26/91 AND TO EPA REGION VI ON 2/27/91

Table 3-5
1991 Active Environmental Permits
(continued)

GRANTING AGENCY	TYPE OF PERMIT/ APPROVAL	PERMIT NUMBER	DATE GRANTED	DATE EXPIRATION	PERMIT STATUS	PERMIT CONDITIONS	ACTION REQUIRED	COMMENTS
U.S. ENVIRONMENTAL PROTECTION AGENCY	NESHAPS (RADIONUCLIDES).							DATA PACKAGE SUBMITTED TO THE DOE ON 11/07/90 DATA PACKAGE SUBMITTED TO THE EPA ON 02/19/91
DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT	RIGHT-OF-WAY FOR WATER PIPELINE.	NM53809	8/17/83	NA	ACTIVE			RIGHT-OF-WAY EXTENDED IN PERPETUITY, MODIFIED FOR CONSTRUCTION OF FENCE ALONG E AND W SIDES OF NORTH ACCESS ROAD.
DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT	RIGHT-OF-WAY FOR NORTH ACCESS ROAD. (20,32,33,06)	NM55676	8/24/83	NA	ACTIVE			RIGHT-OF-WAY EXTENDED IN PERPETUITY, MODIFIED FOR CONSTRUCTION OF FENCE ALONG E AND W SIDES OF NORTH ACCESS ROAD AND TO INSTALL OVERHEAD ELECTRIC LINE.
DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT	RIGHT-OF-WAY FOR RAILROAD.	NM55699	9/27/83	NA	ACTIVE			RIGHT-OF-WAY EXTENDED IN PERPETUITY.
DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT	RIGHT-OF-WAY FOR DOSIMETRY AND AEROSOL SAMPLING SITES. (22,31,20,07)	NM63136	7/3/86	NA	ACTIVE			
DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT	RIGHT-OF-WAY FOR SEVEN SUBSIDENCE MONUMENTS.	NM65801	11/7/86	NA	ACTIVE			

Table [illegible]
1991 Active Environmental Permits
(continued)

GRANTING AGENCY	TYPE OF PERMIT/ APPROVAL	PERMIT NUMBER	DATE GRANTED	DATE EXPIRATION	PERMIT STATUS	PERMIT CONDITIONS	ACTION REQUIRED	COMMENTS
DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT	RIGHT-OF-WAY FOR AEROSOL SAMPLING SITE. (24,32,06,13)	NM77921	8/18/89	8/18/2019	ACTIVE			
DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT	RIGHT-OF-WAY FOR TEN RAPTOR NESTING PLATFORMS	NM82212	09/12/89	09/12/92	ACTIVE			REPLACES NM-060-LUP-235
DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT	RIGHT-OF-WAY FOR SURVEY MONUMENT INSTALLATION (22,31,16,04) (22,31,17,01).	NM82245	12/13/89	12/13/2019	ACTIVE			
DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT	RIGHT-OF-WAY FOR SECURITY FENCE INSTALATION.	NA	NA	NA	PENDING			PENDING BLM APPROVAL.

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CHAPTER 4

ENVIRONMENTAL PROGRAM INFORMATION

It is the policy of the WIPP to conduct its operations so as to comply with all applicable environmental laws and regulations.

4.1 OPERATIONAL ENVIRONMENTAL MONITORING PROGRAM

The OEMP monitors a comprehensive set of parameters in order to detect and quantify any present or potential future environmental impacts. Nonradiological portions of the program focus on the immediate area surrounding the site, whereas radiological surveillance generally covers a broader geographic area including nearby ranches, villages, and cities. Environmental monitoring will continue at the site during project operations and through decommissioning activities.

The goal of the OEMP is to determine whether there are impacts during the operational phase of WIPP on the local ecosystem and, if so, to evaluate their severity, geographic extent, and environmental significance, and identify correctable actions and make every effort to minimize the environmental impacts of the WIPP. Table 4-1 summarizes the OEMP sampling schedule and sampling type, whereas Table 4-2 denotes the analytical array for the various sample types. The tables list the sample types, the number of sampling stations, the approximate sampling schedule, and the environmental/ecological parameters to be monitored or analyzed. Additional or different types of samples will be collected and analyzed as necessary to investigate and explain trends or anomalies that may have a bearing on environmental impacts.

As recommended in DOE/EP-0023 (Corley et al., 1981), the OEMP monitors levels of naturally occurring radionuclides and those associated with world-wide fallout, in addition to those expected in the WIPP waste. The geographic scope of radiological sampling is based on projections of potential release pathways (see Figure 4-1, Primary Pathway Exposure) and the types of radionuclides in WIPP waste. Also, the surrounding population centers are monitored even though release scenarios involving radiation dose to residents of those population centers are improbable due to the extended distances from the WIPP. Ecological sampling activities will continue to be performed at the permanent ecological monitoring plots, whose locations are unchanged from the earlier EMP.

4.2 CLEAN AIR ACT

The CAA is a broad federal statute which, among other things, specifies national ambient air quality standards and sets emission limits for specific air pollutants from certain sources. These standards are to be achieved by the states through development and adoption of implementation plans. The CAA also authorizes the EPA to set new source performance standards and NESHAPs. The EPA has also developed special programs for prevention of significant deterioration of air quality. The WIPP complies with CAA criteria.

4.3 CLEAN WATER ACT

The Federal Water Pollution Control Act (FWPCA) of 1972, as amended by the CWA and the Water Quality Act (WQA) of 1987, forms a legal framework intended to support the maintenance and restoration of water quality in surface water, with the ultimate goal of "fishable and swimmable" water quality. The FWPCA established the National Pollutant Discharge Elimination System (NPDES) as the regulatory mechanism to achieve this goal by regulating discharge to navigable streams, rivers, and lakes.

The WQA has significantly changed the thrust of enforcement activities. In the future, muc[illegible]te emphasis will be placed on monitoring and control of toxic constituents in wastewater, pern[illegible]o outfall compose entirely of stormwater, and imposition of regulations governing sewage sludge disp Best management practices will influence waste handling from point of discharge back to the sourc applicable the WIPP does comply with the CWA.

4.4 RESOURCE CONSERVATION AND RECOVERY ACT

The RCRA was enacted in 1976, and implementing regulations were promulgated in May of 1980. body of regulations is intended to ensure that hazardous wastes are disposed of in an environmenta safe manner, and that facilities that store, treat, or dispose of hazardous waste do so in a way that protects human health and the environment. The Hazardous and Solid Waste Amendments of 198 created a set of restrictions on land disposal of hazardous wastes unless certain treatment standard be satisfied. This act also places increased emphasis on waste minimization activities and serves as m[illegible]anism to enforce cleanup.

N[illegible]azardous solid waste generated on site consists primarily of paper and cardboard, constructic wastes, and cafeteria waste. Whereas, hazardous wastes are principally petroleum based products. February 1989, the governor of New Mexico signed legislation which authorizes the EID to regulat radioactive mixed waste at the WIPP. The WIPP complies with RCRA requirements as applicable the facility.

4.5 SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT

The SARA Title III provisions added significant public notification requirements to the Comprehe Environmental Response, Compensation and Liability Act (CERCLA). There are no declared CERCLA sites at the WIPP site. At this time, all of the inactive solid waste units and rele[illegible]es WIPP site are being investigated/remediated under regulations of RCRA and not CERCL[illegible]e summary toxic chemical inventory data required under SARA Title III will be prepared in June 19

4.6 FEDERAL INSECTICIDE, FUNGICIDE AND RODENTICIDE ACT

The Federal Insecticide, Fungicide and Rodenticide Act, as amended, contains federal regulations governing the manufacture and use of biocides. Procedures promulgated under this act (40 CFR 150-180) govern the use, storage, and disposal of all pesticides, pesticide containers, and pesticide residues. At the WIPP site, pesticides are used in accordance with these regulations.

4.7 ACCIDENTAL RELEASES

The WIPP site had no accidental releases into the environment during 1990. In the future during operations if a release occurs all state and federal regulatory agencies will be promptly notified of release.

4.8 SIGNIFICANT ENVIRONMENTAL ACTIVITIES

This section addresses significant environmental activities that occurred during 1989.

4.8.1 Waste Minimization and Pollution Prevention Awareness Plan

The WIPP Waste Minimization and Pollution Prevention Awareness Plan has been drafted and is currently being revised to incorporate comments. A second managerial review and an interactive comment session occurred in April of 1991. The final plan will be submitted to DOE/WPO by May 1991.

4.8.2 Environmental Training

During 1990 there were six environmental training courses offer to WIPP personal they were:

- 40 hour hazardous waste operations
- RCRA training
- Environmental regulations
- Basic environmental training
- Fundamentals of groundwater and wells
- Westinghouse School for Environmental Excellence

4.8.3 Cooperative Raptor Research and Management Program

In 1985, the Los Medanos Cooperative Raptor Research and Management Program was initiated under the sponsorship of the DOE with support from the BLM and the New Mexico Living Desert State Park. Part of the goal of this program, which is being conducted by researchers from the University of New Mexico, is to evaluate the impacts of WIPP activities on the breeding success of raptors (i.e., hawks and owls) that are found in great abundance in the area.

During 1990, 80 raptor nests and 31 Chihuahuan raven nests were located and monitored in the study area. Reproductive success of raptor species was poor, especially for Chihuahuan Ravens. The poor success rate was probably due to low prey availability, particularly rabbits. The average clutch size for Harris Hawks, averaged 2.47 with 1.00 offspring fledged, for a total recruitment of 14 individuals into the study population. Similarly, Swainson's hawks and great horned owls experienced low numbers of young fledged.

The calendar year 1990 precipitation was 10cm (3.97in) above normal with a total precipitation amount of 41cm (15.97in). Typically the majority of precipitation occurs in July and August, however only 36 percent of the annual precipitation was received in these months.

With three proceeding years of below normal precipitation prey species have been slow to respond to an above normal year. The previous years reduction in prey lead to a decrease in the nesting success of indigenous raptors. As plant communities and dependant prey species recover, raptor populations should respond accordingly.

4.8.4 Reclamation of Disturbed Lands

There was no reclamation activities performed for WIPP disturbed areas in CY 1990 reclamation studies conducted in 1988 and 1989 were evaluated through 1990.

The WIPP's current studies aim to answer the following questions relative to seed bed preparation and seed mix selection:

- Does single ripping the seed bed on caliche roads produce different results than double ripping?
- Does use of caliche as a top dressing produce different results on a reserve pit th using it?
- Do different directions of tillage produce different results on a dune site?
- Do native forbs and grasses from commercial sources produce different results t prescribed BLM mix? Current studies examine a total of 30 native plant species including 10 grasses, 5 shrubs, and 15 forbs.

Plots on roads, an 18 acre reserve pit, and a brine pit have been marked with permanent identification labels which should allow for long-term identification of plot treatments in t field and facilitate a long-term monitoring schedule.

To fulfill DOE commitments for reclamation of disturbed lands, a draft reclamation plan written to guide future reclamation projects. The reclamation plan takes effect in 1991 wi filling of reserve pits on WIPP well pads and ultimately ends with site decommiss

TABLE 4-1

OEMP SAMPLING SCHEDULE

TYPE OF SAMPLE	SAMPLING LOCATIONS	SAMPLING FREQUENCY
Liquid Influent	1	Semiannual
Liquid Effluent	1	Semiannual
Airborne Effluent	3	Continuous
Meteorology	2	Continuous
Exposure Rate Meter	1	Continuous
Atmospheric Particulate	7	Weekly
Air Quality	1	Continuous
Vegetation-Radioanalysis	4	Annual
Beef	2	Annual*
Game Birds	2	Annual
Rabbits	2	Annual
Soil-Radioanalysis	7	Biennial
Surface Water	8	Annual
Groundwater	14	Annual
Fish	2	Annual
Sediment	6	Biennial
Aerial Photography	Site Wide	Annual
Salt Impact Studies		
Surface Photography	7	Biannual
Soil Chemistry	7	Quarterly
Soil Microbiota	7	Semiannual
Vegetation Survey	7	Biannual
Wildlife Survey	4	Annual

TABLE 4-2

OEMP ANALYTICAL ARRAY

TYPE OF SAMPLE	ANALYSIS
Liquid Influent	Gross α, Gross β, pH, TSS, Specific Radionuclides
Liquid Effluent	Gross α, Gross β, pH, TSS, Specific Radionuclides, Chemical Constituents
Airborne Effluent	Gross α, Gross β, Specific Radionuclides
Meteorology	Temperature, Wind Speed, Wind Directio Precipitation, Dew Point, Barometric Pres.
Exposure Rate Meter	Penetrating Radiation
Atmospheric Particulate	Gross α, Gross β, TSP, Specific Radioncli
Air Quality	O_3, CO, H_2S, SO_2, NO_x
Vegetation Radioanalysis	Specific Radionuclides
Beef	Specific Radionuclides
Game Birds	Specific Radionuclides
Rabbits	Specific Radionuclides
Soil Radioanalysis	Gross α, Gross β, Specific Radionuclides
Surface Water	Gross α, Gross β, Specific Radionuclides TSS, pH
Groundwater	Specific Radionuclides, pH
Fish	Specific Radionuclides
Sediment	Gross α, Gross β, Specific Radionuclides
Aerial Photography	Area of Land Disturbed

TABLE 4-2
(Continued)

OEMP ANALYTICAL ARRRAY

TYPE OF SAMPLE	ANALYSIS
Salt Impact Study	
Surface Photography	Visual Impacts
Soil Chemistry	pH, EC, Na, Cl, Mg, Ca, K
Soil Micorbiota	Microbial Activity, Litter Decomposition
Vegetation Survey	Foliar Coverage, Species Richness, Annual Plant Density
Wildlife Survey	Bird and Small Mammal Population Densities

TSS = Total Suspended Solids
TSP = Total Suspended Particulates
EC = Electrical Conductivity

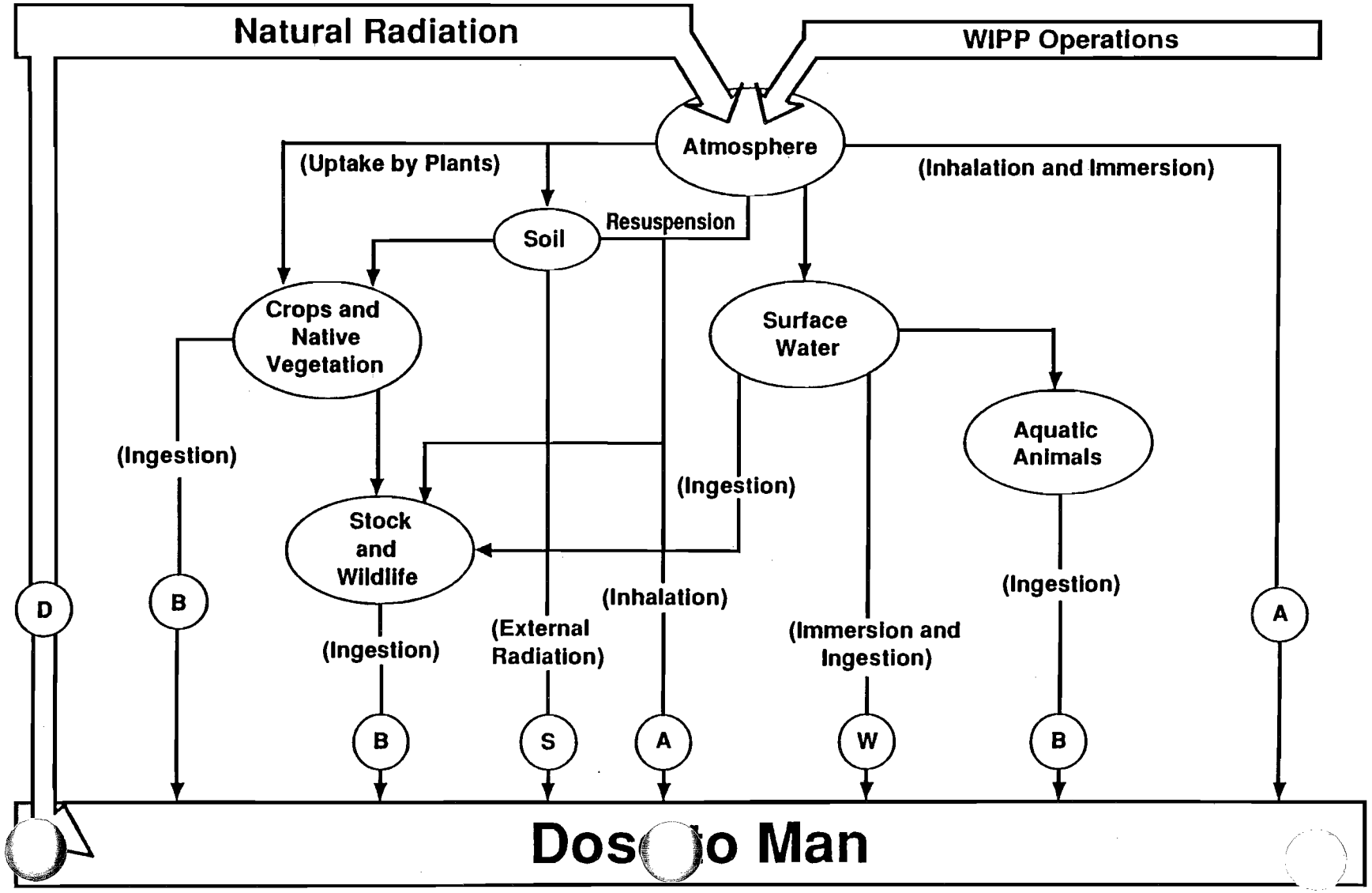
Specific Radionulides = ^{238}Pu, $^{239/240}Pu$, ^{241}Pu, ^{233}U, ^{235}U, ^{241}Am, ^{232}Th, ^{226}Ra, ^{137}Cs, ^{90}Sr, ^{40}K, ^{7}Be, ^{60}Co, U_{nat}, Th_{nat}

Chemical Constituents = Chloride, iron, manganese, phenols, sodium, sulfate, pH, specific conductance, total organic cabon, total organic halogen, arsenic, barium, cadmium, chromium, fluoride, lead, mercury, nitrate, selenium, silver, endrin, methoxychlor, toxaphene, 2, 4-D, 2, 4, 5-T, silvex.

*In addition, surface water samples from Hill Tank and Red Tank will be analyzed for the above chemical constituents biannually.

FIGURE 4-1

PRIMARY PATHWAYS TO MAN FOR RADIOACTIVE RELEASES FROM THE WIPP FACILITY



CHAPTER 5

ENVIRONMENTAL RADIOLOGICAL PROGRAM INFORMATION

The following sections provide a description of the various subprograms constituting the OEMP at the WIPP.

5.1 RADIOACTIVE EFFLUENT MONITORING

During March 1989, the monitoring activities of the Radiological Baseline Program (RBP) were combined into the OEMP. This program is described in the Operational Environmental Monitoring Plan for the Waste Isolation Pilot Plant, (DOE/WIPP 88-025). This plan defines the scope and extent of the WIPP effluent and environmental monitoring programs during the operational life of the facility. The OEMP is the database for all environmental comparisons once the WIPP is operational.

Draft Order DOE 5400.6, Requirements for Radiological Effluent Monitoring and Environmental Surveillance for U.S. DOE Operations (DOE,1988c), requires that monitoring of liquid waste effluent streams be adequate to demonstrate compliance with dose limits in Order DOE 5400.5, Radiation Protection of the Public and the Environment (DOE, 1990). This order also requires the monitoring of potential sources of contaminated airborne emissions. Since no radioactive waste was received at the WIPP site in 1990, no effluent sampling or release data are reported in this document.

It should be noted that a complete environmental radiological baseline summarization is forthcoming from a WIPP subcontractor. It is anticipated this report will be available in CY 1991.

5.2 ENVIRONMENTAL RADIOACTIVITY MONITORING

The following subsections present the monitoring results of the various subprograms of the OEMP for 1990. These include aerosol monitoring, ambient radiation, terrestrial radioactivity, hydrologic radioactivity, and biotic radioactivity baseline subprograms. Figures 5-1 through 5-6 summarize sample type and location for the WIPP and vicinity for the various subprograms.

5.2.1 The Atmospheric Radiation Baseline

Sampling airborne aerosol particulates is an important component of the OEMP. The Final Safety Analysis Report (FSAR) (DOE, 1990) identifies the atmospheric pathway as essentially the only release pathway resulting in a potential dose to the public. Nine continuous particulate aerosol samplers operate at eight locations (two at WIPP East), three within the Zone II boundary and four at local ranches and communities (Figure 5-1). The continuous aerosol samplers presently in use maintain a regulated flow rate of approximately 950 milliliters per second (two cubic feet per minute) of air through a 47-millimeter (1.9-inch) glass fiber filter for particulate collection. Table 5-1 lists the quarterly average concentrations of the alpha and beta activity on the low-volume aerosol filters from each location for the first and second quarters of 1990.

Airborne particulate sampling was initiated in July 1985 at a few locations. Routine weekly filter collections and subsequent radiochemical analysis began in early 1986 for all locations except the Far Field location, where data collection began in October 1986. Particulate filters were collected weekly at all locations in 1990. These filters were analyzed at the Environmental Counting Lab at the WIPP, where a gross alpha and gross beta count of each weekly filter was completed.

Figure 5-2 represents the mean gross alpha concentrations for all eight sampling loc individual gross alpha concentrations reported for each location is documented in A d The mean gross alpha concentrations in Figure 5-2 shows limited fluctuation throughout th year and are consistently less than 1 E-9 Bq/ml. These fluctuations appeared to be consiste among all sampling locations.

The mean gross beta concentrations Figure 5-3, fluctuate throughout the year, typically witi the range of 1.0-3.0 E-9 Bq/ml. Appendix II shows the 1990 gross beta concentration for ea individual sampling location which was used to establish the mean.

Gross beta and alpha measurements provide an indication of total radionuclide concentrat or may indicate changes in a specific radionuclide concentration. These measurements are used for screening to ensure that important radionuclides are not overlooked when perforr a specific measurement. However, gamma spectroscopy is performed in the WIPP Environmental low-level counting lab which identifies individual radionuclides and defines specific baseline environmental parameters. These analysis techniques have previously bee performed under a contract issued to a contract laboratory.

5.2.2 Ambient Radiation Baseline

A Reuter-Stokes High Pressure Ionization Chamber (HPIC), designed to monitor low leve gamma radiation in the environment, was put into operation in May 1986. This unit is loca the WIPP far field location which is 1000 meters northwest of the site. The detector used t measure low levels of gamma radiation is a pressurized ion chamber and measures levels o radiation from 1 to 100 microroentgen per hour (μR/hr). Using the average rate of 7.4 μR, the estimated annual dose is approximately 65 millirem. The fluctuations noted are primar due to calibration of the system and meteorological events such as the high intensi thunderstorms which frequent this area in late summer.

The Reuter-Stokes shows a rise in the average radiation level for the fourth quarter. A sea rise in ambient radiation has been observed in the first and fourth quarters each year. As s in previous reports, it is speculated that this fluctuation may be due to variations in the emi and dispersion of Radon-222 from the soil around the WIPP site. These variations can be caused by meteorological conditions, such as inversions, which would prevent the radon pr from dispersing.

This sensor was down for 2.5 months in CY 1990 as the main battery which supplies the hig voltage input to the pressure chamber ceased to accept the recharge capability from the charging unit. Thus, a new battery had to be procured, installed and the entire system had recalibrated thus requiring downtime.

These estimated annual dose of 65 millirem are calculated from the operational time in C and from historical known values typical for this area as indicated from the HPIC.

5.2.3 Radiological Soil Monitoring

The annual collection of radiological soil samples was conducted December in 1990 at 7 locations (Figure 5-4). A template insert allows the collection of samples at three depths each location: (1) surface sample, 0 - 2 centimeters (0.8 inch deep); (2) intermediate (mi sample, 2 - 5 centimeters (0.8 - 2.0 inches); and (3) deep sample, 5 - 10 centimeters (2.0 - 3 inches deep). Every sample was a composite of 10 randomly located subsamples, each delineated by a 10 by 10 centimeter (3.9 by 3.9 inches) stainless steel template. Soil pl collected during 1990 were archived since the required number of baseline soil sa a already been collected and analyzed for the OEMP.

This program is also valuable in documenting any possible radiological contamination of the soil from any of the local potash mines located primarily in Nash Draw or from the Gnome site which is approximately 12.8 Km (8 miles) southwest of the WIPP site.

5.2.4 Hydrologic Radioactivity

This subprogram is designed to establish baseline radiation levels in surface water bodies, bottom sediments, and groundwater. The following discussion of the hydrologic program includes sampling locations, times and data collected during 1990, and refinements made to the program since the publication of the RBP Sampling Plan (Reith and Daer, 1985). There were no annual surface water or sediment samples collected during CY 1990.

- Radiological Surface Water and Sediment Monitoring

  Surface Water and sediment samples were collected in 1985-1988 as directed by the OEMP (Figure 5-5). This baseline data is being compiled by a subcontractor and should be available by the end of 1991. Two years of preoperational data are required by Order DOE 5400.1 to establish a preoperational baseline for nuclear facilities. This program is also valuable in documenting any possible radiological contamination of the soil from any of the local potash mines located primarily in Nash Draw or from the Gnome site.

- Radiological Groundwater Monitoring

  Groundwater samples were collected in accordance with the Water Quality Sampling Program (WQSP). The primary objective of the WQSP is to obtain representative and repeatable ground water quality data from selected wells under rigorous field and laboratory procedures and protocols. At each well site, the well is pumped and the ground water serially analyzed for specific field parameters. Once the field parameters have stabilized, denoting a chemical steady state with respect to those parameters analyzed, a final groundwater sample is collected to be analyzed for radionuclides. The controlling document for the WQSP is the WIPP Water Quality Sampling Plan and Procedures Manual, WP 02-1, Rev 2.

The primary water bearing units being evaluated by the WQSP are the Culebra and Magenta Dolomite members of the Rustler Formation. Samples have also been collected from the Dewey Lake Redbeds Formation at local ranches. An indepth discussion of groundwater hydrology appears in Chapter 7.0, Groundwater Protection.

Figure 5-6 provides a map of the groundwater sampling locations. Approximately 23 wells are being monitored by the WQSP in support of the OEMP. In 1990, 16 Culebra and three Magenta wells were sampled and analyzed. Four recently drilled wells were added to the WQSP and sampled for the first time in 1987. Wells H-14 and H-15 were drilled in 1986. Wells H-17 and H-18 were drilled in 1987. WIPP-19 was also sampled for the first time in 1987. All five wells are completed in the Culebra and are located to give the RBP and WQSP a more complete coverage of the area surrounding the WIPP site.

For the WQSP, groundwater was sampled at ten privately owned water wells that supply drinking water for livestock and human consumption. Of these ten wells, nine supply groundwater for livestock consumption and one (Barn Well) supplies groundwater for human consumption.

There is extensive oil and gas production in the WIPP vicinity as well and the Gnome site which is located approximately 12.8 Km (8 miles) southwest of the site. However, there is no known source for radiological contamination of the groundwater near the site.

The radiological groundwater samples collected in 1990 CY were archived. The re amount of baseline groundwater samples have been collected and analyzed as spec OEMP for the preoperational baseline.

5.2.5 Biotic Radioactivity

This subprogram characterizes background radioactivity levels in key organisms along pos food chain pathways to man. Vegetation, rabbits, quail, beef, and fish are sampled, and palatable tissues are analyzed for concentrations of transuranics and common naturally occurring radionuclides. During 1990, samples of fish, quail, and rabbits were collected a archived since the required number of baseline biotic samples had already been collected analyzed for the OEMP. Representative sample locations are shown in Figure 5-7.

5.3 ASSESSMENT OF POTENTIAL DOSE TO THE PUBLIC

There was no waste received at the WIPP in 1990, therefore, there was no exposure of the public t radiation due to WIPP operations. Documentation of naturally occurring background radiation is discussed in Section 5.2.2, Ambient Radiation Baseline.

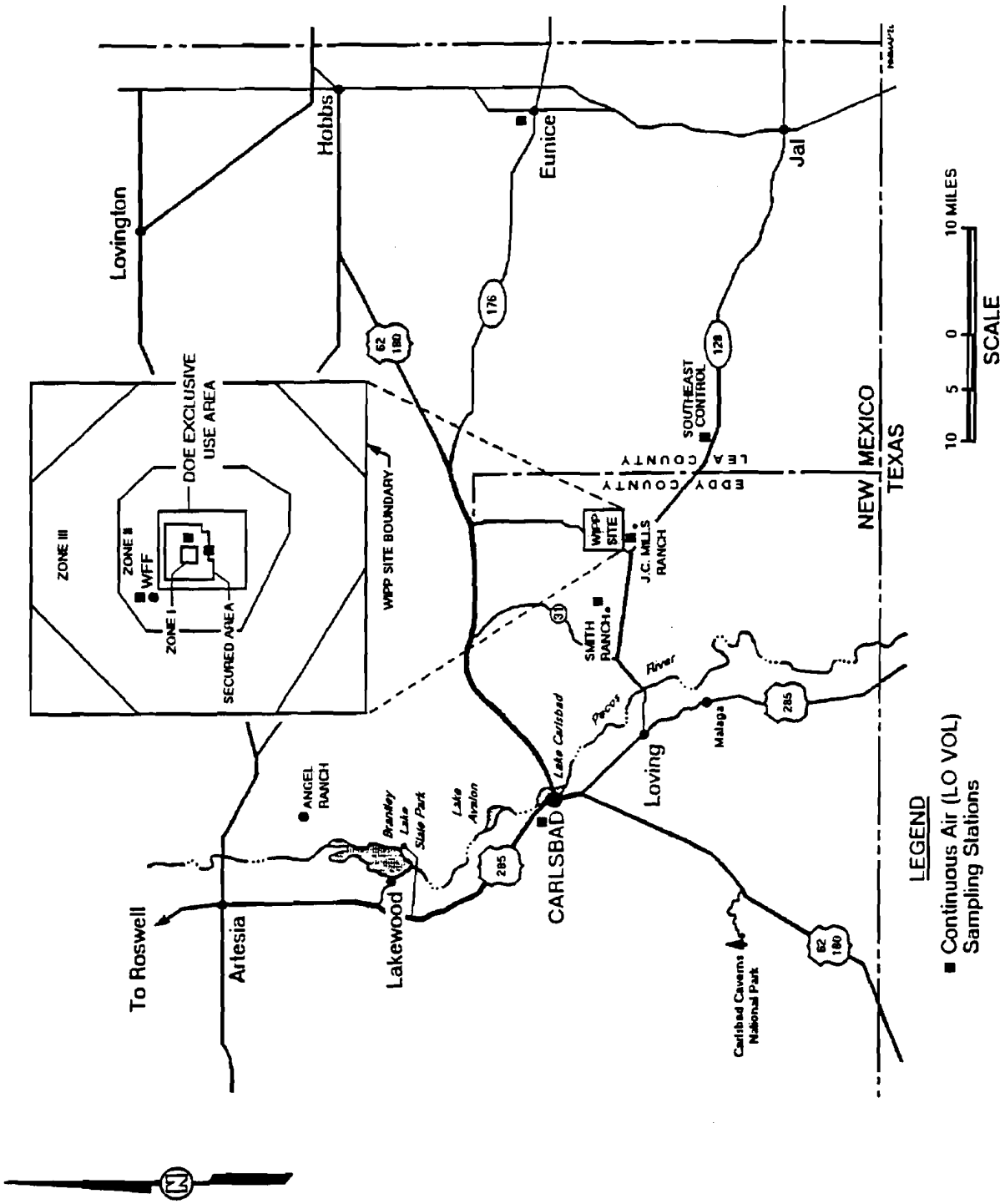


Figure 5-1
Continous Air Sampling Stations

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TABLE 5-1

ACTIVITY CONCENTRATIONS IN QUARTERLY AVERAGES OF THE LOW VOLUME AEROSOL FILTERS (Bq/ml)

FIRST QUARTER 1990

LOCATION	ALPHA	BETA
Carlsbad	5.8 E-10	1.5 E-9
Smith Ranch	4.8 E-10	1.3 E-9
Mills Ranch	5.8 E-10	1.3 E-9
WIPP Far Field	4.6 E-10	1.0 E-9
WIPP South	5.5 E-10	1.3 E-9
WIPP East (1)	5.0 E-10	1.3 E-9
WIPP East (2)	5.5 E-10	1.2 E-9
Eunice	5.5 E-10	1.3 E-9
South East Control	5.0 E-10	1.3 E-9

SECOND QUARTER 1990

LOCATION	ALPHA	BETA
Carlsbad	4.1 E-10	1.2 E-9
Smith Ranch	3.0 E-10	1.2 E-9
Mills Ranch	3.7 E-10	1.0 E-9
WIPP Far Field	3.6 E-10	1.1 E-9
WIPP South	3.4 E-10	1.1 E-9
WIPP East (1)	4.0 E-10	1.1 E
WIPP East (2)	3.8 E-10	1.1 E
Eunice	3.9 E-10	1.1 E-9
South East Control	4.2 E-10	1.3 E-9

THIRD QUARTER 1990

LOCATION	ALPHA	BETA
Carlsbad	3.9 E-10	1.3 E-9
Smith Ranch	7.3 E-10	2.4 E-9
Mills Ranch	6.1 E-10	1.5 E-9
WIPP Far Field	3.8 E-10	2.0 E-9
WIPP South	4.1 E-10	1.0 E-9
WIPP East (1)	3.6 E-10	9.7 E-9
WIPP East (2)	3.8 E-10	1.1 E-9
Eunice	4.0 E-10	1.1 E-9
South East Control	5.1 E-10	1.6 E-9

FOURTH QUARTER

LOCATION	ALPHA	BETA
Carlsbad	6.7 E-10	2.2 E-9
Smith Ranch	6.2 E-10	2.0 E-9
Mills Ranch	6.9 E-10	1.9 E-9
WIPP Far Field	7.0 E-10	2.0 E-9
WIPP South	7.0 E-10	1.8 E-9
WIPP East (1)	7.3 E-10	2.0 E-9
WIPP East (2)	6.7 E-10	1.8 E
Euince	6.9 E-10	1.9 E
South East Control	4.0 E-10	1.3 E-9

Figure 5-2

ALPHA CONCENTRATION

ALL LOCATIONS

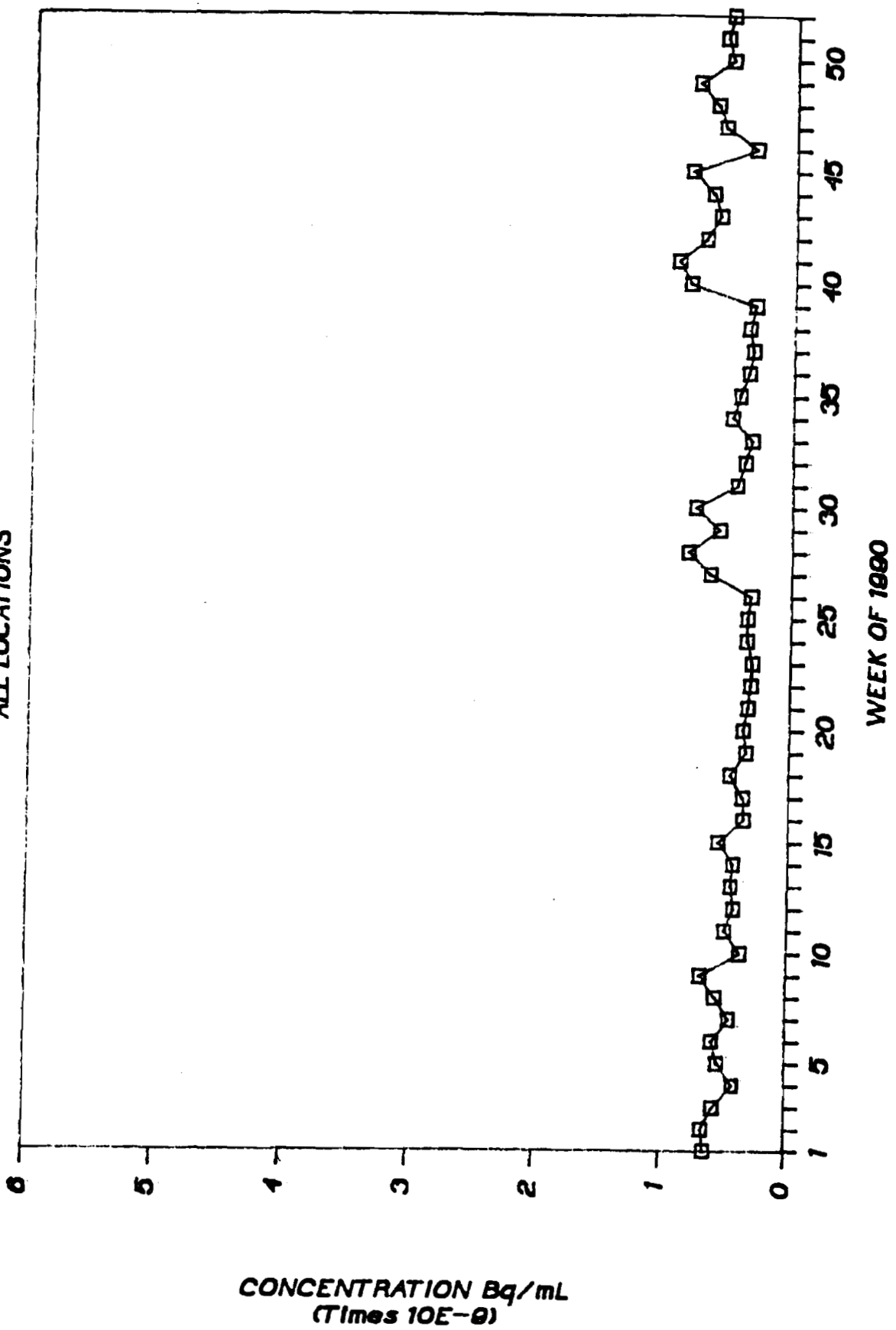
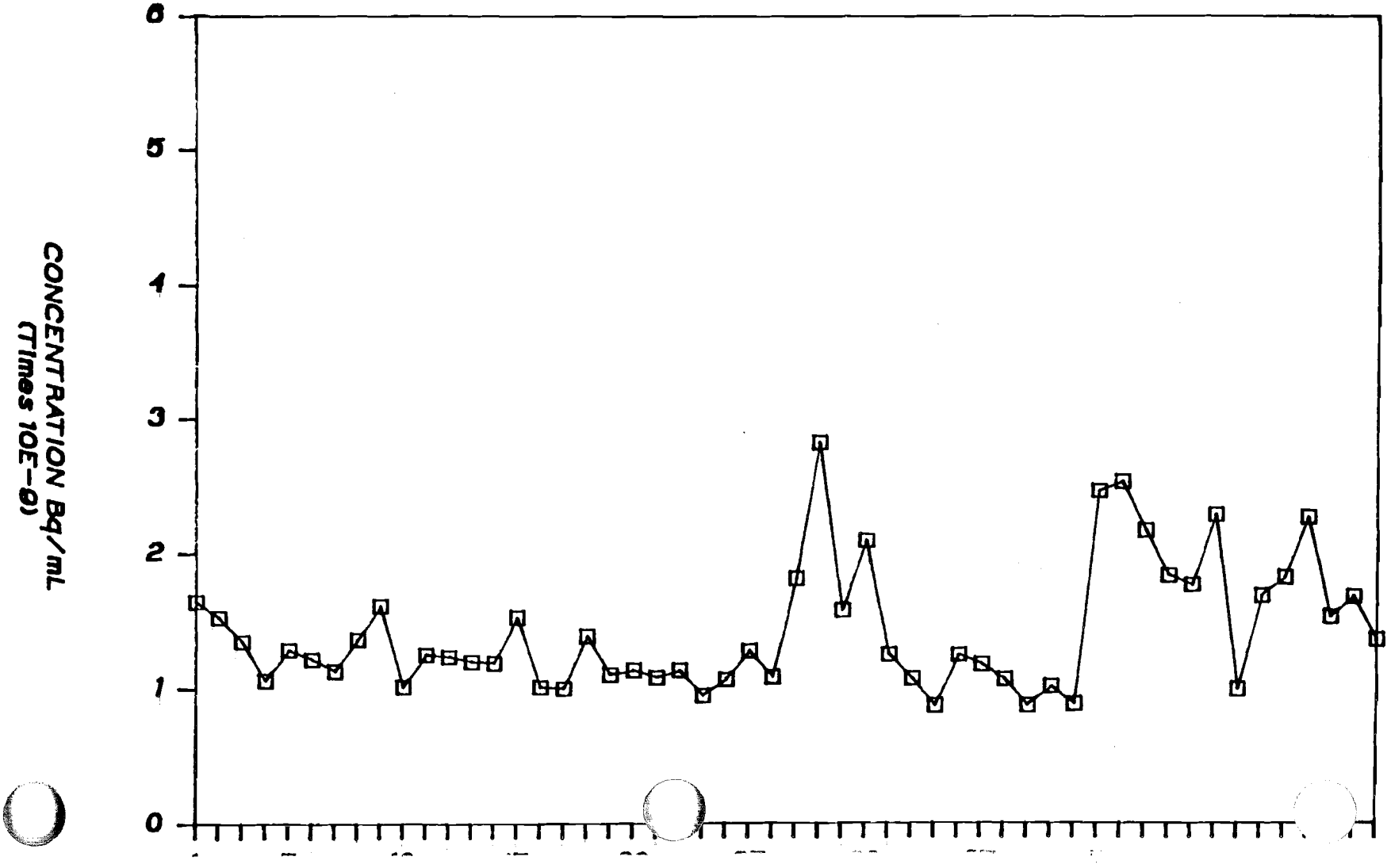


Figure 5-3

BETA CONCENTRATION

ALL LOCATIONS



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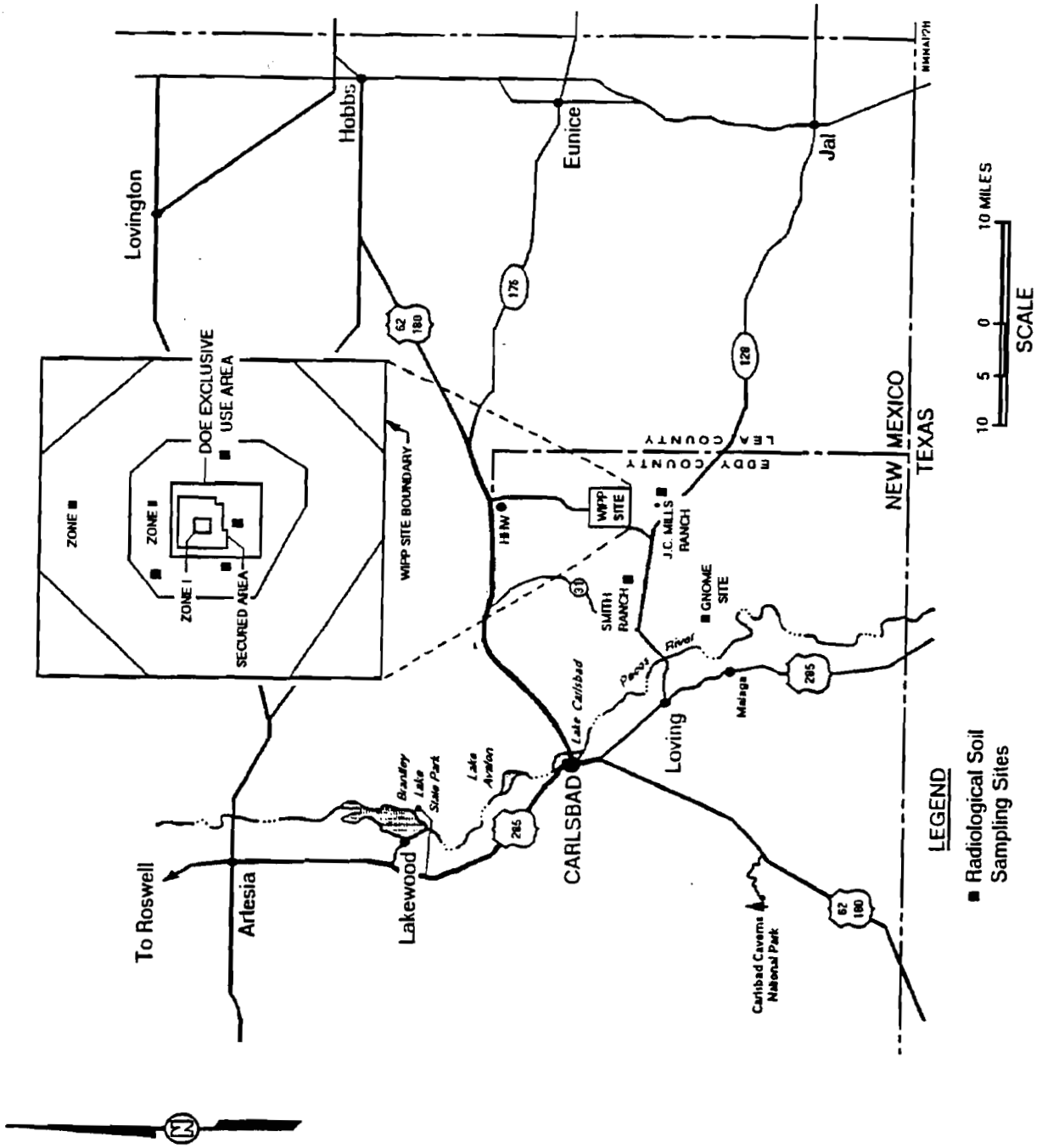

Figure 5-4
Radiological Soil Sampling Sites

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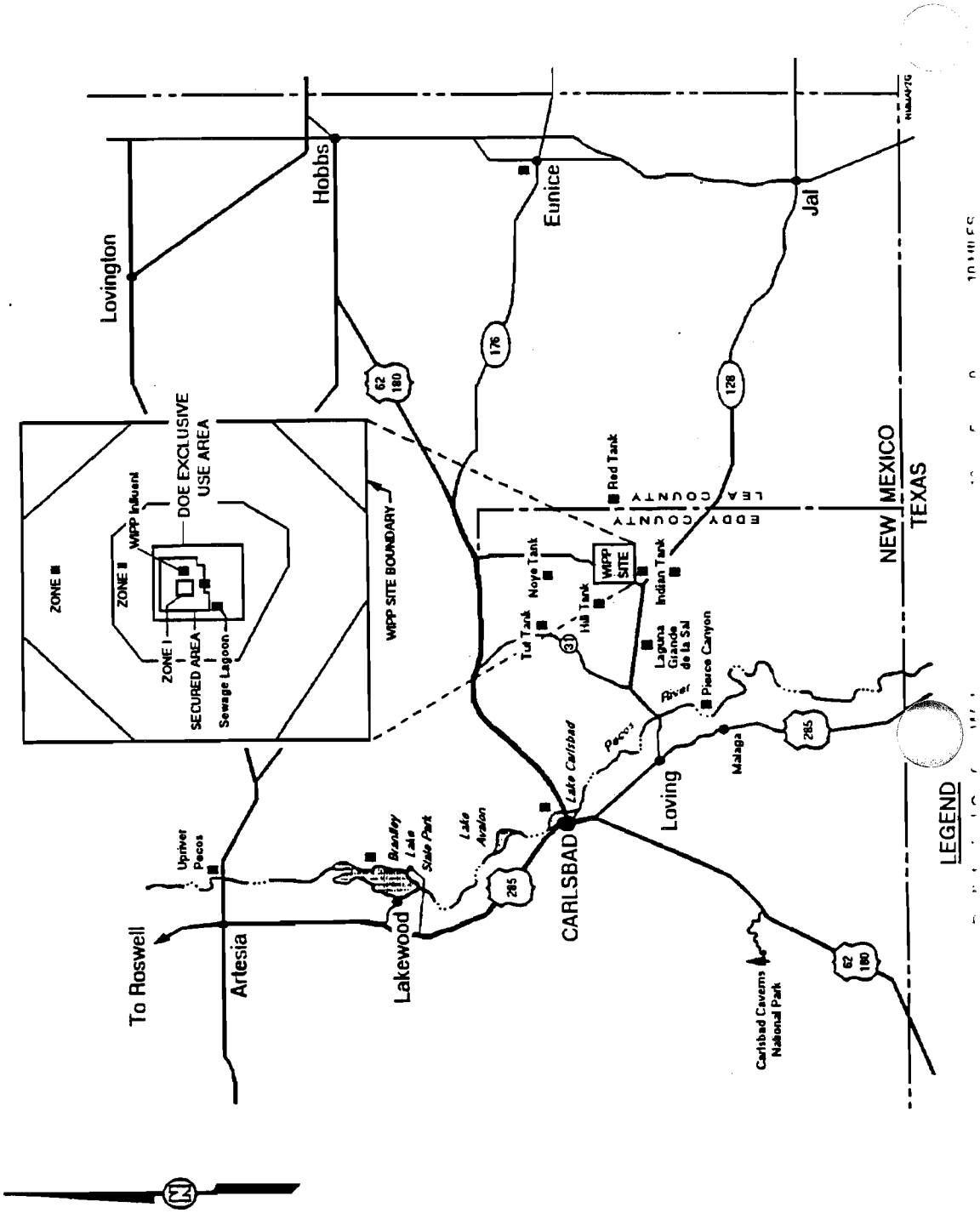

Figure 5-5
Radiological Surface Water Sampling Sites

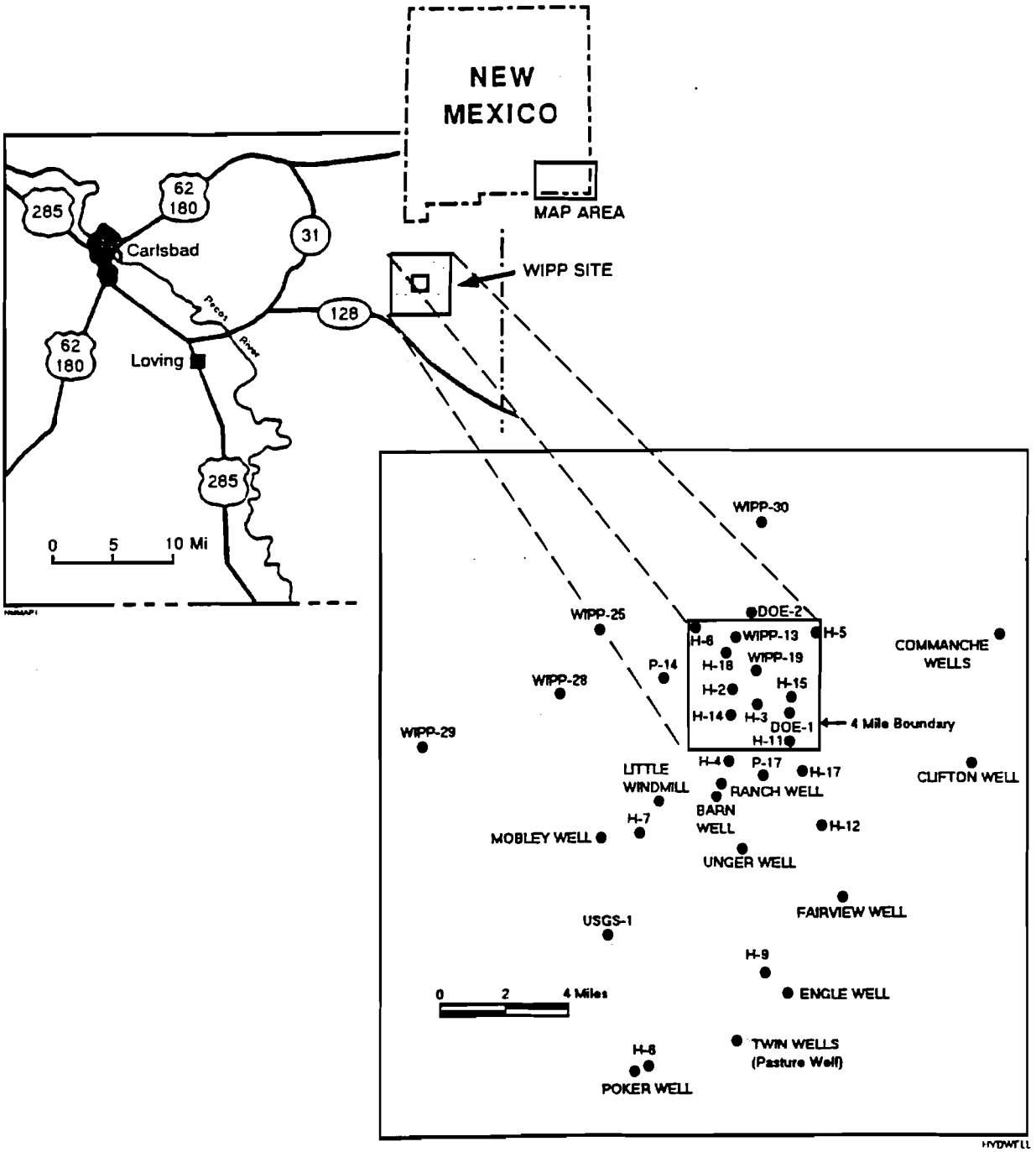

Figure 5-6
Groundwater Sampling Locations

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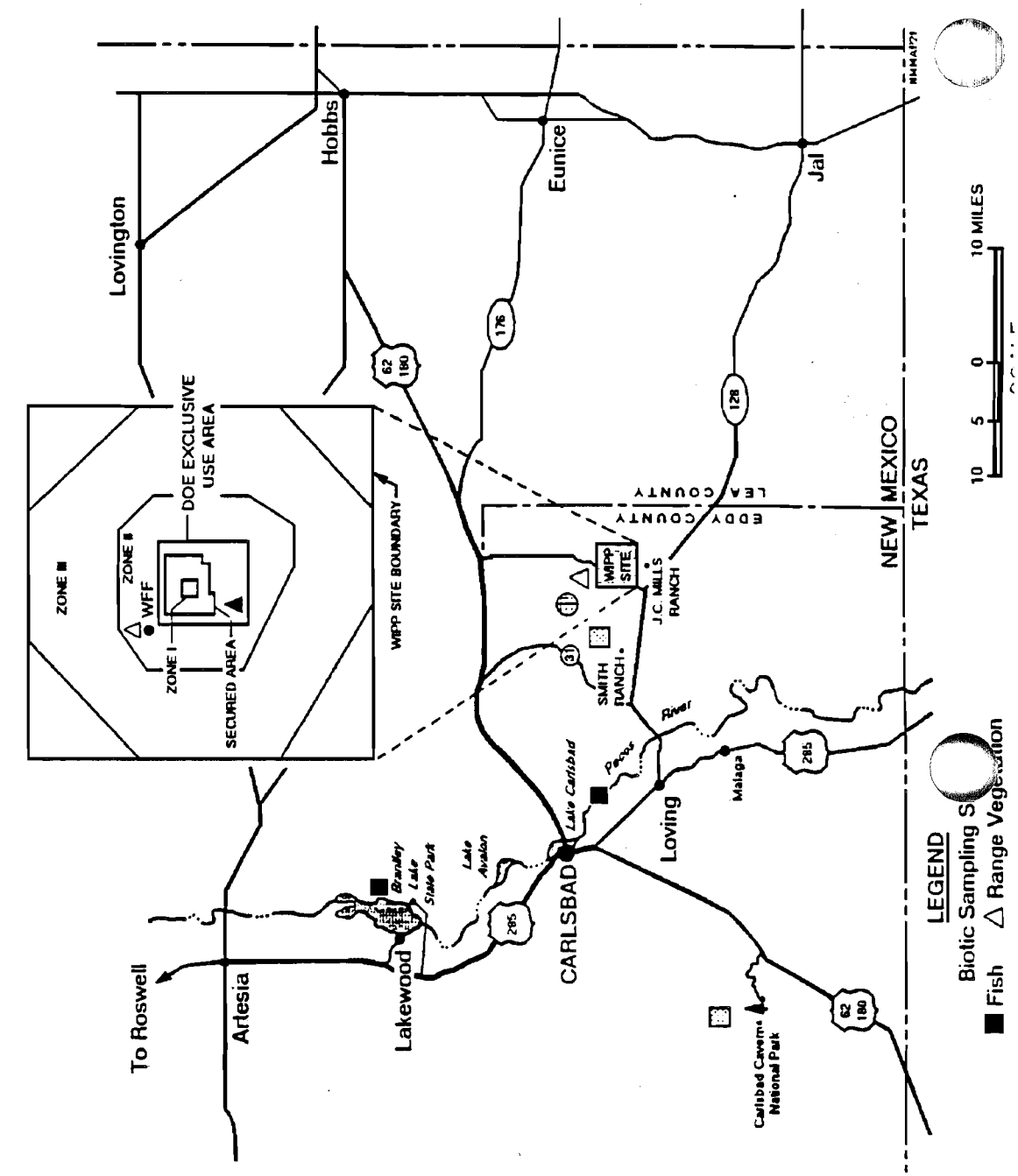


Figure 5-7
Biotic Sampling Sites

CHAPTER 6

ENVIRONMENTAL NONRADIOLOGICAL PROGRAM INFORMATION

During March 1989, the monitoring activities of the EMP were combined into the OEMP. This program is described in DOE/WIPP 88-025 Operational Environmental Monitoring Plan for the Waste Isolation Pilot Plant. This plan defined the scope and extent of the WIPP effluent and environmental monitoring programs during the operational life of the facility. The OEMP is the data base for all environmental comparisons once the WIPP is operational. It also discusses the quality assurance and quality control programs. The Non Radiological Environmental Surveillance (NES) is conducted by the Environmental Monitoring Section of the Environment, Safety, Health Department. This program was preceded by the WIPP Biology Program (1975-1982), which combined scientific and technical expertise from six universities to develop an extensive baseline of information describing the major components of the Los Medanos ecosystem prior to the initiation of WIPP construction activities. The principal functions of the NES are:

- To detect and quantify the impacts of construction and operational activities at the WIPP on the surrounding ecosystem
- To continue the development of the ecological data base for the Los Medanos Area which was initiated by the WIPP biology program
- To investigate unusual and unexpected elements in the ecological and radiological data bases
- To provide environmental data which are important to the mission of the WIPP project, but which have not or will not be acquired by other programs

This section of the ASER presents and discusses data collected between January 1, 1990, and December 31, 1990, as part of the NES of the OEMP. Ecological monitoring at the WIPP includes five subprograms (1) meteorological monitoring, (2) air quality monitoring, (3) water quality monitoring, (4) wildlife population monitoring, and (5) surface disturbance monitoring through the analysis of aerial photographs. The salt impact studies include three subprograms: soil chemistry, soil microbial activity, and vegetation. The results of the environmental monitoring activities and discussions of significant findings are presented in this report.

Unless otherwise noted, all methods used in data collection are those described in the first Ecological Monitoring Program semiannual report (DOE/WIPP 86-002) and incorporating the modifications described in subsequent reports (Fisher et al., 1985; Fisher, 1987; Fisher, 1988; Jones, 1989).

6.1 METEOROLOGY

The WIPP NES includes a primary meteorological station which provides support for various programs at the WIPP. Its primary function is to generate data to aid in modeling atmospheric conditions for RES. The meteorological station documents standard meteorological measurements of wind speed, wind direction, and temperatures at 3, 10, and 40 meters, respectively, with dew point, and precipitation monitored at ground level. These parameters are continuously measured and the data are stored as real time data in the central monitoring system.

In addition to the primary meteorological station, the WIPP is equipped with an atmospheric monitoring station (AMS) which monitors pollutant gases. At the AMS a secondary meteorological station measures and records temperature and barometric pressure, with wind speed and wind direction at 30 feet (10 meters).

6.1.1 Climatic Data Summary

The average annual temperature for the WIPP area in 1990 was 18 °C (64°F). The range fc monthly mean temperatures for the WIPP area was 7° to 32 ° C (45° to 89 ° F). (Daily maximum, minimum, and average temperature are presented in Appendix III.) Maximum temperatures occur May through August and minimums occur in December through Febru

The last freezing day of the 1989-90 winter season was May 2, with a temperature of 0° C (3 The first freezing day of the 1990-91 winter season occurred November 5, with 0° C (32° F). The maximum temperature recorded was 46 °C (115 ° F) on June 24. The minimum temperature was -14 °C (7 ° F) on December 23, 1990.

The annual precipitation at the WIPP for 1990 was 41 cm (15.97 in), which is above the aver for this area by 10 cm (3.97 in). The precipitation for 1990 was 62% more than that recorde 1989. This has helped to alleviate the drought effects on the ecosystem of this area. Figure displays the monthly precipitation at the WIPP for CY 1990.

6.1.2 Wind Direction and Wind Speed

In 1990 the predominate winds in the WIPP area were from the southeast sector. Other no winds occur in late spring and are primarily from the west. Various storm systems move thr this area which briefly alter the predominate southeasterly winds. Wind speed noted as cal (less than 0.5 meters per second (MPS) occurred less than one percent of the time. Winds 1.4 through 10.7 MPS were the most prevalent over 1990.

6.2 ENVIRONMENTAL PHOTOGRAPHY

Aerial photographs of the WIPP site were taken semiannually from 1982 till 1989. The 199 al photographs were taken once, during late summer, to document surface disturbance, development, reclamation activities at the WIPP site and surrounding BLM/DOE lands. Spot photographs and a flight lines are archived for future reference use.

Surface photography has been conducted at seven ecological study plots since 1984. These photogr are used to document surface impacts at the study plots. Other than the development of trails begir in some plots due to foot traffic, 1990 comparative examinations of these photographs show very litt surface impact.

6.3 AIR QUALITY MONITORING

Seven classes of pollutant gases are monitored 1000 meters (0.6 mile) northeast of the exhaust shaft the WIPP site on a continuous basis. These are: sulfur dioxide (SO_2), carbon monoxide (CO), ozor (O_3), hydrogen sulfide (H_2S), and oxides of nitrogen (NO, NO_2, NO_x). In addition, weekly measurements of Total Suspended Particulates are made from the particulates collected by the low-volume continuous air sampler at the far-field air sampling location.

The ambient gas monitors are extremely sensitive instruments which require semiannual recertifica by a factory engineer. Other than typical adjustments, replacement of filters, and replacement of w parts the ambient gas analyzers required no significant maintenance action.

The data generated by the analyzers was at the lower limit of detection, which is below the permissible concentrations for the State of New Mexico. The permissible New Mexico state standard for the gases monitored at the WIPP are listed below:

- SO_2 10 ppm annually
- CO 8.70 ppm per eight hour average
- O_3 0.06 ppm per one hour average
- NO_x 0.10 ppm per one-hour average
- H_2S 0.10 ppm per one-half hour average

6.4 SURFACE WATER AND SEDIMENT QUALITY MONITORING

During CY 1990, no annual surface water or sediment quality monitoring was conducted. The OEMP requires annual collection and monitoring of these parameters when the WIPP is operational. However, with the WIPP being in a preoperational state during 1990, there is no requirement to sample annually, since a preoperational baseline has been established. Preoperational monitoring began in 1985 and continued through 1988 with samples collected annually (Figure 6-2). With three years of background data, continuing with annual monitoring is not required.

6.5 WILDLIFE POPULATION MONITORING

Population density measurements of breeding birds and small nocturnal mammals are performed annually to assess the effects of the WIPP activities on wildlife populations. Two permanent study sites adjacent to the WIPP facility are used for each of these two classes of wildlife. The data are compared to two control sites for each class in order to assess the effects of WIPP on wildlife populations. Trap grids are used to measure small mammal populations, and 2500 ft Emlen-type transacts are used to measure bird population densities.

6.5.1 Breeding Bird Densities

Breeding bird densities maintained similar pattern variations as previous years as is represented in Table 6-1, Breeding Bird Densities. Population densities were low in control plots compared to previous years data. Additionally, control plots displayed densities lower than those found in WIPP transects. Variations worthy of note occurred in Northern Mockingbirds, Bobwhites, and Mourning dove. Insect dependant species, most notable ladderbacked woodpeckers, were more abundant near the site than in previous years. Overall, the patterns of species distribution between the WIPP transacts and the Control transacts follow that of previous years. More species and a higher total density were found in the WIPP transects, probably due to greater habitat diversity near the facility and perhaps more abundant food. Greater numbers of flycatchers account for the largest increase of birds near the facility.

6.5.2 Small Nocturnal Mammal Population Densities

Tables 6-2 and 6-3 summarize the results of the 1990 small mammal surveys in the Control 1 and 2 (CT1 and CT2, respectively) and WIPP Northwest 2 and Southeast 2 (NW2 and SE2, respectively) trap grids. Grids are composed of 100 traps set in a 150m x 150m grid with traps spaced 15m apart; the Y axis is noted as 1 through 10 and the X axis is noted as A through J. Trapping sessions began May 15, 1990 for the NW2 and CT2 grids and ended on May 25, 1990, and May 30, respectively. For the SE2 and CT1 grids, they were initiate May 30 and completed June 21, 1991. Mammals were trapped using Sherman live traps baited with cracked grains.

Mammals were trapped and released for two weeks, three successive nights per week. For kangaroo rats, wood and hispid cotton rats, deer mice, and grasshopper mice, numb a tags were used to identify individuals while clipping of the rear left outer digit was u smaller pocket mice. Grid location of trapped individuals as well as genus, species, new or recapture, tag number or digit removal, sex and weight were logged on Small Mammal Dat Sheets. From this data population densities, actual numbers of captures for each genus, tra distances for recaptured individuals, and male/female ratios were calculated.

Population densities were calculated using the "Schnabel method" (Tanner 1978) for mark recapture mammal trapping. Kangaroo rats were the most common species encountered an are the only genus calculable (Table 6-2) for determining the maximum likelihood estimatic population and variance estimation. All other genera were generally too small in number to calculate population densities using the "Schnabel method" and are listed in Table 6-3 whic lists the actual number of captures (including kangaroo rats) rather than statistical populati for each plot.

Within each grid, all the rodents occupy a certain amount of space. By using the data sheets plotting all recaptured animals, their unique numbers and their grid locations, total distanc each animal moved within the grids during the two trapping sessions was determinable. Of t 115 kangaroo rats surveyed, 25 moved 0m (that is they were recaptured consecutively each i in the same trap location). This may be due to home ranges or lactating females, as 17 of th were females. The longest distance traveled was a male in NW2 which traveled 246m. (807 f The average distance males traveled in all plots was 55.1m (180.8ft.), females traveled an average of 48.9m (160.4ft.).

In all grids, except NW2, females were dominant. The CT1 population was 69.23% female a 30.77% male, CT2 was 72.22 % female and 27.78% male, SE2 was 85.71% female and 14.29 male, and NW2 was 42.86% female and 57.14% male.

Densities were generally higher in all species in 1990 than the six year average except for th Plains Pocket Mouse. Plains Pocket Mice were most dense in the control plots. Populations White-footed and Deer Mice were most prevalent around the site. Of interest to note, one Hispid Cotton Rat (Sigmodon hispidus) was trapped in Control 1. This genus was last trapp in the same plot in 1985 and has not been trapped in any other plot since the previous 1985 trapping

6.6 SURFACE AND SUBSURFACE SOIL MONITORING

During CY 1990 the quarterly sampling of the surface soil as well as the annual deep series was conducted during the second quarter. The subsurface soil is collected at two depths, 30 to 45 centimeters (11.8 to 17.7 in) and 60 to 75 centimeters (23.6 to 29.5 in), in the soil profile (Figure 6-3 However, with the WIPP being in a preoperational, state during 1990, and with on adequate baselin established concerning soil properties at the WIPP. No analysis was performed on the soil samples collected. The sample collected are archived for future analysis if conditions indicate additional soi analytical data is warranted.

With the baseline data established, continuing the quarterly soil analysis was not required by the OE However with the anticipation of the WIPP becoming operational in 1991. The quarterly analysis o samples will once again commence as directed by the OEMP with the awarding of a new laboratory contract for soil analysis.

6.7 SOIL MICROBIOTA

The soil microbial sampling subprogram is designed to monitor an important portion of the biological community which can be affected by changes in chemical properties at the soil surface. The normal cycle of microbial activity is generally influenced by climatic factors as well as the physical and chemical nature of the substrate, which in this study is plant litter. Microbial activity levels and the rate at which the surface litter is decomposed by the microbial community in the control plots are compared to those in the near-field and far-field plots to detect any effect of salt deposition on these biological processes.

6.7.1 Methods

A litter sample is composed of two nylon mesh bags fastened together with a nylon tie, each containing ten grams of oven-dried shinnery oak leaves (Quercus havardii) which are collected at the time of leaf fall. In February, six samples of litter are placed at random locations in each of the ecological monitoring plots. Each sample is attached to the base of a shinnery oak stem. Three samples are collected from each plot every six months.

Two parameters are measured for each litter sample collected: the level of microbial activity and the rate at which organic matter is lost from the sample via decomposition. Microbial activity levels are measured indirectly using the fluorescein diacetate hydrolysis assay (FDA), described by Schnurer and Rosswall (1982). The assayed enzymes are produced in small quantities in dormant organisms and spores relative to the quantity produced by active colonies. Therefore, the optical density of the sample, which is a measure of the amount of breakdown product produced from a known quantity of fluorescein diacetate substrate, is proportional to the total microbial respiration in the sample. Activity levels measured at a given time are affected by the immediate chemical and physical conditions in the environment, (i.e., moisture, temperature, and nutrient availability).

The rate at which plant litter is broken down by microbial action is another indirect measure of a biotic soil process. The amount of organic matter lost from the litter over time is determined using the ashing technique described by Santos, et al. (1984). Decomposition rates reflect to a greater degree than microbial activity levels, the long-term impacts of the physical and chemical environment.

Results of the FDA assay are analyzed using an analysis of variance (ANOVA) method. To determine decomposition rates, an arcsine transformation is applied to the percentage values prior to the ANOVA use. When the ANOVA indicates that significant differences exist between plot means, a Student-Newan-Keuls test is performed to identify homogeneous means.

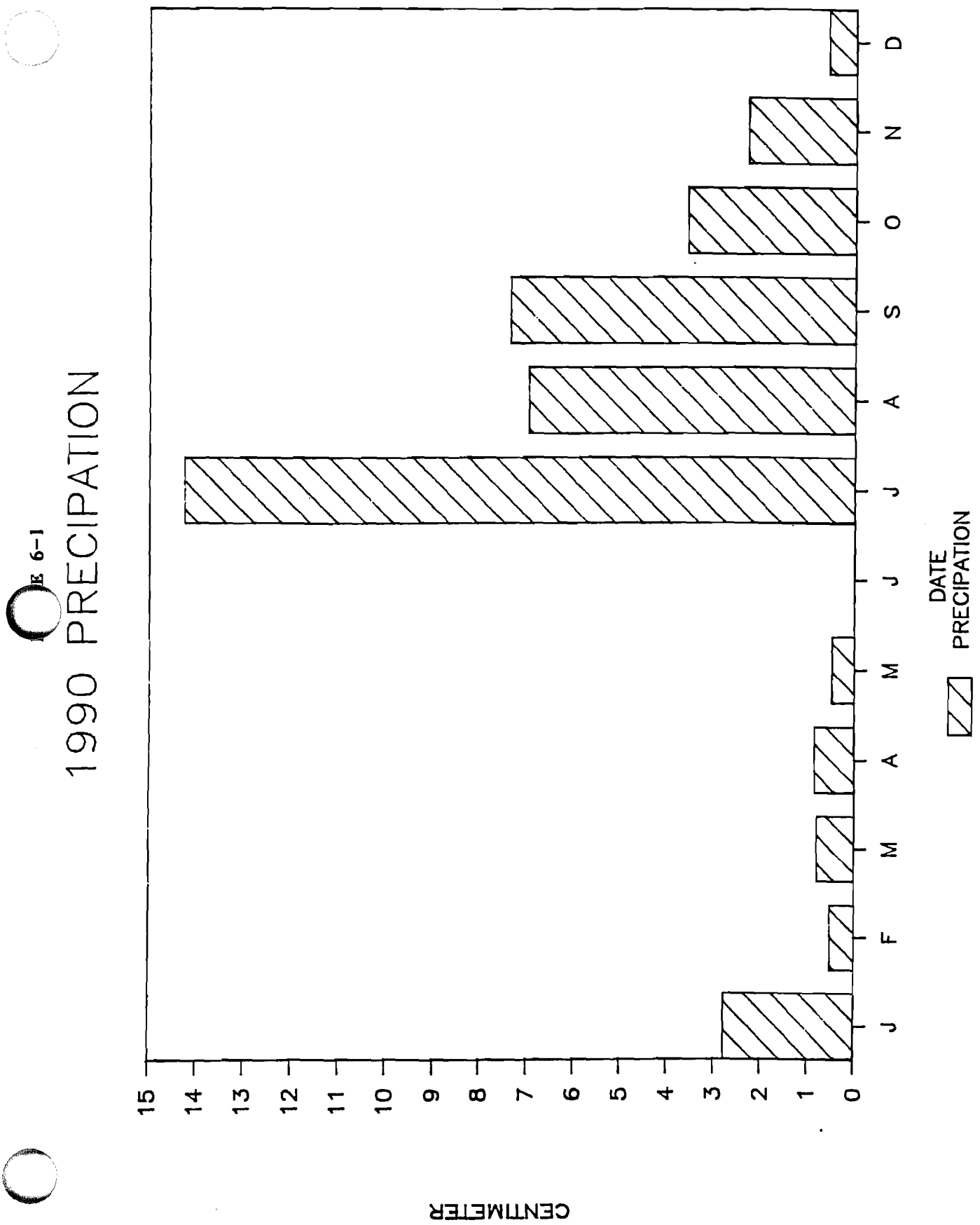
In February 1990, six litter samples were placed in each of the ecological monitoring plots. Three samples were collected from each plot in August. The second set was collected in February 1990. No significant differences were found in either the rate of decomposition or the microbial activity between plots in 1990.

6.8 VEGETATION MONITORING

The vegetation in each of the seven ecological monitoring plots was measured in the early summer (June and July) and again in the early fall (September and October) to assess the effect the salt piles may be having on proximal plant community structures. In each plot, foliage of each species, and species diversity are measured using the methods described in Reith, et al, 1985; and of 20 quadrat frames ($1m^2$) was also calculated. The frequency of a species is defined as the proportion (percent) of the quadrats containing that species.

Summaries of the data for the spring and fall sampling periods are presented in Tables 6-4 a[illegible] respectively. The CY 1990 precipitation of 41 cm (15.97 in) was a substantial increase over [illegible] drought condition of 25 cm (9.84 in). Drought conditions persisted form February through June, as reflected in the spring vegetation data Table 6-4, but dramatically changed as precipitation began in and continued through November which is reflected in the increases in all parameters for the fall vegetation data, Table 6-5.

The 1990 vegetation monitoring data showed a continual increase in shrub cover and a continual decrease in the grasses in proximity to the salt piles. These values are consistent with the 1988 and data. The responses of these plots to higher rainfall in later years will reveal whether this pattern is reflecting the start of a significant change in the structure of the plant community or whether it is or short-term effect caused by short-term weather conditions. A differential effect resulting from salt-induced physiological stress near the salt pile was not observed. Of greatest significance in the vegetation monitoring data was the observation that the drought conditions of this year have had a uniform effect on vegetation in all plots. A differential effect resulting from salt-induced physiologi stress near the salt piles was not observed.


1990 PRECIPATION
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E 6-1

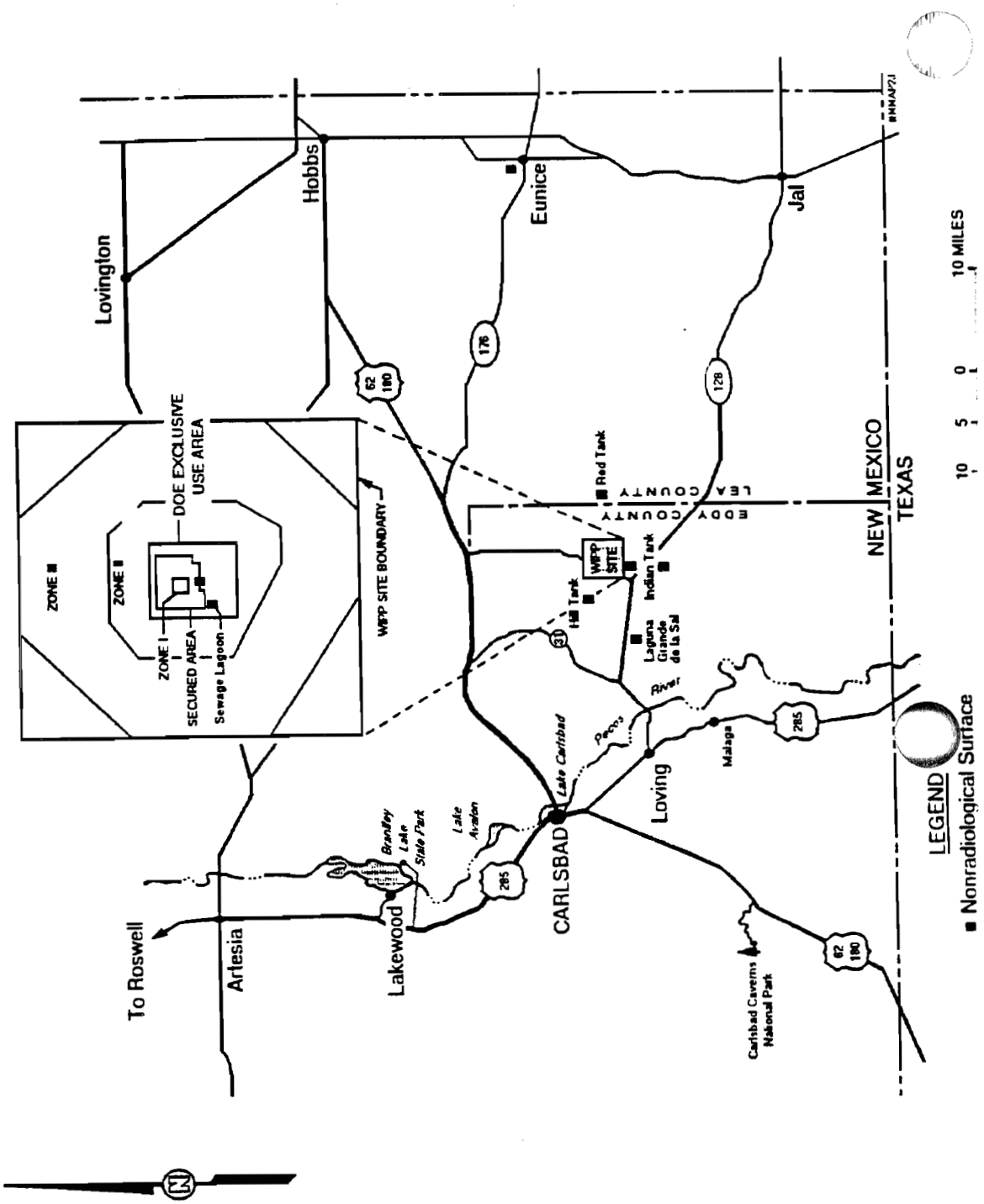

Figure 6-2
Nonradiological Surface Water Sampling Sites

Table 6-1

SUMMARY OF THE 1990 BREEDING BIRD DENSITY MEASUREMENTS (in birds per 40ha)

	CONTROL TRANSECTS				WIPP TRANSECTS			
	CT1	CT2	AVERAGE 1990	AVERAGE 1984-1990	NW	SE	AVERAGE 1990	AVERAGE 1984-1990
-DOMINANT CONTROL SPECIES-								
BLACK-THROATED SPARROW	16.1	30.1	23.1	25.8	17.2	17.2	17.2	22.0
PYRRHULOXIA	23.7	22.6	23.2	18.8	23.7	19.4	21.6	16.5
NORTHERN MOCKINGBIRD	4.3	2.2	3.3	10.7	8.6	8.6	8.6	13.6
NORTHERN BOBWHITE	1.1	0.0	0.6	9.8	2.2	1.1	1.7	4.9
MOURNING DOVE	0.0	0.0	0.0	7.1	6.5	2.2	4.4	4.3
BROWN-HEADED COWBIRD	4.3	4.3	4.3	5.0	4.3	8.6	6.5	3.0
LOGGERHEAD SHRIKE	0.5	4.3	2.4	4.5	0.5	4.3	2.4	3.1
EASTERN MEADOWLARK	0.0	1.1	0.6	3.0	0.0	0.0	0.0	1.1
CACTUS WREN	3.2	8.6	5.9	2.6	0.0	8.6	4.3	6.4
COMMON NIGHTHAWK	0.0	4.3	2.2	2.5	1.1	2.2	1.7	2.1
SCALED QUAIL	1.1	0.0	0.6	2.3	0.0	0.0	0.0	0.5
CHIHUAHUAN RAVEN	2.2	0.0	1.1	1.2	0.0	4.3	2.2	1.3
WESTERN KINGBIRD	8.6	0.0	4.3	1.1	4.3	12.9	8.6	6.6
-MINOR CONTROL SPECIES-								
CASSIN'S SPARROW	1.1	0.0	0.6	0.9	2.2	0.0	1.1	0.4
CRISSAL THRASHER	1.1	2.2	1.7	0.8	0.0	0.0	0.0	0.0
ASH-THROATED FLYCATCHER	0.0	0.0	0.0	0.8	2.2	12.9	7.6	3.8
POORWILL	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.3
SCISSOR-TAILED FLYCATCHER	0.0	1.1	0.6	0.7	0.0	0.5	0.3	0.6
BREWER'S SPARROW	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0
HOUSE FINCH	0.0	0.0	0.0	0.4	0.0	0.0	0.0	1.7
LARK BUNTING	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.3
YELLOW-HEADED BLACKBIRD	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.3
GREAT HORNED OWL	0.0	0.0	0.0	0.1	2.2	0.0	1.1	0.5
SWAINSON'S HAWK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
HARRIS' HAWK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
-WIPP SPECIES-								
NORTHERN ORIOLE	0.0	0.0	0.0	0.0	2.2	4.3	3.3	2.1
LADDER-BACKED WOODPECKER	0.0	0.0	0.0	0.0	4.3	8.6	6.5	1.7
BARN SWALLOW	0.0	0.0	0.0	0.0	0.0	4.3	2.2	1.4
GREATER ROADRUNNER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7
LARK SPARROW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
LESSER GOLDFINCH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
BELL'S VIREO	0.0	0.0	0.0	0.0	0.0	4.3	2.2	0.3
YELLOW WARBLER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
KILLDEER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
HOUSE SPARROW	0.0	0.0	0.0	0.0	0.0	2.2	1.1	0.2
TOTAL DENSITY	67.3	80.8	74.1	99.6	81.5	126.5	104.0	101.1
NUMBER OF SPECIES	12	10	15	23	14	18	20	32

Table 6-1
(continued)

SUMMARY OF THE 1990 BREEDING BIRD DENSITY MEASUREMENTS (IN BIRDS PER 40ha) CONTINUED

	AVERAGE 1984-1989		AVERAGE 1990	AVERAGE 1984-1990	AVERAGE 1984-1989		AVERAG 1990
-DOMINANT CONTROL SPECIES-	----------CONTROL TRANSECTS----------				----------WIPP TRANSE		
BLACK-THROATED SPARROW	26.3	157.8	23.1	25.8	22.8	136.8	17.2
PYRRHULOXIA	18.1	108.6	23.2	18.8	15.6	93.6	21.6
NORTHERN MOCKINGBIRD	11.9	71.4	3.3	10.7	14.4	86.4	8.6
NORTHERN BOBWHITE	11.3	67.8	0.6	9.8	5.4	32.4	1.7
MOURNING DOVE	8.3	49.8	0.0	7.1	4.3	25.8	4.4
BROWN-HEADED COWBIRD	5.1	30.6	4.3	5.0	2.4	14.4	6.5
LOGGERHEAD SHRIKE	4.8	28.8	2.4	4.5	3.2	19.2	2.4
EASTERN MEADOWLARK	3.4	20.4	0.6	3.0	1.3	7.8	0.0
CACTUS WREN	2.0	12.0	5.9	2.6	6.7	40.2	4.3
COMMON NIGHTHAWK	2.5	15.0	2.2	2.5	2.2	13.2	1.7
SCALED QUAIL	2.6	15.6	0.6	2.3	0.6	3.6	0.0
CHIHUAHUAN RAVEN	1.2	7.2	1.1	1.2	1.2	7.2	2.2
WESTERN KINGBIRD	0.6	3.6	4.3	1.1	6.3	37.8	8.6
-MINOR CONTROL SPECIES-							
CASSIN'S SPARROW	0.9	5.4	0.6	0.9	0.3	1.8	1.1
CRISSAL THRASHER	0.7	4.2	1.7	0.8	0.0	0.0	0.0
ASH-THROATED FLYCATCHER	0.9	5.4	0.0	0.8	3.2	19.2	7.6
POORWILL	0.9	5.4	0.0	0.8	0.3	1.8	0.0
SCISSOR-TAILED FLYCATCHER	0.7	4.2	0.6	0.7	0.6	3.6	0.3
BREWER'S SPARROW	0.6	3.6	0.0	0.5	0.0	0.0	0.0
HOUSE FINCH	0.5	3.0	0.0	0.4	2.0	12.0	0.0
LARK BUNTING	0.2	1.2	0.0	0.2	0.4	2.4	0.0
YELLOW-HEADED BLACKBIRD	0.2	1.2	0.0	0.2	0.3	1.8	0.0
GREAT HORNED OWL	0.1	0.6	0.0	0.1	0.4	2.4	1.1
SWAINSON'S HAWK	0.0	0.0	0.0	0.0	0.2	1.2	0.0
HARRIS' HAWK	0.0	0.0	0.0	0.0	0.0	0.0	0.0
-WIPP SPECIES-							
NORTHERN ORIOLE	0.0	0.0	0.0	0.0	1.9	11.4	3.3
LADDER-BACKED WOODPECKER	0.0	0.0	0.0	0.0	0.9	5.4	6.5
BARN SWALLOW	0.0	0.0	0.0	0.0	1.3	7.8	2.2
GREATER ROADRUNNER	0.0	0.0	0.0	0.0	0.8	4.8	0.0
LARK SPARROW	0.0	0.0	0.0	0.0	0.6	3.6	0.0
LESSER GOLDFINCH	0.0	0.0	0.0	0.0	0.4	2.4	0.0
BELL'S VIREO	0.0	0.0	0.0	0.0	0.0	0.0	2.2
YELLOW WARBLER	0.0	0.0	0.0	0.0	0.3	1.8	0.0
KILLDEER	0.0	0.0	0.0	0.0	0.3	1.8	0.0
HOUSE SPARROW	0.0	0.0	0.0	0.0	0.0	2.2	1.1
	---	---	---	---	---	---	---
TOTAL DENSITY	103.8	622.8	74.1	99.6	100.6	605.8	104.0
NUMBER OF SPECIES	23	23	15	23	30	31	20

Table 6-4

WIPP 1990 SPRING VEGETATION REPORT

	CONTROL PLOTS (1)			EXCLOSURE PLOTS (2)		
	COVER (5)	FREQ. (6)	DENS. (7)	COVER	FREQ.	DENS.
--------SHRUBS--------						
SAND SAGE	0.52	33%	0.00	0.42	35%	0.00
FOUR-WING SALTBUSH	0.00	0%	0.00	0.00	0%	0.00
HARTWEG PRIMROSE	0.00	0%	0.00	0.00	0%	0.00
SOUTHWEST RABBITBUSH						
CROTON	0.15	8%	0.00	0.09	10%	0.00
SNAKEWEED	0.34	10%	0.00	0.25	8%	0.00
ENGELMANN PRICKLY-PEAR	0.08	3%	0.00	0.00	0%	0.00
HONEY MESQUITE	0.81	10%	0.00	1.88	8%	0.00
SHINNERY OAK	3.41	78%	0.00	2.72	80%	0.00
WILD CHINABERRY						
YUCCA	1.62	30%	0.00	0.18	5%	0.00
---PERENNIAL FORBES---						
SNAPDRAGON						
MILKWEED						
COMMELINA SP.						
CYPERUS SP.						
WOLLEY DALA						
SPINY YELLOW ASTER	0.18	10%	0.00	0.00	0%	0.00
HOG POTATO	0.01	3%	0.00	0.00	0%	0.00
SMOOTH OXYBAPHUS						
LEAF-FLOWER						
CLIMBING MILKWEED						
ELEGANT NIGHTSHADE						
COTTA						
GOLDEN CROWNBEARD						
----ANNUAL FORBES-----						
RAGWEED	0.01	3%	0.00	0.00	0%	0.00
ARIZONA DOZE DAISY						
BUGSEED						
ANNUAL BUCKWHEAT	0.00	0%	0.00	0.01	3%	0.05
FLEABANE						
LACE SPURGE						
EUPHORBIA SP.						
FORB SEEDLING						
BINDWEED HELIOTROPE						
PRAIRIE SUNFLOWER	0.00	0%	0.00	0.00	0%	0.00
WHITE RAGWEED						
KOCHIA						
INDIAN CHICKWEED						
PALAFOXIA						
FETID MARIGOLD						
PORTULACE SP.						
DUNE DEVILS-CLAW						
RUSSIAN THISTLE						
PRICKLY SOWTHISTLE						
--PERENNIAL GRASSES---						
LITTLE BLUESTEM						
PURPLE THREE-AWN	1.09	63%	0.00	0.23	45%	0.00
BLACK GRAMA	0.00	0%	0.00	0.00	0%	0.00
SANDHILL GRASS	0.00	0%	0.00	0.00	0%	0.00
SANDBUR	0.00	0%	0.00	0.00	0%	0.00
INTERMEDIATE LOVEGRASS	0.03	8%	0.00	0.01	3%	0.00
MEXICAN LOVEGRASS						
FALL WITCHGRASS	0.00	0%	0.00	0.02	5%	0.00
EAR MUHLY	0.00	0%	0.00	0.00	0%	0.00
KNOTGRASS						
PLAINS BRISTLEGRASS						
SPIKE DROPSEED	0.02	8%	0.00	0.02	5%	0.00
SAND DROPSEED	0.08	13%	0.00	0.16	38%	0.00
MESA DROPSEED						
GIANT DROPSEED	0.00	0%	0.00	0.07	18%	0.00
----ANNUAL GRASSES----						
GRASS SEEDLING						
FALSE BUFALOGRASS						
PURPLE SANDGRASS						

----------TOTALS BY GROUP----------

	CONTROL			EXCLOSURE		
----SPECIES GROUP-----	COVER	DENS.	NO. OF SP.	COVER	DENS.	NO. OF SP.
SHRUBS (8)	6.12	0.00	7	3.66	0.00	6
PERENNIAL FORBES	0.19	0.00	2	0.00	0.00	0
ANNUAL FORBES	0.01	0.00	1	0.01	0.05	1
PERENNIAL GRASSES	1.22	0.00	4	0.51	0.00	6
ANNUAL GRASSES (9)	0.00	0.00	0	0.00	0.00	0
TOTAL	7.54	0.00	14	4.18	0.05	13

(1) Control Plots include plots CT1 and CT2, more than 2km from the salt piles
(2) Exclosure Plots include plots DOE-1 and EZ-RR, which are fenced areas
(3) Far Field Plots include plots NW2 and SE2, approximately 200km from the salt piles
(4) Near Field Plots include plots NW1, SE1 and E1, which are adjacent to the salt piles
(5) Foliar cover, in percent
(6) Frequeny in the sample, in percent
(7) Density of annual species only, in plants per square meter
(8) Coverage does not include honey mesquite
(9) Number of species does not include grass seedlings

Table 6-4
(continued)

	FAR FIELD PLOTS (3)			NEAR FIELD PLOTS (4)		
	COVER	FREQ.	DENS.	COVER	FREQ.	DENS.
--------SHRUBS--------						
SAND SAGE	1.13	53%	0.00	3.94	60%	
FOUR-WING SALTBUSH	0.00	0%	0.00	0.02	2%	
HARTWEG PRIMROSE	0.01	3%	0.00	0.01	2%	
SOUTHWEST RABBITBUSH						
CROTON	0.00	0%	0.00	0.06	3%	0.00
SNAKEWEED	0.00	0%	0.00	0.11	7%	0.00
ENGELMANN PRICKLY-PEAR	0.00	0%	0.00	0.01	2%	0.00
HONEY MESQUITE	1.02	8%	0.00	2.55	12%	0.00
SHINNERY OAK	4.39	88%	0.00	6.04	83%	0.00
WILD CHINABERRY						
YUCCA	1.05	20%	0.00	1.11	12%	0.00
---PERENNIAL FORBES---						
SNAPDRAGON						
MILKWEED						
COMMELINA SP.						
CYPERUS SP.						
WOLLEY DALA						
SPINY YELLOW ASTER	0.00	0%	0.00	0.00	0%	0.00
HOG POTATO	0.01	3%	0.00	0.03	5%	0.00
SMOOTH OXYBAPHUS						
LEAF-FLOWER						
CLIMBING MILKWEED						
ELEGANT NIGHTSHADE						
COTTA						
GOLDEN CROWNBEARD						
----ANNUAL FORBES-----						
RAGWEED	0.00	0%	0.00	0.00	0%	0.00
ARIZONA DOZE DAISY						
BUGSEED						
ANNUAL BUCKWHEAT	0.00	0%	0.00	0.04	3%	0.00
FLEABANE						
LACE SPURGE						
EUPHORBIA SP.						
FORB SEEDLING						
BINDWEED HELIOTROPE						
PRAIRIE SUNFLOWER	0.00	0%	0.00	0.01	2%	0.02
WHITE RAGWEED						
KOCHIA						
INDIAN CHICKWEED						
PALAFOXIA						
FETID MARIGOLD						
PORTULACE SP.						
DUNE DEVILS-CLAW						
RUSSIAN THISTLE						
PRICKLY SOWTHISTLE						
--PERENNIAL GRASSES---						
LITTLE BLUESTEM						
PURPLE THREE-AWN	0.42	45%	0.00	0.29	28%	0.00
BLACK GRAMA	0.01	3%	0.00	0.00	0%	0.00
SANDHILL GRASS	0.00	0%	0.00	0.02	2%	0.00
SANDBUR	0.04	8%	0.00	0.00	0%	0.00
INTERMEDIATE LOVEGRASS	0.03	3%	0.00	0.02	3%	0.00
MEXICAN LOVEGRASS						
FALL WITCHGRASS	0.01	3%	0.00	0.00	0%	0.00
EAR MUHLY	0.01	3%	0.00	0.00	0%	0.00
KNOTGRASS						
PLAINS BRISTLEGRASS						
SPIKE DROPSEED	0.01	3%	0.00	0.03	8%	0.00
SAND DROPSEED	0.08	18%	0.00	0.02	5%	0.00
MESA DROPSEED						
GIANT DROPSEED	0.07	18%	0.00	0.02	2%	0.00
----ANNUAL GRASSES----						
GRASS SEEDLING						
FALSE BUFALOGRASS						
PURPLE SANDGRASS						

TOTALS BY GROUP

	FAR FIELD			NEAR FIELD		
----SPECIES GROUP-----	COVER	DENS.	NO. OF SP.	COVER	DENS.	NO. OF
SHRUBS (8)	6.58	0.00	5	11.30	0.00	9
PERENNIAL FORBES	0.01	0.00	1	0.03	0.00	1
ANNUAL FORBES	0.00	0.00	0	0.05	0.02	2
PERENNIAL GRASSES	0.68	0.00	9	0.40	0.00	6
ANNUAL GRASSES (9)	0.00	0.00	0	0.00	0.00	0
TOTAL	7.27	0.00	15	11.78	0.02	18

(1) Control Plots include plots CT1 and CT2, more than 2km from the salt piles
(2) Exclosure Plots include plots DOE-1 and EZ-RR, which are fenced areas
(3) Far Field Plots include plots NW2 and SE2, approximately 200km from the salt piles
(4) Near Field Plots include plots NW1, SE1 and E1, which are adjacent to the salt pi
(5) Foliar cover, in percent
(6) Frequeny in the sample, in percent
(7) Density of annual species only, in plants per square meter
(8) Coverage does not include honey mesquite
(9) Number of species does not include grass seedlings

TABLE 6-2

Maximum estimation and variance for population density of Dipodomys ordii (Ords Kangaroo Rat).

ORD'S KANGAROO RAT		CT1	CT2	NW2	SE2
ESTIMATED POPULATION	39.8	18.8	34.6	24.6	
ESTIMATED MINIMUM	33.3	14.7	28.8	19.6	
ESTIMATED MAXIMUM	49.5	26.2	43.3	33.2	
ACTUAL CAPTURES	42	21	36	25	

TABLE 6-3

Actual captures of nocturnal mammals in 1990.

	CT1	CT2	NW2	SE2
ORD'S KANGAROO RAT	42	21	36	25
WHITE FOOTED/DEER MOUSE	0	0	1	8
PLAINS POCKET MOUSE	4	3	1	0
GRASSHOPPER MOUSE	7	0	0	3
HISPID COTTON RAT	1	0	0	0
PLAINS WOOD RAT	3	0	5	2

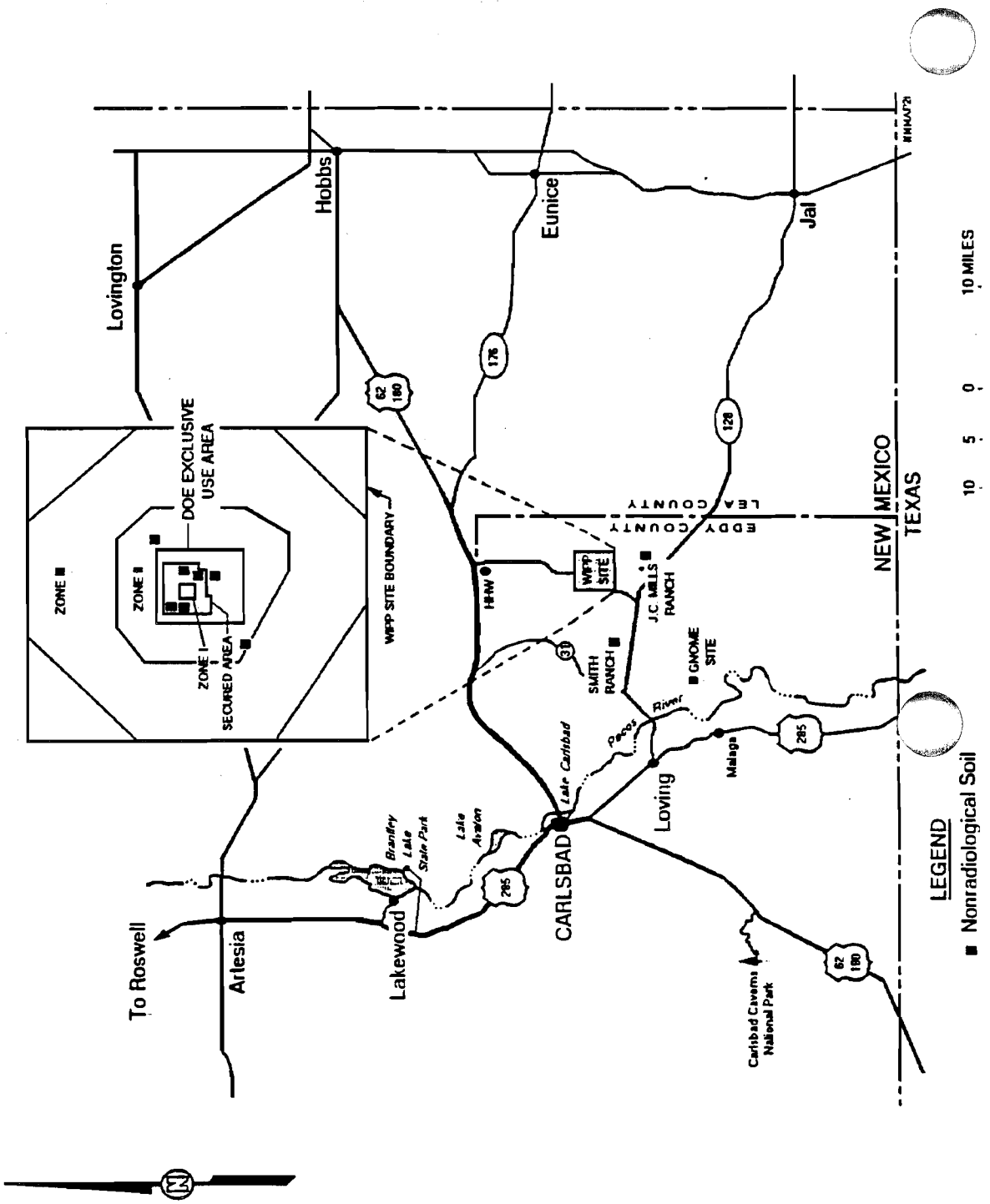

Figure 6-3
Nonradiological Soil Sampling Sites

Table 6-5

WIPP 1990 FALL VEGETATION REPORT

	CONTROL PLOTS (1)			EXCLOSURE PLOTS (2)		
	COVER (5)	FREQ. (6)	DENS. (7)	COVER	FREQ.	DENS.
--------SHRUBS--------						
SAND SAGE	1.89	25%	0.00	2.86	53%	0.00
FOUR-WING SALTBUSH						
HARTWEG PRIMROSE	0.00	0%	0.00	0.03	3%	0.00
SOUTHWEST RABBITBRUSH	0.00	0%	0.00	0.16	3%	0.00
CROTON	0.37	18%	0.00	0.45	15%	0.00
SNAKEWEED	0.11	3%	0.00	0.40	5%	0.00
ENGELMANN PRICKLY-PEAR	0.00	0%	0.00	0.00	0%	0.00
HONEY MESQUITE	3.53	28%	0.00	1.00	8%	0.00
SHINNERY OAK	10.17	78%	0.00	10.20	85%	0.00
WILD CHINABERRY	0.11	3%	0.00	0.00	0%	0.00
YUCCA	0.29	10%	0.00	0.31	8%	0.00
---PERENNIAL FORBES---						
MILKWEED	0.00	0%	0.00	0.03	3%	0.00
COMMELINA SP.	0.01	3%	0.00	0.00	0%	0.00
CYPERUS SP.	0.23	25%	0.00	0.07	10%	0.00
WOOLLY DALA	0.39	25%	0.00	0.09	15%	0.00
SPINY YELLOW ASTER	0.05	8%	0.00	0.00	0%	0.00
HOG POTATO	0.00	0%	0.00	0.00	0%	0.00
SNAPDARGON	0.00	0%	0.00	0.06	3%	0.00
SMOOTH OXYBAPHUS	0.17	13%	0.00	0.07	8%	0.00
LEAF-FLOWER	0.34	48%	0.00	0.65	53%	0.00
CLIMBING MILKWEED	0.00	0%	0.00	0.03	3%	0.00
ELEGANT NIGHTSHADE	0.16	10%	0.00	0.02	3%	0.00
COTTA	0.01	3%	0.00	0.00	0%	0.00
GOLDEN CROWNBEARD	0.12	5%	0.00	0.00	0%	0.00
----ANNUAL FORBES-----						
RAGWEED	0.13	5%	0.20	0.00	0%	0.00
ARIZONA DOZE DAISY	0.00	0%	0.00	0.00	0%	0.00
BUGSEED	0.00	0%	0.00	0.00	0%	0.00
ANNUAL BUCKWHEAT	0.06	8%	0.10	0.00	0%	0.00
FLEABANE	0.02	3%	0.03	0.02	8%	0.08
LACE SPURGE	0.63	63%	0.88	0.61	48%	0.80
EUPHORBIA SP.	0.73	23%	1.28	0.36	15%	0.70
FORB SEEDLING	0.00	0%	0.00	0.01	3%	0.03
BINDWEED HELIOTROPE	0.15	18%	0.13	0.02	3%	0.03
PRAIRIE SUNFLOWER	0.01	3%	0.00	0.00	0%	0.00
WHITE RAGWEED	0.14	23%	0.38	0.07	5%	0.20
KOCHIA	0.02	3%	0.03	0.03	3%	0.03
INDIAN CHICKWEED	0.69	50%	1.50	0.28	28%	0.58
PALAFOXIA	0.36	30%	0.48	0.26	18%	0.35
FETID MARIGOLD	1.40	55%	3.18	1.00	28%	2.73
PORTULACE SP.	0.02	3%	0.03	0.00	0%	0.00
DUNE DEVILS-CLAW	0.07	8%	0.05	0.00	0%	0.00
RUSSIAN THISTLE	0.00	0%	0.00	0.00	0%	0.00
PRICKLY SOWTHISTLE	0.00	0%	0.00	0.02	3%	0.03
--PERENNIAL GRASSES---						
LITTLE BLUESTEM	0.00	0%	0.00	0.00	0%	0.00
PURPLE THREE-AWN	1.96	75%	0.00	1.43	60%	0.00
BLACK GRAMA	0.01	3%	0.00	0.13	5%	0.00
SANDHILL GRASS						
SANDBUR	1.55	78%	0.00	0.87	45%	0.00
INTERMEDIATE LOVEGRASS						
MEXICAN LOVEGRASS	0.04	3%	0.00	0.01	3%	0.00
FALL WITCHGRASS	0.48	23%	0.00	1.71	58%	0.00
EAR MUHLY	0.00	0%	0.00	0.00	0%	0.00
KNOTGRASS	0.17	15%	0.00	0.36	18%	0.00
PLAINS BRISTLEGRASS	0.15	8%	0.00	0.00	0%	0.00
SPIKE DROPSEED	0.04	5%	0.00	0.02	5%	0.00
SAND DROPSEED	0.38	35%	0.00	1.04	35%	0.00
MESA DROPSEED	0.25	25%	0.00	0.45	18%	0.00
GIANT DROPSEED	0.16	18%	0.00	0.77	28%	0.00
----ANNUAL GRASSES----						
GRASS SEEDLING	0.34	78%	6.45	0.32	53%	8.53
FALSE BUFFALOGRASS	0.60	50%	1.35	0.57	48%	1.25
PURPLE SANDGRASS	0.21	18%	0.40	0.07	10%	0.15

TOTALS BY GROUP

	CONTROL PLOTS			EXCLOSURE		
----SPECIES GROUP-----	COVER	DENS.	NO. OF SP.	COVER	DENS.	NO. OF SP.
SHRUBS (8)	12.94	0.00	7	14.41	0.00	8
PERENNIAL FORBES	1.47	0.00	9	1.02	0.00	8
ANNUAL FORBES	4.43	8.27	14	2.66	5.56	11
PERENNIAL GRASSES	5.18	0.00	11	6.78	0.00	10
ANNUAL GRASSES (9)	1.15	8.20	2	0.96	9.93	2
TOTAL	25.16	16.47	43	25.82	15.49	39

(1) Control Plots include plots CT1 and CT2, more than 2km from the salt piles
(2) Exclosure Plots include plots DOE-1 and EZ-RR, which are fenced areas
(3) Far Field Plots include plots NW2 and SE2, approximately 200km from the salt piles
(4) Near Field Plots include plots NW1, SE1 and E1, which are adjacent to the salt piles
(5) Foliar cover, in percent
(6) Frequeny in the sample, in percent
(7) Density of annual species only, in plants per square meter
(8) Coverage does not include honey mesquite
(9) Number of species does not include grass seedlings

Table 6-5
(continued)

WIPP 1990 FALL VEGETATION REPORT

	FAR FIELD PLOTS (3)			NEAR FIELD PLOTS (4)		
	COVER	FREQ.	DENS.	COVER	FREQ.	
--------SHRUBS--------						
SAND SAGE	3.00	50%	0.00	2.85	52%	[illegible]
FOUR-WING SALTBUSH						
HARTWEG PRIMROSE	0.02	5%	0.00	0.00	0%	0.
SOUTHWEST RABBITBRUSH	0.01	3%	0.00	0.00	0%	0.
CROTON	0.02	3%	0.00	0.13	7%	0.
SNAKEWEED	0.00	0%	0.00	0.05	2%	0.
ENGELMANN PRICKLY-PEAR	0.00	0%	0.00	0.03	2%	0.
HONEY MESQUITE	0.39	5%	0.00	1.11	10%	0.
SHINNERY OAK	10.25	95%	0.00	12.37	87%	0.
WILD CHINABERRY	0.00	0%	0.00	0.00	0%	0.
YUCCA	0.55	10%	0.00	0.74	10%	0.
---PERENNIAL FORBES---						
MILKWEED	0.05	3%	0.00	0.01	2%	0.
COMMELINA SP.	0.00	0%	0.00	0.34	3%	0.
CYPERUS SP.	0.09	15%	0.00	0.11	22%	0.
WOOLLY DALA	0.11	13%	0.00	0.14	12%	0.
SPINY YELLOW ASTER	0.00	0%	0.00	0.07	2%	0.
HOG POTATO	0.05	5%	0.00	0.23	17%	0.
SNAPDARGON	0.00	0%	0.00	0.00	0%	0.
SMOOTH OXYBAPHUS	0.07	10%	0.00	0.17	10%	0.
LEAF-FLOWER	2.03	95%	0.00	0.90	55%	0.
CLIMBING MILKWEED	0.00	0%	0.00	0.02	2%	0.
ELEGANT NIGHTSHADE	0.00	0%	0.00	0.00	0%	0.
COTTA	0.00	0%	0.00	0.00	0%	0.
GOLDEN CROWNBEARD	0.00	0%	0.00	0.01	2%	0.
----ANNUAL FORBES-----						
RAGWEED	0.00	0%	0.00	0.00	0%	0.
ARIZONA DOZE DAISY	0.05	3%	0.00	0.00	0%	0.
BUGSEED	0.00	0%	0.00	0.01	2%	0.
ANNUAL BUCKWHEAT	0.01	0%	0.03	0.00	0%	0.
FLEABANE	0.00	0%	0.00	0.00	0%	0.
LACE SPURGE	0.47	45%	0.68	0.59	65%	0.
EUPHORBIA SP.	0.03	5%	0.03	0.42	7%	0.
FORB SEEDLING	0.00	0%	0.00	0.03	10%	0.
BINDWEED HELIOTROPE	0.03	5%	0.05	0.03	7%	0.
PRAIRIE SUNFLOWER	0.00	0%	0.00	0.00	0%	0.
WHITE RAGWEED	0.00	0%	0.00	0.01	3%	0.
KOCHIA	0.00	0%	0.00	0.00	0%	0.
INDIAN CHICKWEED	0.16	18%	0.40	0.06	12%	0.
PALAFOXIA	0.11	18%	0.20	0.11	17%	0.
FETID MARIGOLD	0.52	30%	1.53	2.36	55%	1.
PORTULACE SP.	0.00	0%	0.00	0.00	0%	0.
DUNE DEVILS-CLAW	0.00	0%	0.00	0.01	2%	0.
RUSSIAN THISTLE	0.00	0%	0.00	0.09	2%	0.
PRICKLY SOWTHISTLE	0.00	0%	0.00	0.00	0%	0.
--PERENNIAL GRASSES---						
LITTLE BLUESTEM	0.27	5%	0.00	0.00	0%	0.
PURPLE THREE-AWN	1.56	70%	0.00	1.37	48%	0.
BLACK GRAMA	0.05	3%	0.00	0.00	0%	0.
SANDHILL GRASS						
SANDBUR	1.01	58%	0.00	1.32	67%	0.
INTERMEDIATE LOVEGRASS						
MEXICAN LOVEGRASS	0.00	0%	0.00	0.03	2%	0.
FALL WITCHGRASS	1.05	55%	0.00	0.86	35%	0.
EAR MUHLY	0.00	0%	0.00	0.02	2%	0.
KNOTGRASS	0.29	28%	0.00	0.26	20%	0.
PLAINS BRISTLEGRASS	0.00	0%	0.00	0.00	0%	0.
SPIKE DROPSEED	0.07	10%	0.00	0.07	3%	0.
SAND DROPSEED	0.45	43%	0.00	0.38	25%	0.
MESA DROPSEED	0.07	8%	0.00	0.41	18%	0.
GIANT DROPSEED	0.29	33%	0.00	0.39	23%	0.
----ANNUAL GRASSES----						
GRASS SEEDLING	0.17	45%	2.23	0.32	60%	8.
FALSE BUFFALOGRASS	0.59	53%	1.63	0.67	63%	2.
PURPLE SANDGRASS	0.08	15%	0.15	0.10	13%	0.

----------TOTALS BY GROUP----------

	FAR FIELD PLOTS			NEAR FIELD PLOTS		
----SPECIES GROUP-----	COVER	DENS.	NO. OF SP.	COVER	DENS.	NO.
SHRUBS (8)	13.85	0.00	7	16.17	0.00	
PERENNIAL FORBES	2.37	0.00	6	2.00	0.00	
ANNUAL FORBES	1.37	2.92	7	3.73	13.56	
PERENNIAL GRASSES	5.10	0.00	10	5.09	0.00	
ANNUAL GRASSES (9)	0.83	4.01	2	1.08	11.37	
TOTAL	23.52	6.93	32	28.06	24.93	

(1) Control Plots include plots CT1 and CT2, more than 2km from the salt piles
(2) Exclosure Plots include plots DOE-1 and EZ-RR, which are fenced areas
(3) Far Field Plots include plots NW2 and SE2, approximately 200km from the salt [illegible]
(4) Near Field Plots include plots NW1, SE1 and E1, which are adjacent to the sal[illegible]s
(5) Foliar cover, in percent
(6) Frequency in the sample, in percent
(7) Density of annual species only, in plants per square meter
(8) Coverage does not include honey mesquite
(9) Number of species does not include grass seedlings

CHAPTER 7

GROUNDWATER PROTECTION

Current groundwater protection activities at the WIPP are outlined in the WIPP Groundwater Monitoring Program Plan and Procedure Manual. WP 02-1, Rev. 2 is a Quality Assurance document that contains program plans for each of the activities performed by groundwater surveillance personnel. Detailed procedures for performing specific activities such as pumping system installations, field parameter analysis and document and quality assurance records management are also contained in WP 02-1 Rev 2. Groundwater protection activities are also defined in the OEMP.

The objective of this program is to determine the physical and chemical characteristics of the groundwater surrounding the WIPP facility, both before and throughout the operational lifetime of the facility. Baseline water quality data has been collected since January 1985. A report is currently being prepared by IT Corporation evaluating the baseline data from 1985 through the 1990 sampling period and should be available for publication in early 1992. This preoperational data will be compared to water quality data collected after TRU waste is placed in the WIPP facility. Data generated by groundwater surveillance programs are also useful in determining future regulatory needs, land use decisions, and updating information for site documents such as the Final Environmental Impact Statement Addendum.

The water quality data obtained by the WQSP in 1990 supported three major programs at the WIPP: (1) Site Characterization; (2) Performance Assessment (in compliance with 40 CFR 191); and (3) The OEMP. Each of these programs requires a unique set of analyses and data, but overlap of analytical needs does occur. Particular sample needs are defined by each program. Radionuclide samples were collected for the Environmental Analysis and Compliance section of the Westinghouse, Waste Isolation Division (WID.) Results of radionuclide sampling are discussed in Chapter 5 of this report. In addition, water samples from each 1990 sampling location were offered to the New Mexico Environmental Evaluation Group (EEG) for their independent analysis, however due to budgetary constraints the EEG was forced to decline a number of offered samples.

The WIPP is located within the Pecos Valley section of the Southern Great Plains physiographic province (Powers et al., 1978). The primary Industries in the area which could contribute to pollution of the ground water are local potash mining, gas and oil drilling activities and cattle ranching. Geologically, the WIPP is located in the northern portion of the Delaware Basin, the western most subsection of the Permian Basin. The northern Delaware Basin is bounded by the Capitan Limestone, a Permian Age reef which is the only major source of potable groundwater in the basin. Interior to the basin, eight rock units make up the stratigraphic column in the vicinity of the WIPP. In ascending order, these units are the Delaware Mountain group (consists of the Brushy Canyon, Cherry Canyon, and the Bell Canyon formations), The Castile Formation, the Salado Formation, The Rustler Formation, the Dewey Lake Redbeds, and the Triassic Dockum group also referred to as the Dockum formation.

The rock units which were sampled in 1990 are in descending order ; the Dewey Lake Redbeds, the Magenta Dolomite, and the Culebra Dolomite, (Figure 7-1). Fluids form these rock units have been collected either from wells at the WIPP or from privately owned wells (windmills). Groundwater sampling at WIPP focuses on the Magenta and Culebra Dolomite Members of the Rustler Formation. The Magenta and Culebra Dolomites are the most significant water bearing units within the vicinity of the WIPP. No known hydrologic connection exists between the repository horizon and these rock units. Surveillance of the characteristics of the water contained in both the Culebra and the Magenta Dolomite is beneficial to the WIPP because it provides data which can be used to determine if the characteristics of the water in either the Culebra or Magenta is changing. It also provides additional data for use in hydrologic modules designed to predict long term performance of the repository environment (i.e., performance assessment). A brief description of these geological formations and their hydrology follows.

The Dewey lake Redbeds are comprised of a deltaic sequence of alternating thin, even beds of orange-red siltstone and mudstone with lenticular interbeds of fine grained sandstone. Geologic data for the area around the WIPP facility indicate that the sands are lenticular and pinch out laterally. Hydrologic

SYSTEM	SERIES	GROUP	FORMATION	MEMBER
RECENT	RECENT		SURFICIAL DEPOSITS	
QUATER-NARY	PLEIST-OCENE		MESCALERO CALICHE	
			GATUNA	
TRIASSIC		DOCKUM	UNDIVIDED	
PERMIAN	OCHOAN		DEWEY LAKE REDBEDS	
			RUSTLER	FORTY-NINER
				MAGENTA
				TAMERISK
				CULEBRA
				UNNAMED
			SALADO	UPPER
				McNUTT
				LOWER
			CASTILE	
	GUADALUPIAN	DELEWARE MOUNTAIN	BELL CANYON	
			CHERRY CANYON	
			BRUSHY CANYON	

STRATCOL

Figure 7-1
Stratigraphic Column

TABLE 7-1.0

MONTHLY GROUND-WATER LEVEL MEASUREMENTS

CULEBRA

AEC-07	H-09b	WIPP-12
CABIN BABY (CB-1)	H-10b	WIPP-13
D-268	H-11b2	WIPP-18
DOE-01	H-12	WIPP-19
DOE-02	H-14	WIPP-21
ERDA-09	H-15	WIPP-22
H-01	H-17	WIPP-25
H-02b2	H-18	WIPP-26
H-03b2	P-14	WIPP-27
H-04b	P-15	WIPP-29
H-05b	P-17	WIPP-30
H-06b	P-18	
H-07b1		

MAGENTA

H-01	H-05c	WIPP-25
H-02b1	H-06c	WIPP-27
H-03b1	H-08a	WIPP-30
H-04c	H-10a	

OTHER FORMATIONS

AEC-08	BELL CANYON
H-03d/49	FORTY-NINER
H-03d/DL	DEWEY LAKE
H-08c	RUSTLER/SALADO
WIPP-28	RUSTLER/SALADO

TABLE 7-1.1

QUARTERLY GROUND WATER-LEVEL MEASUREMENTS

CULEBRA

H-02a	H-07b2	H-11b3
H-02c	H-07c	H-11b4
H-03b3	H-09a	WIPP-28
H-05a	H-09c	
H-06a	H-11b1	

TABLE 7-2

WATER QUALITY SAMPLING PROGRAM MONITORING LOCATIONS

LOCATIONS MONITORED EACH YEAR

1. H-02c	CULEBRA
2. H-03b1	MAGENTA
3. H-03b3	CULEBRA
4. H-04b	CULEBRA
5. H-04c	MAGENTA
6. H-05b	CULEBRA
7. H-05c	MAGENTA
8. H-06b	CULEBRA
9. H-06c	MAGENTA
10. H-14	CULEBRA
11. WIPP-19	CULEBRA
12. RANCH WELL	DEWEY LAKE
13. BARN WELL	DEWEY LAKE
14. TWIN WELL (PASTURE)	DEWEY LAKE

WELLS MONITORED EVERY THREE YEARS

1. H-09b	CULEBRA
2. H-11b3	CULEBRA
3. H-12	CULEBRA
4. H-07b	CULEBRA
5. H-15	CULEBRA
6. H-18	CULEBRA
7. P-14	CULEBRA
8 P-17	CULEBRA
9. WIPP-25	CULEBRA

investigations at and near the WIPP facility have not identified a continuous zone of saturation withi Dewey Lake Redbeds. Several private wells (located approximately 5 miles south of the WIP completed in the Dewey Lake Redbeds. These wells appear to be producing from thin lentic that are locally recharged (Mercer, 1983). Four private wells in this area have been sampled b (Barn well, Fairview Well, Unger Well, and Ranch Well), and the data are reported in Randall et al. and Lyon 1989. Each of these wells supply water for livestock.

The Rustler formation underlies the Dewey Lake Redbeds and consists of interbedded anhydrite, g halite, polyhalite, dolomite, and limestone. The Rustler formation is divided into five lithologic units These units are in descending order; the Forty-niner member, the Magenta Dolomite, the Tamarisk member, the Culebra Dolomite, and the Unnamed lower member consisting of reddish-brown siltst interbedded with gypsum or anhydrite and halite. The Forty-niner and Tamarisk members are prim anhydrite and include some halite and potash minerals. Where dissolution has occurred, the anhydr altered to gypsum, and halite salts are absent. The Magenta and Culebra Dolomites are aerially exte and are the most significant water-bearing units in the WIPP vicinity. Water from the Magenta and Culebra has undergone five years of sampling (Broberg et. al, 1990; Lyon 1989; Randall et al., 1988; Uhland et al, 1987, and Uhland et al., 1986).

The Magenta dolomite is the uppermost significant water-bearing stratum in the Rustler formation consists of a clastic carbonate bed with thin laminae of anhydrite. The unit ranges in thickness from 30 feet and is a vuggy, finely crystalline dolomite. The formation contains water (under confined conditions) of variable density ranging from brackish to brine. Hydrologic testing has shown the Cu Dolomite to be a heterogenous, fractured unit with transmissibility varying locally from 0.07 to great 200 square feet per day (Mercer, 1983). The high transmissibility values in the Culebra have been reported from well locations south and west of the WIPP facility. In this area near the WIPP, the C fluids exhibit relatively low concentrations of Total Disolved Solids (TDS). South of the WIPP site (Poker Trap) a few wells that are completed in the Culebra are used by local ranchers for watering livestock. In areas lying east of the WIPP, transmissibility in the Culebra are quite low, and fluid sam show high TDS concentrations. Based on actual formation measurements, Crawley, 1988 estimated regional groundwater flow directions near the WIPP site are towards the south and southw ha suggested, since the water flow in the Culebra Dolomite is affected by fractures, variable flu sit and heterogeneity of the rock, that regional flow direction may have little, if any, relationship to loca flow paths.

Groundwater surveillance activities during 1990 consisted of two separate programs, groundwater q sampling and groundwater level measurements. Groundwater surveillance programs utilize 57 well to gather data. Six of these bores are equipped with production inflated packers in order to allow groundwater level surveillance of more than one producing zone through the same well bore. Grou water level measurements are taken at each well location either monthly or quarterly see Tables 7-1. 7-1.1 for the sampling frequency of each particular location.

Groundwater Quality data are gathered from 23 well locations. Data are collected at 16 locations completed in the Culebra dolomite and 4 locations completed in the Magenta dolomite. Water qua data are also collected from three privately owned wells in the vicinity of the WIPP that are complet the Dewey Lake Redbeds. Sampling is performed at each location either yearly or every three years Table 7-2 for the sampling frequency of water quality locations.

The water quality sampling process has been developed around the logistics of using groundwater w that were originally constructed for characterization and not groundwater monitoring activities. Th WIPP site has been given a conditional No-Migration Determination and is not required to have a monitoring program in compliance with the RCRA. The original wells are therefore being used for surveillance. These wells, not being designed for a long term surveillance program, did not consider geochemistry of the area, anticipated lifetime of the surveillance program nor the chemical paramet be analyzed. A majority of the wells were drilled using saturated brine water as a drilling fluid whic left standing in the open well bore for various time periods. Many of the wells were cored through t culebra dolomite into the upper part of the Unnamed member of the Rustler formation lea halit deposits exposed to the waters of the Culebra. Most of the wells are constructed with J-55 5 i casing. In order to decrease the sampling bias created by well construction deficiencies an bin

with the low transmissibilities of the formations involved a labor intensive sampling process has been initiated. Because of the time involved to collect a representative sample and the number of wells to be sampled each year, wells are sampled only once per year. Sampling episodes are referred to as a "sampling round". Each yearly sampling round consists of the collection of two types of samples: (1) serial samples and (2) final samples. Serial samples are taken once a day, while the well is being purged. Key physical and chemical parameters (known as field parameters) are analyzed daily until a chemical steady state has been reached. A chemical steady state is usually defined as + \- 5% of the average of the three preceding parameter measurements. Stabilization of these field parameters is a function of purging and is used as an indicator to determine if the groundwater is representative of the zone being sampled. A final sample is collected, once it has been determined the pumped groundwater has achieved a representative state, and is sent off site to a contract laboratory for analysis.

Groundwater level measurements are conducted by lowering an electronic Water-Level conductance probe to the water level. When the probe contacts water it trips a buzzer alarm at the surface. The graduated tape on the conductance probe is read, adjusted to the top of the casing and documented in the field. The probe is then brought to the surface, rinsed with fresh water and wiped clean with a cloth. Top of casing elevation is later referenced to sea level and a groundwater elevation above mean sea level is calculated.

Groundwater surveillance activities during 1990 consisted of water quality sampling of 18 well sites and groundwater level measurements at 57 well locations. The results of the data gathered in each of these subprograms is discussed below. The results of the data gathered in 1990 are presented in appendices at the end of this report.

7.1 GROUNDWATER QUALITY

Sampling for groundwater quality was performed at 18 well locations including 4 privately owned well sites during 1990 (Figure 7-2). With the exception of the four privately owned wells each well was purged a minimum of 24 hours prior to the commencement of the serial sampling phase of the purging process. Field analysis for Eh, pH, alkalinity, chloride, divalent cations, and Iron (total and ferrous) were performed on a daily basis during serial sampling. Specific gravity and specific conductance were performed on the first and last day of serial sampling. These field parameters were used as an indicator, during the purging process, to better determine when the formation water being pumped had reached a representative state. Normally this process required seven to ten days to complete. Following the field analysis of the final serial sample, samples were collected and shipped to International Technologies Analytical Services Laboratory (ITAS), an independent contracted laboratory, for analysis. Parameters of analysis by the contracted laboratory are listed in table 7.1.1. Splits of samples were also offered to the EEG, Sandia National Laboratories (SNL) and selected samples were collected by the University of New Mexico Geology Department. Samples were also archived at the WIPP site for future analytical needs.

During the 1990 calendar year 11 Culebra, 4 Magenta and 3 Dewey Lake well bore completions were sampled. The 3 wells sampled in the Dewey Lake formation (Barn, Ranch, and Twin Pasture) and 1 of the wells sampled in the Culebra dolomite (Engle) were privately owned wells utilized for the supply of water to area ranch live stock. Because these wells are pumped on a routine basis year around the purging and serial sampling process was not necessary.

The total gallons of water removed from the Culebra dolomite member of the Rustler formation as a result of water quality sampling activity was approximately 52,400 gallons through out the year. The total gallons removed from the Magenta Dolomite member of the Rustler formation during the same period was approximately 5,986 gallons of water. The final day average results of final serial analysis show relative consistency when compared to averages of earlier sampling rounds. Appendices IV through VIII contain detailed results of data for each individual well sampled. Data in these appendices are presented in summary discussion, tabulated and graphical form.

Water quality of the Magenta and Culebra are naturally poor and the waters are not usable for human consumption or for agricultural purposes. The waters contain naturally high concentrations of total dissolved solids and mineral constituents primarily of chloride, calcium, magnesium, sodium and potassium (Mercer, 1983). The generally high TDS of the waters poses a problem in the analysis of the

waters because it tends to clog or interfere with standard laboratory equipment such as Atomic Absorption Inductively Coupled Plasma or ICP, causing detection limits to be inconsistent. No inconsistencies of general chemistry parameters were noted in either the Magenta or Culebra d 1990 sampling period.The only usable water in the area of the WIPP are from wells Completed in the Dewey Lake Redbeds which produce water from discontinuous saturated zones of thin lenticular sanc that are believed to be locally recharged. Three Wells were sampled in the Dewey Lake Redbeds the were; Ranch Well located approximately 3 and 2 tenths miles south to the WIPP site, Barn well locate approximately 3 and 4 tenths miles south of the WIPP site and Twin well Pasture well located approximately 10 miles south of the WIPP site. Each of these wells showed elevated levels of nitrate in groundwater analysis. Ranch well showed the highest concentration with 71 mg/l followed by Twin we and Barn with concentrations of 9.2 mg/l and 8.9 mg/l respectively. The most probable source of these nitrate concentrations are the large numbers of livestock that utilize these wells for drinking water.

7.1.1 SUSPECT DATA

The chloride concentration reported for H-04B round five of 615 mg/l, as reported by the contra laboratory, appears abnormally low when compared to previous rounds rounds 1, 3 and 4) where chloride content normally averaged approximately 7500 mg/l. Round 2 chloride content was 12,0 mg/l which may have been considered suspect also.

The sodium concentration reported by ITAS for H-04c round five of 3600 mg/l appears low whe: compared to the average value of 8875 mg/l for rounds one through four.

The lower detection limit of 50 mg/l set by ITAS for the Potassium value for H-07b1 round five appears inconsistent with previous rounds where values reported for rounds one through four w 7.0 mg/l, 7.7 mg/l, 8.3 mg/l and 7.3 mg/l respectively.

The reported concentration for H-09b, round four, by ITAS of 20 mg/l 1-3-dichlorobenz suspect for the following reasons: (1) rounds one, two and three all show less than detectable lim for 1-3-dichlorobenzene, (2) the analysis also show 13 mg/l concentration of 1-3-dichlorobenzen a method blank composed of deionized water and (3) 1-3-dichlorobenzene is a constituent of va cleaning compounds used by laboratories on a routine basis, to clean laboratory instruments and glass ware.

7.1.2 ANALYSIS FOR ORGANIC COMPOUNDS

Analysis for organic compounds were completed on 6 of the 18 wells sampled as part of the Groundwater quality sampling program. These wells were H-09B Culebra, Engle well Culebra, H-06B Culebra, H-06c Magenta, H-18 Culebra and H-05b Culebra. Only one analysis revealed concentrations of organic compounds above detectable limits. The value for 1-3-dichlorobenzer reported for H-09b of 20 mg/l has been discussed in the previous section. Organic analysis was r performed on the remaining 12 wells sampled in 1990 due to budgetary concerns.

Observations have been made that pose concerns as to the validity of volatile organic analysis fo wells sampled in 1990 as well as previous years. Solutions as to the problems posed in validating these data are currently being considered.

7.2 GROUND WATER LEVEL SURVEILLANCE

In October 1988 the Westinghouse, WID was tasked with conducting a groundwater level surveillanc program in the area of the WIPP Site. The 57 well bores are utilized to perform surveillance of six wa bearing zones in the WIPP area. The two zones of primary interest are the Culebra dolomit Ma dolomite members of the Rustler formation, 46 measurements are taken in the Culebra dol an measurements are taken in the Magenta dolomite. Two measurements are taken in the Rustler/Salad

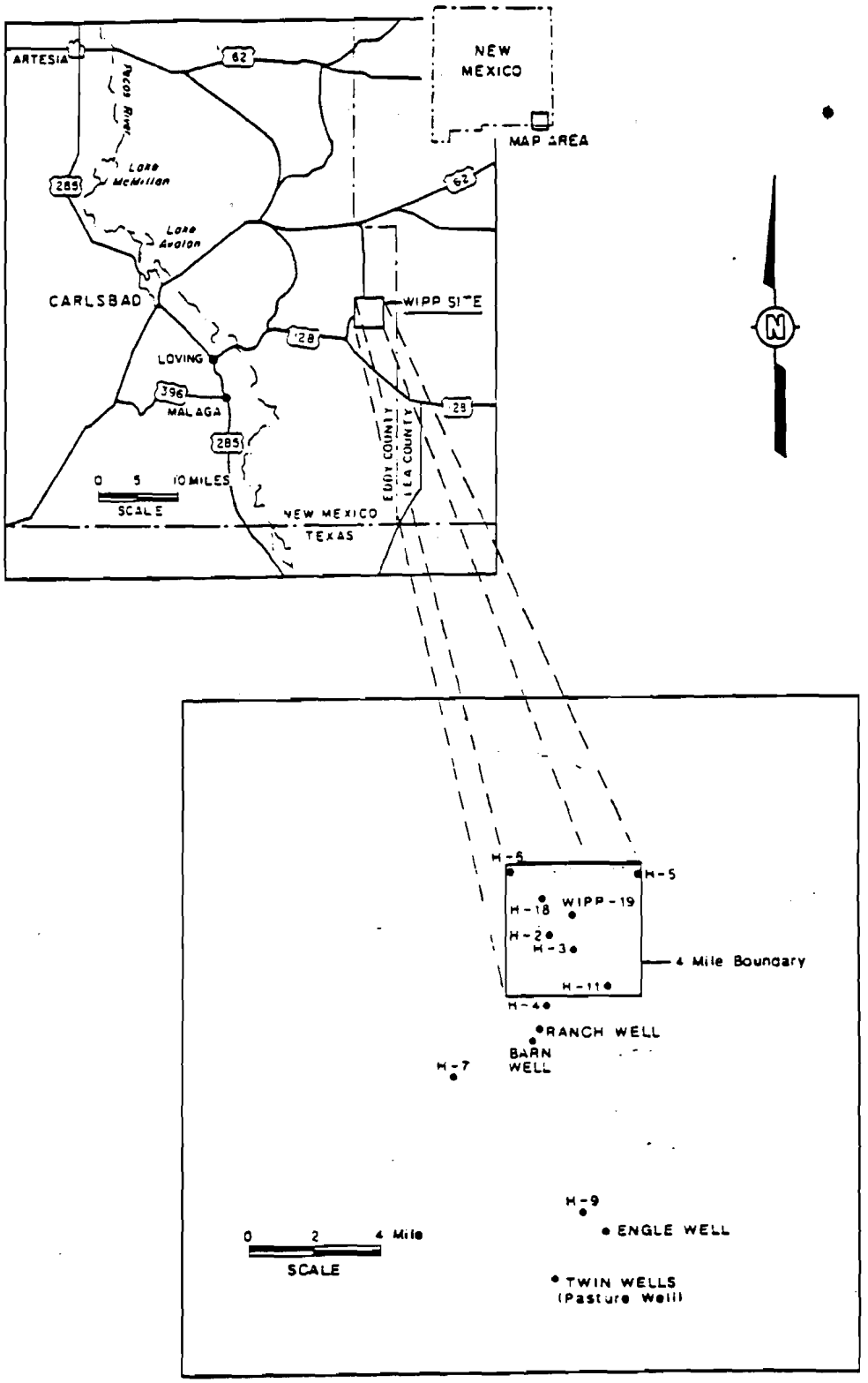

FIGURE 7-2 GROUNDWATER SAMPLING LOCATIONS SAMPLED IN 1990

TABLE 7.1.1

GROUND WATER MONITORING CHEMICAL PARAMETERS

GENERAL CHEMISTRY	METALS (CATIONS)	TOTAL M
pH	Calcium	Aluminu
Specific Conductance	Magnesium	Antimon
Bicarbonate	Potassium	Arsenic
Bromide	Sodium	Barium
Carbonate		Berylliu
Chloride		Boron
Cyanide, Total		Cadmiu
Fluoride		Cesium
Iodide		Chromiu
Nitrate		Cobalt
Total Phenolics		Copper
Total Phosphorus		Iron
Residue filterable at 180 C (TDS)		Lead
Residue nonfilterable at 105 C (TSP)		Lithium
Silica		M n
Sulfate		M ry
Total organic Carbon		Molybde
Total organic Halides		Nickel
		Seleniun
		Silver
		Strontiu
		Thalliu
		Vanadiu
		Zinc

In addition to the above list;

Volatile Organic Hazardous Substance analyses were performed for H-05b, H-06b, H-
H-09b, H-18 and Engle wells.

Semi-volatile Organic Hazardous Substance analyses were performed for H-09b and
wells.

Pesticide analyses were performed for Engle well.

contact and one measurement each are taken in Bell Canyon, the Forty-niner member of the Rustler formation and the Dewey Lake formation. H-16 was added to the program in November 1990 which provides a surveillance location for the Unnamed lower member of the Rustler formation and an additional location for the Dewey Lake formation. Groundwater elevations for November and December 1990 for the Unnamed Lower Member were 3062.97 feet above mean sea level (AMSL) and 3062.76 feet amsl respectively. For the Dewey Lake formation at H-16 the measurements were 3381.10 feet AMSL in November and 3380.16 feet AMSL for the month of December 1990. These measurements reflect a loss of elevation in water levels for the Unnamed Lower Member of 0.21 feet and a loss of 0.94 feet of elevation in water levels for the Dewey Lake formation. Tabulated and graphical data for H-16 are not presented in this report due to a lack of data points. Measurements for November and December 1990 will be presented with data presented in the 1992 Environmental Report.

The groundwater level data presented in this report indicates that there is a gradual trend of rising water level elevations within the Culebra dolomite (Table 7.2.1). Forty-four of forty-six surveillance locations showed some increase in water level elevations within the Culebra dolomite. Two anomalous occurrences were noted in the data presented in this report. The first, was a net loss of 8.67 feet of groundwater level elevation at Cabin Baby well site located approximately 2.5 miles south of the WIPP site from April through December 1990, and the second was a gain of 32.51 feet of groundwater level elevation at P-18 located approximately 3 miles southeast of the WIPP site. The two wells are located within five miles of each other. Groundwater elevation measurements in the Culebra dolomite indicate that the generalized directional flow of ground water is north to south. However, caution should be used when making assumptions based on groundwater level data alone, recent studies in the Culebra dolomite have shown that fluid density variations in the Culebra dolomite can affect flow direction (Crawley, 1988); (Davies, 1989). One should also be aware that the fractured media of the Culebra dolomite coupled with variable fluid densities can cause localized flow patterns to have little or no relationship to general flow patterns. (Crawley, 1988)

Measurements at 11 surveillance locations in the Magenta dolomite also indicated an upward trend in water level elevations (Table 7.2.2). No anomalous losses or gains were noted within the Magenta dolomite. Seven of eleven Magenta surveillance locations show a gain in the elevation of groundwater levels from January to December 1990. Four wells showed a lower elevation of groundwater level elevation in December than in January of 1990. Three of the four surveillance locations that indicate a loss of head elevation from January to December were wells that are pumped routinely as part of the water quality sampling program. These locations are H-03B1, H-04C and H-05C.

Recovery from these pumping events may have influenced the water level data collected at these locations. A 21.82 foot rise in water level elevation at H-02b1 well location from January and continuing through December may appear anomalous, however it may be attributed to a water quality sampling attempt which occurred in November 1989.

Groundwater flow directions in the Magenta dolomite appear to be generally from a easterly to a western direction across the WIPP site. No studies have been performed in the Magenta dolomite to the magnitude that the Culebra dolomite has been studied to determine spacial variations in the fluid densities of the Magenta. It is very possible if not likely that density variations do occur in the Magenta dolomite. Therefore the potential may exist that to some extent flow patterns in the Magenta dolomite may be affected by variations in fluid density. Also flow through the fractured media of the Magenta dolomite may well dictate the behavior of localized flow patterns.

Groundwater elevations in the Dewey Lake Redbeds did not yield sufficient data to draw any conclusions as to trends in groundwater elevation or the direction of groundwater flow in that formation. However groundwater flow in the Dewey Lake Redbeds is considered to be restricted due to the perched characteristics of the formation (Mercer 1983).

When groundwater elevations taken in 1990 are compared to potentiometric elevation maps produced by Mercer, 1983, groundwater elevations appear to be below 1983 levels. The 1983 Mercer study was performed prior to the onset of the large scale hydrologic activities which took place in the vicinity of the WIPP to support site characterization and other hydrological orientated activities during the mid to late 1980's. Since the end of the 1980's only modest amounts of groundwater have been removed from these

formations. The possibility exists that the trends toward increasing groundwater elevations observed 1990 is a natural trend for the formations to recover to groundwater elevations near those of 19 potentiometric elevations.

Detailed tabular and graphical data of data collected in 1990 are listed in appendix X. Historical da from October 1988 through December 1989 is presented in graphical form in appendix XI.

TABLE 7-2.1

Variation Table For Water Levels Culebra Dolomite

WELL #	FEET GAIN/LOSS JAN-DEC	FEET AMSL HIGH	MONTH	FEET AMSL LOW	MONTH	FEET TOTAL VARIATION
AEC-07	+0.13	3034.50	5/90	3034.05	3/90	0.45
CABIN BABY	-6.77	2990.52	4/90	2981.85	12/90	8.67
DOE-01	+1.70	2975.99	12/90	2974.29	1/90	1.70
DOE-02	+1.11	3054.77	12/90	3053.56	3/90	1.21
D-268	+1.44	3005.61	8/90	3002.51	3/90	3.10
ERDA-09	+3.66	2947.57	12/90	2943.91	1/90	3.66
H-01	+3.54	2975.18	2/90	2971.34	1/90	3.84
H-02a (Q)*	+3.69	3002.50	12/90	2998.81	3/90	3.69
H-02b2	+4.56	3006.89	12/90	2984.31	7/90	22.58
H-02c (Q)	+3.44	3003.88	12/90	3000.44	3/90	3.44
H-03b2	+2.50	2984.36	12/90	2978.31	8/90	6.05
H-03b3 (Q)	+2.22	2984.59	12/90	2982.37	3/90	2.22
H-04b	+1.20	2999.02	12/90	2997.82	1/90	1.20
H-05a (Q)	+0.04	3024.87	12/90	3021.10	6/90	3.77
H-05b	+0.50	3020.29	4/90	3011.35	5/90	8.94
H-06a (Q)	+0.80	3045.99	12/90	3045.19	3/90	0.80
H-06b	+0.91	3045.67	12/90	3044.62	2/90	1.05
H-07b1	+0.40	2995.60	12/90	2995.08	4/90	0.52
H-07b2 (Q)	+0.46	2995.40	12/90	2994.94	3/90	0.46
H-09a (Q)	+1.54	2990.50	12/90	2988.79	6/90	1.71
H-09b	+1.51	2990.78	12/90	2989.23	2/90	1.55
H-09c (Q)	+1.51	2990.70	12/90	2989.19	3/90	1.51
H-10b	+0.06	2989.30	9/90	2989.01	3/90	0.29
H-11B1 (Q)	+0.96	2976.95	12/90	2975.99	3/90	0.96
H-11B2	+1.28	2976.56	12/90	2975.28	1/90	1.28
H-11B3 (Q)	+1.13	2976.30	12/90	2975.17	3/90	1.13
H-12	+1.18	2967.44	12/90	2966.26	1/90	1.18
H-14	+1.37	3001.59	12/90	3000.22	1/90	1.37
H-15	+1.68	2954.28	12/90	2952.60	1/90	1.68
H-17	+1.95	2951.80	12/90	2949.85	1/90	1.95
H-18	+3.29	3048.58	12/90	3043.63	4/90	4.95
P-14	+1.15	3039.07	12/90	3037.87	2/90	1.20
P-15	+1.10	3010.15	12/90	3009.05	1/90	1.10
P-17	+1.11	2984.16	12/90	2983.05	1/90	1.11
P-18	+32.51	3039.43	12/90	3006.92	1/90	32.51
WIPP-12	+0.67	3024.46	12/90	3023.34	6/90	1.12
WIPP-13	+1.08	3053.79	12/90	3052.58	3/90	1.21
WIPP-18	+1.92	3012.41	12/90	3006.88	6/90	5.53
WIPP-19	+3.51	3003.00	12/90	2988.86	6/90	14.14
WIPP-21	+3.73	2945.00	12/90	2941.27	1/90	3.73
WIPP-22	+3.56	2978.45	12/90	2965.85	6/90	12.60
WIPP-25	+1.78	3051.84	12/90	3050.06	1/90	1.78
WIPP-26	+0.91	3017.48	12/90	3016.42	5/90	1.06
WIPP-27	+0.80	3075.32	10/90	3074.49	1/90	0.83
WIPP-29	-0.36	2967.93	2/90	2966.67	6/90	1.26
WIPP-30	+0.85	3061.87	12/90	3060.98	2/90	0.89

TABLE 7-2.2

Variation Table For Water Levels Magenta Dolomite

WELL #	FEET GAIN/LOSS JAN-DEC	FEET AMSL HIGH	MONTH	FEET AMSL LOW	MONTH	FEE TOT VARIA
H-01	-0.39	3121.77	1/90	3120.92	3/90	0.8
H-02b1	+21.82	3124.95	12/90	3103.13	1/90	21.8
H-03b1	-1.08	3138.72	8/90	3133.34	9/90	5.3
H-04c	-0.96	3141.86	8/90	3137.22	10/90	4.6
H-05c	-0.07	3153.86	4/90	3107.63	5/90	46.2
H-06c	+1.01	3058.60	12/90	3050.93	3/90	7.6
H-08a	+0.30	3027.20	11/90	3026.88	1/90	0.3
H-10a	+0.12	3158.56	10/90	3158.41	1/90	0.1
WIPP-25	+1.51	3052.96	12/90	3051.45	1/90	.5
WIPP-27	+0.34	3070.89	8/90	3070.20	1/90	.6
WIPP-30	+0.79	3124.91	12/90	3124.12	1/90	0.7

CHAPTER 8

QUALITY ASSURANCE

This chapter outlines the Quality Assurance/Quality Control (QA/QC) program goals and procedures for the radiological and nonradiological monitoring programs at the WID and offsite subcontractor laboratories. The purpose of the program is to monitor the reliability, accuracy, and precision of all data, and to detect problems in the sample collection, preparation, analysis, or data evaluation phases of the monitoring program.

QA comprises all planned and programmed events undertaken to ensure the validity of the results of a monitoring program. QA includes QC, which is task specific and provides a context for assessing the performance of equipment, instruments, and procedures. The QA/QC program for the WIPP environmental programs is established within the framework of the overall Quality Assurance Program Manual of the Westinghouse Electric Corporation, Waste Isolation Division.

A comprehensive QA program has been implemented to ensure that the data collected reflects actual concentrations in the environment and has been obtained prior to commencement of operations in order to provide sound baseline data for comparison with potential impacts of the WIPP. The focus of this program includes:

- Sample collection at all locations, according to procedures based on accepted practices and widely recognized methodologies and criteria
- Procedure review and revision as appropriate to minimize uncertainty due to sampling error while maintaining comparability and continuity between past and future data
- Data verification through a continuing program of analytical laboratory quality control, including participation in inter-laboratory cross-checks; duplicate sample analysis, and, for radiological samples, splits provided to the EEG for analysis

Adherence to policies set forth by federal QA regulations including: ASME NQA-1, Quality Assurance Program Requirements for Nuclear Facilities, (ASME, 1989) and EPA, QAMS-005/80, Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, (EPA, 1980), fulfills the requirements of the QA plan specified in DOE Orders 5400.1 (DOE, 1988d), 5400.3 (DOE, 1988e), 5700.6B (DOE, 1986c) and draft DOE 5400.6 (DOE, 1988f).

8.1 BASELINE DATA

There are four environmental programs currently in place at the WIPP: the NES , the Radiological Environmental Surveillance (RES), the Cooperative Raptor Research Program, and the WIPP Groundwater Surveillance Program. Their purpose is to collect the data needed to detect and quantify any impacts that construction and operational activities at the WIPP site may have on the surrounding ecosystem. A baseline data base spanning several years prior to operations at the WIPP can provide objective evidence of location-specific anomalies in the test results.

Preliminary studies are important when considering WIPP environmental monitoring efforts since they contribute to the baseline data useful during the construction phase, and because they are the predecessors to the long-term monitoring programs. These studies include:

- WIPP Site Characterization Program - instituted in 1976 by SNL to monitor air quality, background radiation levels, and groundwater quality (Pocalujka et al., 1979; 1980a, b, c; 1981a, b; Powers et al., 1978; Lappin, 1989)

- WIPP Biology Program - begun in 1975 with baseline studies of climate, soils, ge arthropods, and vertebrates (Best, 1980)
- Investigations of the site geohydrology - conducted by the U.S. Geological Survey (USGS request of the DOE. In addition, the NRC issued a contract to Columbia University to p a study of radionuclide mobility in the highly saline groundwaters of the Delaware Basi Geological Survey, 1983)
- Radiological monitoring of air, water, and biological media - conducted by the Atomic Commission before and after the Project Gnome nuclear detonation (USAEC, 1962a,b,c

8.2 SAMPLE COLLECTION METHODOLOGIES

Written procedures provide guidance to field personnel for every sample taken and form the basis auditable program. The QA Department periodically conducts surveillance reports, inspection rep and internal audits to ensure compliance with established procedures. An inspection report survey personnel performance in one activity. A surveillance report assesses a procedure from data collec through data management. Surveillances are conducted according to WP 13-011. An internal audi more comprehensive investigation, evaluates the adequacy and effectiveness of the QA program implementation and related procedures and practices. An audit may include procedure review, file management, and test equipment. Audits are conducted according to WP 13-005. Results of each surveillance, and overview are kept on file at the WIPP. In 1990, Westinghouse QA conducted a to 13 evaluations of the Environmental Department. There were two surveillance reports performed the Environmental Monitoring Section. One was closed out and the other is awaiting an engineerir upgrade to alleviate the use of strip charts, whose performance was noted as inadequate. (Note: th charts are a secondary data collection method to the Central Monitoring System.)

There were a total of 11 inspection reports performed on the Environmental Department in 1990. were five performed on the Environmental Monitoring Section. For the Environmental Mo rin Section, three addressed the WQSP (groundwater surveillance) and three on overall envir ta monitoring surveillance (other than groundwater surveillance). Two inspection reports req d fu action, Inspection Report 90-28, 828A identified and required that all data loggers and pressure transducers receive periodic recertification by the WIPP Calibration laboratory. Inspection Repor 90-038, noted appropriate procedures and updated procedures were lacking as well as, ventilation, labeling, wall brackets for spill canisters, and training records. A draft procedure, Management o Hazardous Materials WP 02-507 is being reviewed to correct these deficiencies.

One QA audit was performed which involved the Environmental Department's equipment from a maintenance and calibration standpoint. After review of the calibration and maintenance records noted that an exemplary system was being utilized to track, update and recertify monitoring equipr in the Environmental Department. Corrective actions are implemented as directed in WP 13-002, Isolation Pilot Plant, Waste Isolation, Division Quality Assurance Program Manual.

Sampling procedures are contained in the following documents:

- WIPP Groundwater Monitoring Program Plan and Procedure Manual (WP 02-1)
- WIPP Environmental Procedures Manual (WP 02-3)
- Geotechnical Engineering QA Program Plan (WP 07-1)
- Water Quality Sampling Program (WP 07-2)
- Ecological Monitoring Program Semiannual Report (Reith et al., 1985)
- Radiation Safety Manual (WP 12-5)
- WIPP Quality Assurance Program Manual (WP 13-1)

The sampling procedures describe the methods for sample location determination; timing of collection; equipment calibration; specific steps for sample collection, analysis, and shipment preparation; and the shipment method. The sampling procedures also provide program requirements for data entry, sample tracking, and record-keeping; this ensures data collected and entered becomes a quality record. Standard sample location codes are used for reporting results. The OEMP, the current guiding document for all environmental programs, provides details on the sampling procedures and cites the document containing those procedures. Chapter 11 of the OEMP defines the policies and practices that are applied to provide confidence in the quality of the data.

The data collected in the NES monitoring programs are analyzed as stated in guidance documents, DOE/EH-0023 (Corley et al., 1981) and DOE/EH-XXX (DOE, 1987). Section 8.0 of the OEMP discusses at length the procedures used to analyze the data statistically.

8.3 REVISION OF PROCEDURES

One of the responsibilities of data collection personnel is to assess the performance of collection and analysis methodologies. Sample collection field procedures, analysis preparation, and the laboratory analysis methodology are periodically reviewed and updated and continually scrutinized for adequacy. The method for modifying procedures is set forth in WP 15-101. Additionally, cooperative sampling efforts and radiological samples split with the EEG act as a check that procedures are adequate and that data results are comparable between WIPP and EEG samples. All procedure manuals are reviewed regularly and updated and expanded as necessary.

8.4 INTERLABORATORY COMPARISONS

In October 1990, the WIPP was notified that it was accepted by the DOE-Environmental Measurements Laboratory (EML) to be included in the DOE-EML cross check intercomparison program. The first set of samples for the interlaboratory comparison were shipped to the WIPP in March 1991.

The DOE-EML will periodically send to the WIPP samples of soil, water, vegetation, animal tissues, and air filters. Analytical results are reported to DOE-EML within 90 days and compared with the test results of other participating laboratories. The DOE-EML evaluates and distributes the results to the participating laboratories.

This 1990 Site Environmental Report makes no reference to data comparison's from the comparison program as the WIPP did not participate in 1990.

8.5 LABORATORY QUALITY CONTROL

The WIPP has had contract analytical support for the environmental programs from Westinghouse Advanced Energy Systems Division, Waltz Mill, Pennsylvania; Eberline Analytical Corporation, Santa Fe, New Mexico; the University of New Mexico, Albuquerque, New Mexico; International Technology Corporation Laboratories (Export, Pennsylvania, and Cerritos, California); and United Nuclear Corporation Grand Junction, Colorado.

The contracts with the above mentioned laboratories are currently being rebid/renegotiated. Upon the acceptance of any laboratory to perform analytical analysis for the WIPP. They must adhere to and provide evidence of the following compliance with the ASME NQA-1.

- Routine calibration of instruments
- Frequent source and background counts (as appropriate)
- Routine yield determinations of radiochemical procedures

- Replicate/duplicate analyses to check precision
- Analyses of reagents to ensure chemical purity that could affect the results of t a process

Each laboratory will have a written and implemented QA program that utilizes standard analysis methods for each parameter studied. These methods are listed in detail in the OEMP.

Participation in interlaboratory cross-checks can reveal outdated, previously acceptable lab procedu that are currently unsuitable or inadequate. Steps are then taken to find updated methodologies. T four laboratories providing chemical analytical services for the WIPP are required to participate in interlaboratory cross-checks conducted by the EPA.

8.6 RECORD KEEPING

Records generated in support of the OEMP are controlled and maintained in accordance with Ord DOE 1324.2 (DOE, 1982a), W Records Management Procedures (WP 15-030). All original rec are maintained in a fire resista cabinet at the WIPP until they are transmitted to the WIPP Ma Records Center for permaner (WP 15-030). All records, including raw data, calculations, computer programs or other anipulation, are subject to review and verification under the WI Quality Assurance Program. Environmental Monitoring Section is responsible for validation of these records prior to transmittal to the Master Records Center in accordance with the Records Inventory Disposition Schedule.

Records (such as reports of analyses and sample receipt forms transmitted by contract analytical laboratories) are dated upon receipt and a copy made for QC review as specified in NES/RES QA/ Implementation Procedures (WP 02-302). Specific record and data management procedures includ the recording and referencing of data manipulations are implemented according to the WI Groundwater Monitoring Program Plan and Procedures Manual, RES Data Management ur (WP 02-305), and NES Data Management Procedure (WP 02-334).

The WIPP complies with record-keeping requirements as promulgated under 40 CFR Part 61, Subp H (EPA, 1985b), which pertain to atmospheric radionuclide emissions (WP 02-301). In addition, ur regulations are amended in the future, records development pursuant to these criteria will be maint at least 30 years, as specified in DOE 1324.2 (DOE, 1982a), Chapter V, Attachment 1, Schedule 25 (Medical, Health and Safety Records).

Consistent record keeping in all aspects of the Environmental Monitoring Programs are a part of Q. requirements. Section 10.0 of the OEMP (DOE, 1989) includes a listing of the required records an reports and the laws, regulations, or DOE Orders that contain the requirements. Records are maintained in accordance with WP 15-030, Records Management.

CHAPTER 9

REFERENCES

American National Standards Institute/American society of Mechanical Engineers (ASME/NQA-1), 1986, Revised 1989, "Quality Assurance Program Requirements for Nuclear Facilities," NQA-I-1989.

Atomic Energy Commission, Project Gnome: Project Manager's Report, Washington, D. C., 1962a.

Atomic Energy Commission, Project Gnome Final Report: Weather and Surface Radiation Prediction Activities, PNE-126F, Washington, D. C., 1962b.

Atomic Energy Commission, Project Gnome Final Report: Off-Site Radiological Safety Report, PNE-132F, Washington, D. C., 1962c.

Atomic Energy Commission, Project Gnome Final Report: On-Site Radiological Safety Report, PNE-133F, Washington, D. C., 1962d.

Banz, I. P., et al., Annual Site Environmental Monitoring Report for the Waste Isolation Pilot Plant, Calendar Year 1986, DOE/WIPP-87-002, Waste Isolation Pilot Plant, Carlsbad, New Mexico., 1987.

Bednarz, J. C. The Los Medanos Cooperative Raptor Research and Management Program: 1986 Annual Report, University of New Mexico, Contract No. 59-WRK-90469-SD, Albuquerque, New Mexico., 1987.

Best, T. L., and S. Neuhauser, A Report of Biological Investigations at the Los Medanos Waste Isolation Pilot Plant (WIPP) Area of New Mexico During FY 1978, Sandia National Laboratories Report SAND79-0368, Albuquerque, New Mexico., 1980.

Bradshaw, P. L., and E. T. Louderbough, Compilation of Historical Radiological Data Collected in the Vicinity of the WIPP Site, DOE/WIPP 87-004, Waste Isolation Pilot Plant, Carlsbad, New Mexico., 1987.

Broberg, et. al., "Annual Water Quality Data Report for the Waste Isolation Pilot Plant", (Draft) WIPP Project, Carlsbad, New Mexico., 1990.

Colton, I. D., and J. G. Morse, Water Quality Sampling Plan, WIPP-DOE-215, Waste Isolation Pilot Plant, Carlsbad, New Mexico., 1985.

Corley, J. P., et al., A Guide for Environmental Radiological Surveillance at U.S. Department of Energy Installations, DOE/EH-0023, U.S. Department of Energy, Washington, D. C., 1981.

Crawley, M.E., "Hydrostatic Pressure and Fluid Density Distribution of the Culebra Dolomite Member of the Rustler Formation near the Waste Isolation Pilot Plant, Southeastern NM.", Waste Isolation Pilot Plant Project, Carlsbad, New Mexico., 1988.

Crawley, M. E., Hydrostatic Pressure and Fluid Density Distribution of the Culebra Dolomite Member of the Rustler Formation near the Waste Isolation Pilot Plant, Southeastern New Mexico, DOE/WIPP 88-030, Waste Isolation Pilot Plant, Carlsbad, New Mexico., 1988.

Department of Energy, Final Environmental Impact Statement, Waste Isolation Pilot Plant, DOE/EIS-0026, Vols. 1 and 2, Washington, D.C., 1980.

Department of Energy, "Implementation of the National Environmental Policy Act (NEPA)," DOE Order AL 5440.1C, Albuquerque Operations Office, Albuquerque, New Mexico., 1985.

Department of Energy, "Environmental Policy Statement," Secretary of Energy Herrington, Washin 1986.

Department of Energy, "Quality Assurance, U.S. DOE Operations, DOE Order 5400.6B, Washington, D.(1986.

Department of Energy, Radiological Effluent Monitoring and Environmental Surveillance for U.S. DOE Operations, DOE/EH-XXX (draft), Washington, D. C., 1987.

Department of Energy, "General Environmental Protection Program," DOE Order 5400.1, Washington, D 1988a.

Department of Energy, "Radiation Protection of the Public and the Environment," DOE Order 5400.5, Washington, D.C., 1988b.

Department of Energy, "Requirements for Radiological Effluent Monitoring and Environmental Surveillar for U.S. DOE Operations," DOE Order 5400.xy (draft), Washington, D.C., 1988c.

Department of Energy, "Radioactive Waste Management," DOE Order 5820.2A, Washington, D.C., 1988d

Department of Energy, "Hazardous and Radioactive Mixed Waste Program, U.S. DOE Operations, DOE Order 5400.3, Washington, D.C., 1989.

Department of Energy, Final Safety Analysis Report, Waste Isolation Pilot Plant , DOE/WIPP 02-9, Waste Isolation Pilot Plant, Carlsbad, New Mexico., 1990.

Department of Energy, Operational Environmental Monitoring Plan for the Waste Isolation Pilot DOE-WIPP 88-025, Waste Isolation Pilot Plant, Carlsbad New Mexico., 1989.

EG&G/Energy Measurements, An Aerial Radiological Survey of the Waste Isolation Pilot Plant and Surrounding Area (Draft), EG&G/EM Survey Report AMO-8809, EG&G/Energy Measurements, Las Ve Nevada., 1988.

Environmental Protection Agency, Interim Guidelines and Specifications for preparing Quality Assurance Project Plans, EPA Publication QAMS-005/80, December 29, 1980.

Environmental Protection Agency, "Proposed Guidance on Dose Limits to Transuranic Elements in the General Environment," Office of Radiation Programs, Criteria and Standards Division, Washington, D.C.,

Environmental Protection Agency, "Individual Laboratory Summary Report for QB 1 FY 88" for the International Technology Corporation, Export, Pennsylvania, Laboratory, February 2, 1988., 1988a.

Environmental Protection Agency, Letter from Butler, Larry, Office of Research and Development, Environmental Monitoring Systems Laboratory, Environmental Protection Agency, Las Vegas, Nevada, transmitting "Individual Laboratory Summary Report for QB 2 FY 88" for the International Technology Corporation, Export, Pennsylvania Laboratory, undated., 1988b.

Environmental Protection Agency, Letter from Butler, Larry, Office of Research and Development, Environmental Monitoring Systems Laboratory, Environmental Protection Agency, Las Vegas, Nevada, transmitting "Individual Laboratory Summary Report for QB 3 FY 88" for the International Technology Corporation, Export, Pennsylvania Laboratory, July 14, 1988, 1988c.

Environmental Protection Agency, Letter from Forrest, Robert G., Office of Quality Assurance, Region VI, Environmental Protection Agency, Dallas, Texas, transmitting "Water Pollution Performance Evaluation Study 20" results for the International Technology Corporation, Cerritos, California Laboratory, July 15, 1988, 1988d.

Environmental Protection Agency, Letter from Butler, Larry, Office of Research and Development, Environmental Monitoring Systems Laboratory, Environmental Protection Agency, Las Vegas, Nevada, transmitting "Individual Laboratory Summary Report for QB 4 FY 88" for the International Technology Corporation, Export, Pennsylvania Laboratory, November 8, 1988., 1988e.

Environmental Protection Agency, 1988 Intercomparison Study results for the Waltz Mill Laboratory as contained in a memorandum from Blackburn, Charles, Waltz Mill Laboratory, to Joe Harvill, Westinghouse Electric Corporation, WIPP Site, Carlsbad, New Mexico, April 3, 1989, 1988f.

Fischer, N. T., et al., Ecological Monitoring Program, Second Semi-Annual Report, DOE/WIPP 85-002, Waste Isolation Pilot Plant, Carlsbad, New Mexico, 1985.

Fischer, N. T. (ed.), Ecological Monitoring Program, Annual Report, Fiscal Year 1986, DOE/WIPP 87-003, Waste Isolation Pilot Plant, Carlsbad, New Mexico., 1987.

Fischer, N. T. (ed.), Ecological Monitoring Program at the Waste Isolation Pilot Plant, Annual Report, CY 1987, DOE/WIPP 88-008, Waste Isolation Pilot Plant, Carlsbad, New Mexico., 1988

Fisher, N. T.(ed), Annual Site Environmental Report For the Waste Isolation Pilot Plant, CY 1988, DOE/WIPP 89-005, Waste Isolation Pilot Plant, Carlsbad, New Mexico, 1989.

Flynn, D. T. (ed.), Annual Site Environmental Monitoring Report for the Waste Isolation Pilot Plant, Calendar Year 1987, DOE/WIPP 88-009, Waste Isolation Pilot Plant, Carlsbad, New Mexico., 1988.

Hayden, T. J., and J. C. Bednarz, The Los Medanos Cooperative Raptor Research and Management Program: 1988 Annual Report, University of New Mexico, Contract No. 59-WRK-90469-SD, Albuquerque, New Mexico., 1989.

Jones, S. B. (ed.), Waste Isolation Pilot Plant Site Environmental Report for Calendar Year 1989, DOE/WIPP 90-003, Waste Isolation Pilot Plant, Carlsbad, New Mexico, 1990.

Louderbough, E. T., Operational Environmental Permit Compliance Plan for the Waste Isolation Pilot Plant, WIPP-2-4, Albuquerque, New Mexico., 1986.

Lyon, M. L., Annual Water Quality Data Report for the Waste Isolation Pilot Plant, DOE/WIPP-89-001, Waste Isolation Pilot Plant, Carlsbad, New Mexico., 1989.

Lyon, M.L., "Annual Water Quality Data Report for the Waste Isolation Pilot Plant", WIPP Project, Carlsbad, New Mexico., 1989.

McGowan et. al., "Depositional Framework of the Lower Dockum Group (Triassic), Texas Panhandle," Bureau of Economic Geology Report of Investigations No. 97, University of Texas at Austin, Austin, TX.

Mercer, J. W., Geohydrology of the Proposed Waste Isolation Pilot Plant Site, Los Medanos Area, Southeastern New Mexico, Water Resources Investigations Report 83-4016, U.S. Geological Survey., 1983.

National Council on Radiation Protection and Measurement, Natural Background Radiation in the United States, Report No. 45, Washington, D.C., 1975.

National Council on Radiation Protection and Measurement, Environmental Radiation Measurements, Re
No. 50, Washington, D.C., 1976.

Pocalujka, L. P., et al., Meteorological and Air Quality Data Quarterly Report WIPP Site: Eddy County, Ne
Mexico, Winter Quarter, December 1976 - February 1977, Sandia National Laboratories Report SAND 79-1042, Albuquerque, New Mexico., 1979.

Pocalujka, L. P., et al., Meteorological and Air Quality Data Quarterly Report WIPP Site: Eddy County, Ne
Mexico, Spring Quarter, March 1977 - May 1977, Sandia National Laboratories Report SAND 79-7109, Albuquerque, New Mexico., 1980a.

Pocalujka, L. P., et al., Meteorological and Air Quality Data Quarterly Report WIPP Site: Eddy County, Ne
Mexico, Summer Quarter, June 1977 - August 1977, Sandia National Laboratories Report SAND 80-7107, Albuquerque, New Mexico., 1980b.

Pocalujka, L. P., et al., Meteorological and Air Quality Data Quarterly Report WIPP Site: Eddy County, Ne
Mexico, Autumn Quarter, September 1977 - November 1977, Sandia National Laboratories Report SAND 80-7121, Albuquerque, New Mexico., 1980c.

Pocalujka, L. P., et al., Meteorological and Air Quality Data Quarterly Report WIPP Site: Eddy County, Ne
Mexico, Winter Quarter, December 1977 - February 1978, Sandia National Laboratories Report SAND 80-7160, Albuquerque, New Mexico., 1981a.

Pocalujka, L. P., et al., Meteorological and Air Quality Data Quarterly Report WIPP Site: Eddy County, Ne
Mexico, March 1978 - February 1980, Sandia National Laboratories Report SAND 81-7052, Albuquerque, N
Mexico., 1981b.

Powers, D. W., et al., (eds.), Geological Characterization Report, Waste Isolation Pilot Plant (WIP
SAND 78-1596, Sandia National Laboratories, Albuquerque, New Mexico., 1978.

Powers et. al., "Geological Characterization Report", Waste Isolation Pilot Plant (WIPP) Site, Southeastern New Mexico, SAND78-1596, Sandia National Laboratories, Albuquerque, New Mexico., 1978.

Prill, S. D., and G. R. Buckle, Guidance Manual: Surface Water and Sediment Sampling for the Environme
Monitoring Program., 1987.

Randall et. al., "Annual Water Quality Data Report for the Waste Isolation Pilot Plant", WIPP Project, Carlsbad, New Mexico., 1988.

Reith, C. C., Environmental Data Acquisition at the Waste Isolation Pilot Plant: A Chronological Descript
and Justification Matrix, International Technology Corporation, Contract No. DE-AC04-78AL05346, Carls
New Mexico., 1985.

Reith, C. C., and G. Daer, Radiological Baseline Program for the Waste Isolation Pilot Plant: Program Pla
WTSD-TME-057, Waste Isolation Pilot Plant, Carlsbad, New Mexico., 1985.

Reith, C. C., et al., Ecological Monitoring Program for the Waste Isolation Pilot Plant, Semi-Annual Repor
July-December 1984, WTSD-TME-058, Waste Isolation Pilot Plant, Carlsbad, New Mexico., 1985.

Reith, C. C., et al., Annual Site Environmental Report for the Waste Isolation Pilot Plant, DOE/WIPP-86-0
Waste Isolation Pilot Plant, Carlsbad, New Mexico., 1986.

Santos, P. F., et al., "A Comparison of Surface and Buried Larrea tridentata Leaf Litter Decomposition in North American Hot Deserts," Ecology, Vol. 65, pp. 278-284., 1984.

Schnurer, J., and T. Rosswall, "Fluorescein Diacetate Hydrolysis as a Measure of Total Microbial Activity in Soil and Litter," Applied Environmental Microbiology, Vol. 43 (6), pp. 1256-1261., 1982.

Simpson, H. J., et al., Mobility of Radionuclides in High Chloride Sediments: A Case Study of Waters Within and Near the Delaware Basin, Southeastern New Mexico, NUREG/CR-4237, Lamont-Doherty Geological Laboratory, Columbia University for Division of Radiation Programs in Earth Sciences, Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission., 1985.

Uhland, D. W., and W. S. Randall, Annual Water Quality Data Report, Waste Isolation Pilot Plant, Carlsbad, New Mexico, DOE/WIPP-86-006, Waste Isolation Pilot Plant, Carlsbad, New Mexico., 1986.

Uhland, D. W., et al., 1987. Annual Water Quality Data Report, Waste Isolation Pilot Plant, Carlsbad, New Mexico, DOE/WIPP-87-007, Waste Isolation Pilot Plant, Carlsbad, New Mexico., 1987.

Uhland et al., Annual Water Quality Data Report for the Waste Isolation Pilot Plant, WIPP Project, Carlsbad, New Mexico., 1986.

Uhland et al., Annual Water Quality Data Report for the Waste Isolation Pilot Plant, WIPP Project, Carlsbad, New Mexico., 1987.

U.S. Geological Survey, Geohydrology of the Proposed Waste Isolation Pilot Plant site, Los Medanos Area, Southeastern New Mexico, USGS 83-4016., 1983.

Westinghouse Electric Corporation, Management and Operating Contractor - WIPP Quality Program Manual, WP 13-1, Waste Isolation Pilot Plant, Carlsbad, New Mexico., 1986.

Westinghouse Electric Corporation, Environmental Protection Implementation Plan for the Waste Isolation Pilot Plant, DOE/WIPP 90-001, Waste Isolation Pilot Plant, Carlsbad, New Mexico, 1990.

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University of California at Berkeley
Hearst Mining Building, #320
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Mr. Charles L. Cox
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Bureau of Radiological Health
Food and Drug Administration
5600 Fishers Lane
Rockville, MD 20857

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Los Angeles, CA 90024

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Box U-97
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Rep. Robert M. Hawk
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P.O. Box 1663
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Mr. Alan Krause
Bureau of Land Man.
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Dr. Konrad B. Krauskopf
Department of Geology
Stanford University
Stanford, CA 94305

Jan Kronenburg, Ad. Assi
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2101 Constitution Avenue
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J. LaGrone, Manager
Oak Ridge Operat[illegible]Of
P.O. Box E
Oak Ridge, TN 37830

LATA
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A. J. (Tony) Matule
Manager, Environmental Eng.
Westinghouse Idaho Nuclear Co.
P.O. Box 4000, CPP-630
Idaho Falls, ID 83403

John M. Matuszek, Jr.
Radiologic Sciences Lab.
New York State
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Department of Hydrology
Pennsylvania State University
University Park, PA 16802

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108 New Engineering Building
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24th Avenue, South
Nashville, TN 37235

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Western Zirconium
P.O. Box 3208
Ogden, UT 84409

Dr. Thomas H. Pigford
Department of Nuclear Engin.
University of California
Berkely, CA 94720

Sam Pitts
Director, Environmer
Gateway Center
1558 Westinghouse Buildir
Pittsburgh, PA 15222

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Tucson, AZ 85721

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Department of Biology
University of New Mexico
Albuquerque, NM 87131

Radioactive Waste Consult
Room 334
State Capitol
Santa Fe, NM 87503

Dr. Court Randall, Directc
Energy Education D on
Oak Ridge Operatio ff
P.O. Box E
Oak Ridge, TN 37830

Mr. H. J. Rauch, Manager
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Chicago Operations Office
9800 S. Cass Avenue
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Rockville, MD 20857

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233 Virginia
Ponca City, OK 74601

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Office of Radiation Problems, ANR 458
Christal Mall #2 216
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Ms. Elsa Taylor
Department of Biology
University of New Mexico
Albuquerque, NM 87131

Mr. Al Topp
Health Programs Manager 2A
Radiation Protection Burearu
Environmental Improvement Div.
P.O. Box 968
Santa Fe, NM 87503

Walter Gregson Vaux, P.E.
Principal Engineer
Facilitator, Waste & Envir.
R & D Center-501-3022

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Bureau of Radiological Health
Food and Drug Administration
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Department of Biology
New Mexico State University
Las Cruces, NM 88001

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JK Associates
77 Fox Run Road
P.O. Box 2219
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Department of Oceanography
Florida State University
Tallahassee, FL 32307

Richard C. Winter, Ph.D.
Energy and Environmental Systems Div.
Argonne National Laboratory
Argonne, IL 60439

Mr. Harold C. Wyckoff
4108 Montpelier Road
Rockville, MD 20853

APPENDIX I

GROSS ALPHA CONCENTRATIONS

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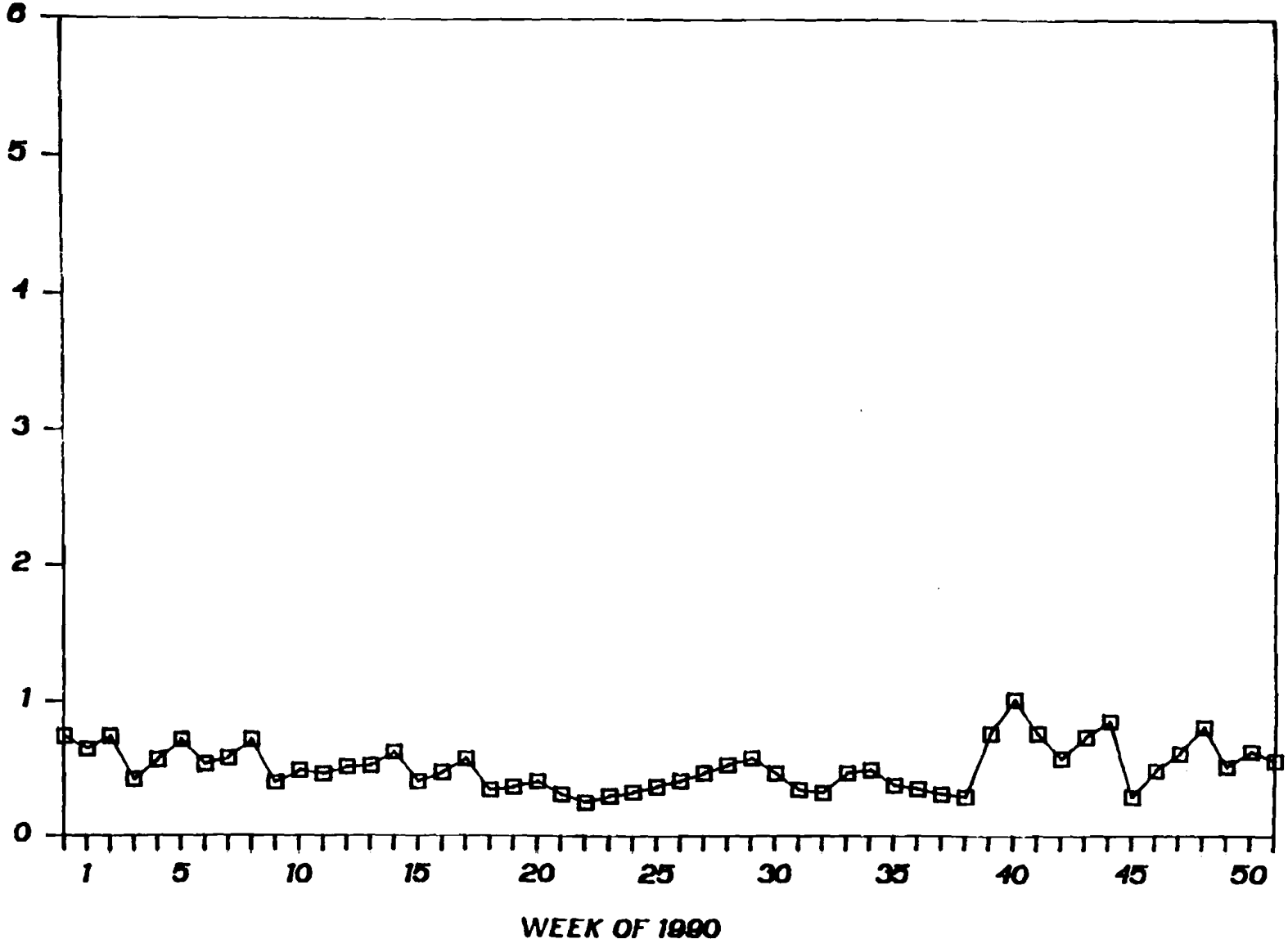
ALPHA CONCENTRATION

CARLSBAD LOCATION



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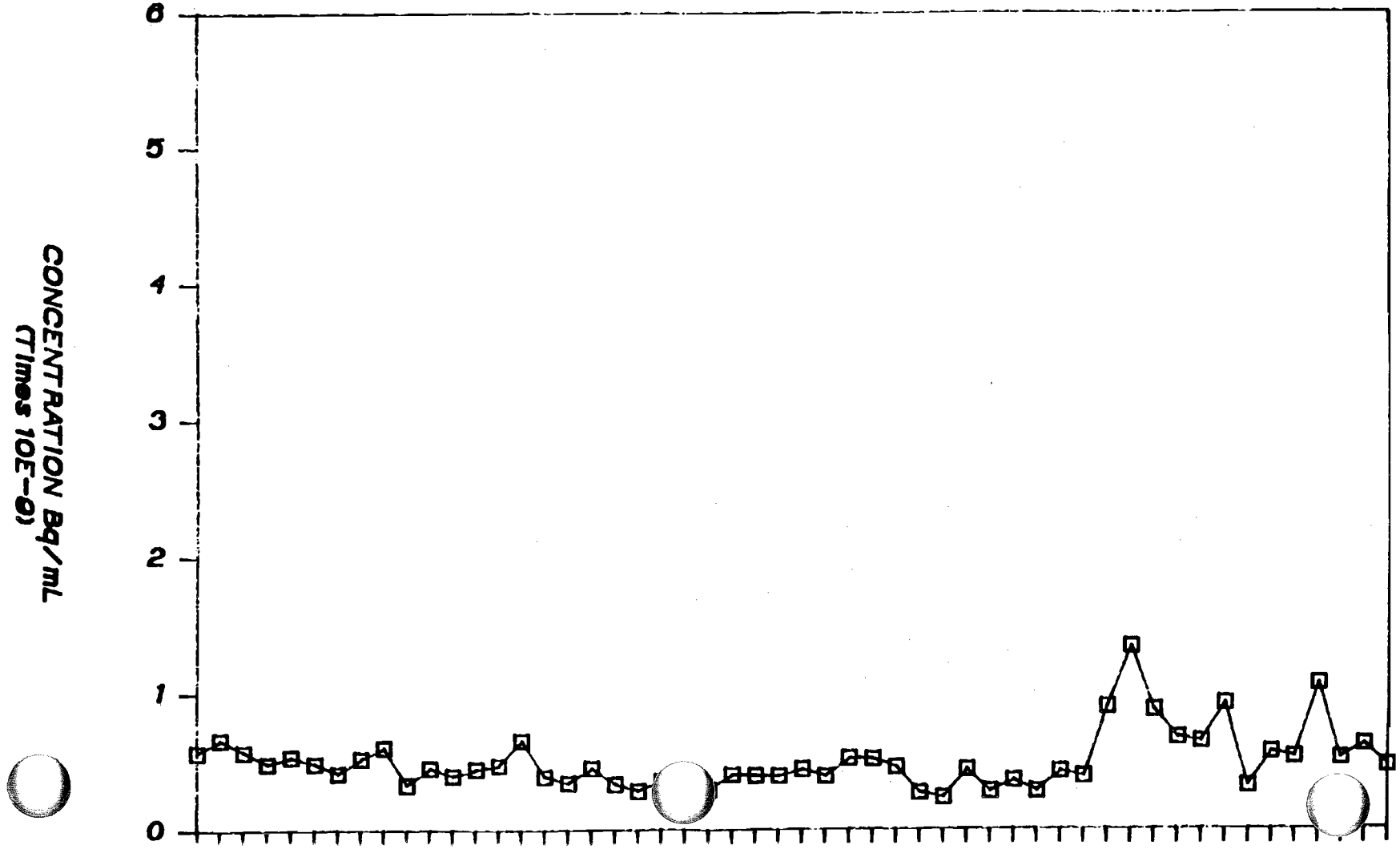

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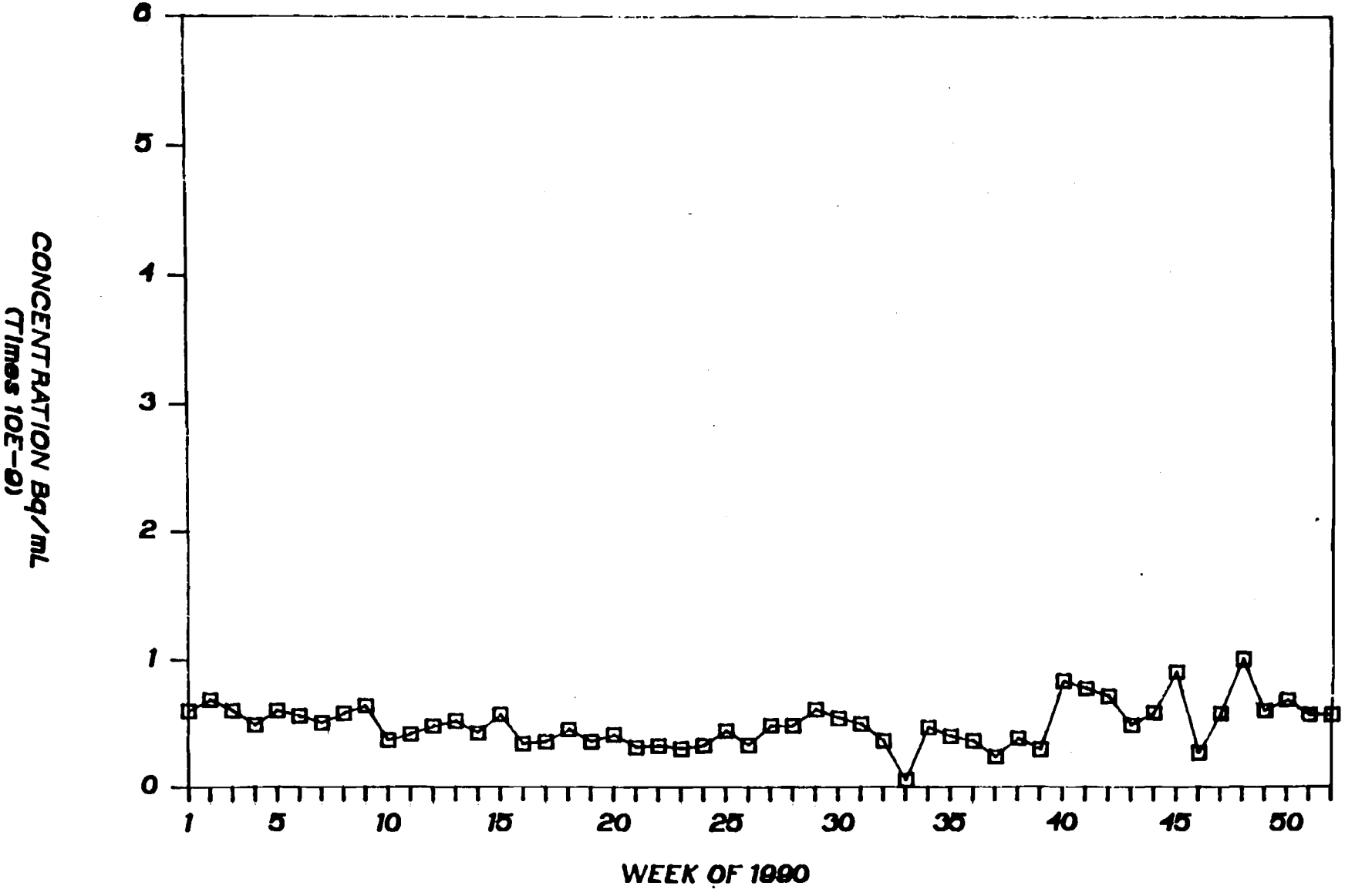

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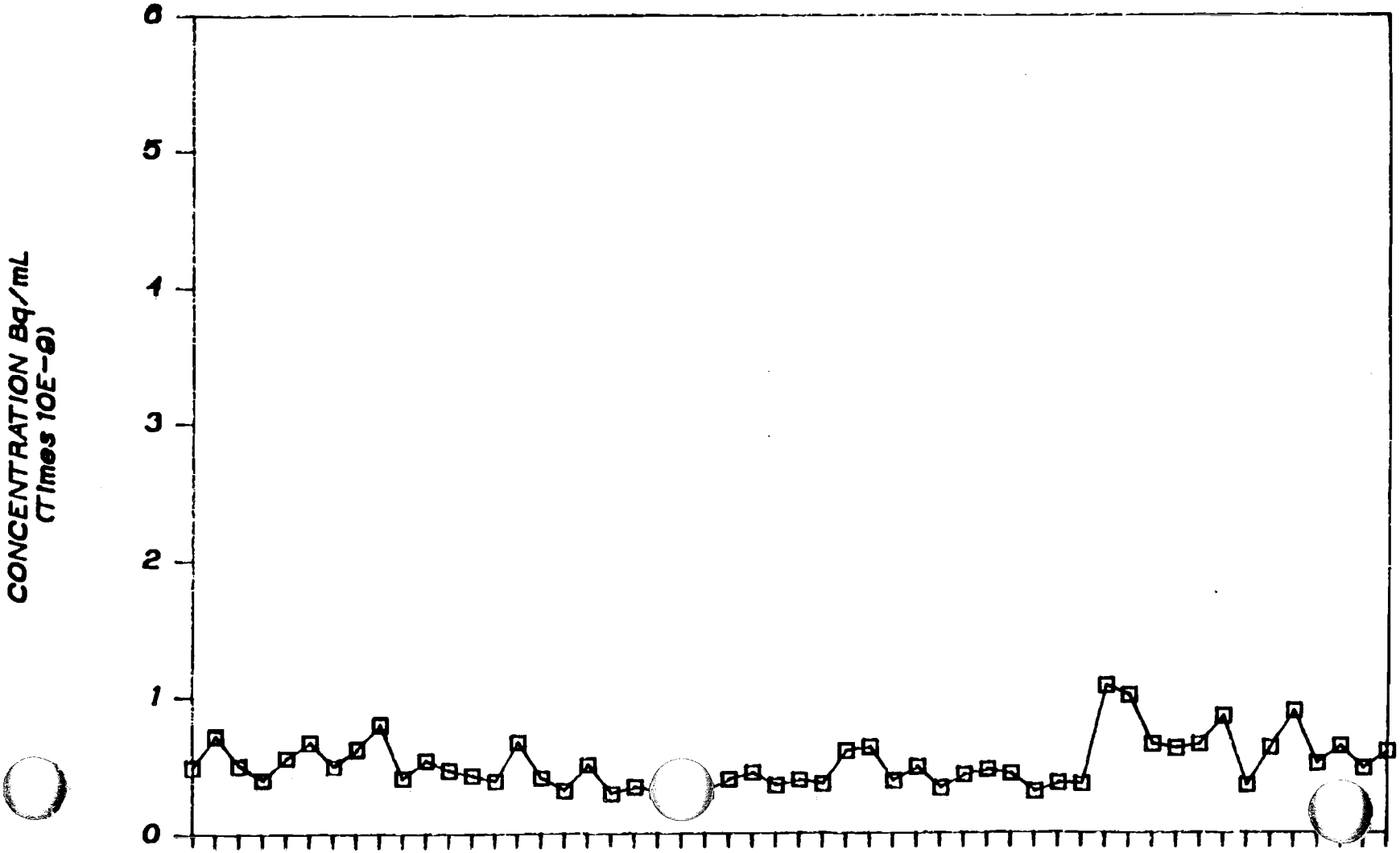

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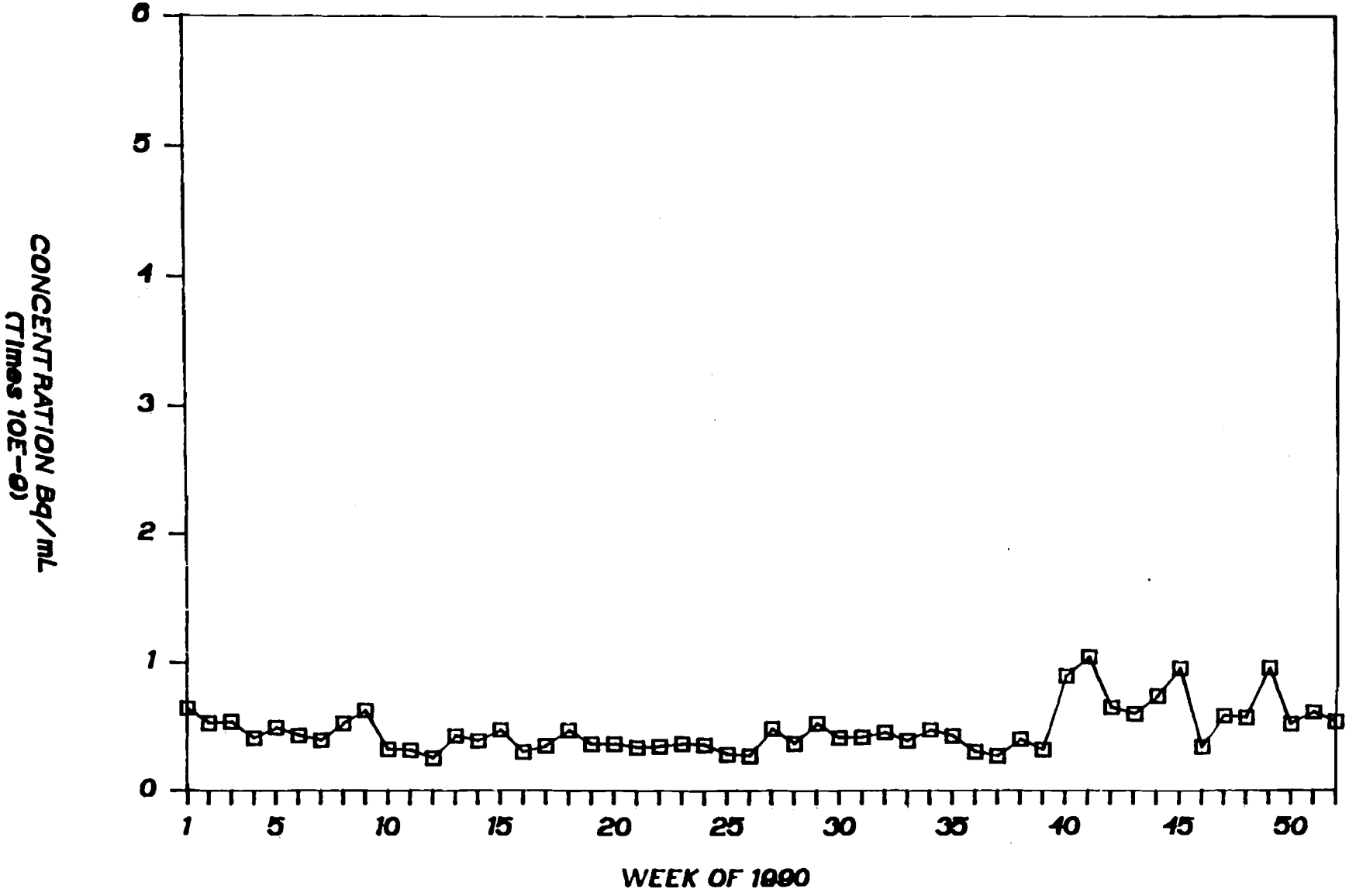

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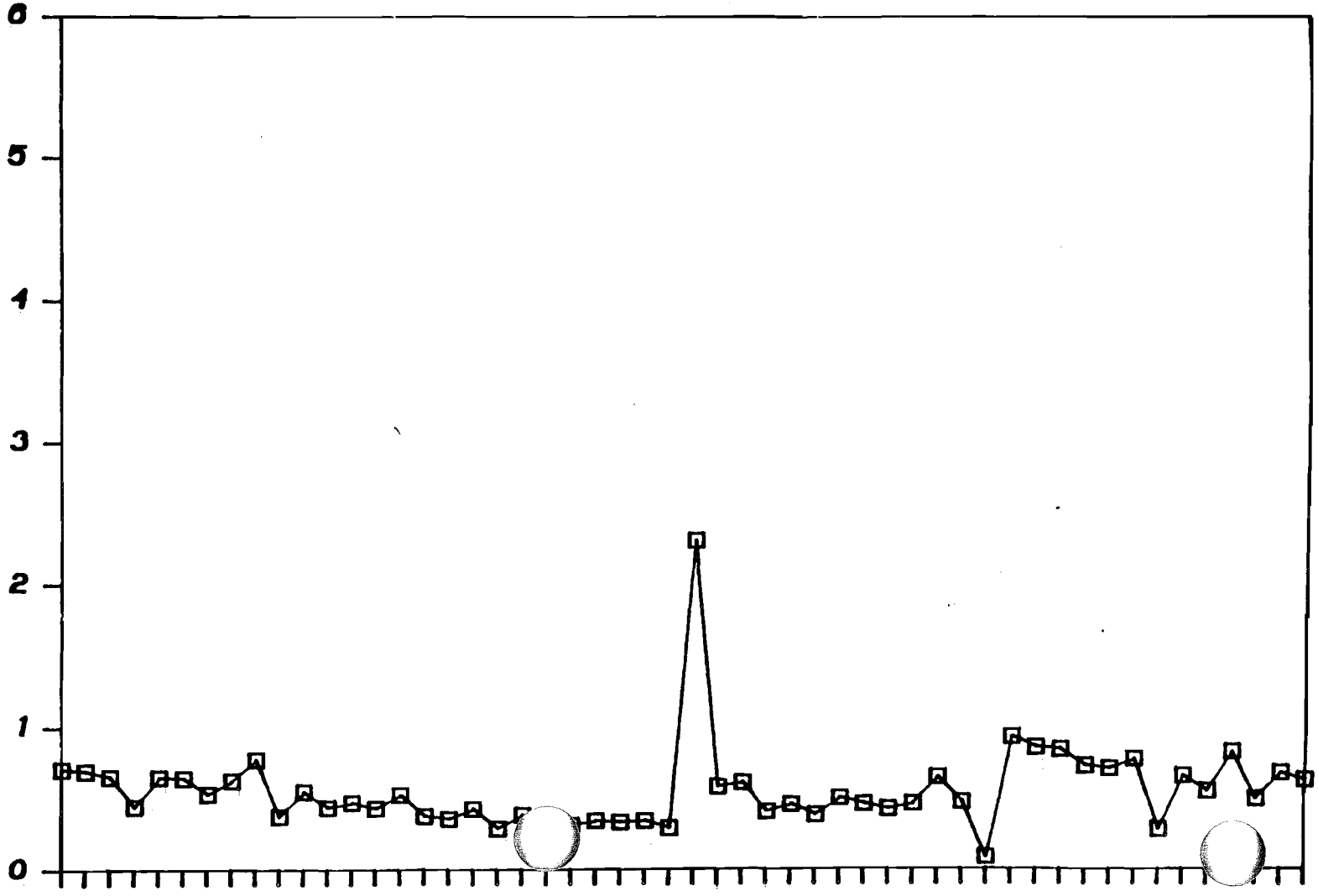

DOE/WI

ALPHA CONCENTRATION

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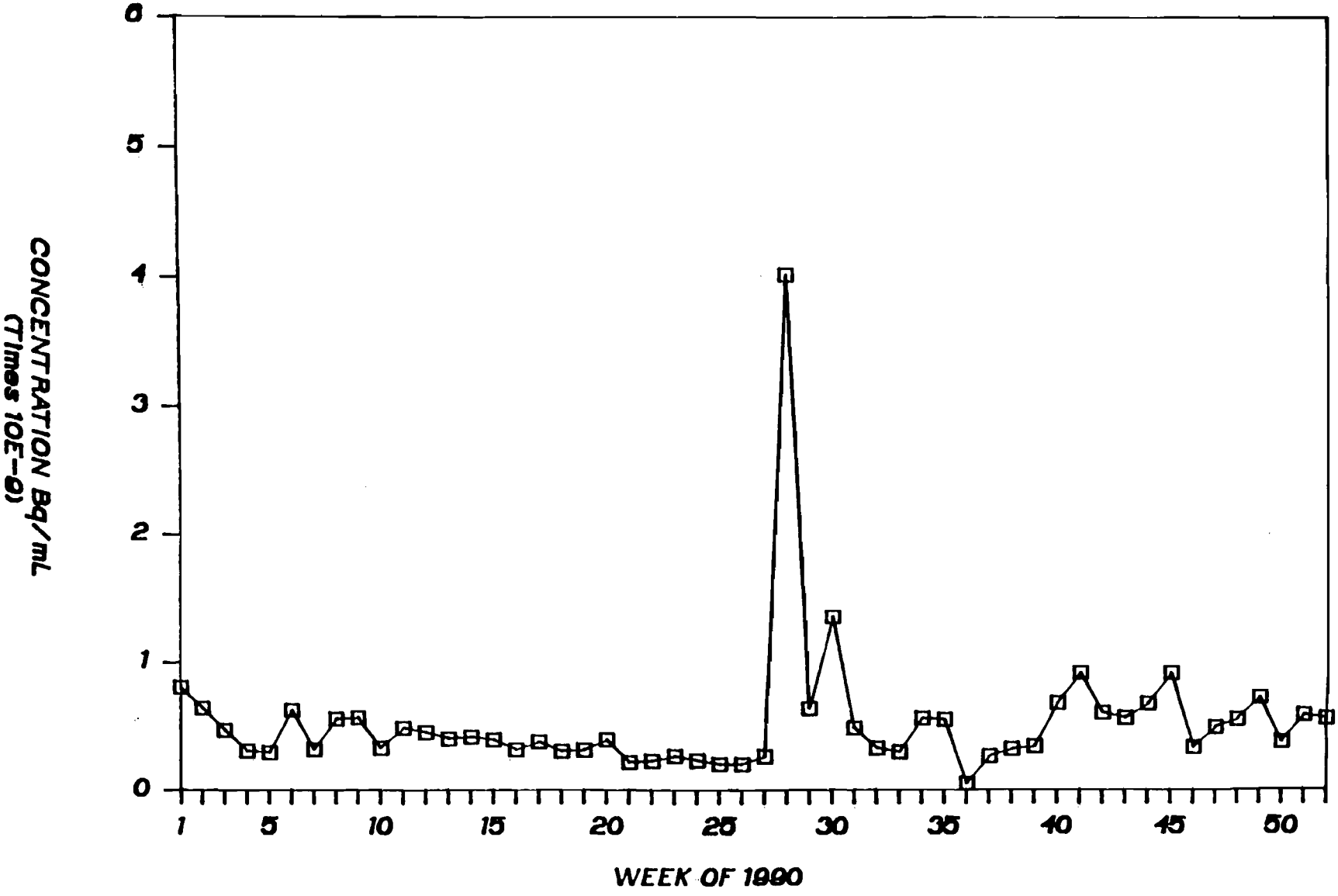

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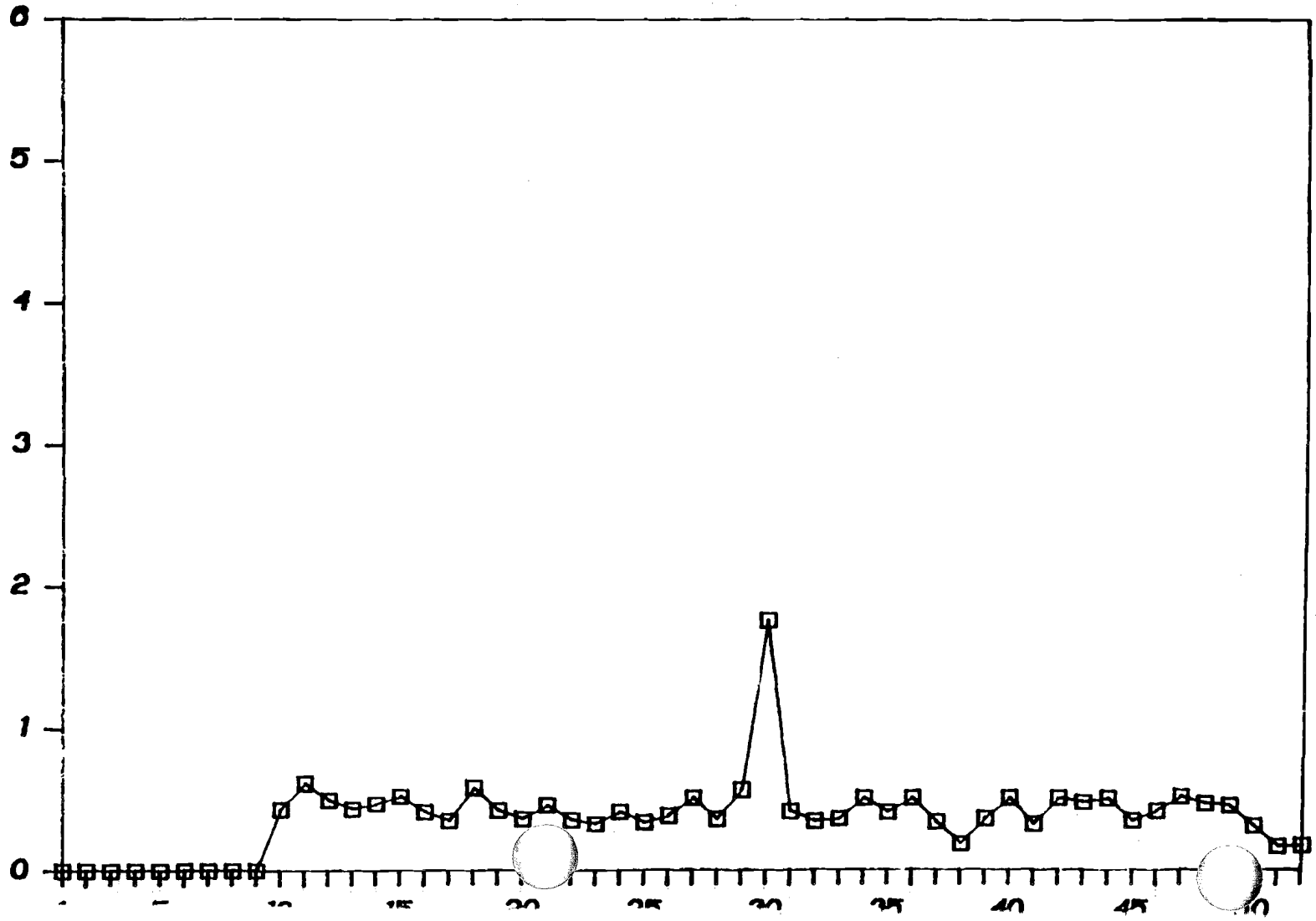
SOUTH EAST CONTROL LOCATION



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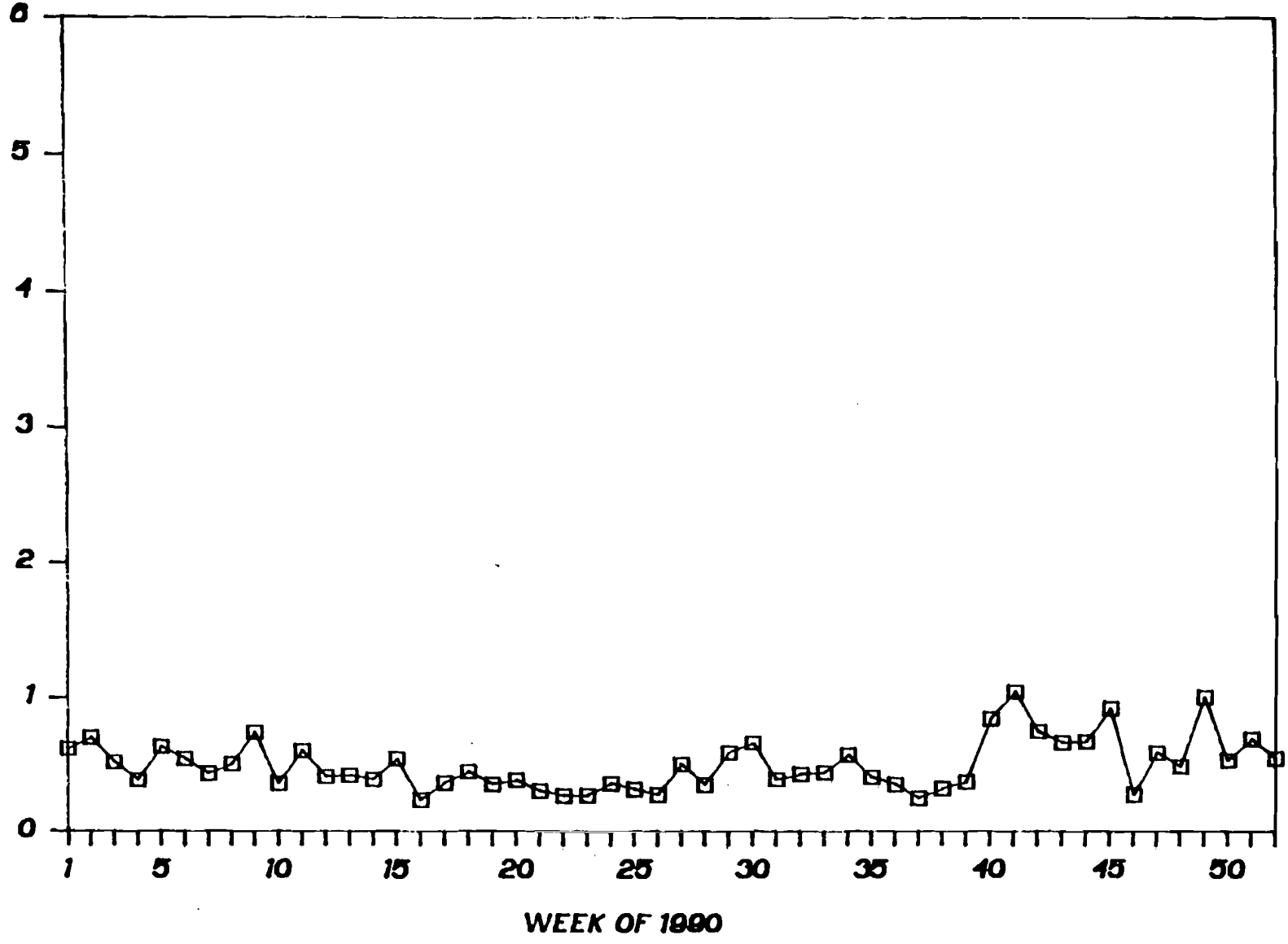
ALPHA CONCENTRATION

SOUTH LOCATION



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APPENDIX II

GROSS BETA CONCENTRATIONS

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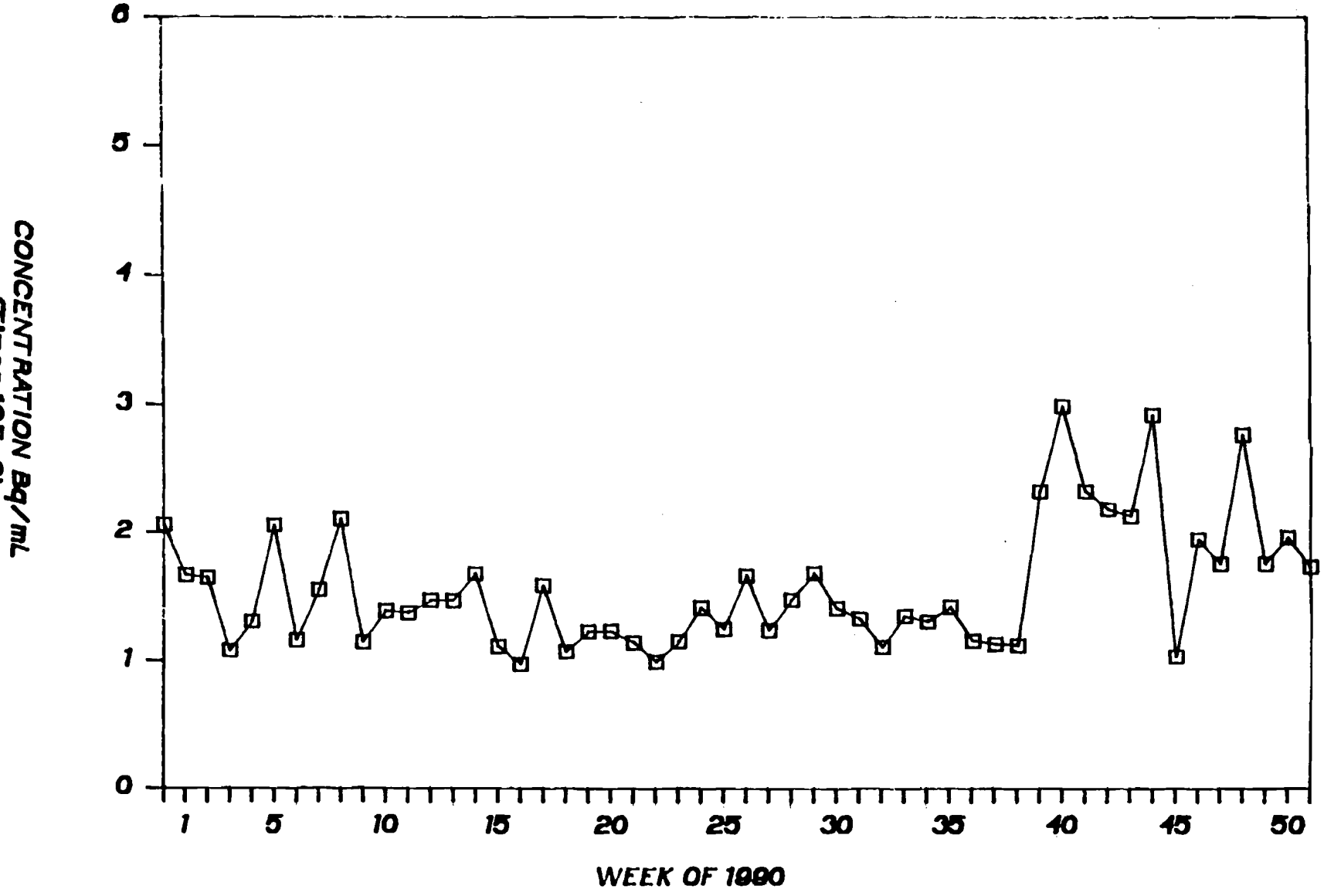
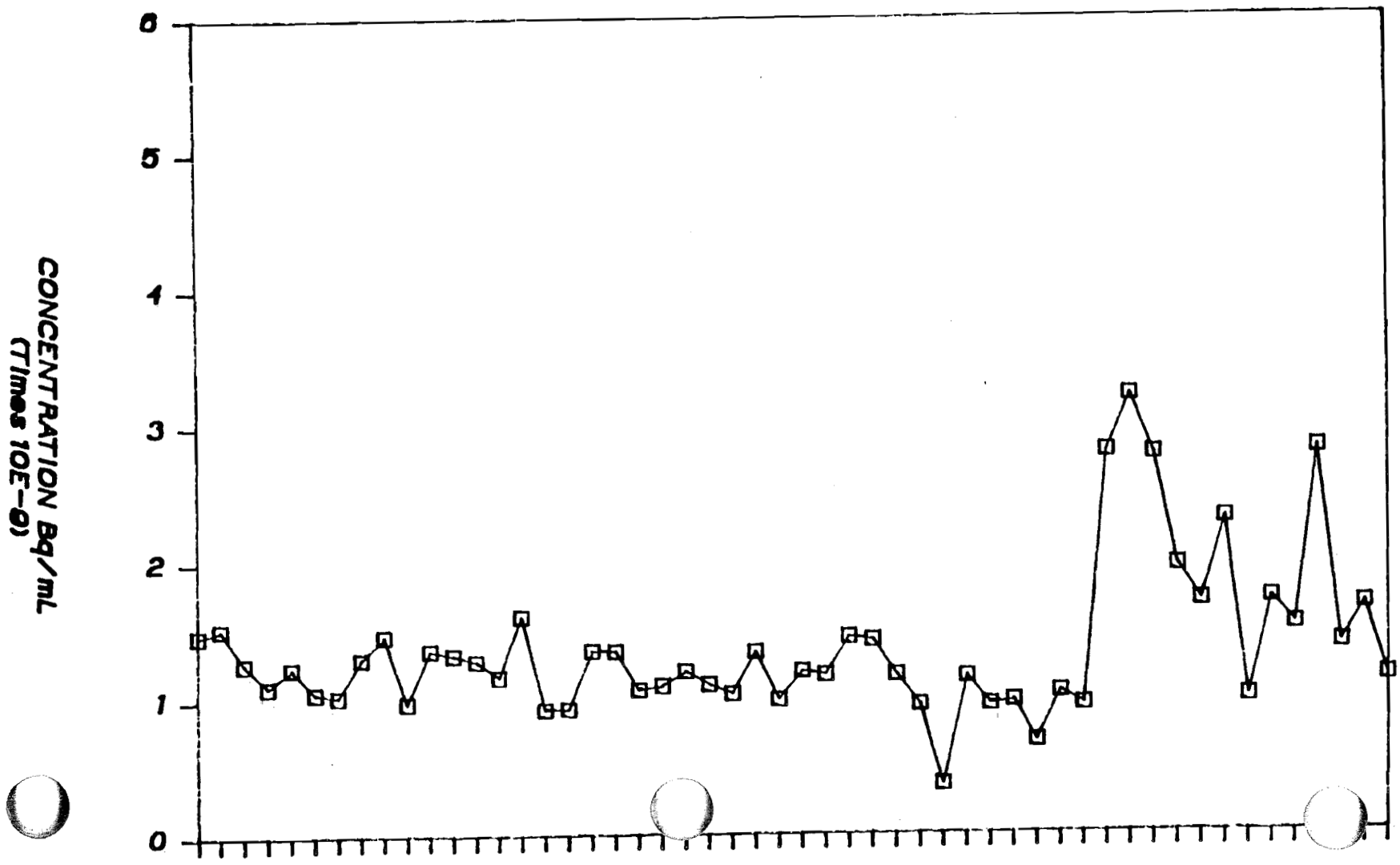
BETA CONCENTRATION

CARLSBAD LOCATION



BETA CONCENTRATION

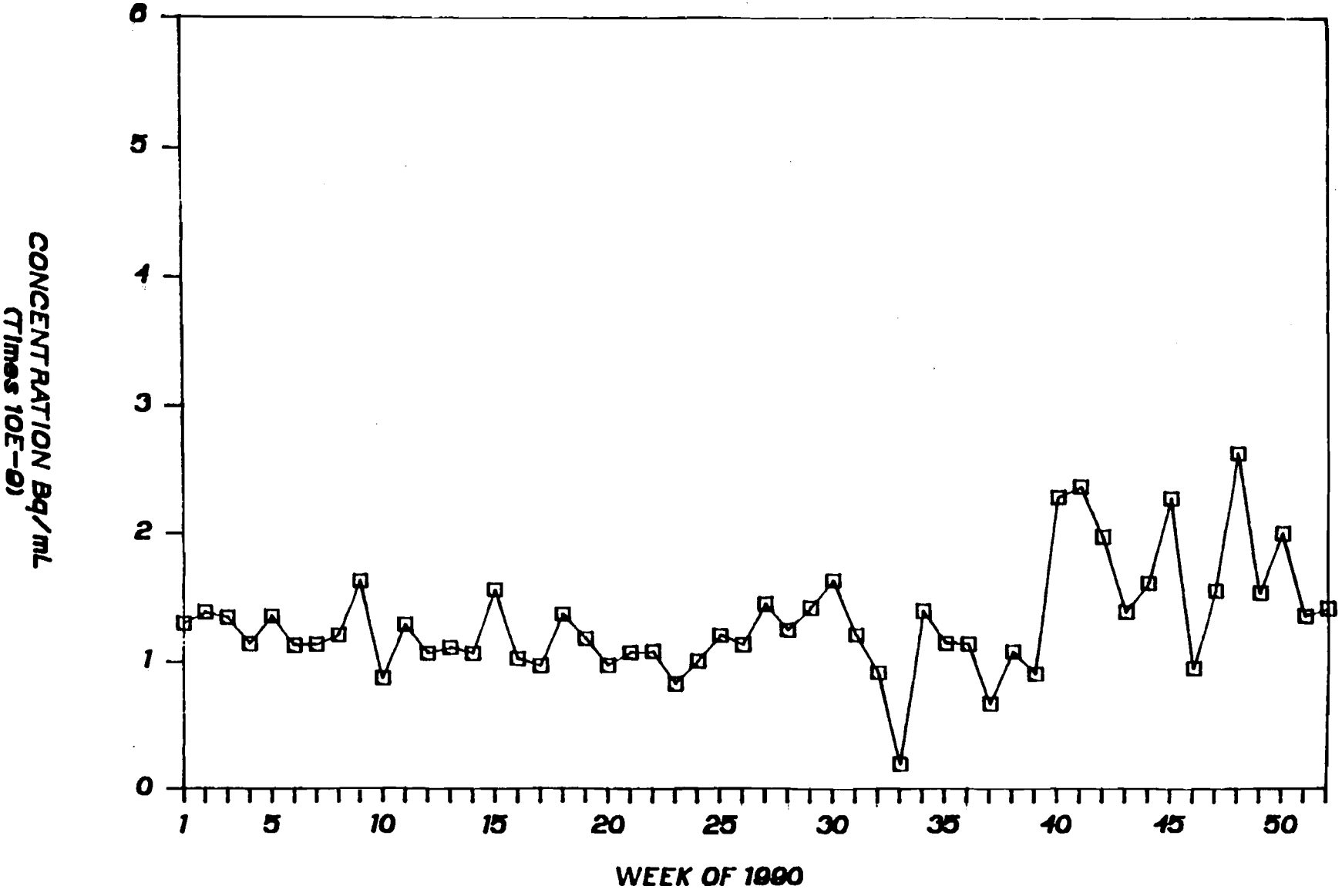
EAST LOCATION ONE



DOE/W

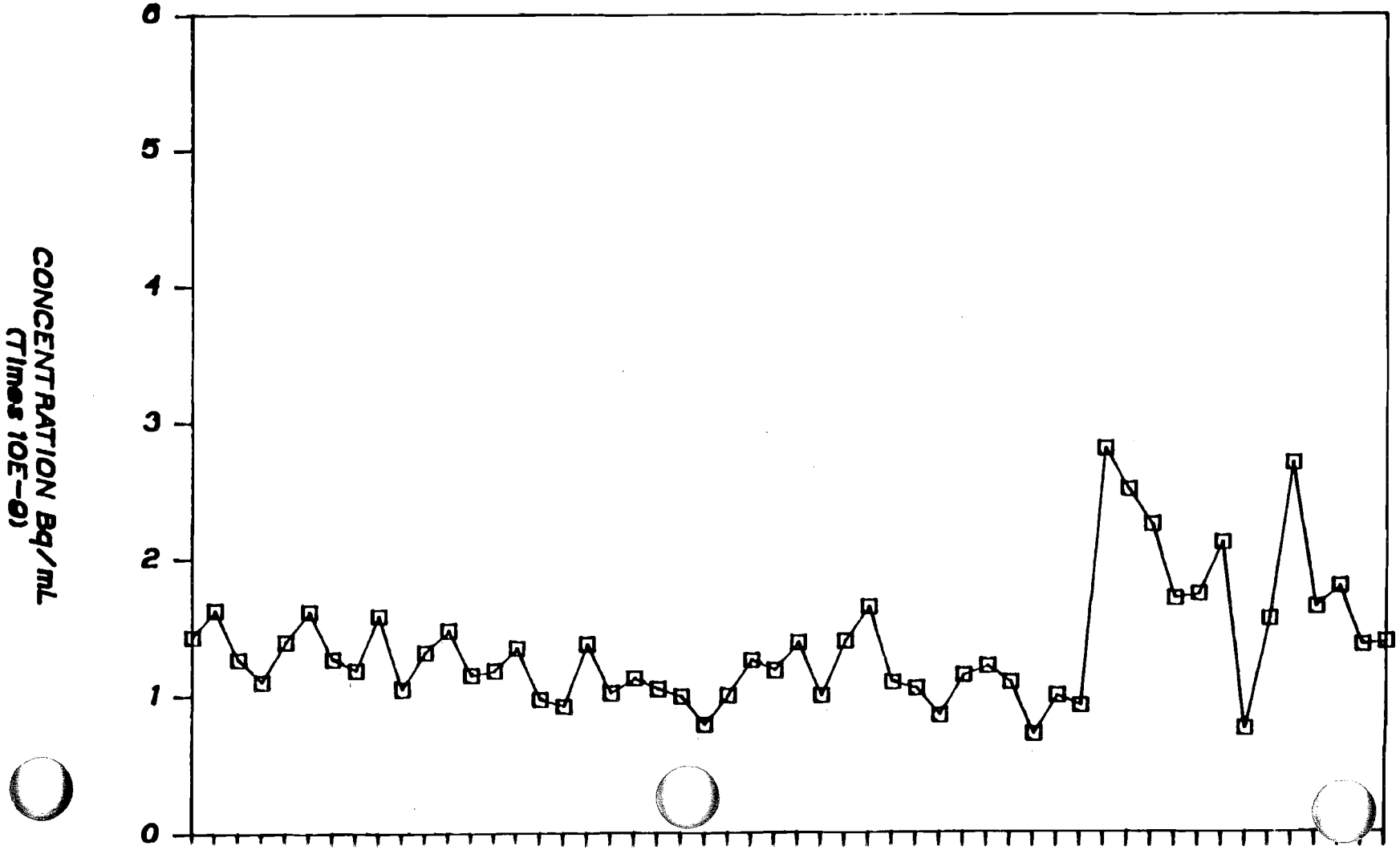
BETA CONCENTRATION

EAST LOCATION TWO



BETA CONCENTRATION

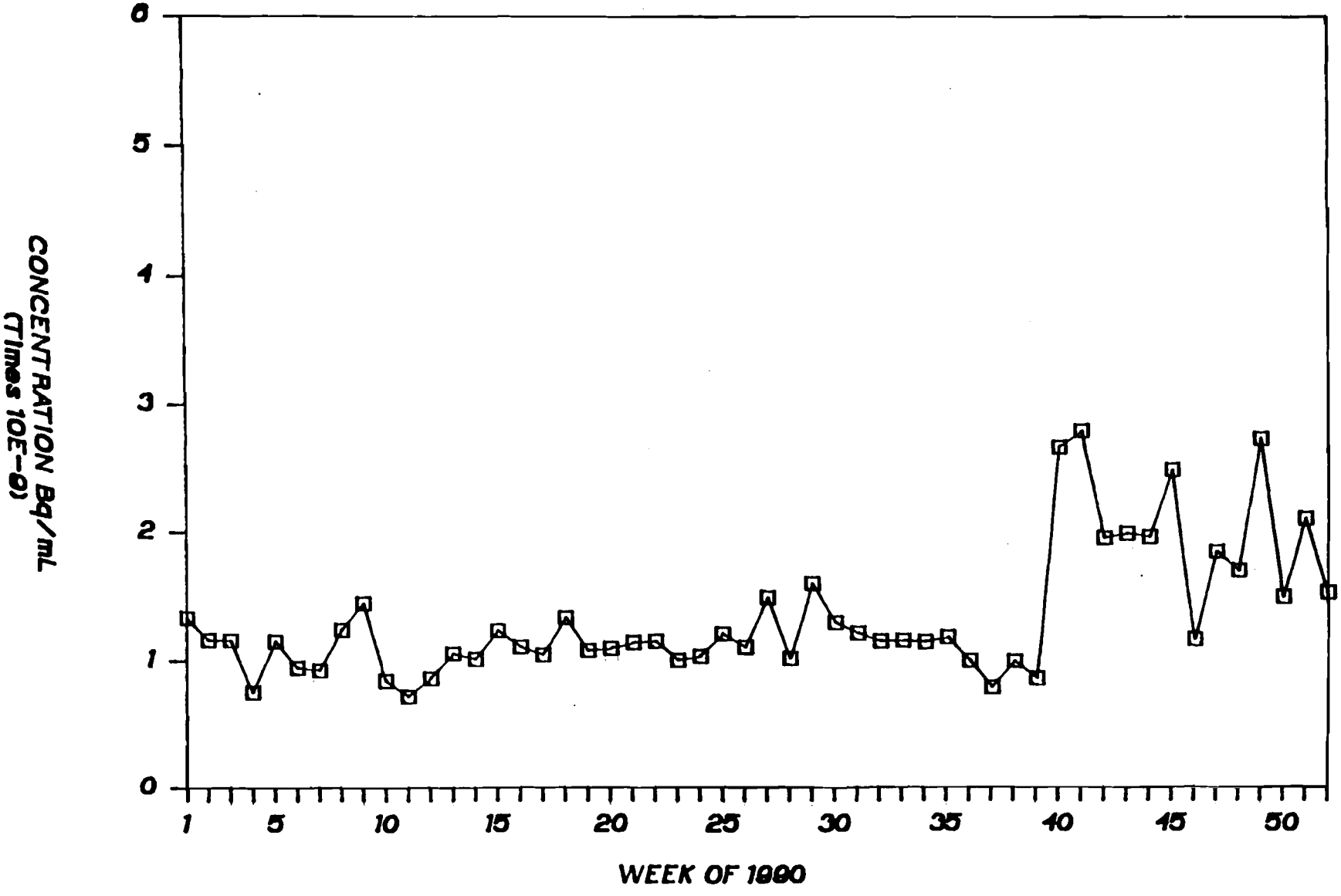
EUNICE LOCATION



DOE/

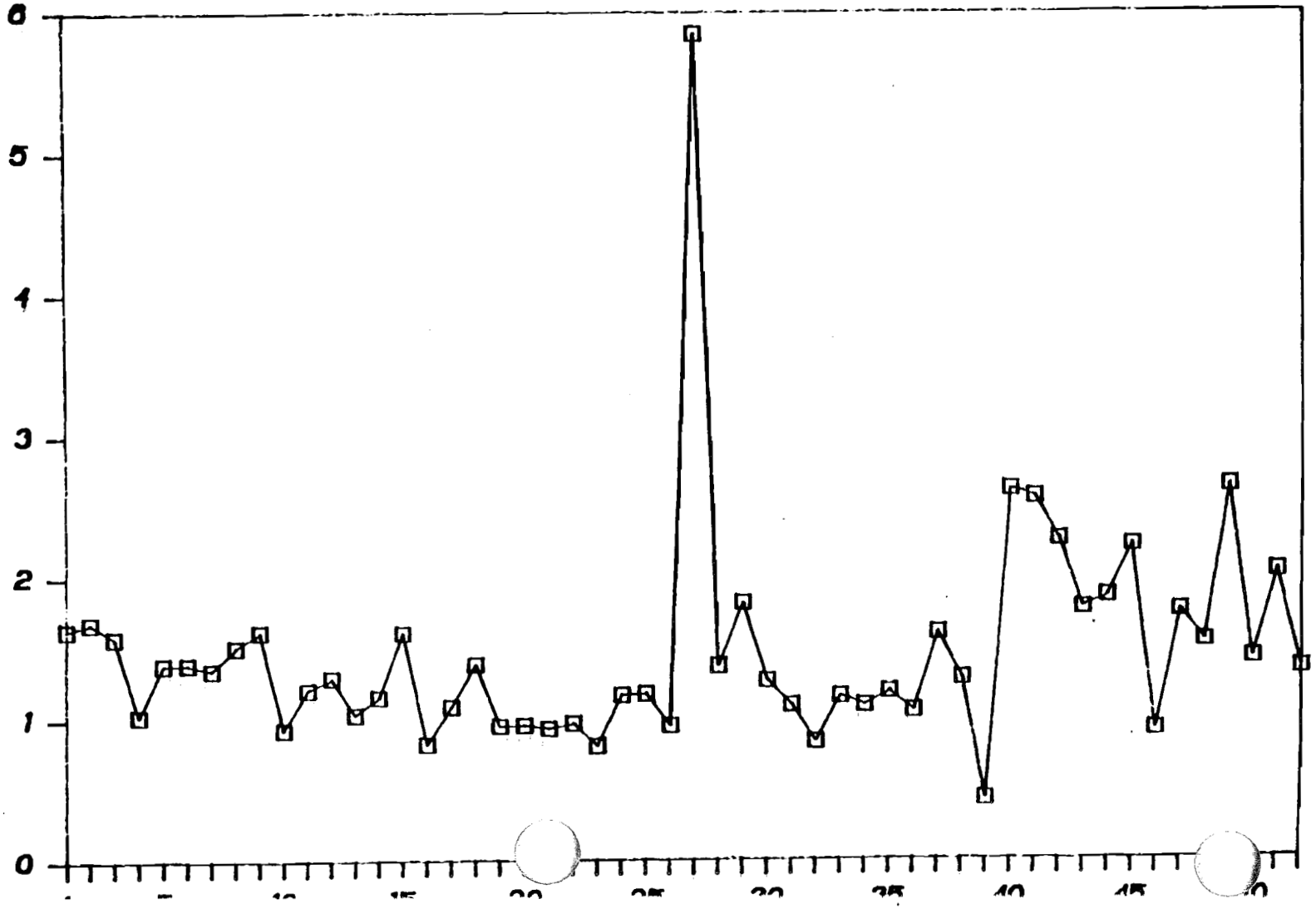
BETA CONCENTRATION

FAR FIELD LOCATION



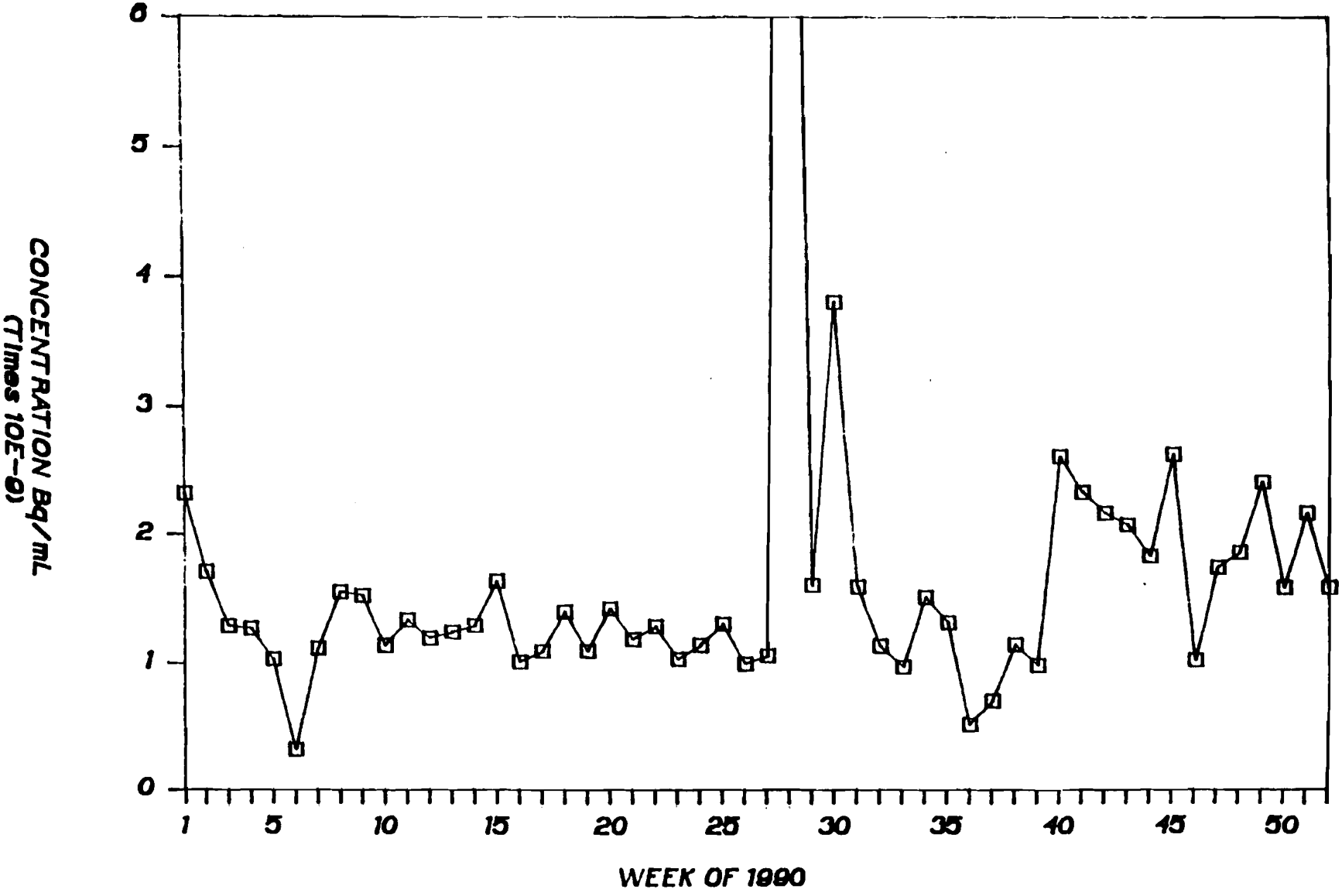
BETA CONCENTRATION

MILLS RANCH LOCATION



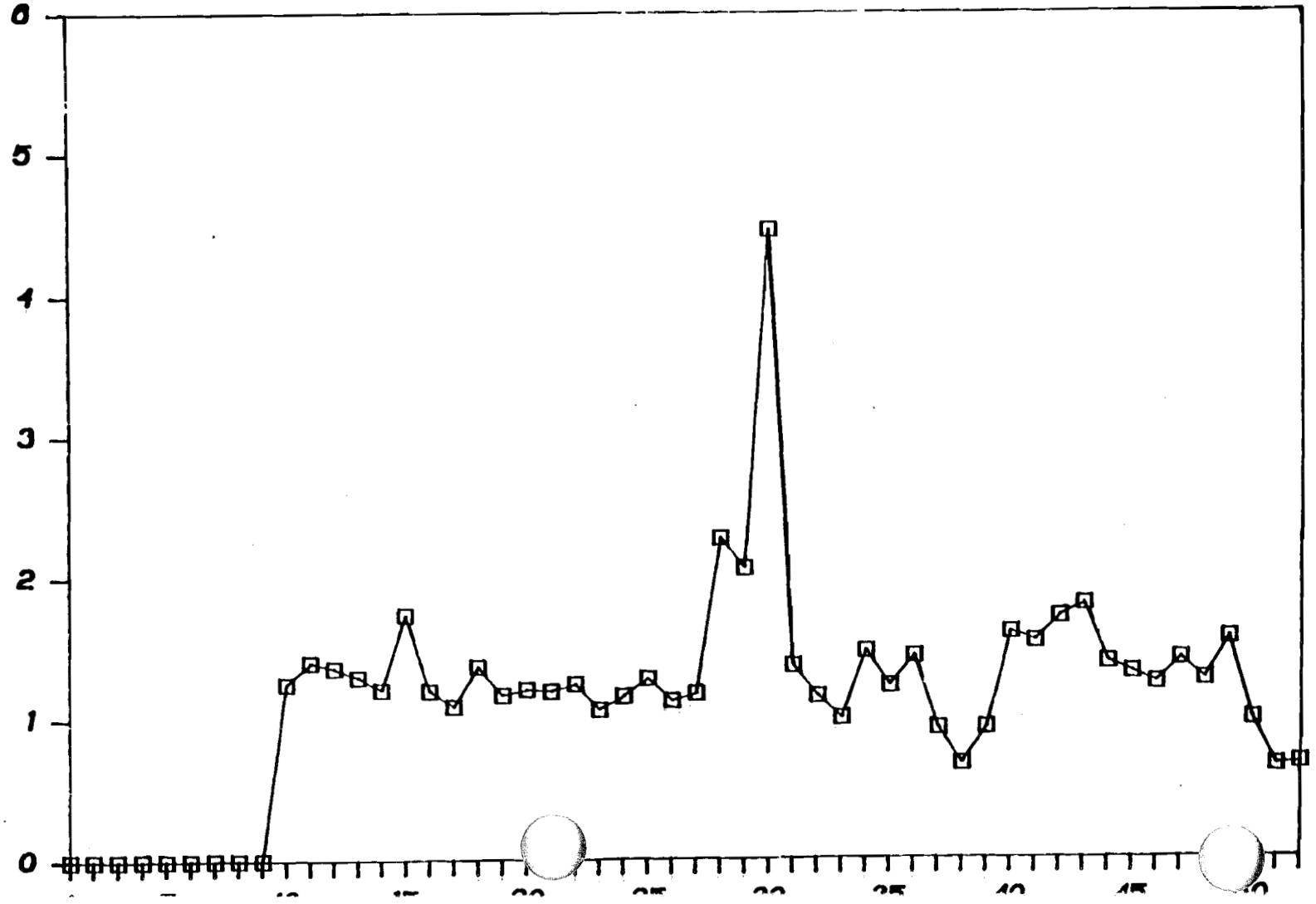
BETA CONCENTRATION

SMITH RANCH LOCATION



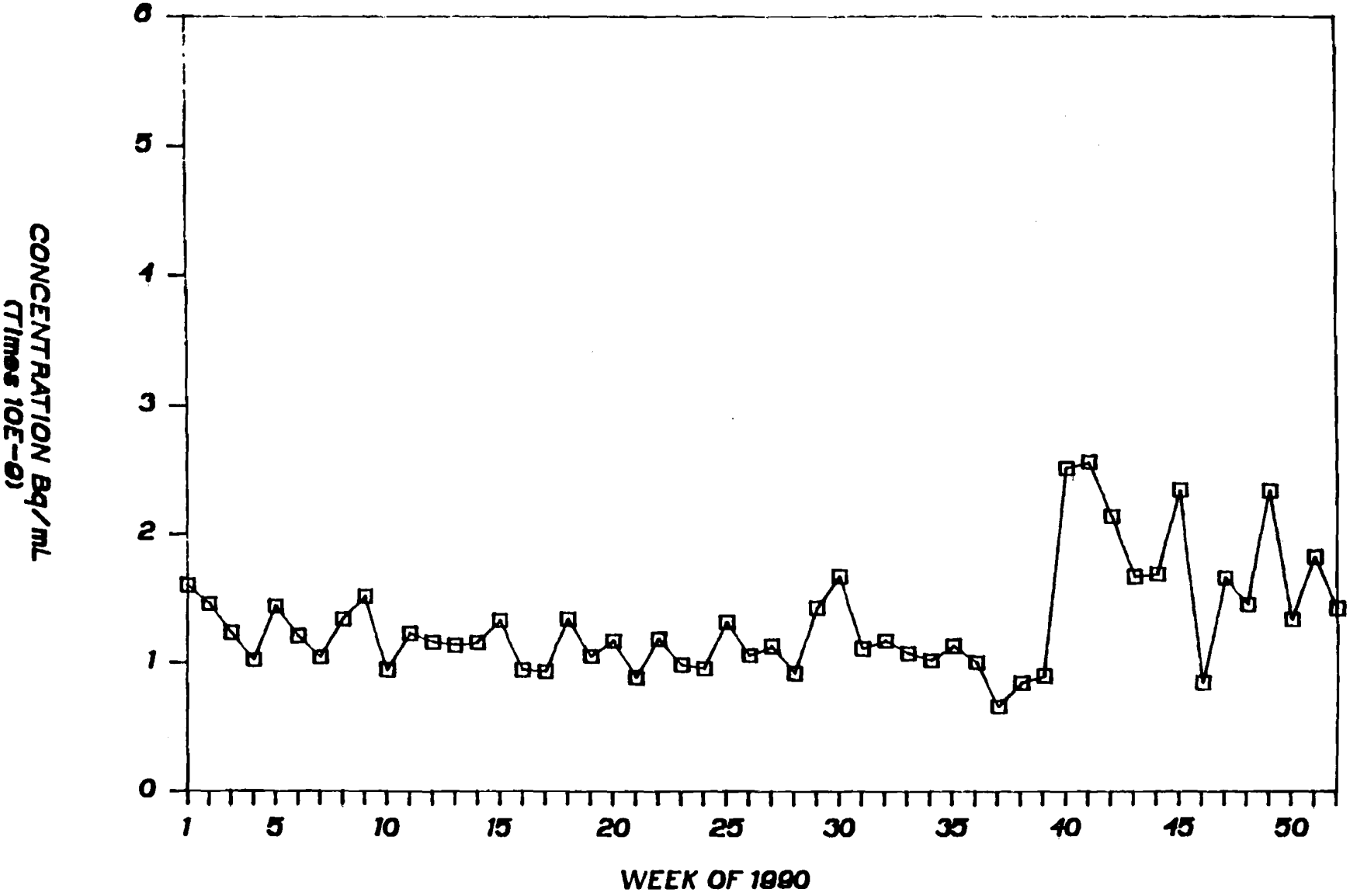
BETA CONCENTRATION

SOUTH EAST CONTROL LOCATION



BETA CONCENTRATION

SOUTH LOCATION



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APPENDIX III

DAILY MAXIMUM, MINIMUM, AND AVERAGE TEMPERATURE

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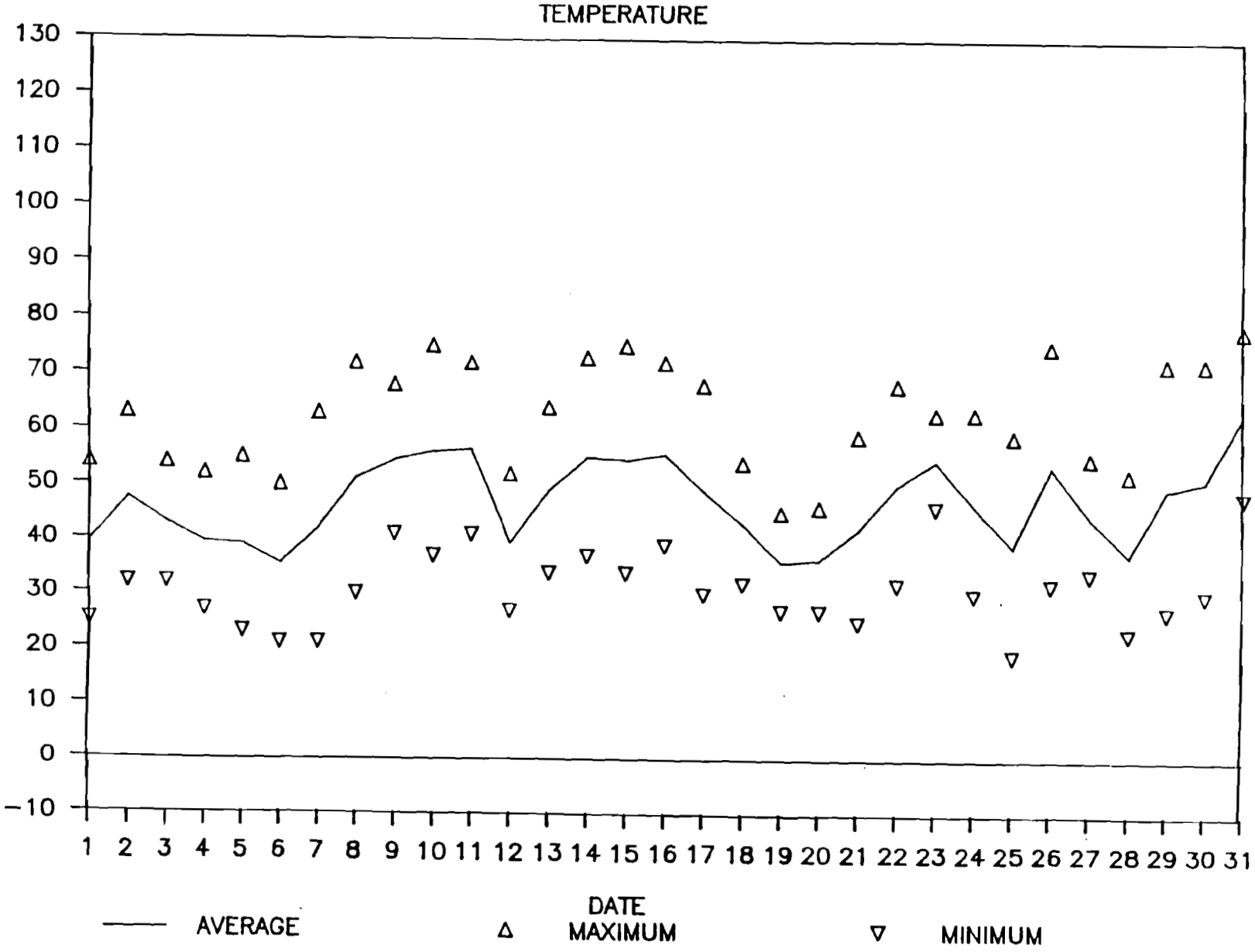
JANUARY 1990



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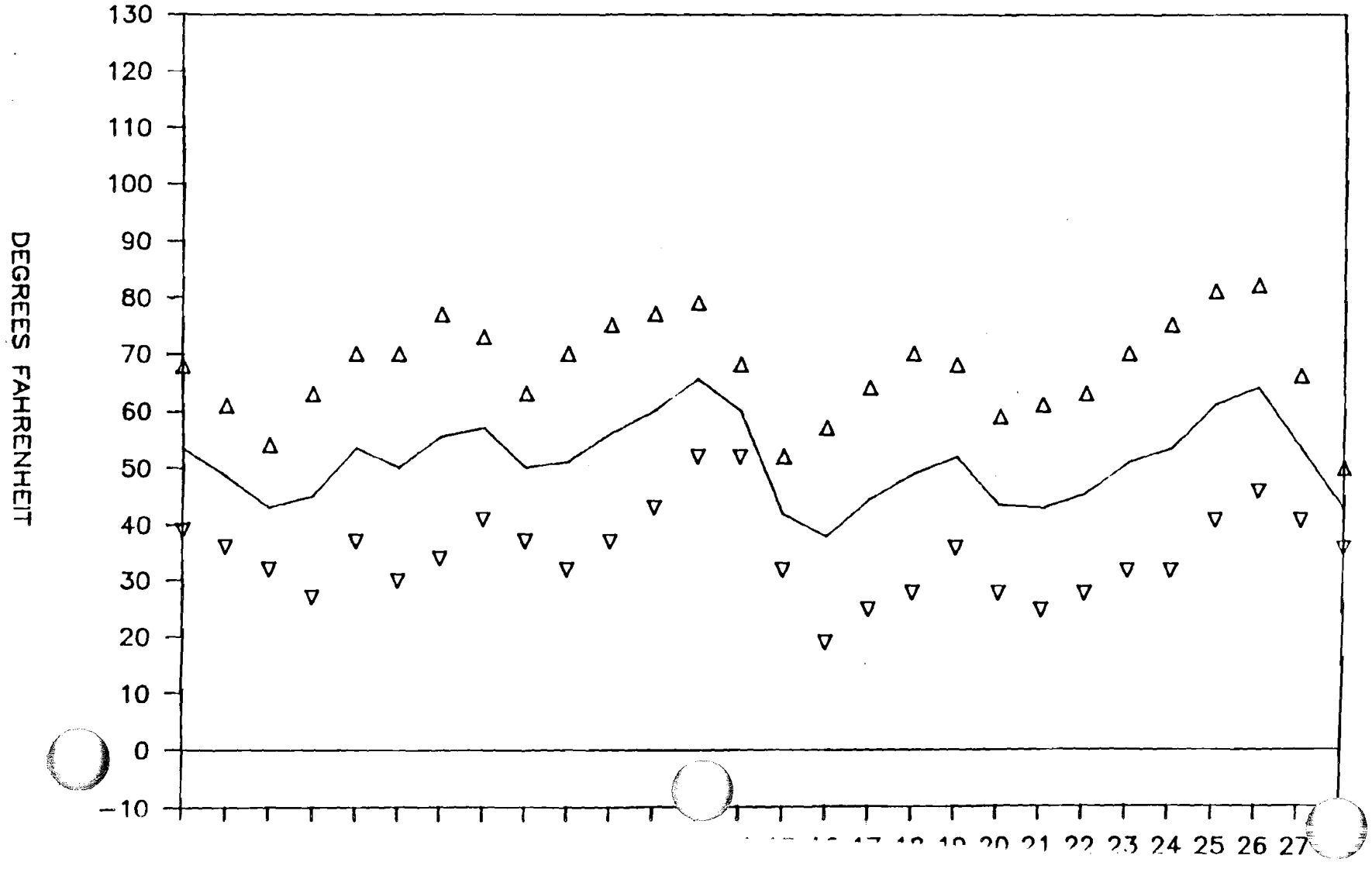
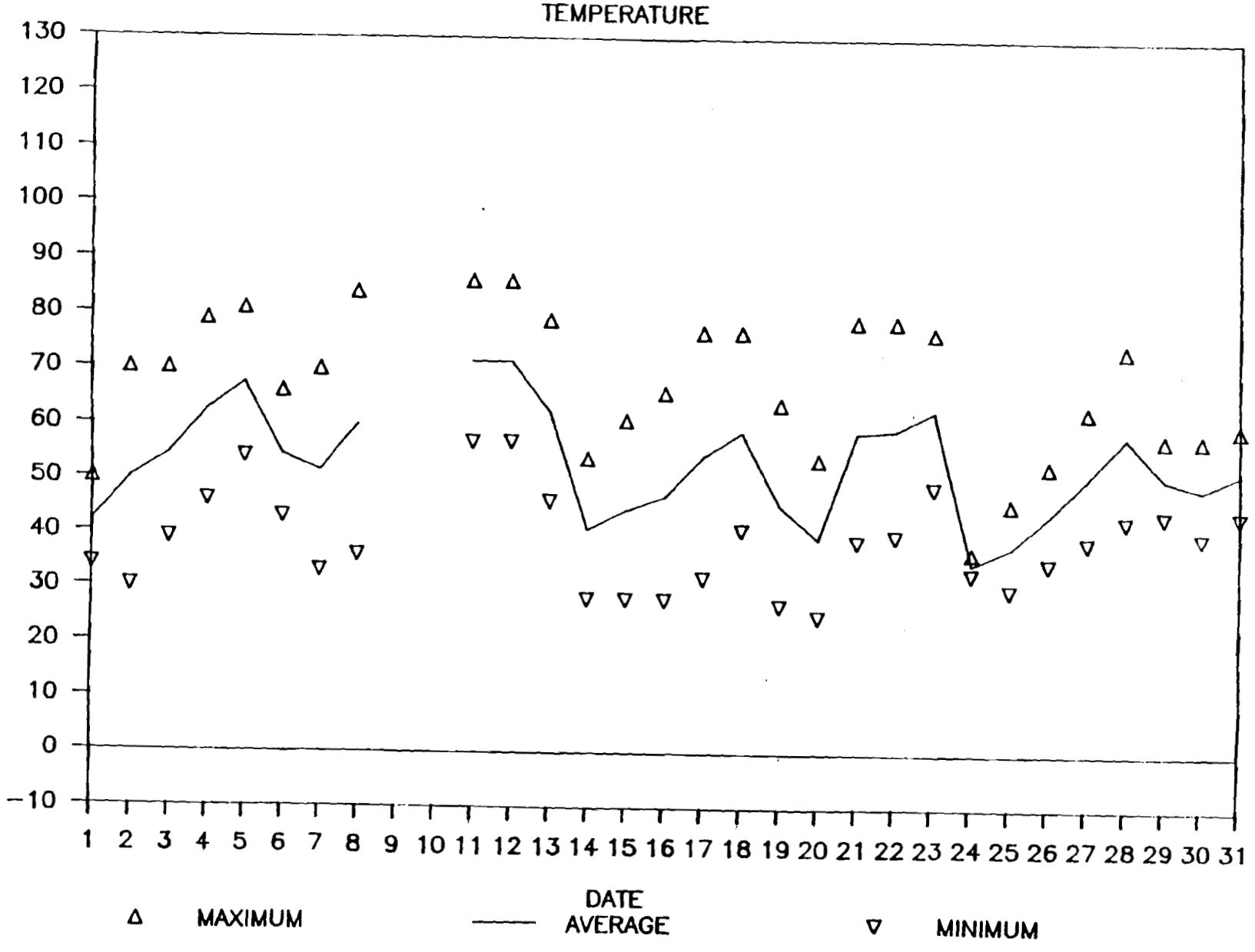
TEMPERATURE



MARCH 1990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20
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-10
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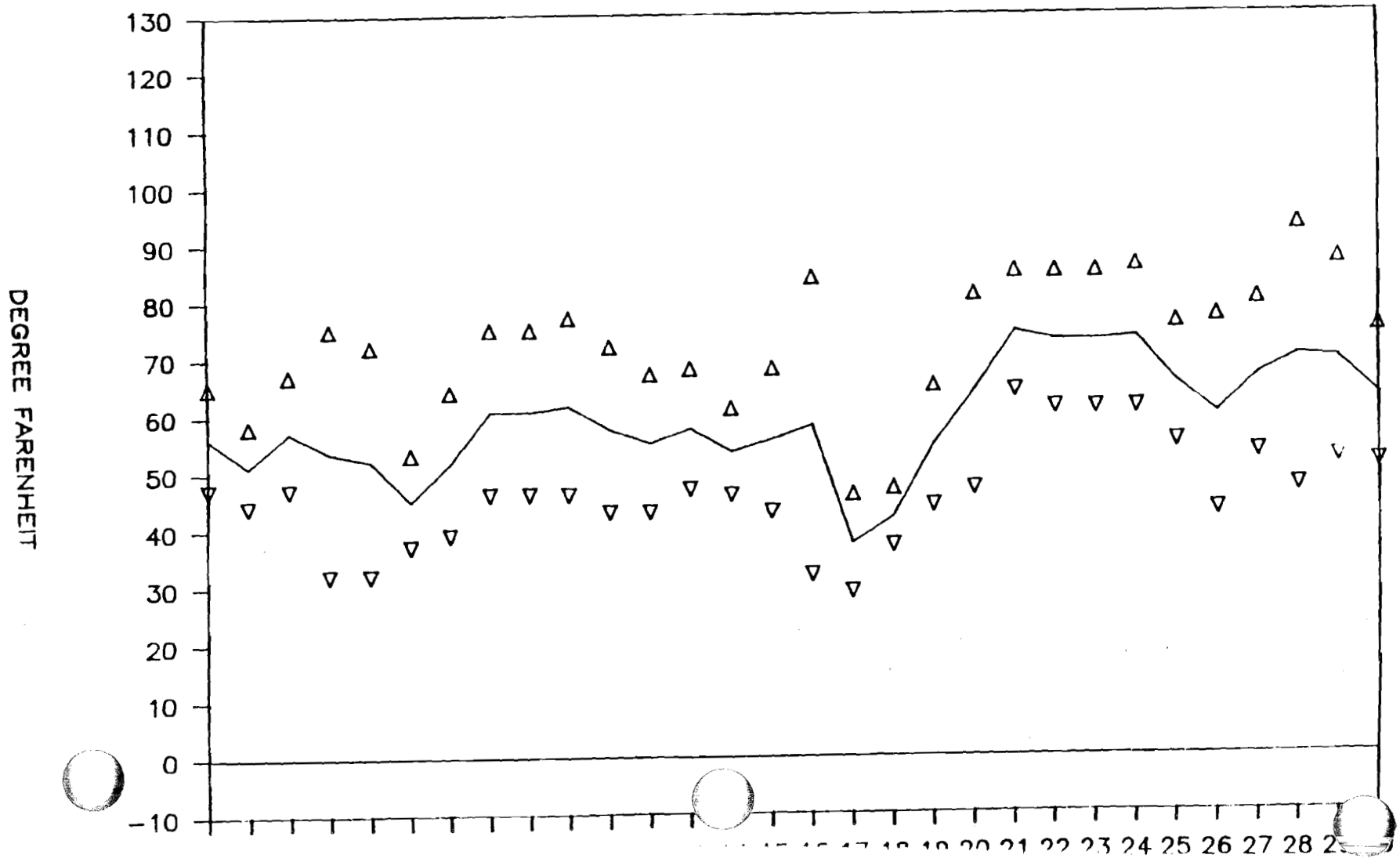
DATE
MAXIMUM
AVERAGE
MINIMUM

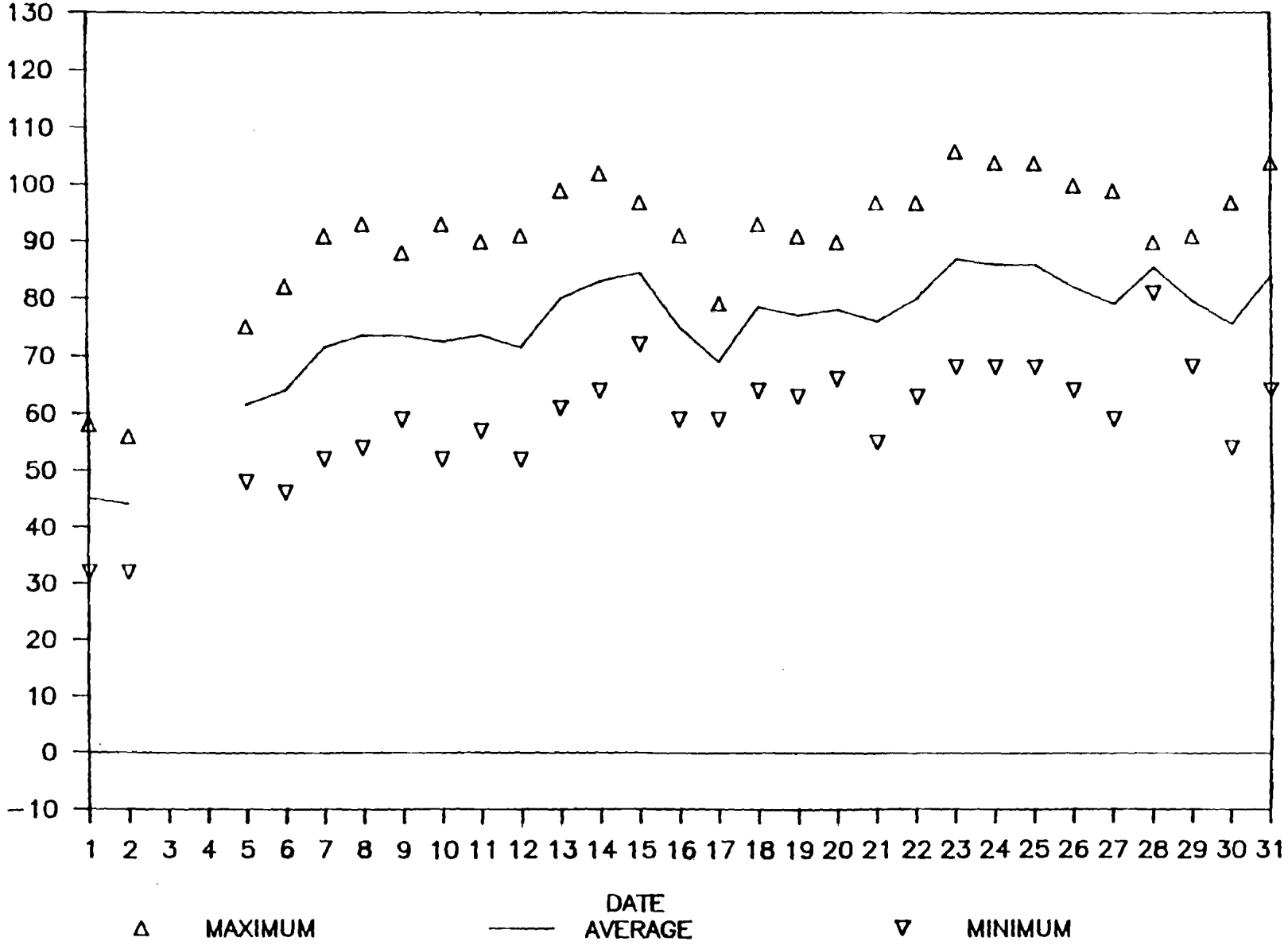
APRIL 1990

TEMPERATURE



MAY 1990

TEMPERATURE



DOE/WIPP91-30

SUMMARY OF WELL H-3b3, CULEBRA, ROUND-5

WELL CHARACTERISTICS

Well H-3b3 is located approximately 0.8 miles south of the WIPP site, (2022.35 FSL, 217.30 FEL, Section 29, Township 22S, Range 31 E). Surface elevation is 3389.42 feet amsl, and top of casing TOC is at an elevation of 3388.67 feet amsl, (SAND88-1065). A casing stick up is located 0.5 feet above ground surface. The well was completed on 01-30-84 to a total depth of 730 feet below ground surface, (BGS). J-55, (15.5 lb/ft, 5.5 O.D) well casing is installed to a depth of 670.5 feet BGS, leaving the Culebra Dolomite, which is located at a depth of 673 to 696 feet BGS, open hole.

SAMPLING PROCESS

Bennett pump/packer assembly was used for this sampling round. The assembly consisted of a model 1800 Bennett sample pump (Sn 1806-21) and an ardvark 2.8 inch sliding end packer inflatable packer (Sn 3690-435). The total length of the assembly was 7.53 feet.

Two geokon 4500H vibrating wire transducers were utilized to monitor formation pressures. A 0-150 psi transducer (SN 3428) was attached to the tubing bundle 25 feet above the top of the pump/packer assembly. A second 0-150 psi transducer (SN 9075) was attached to the packer feed through assembly in order to monitor pressures below the packer. Data was collected and stored on a continuous basis by a micro-10 geokon data logger (SN-18).

On 08-07-90 the pump/packer assembly was installed in the well. The bottom of the assembly was positioned at a depth of 658 feet BTOC. Static water level just prior to installation measured 404.75 feet BTOC. The well was pumped for a total of 9 days at an average rate of 28.91 gallons per hour.

Four serial samples were collected; the first on 08-12-90 after approximately 3403 gallons of water had been pumped from the well. Final samples were collected on 08-15-90 after approximately 5466 gallons of water had been pumped from the well. Final samples were sent to International Technology Analytical Sampling Laboratory (ITAS), and Westinghouse Advanced Energy Systems Division Analytical Lab (WAESD) for analysis. Samples were also provided to Sandia National Laboratories (SNL) and the New Mexico Environmental Evaluation Group (EEG) for independent analysis. Archival samples were collected for the WIPP Project.

ROUND-5 SERIAL SAMPLING RESULTS:

From day 1 to day 4 Eh measured 206 mv, 190 mv, 212 mv, and 175 mv, respectively.

From day 1 to day 4 pH measured 7.51 S.U., 7.41 S.U., 7.44 S.U., and 7.45 S.U., respectively.

From day 1 to day 4, temperature measured 22.1 C., 22.1 C., 22.2 C., and 22.2 C. respectively.

Specific Gravity measured 1.0420 at 22.3 C. on day 1, and 1.0400 at 22.4C. on day 4.

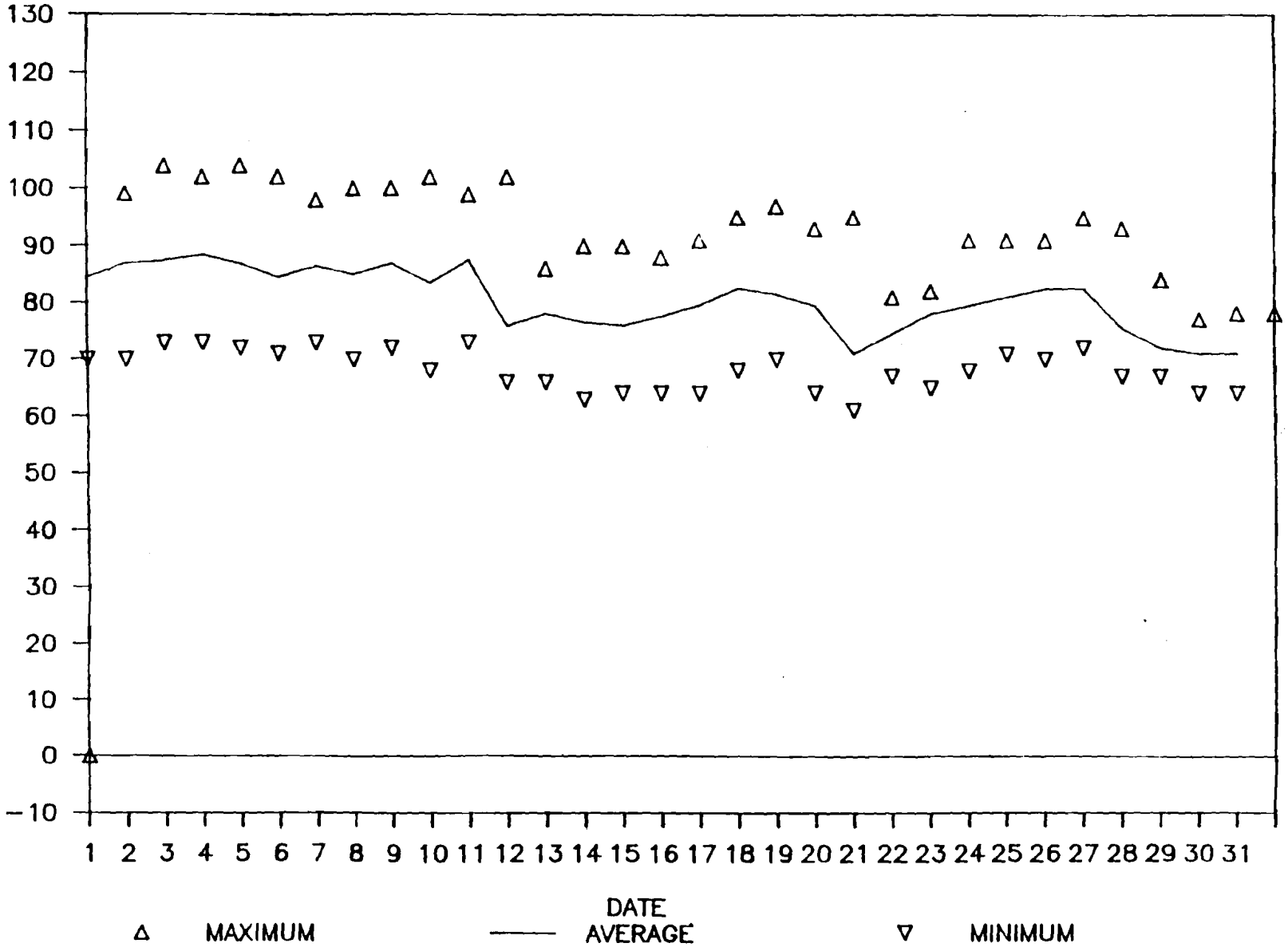
Specific Conductance measured 69,300 umhos/cm at 25 C. on day 1, and 69,300 umhos/cm at 25 C. on day 4.

Alkalinity remained fairly stable throughout round-5. From day 1 to day 4, alkalinity averaged 50.5 mg/l, 50.6 mg/l, 50.5 mg/l, and 50.5 mg/l, respectively.

Chlorides fluctuated slightly. From day 1 to day 4 chlorides averaged 27,747 mg/l, 27,677 mg/l, 27,781 mg/l, and 27,695 mg/l respectively.

JULY 1990

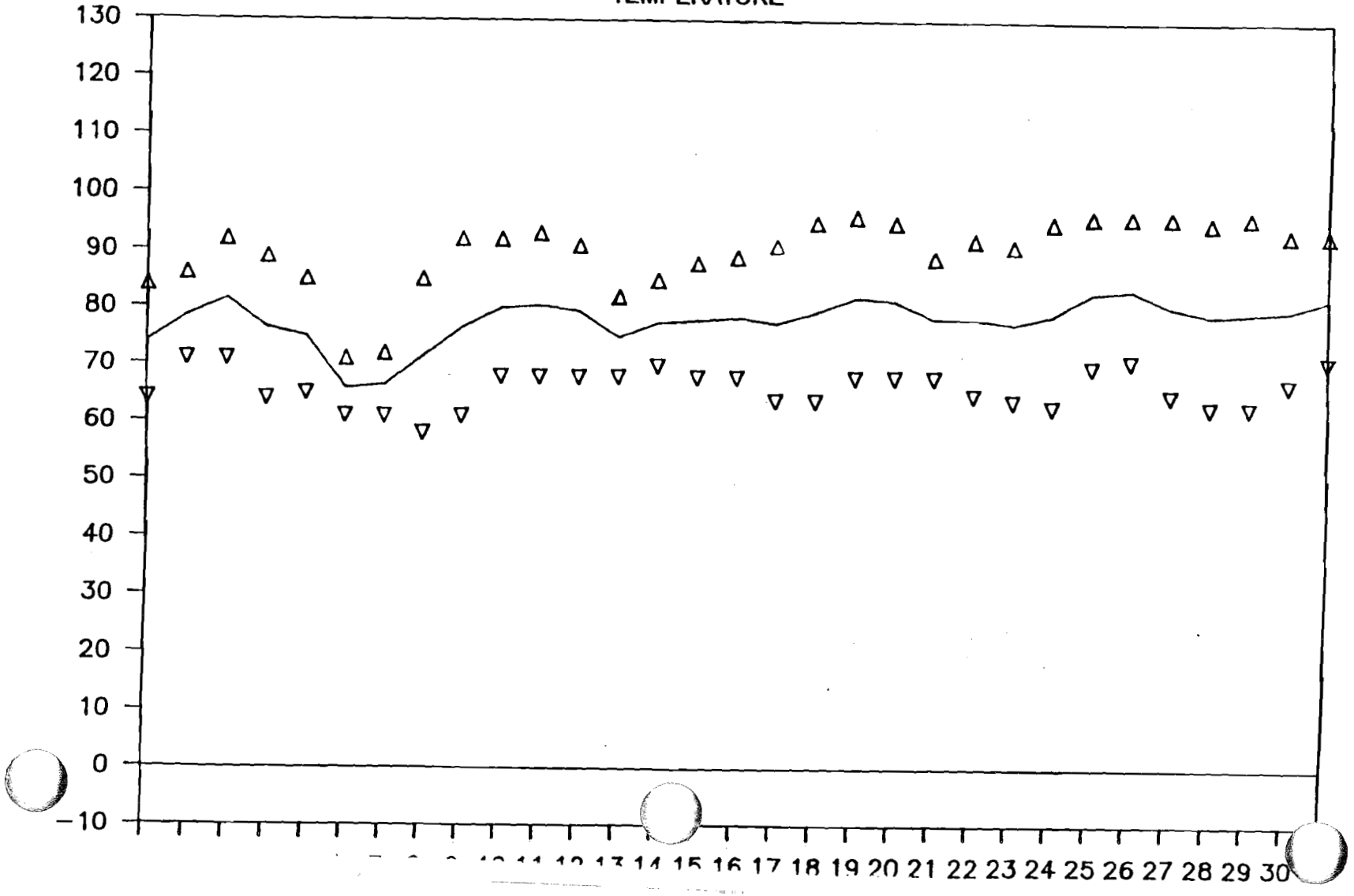
TEMPERATURE

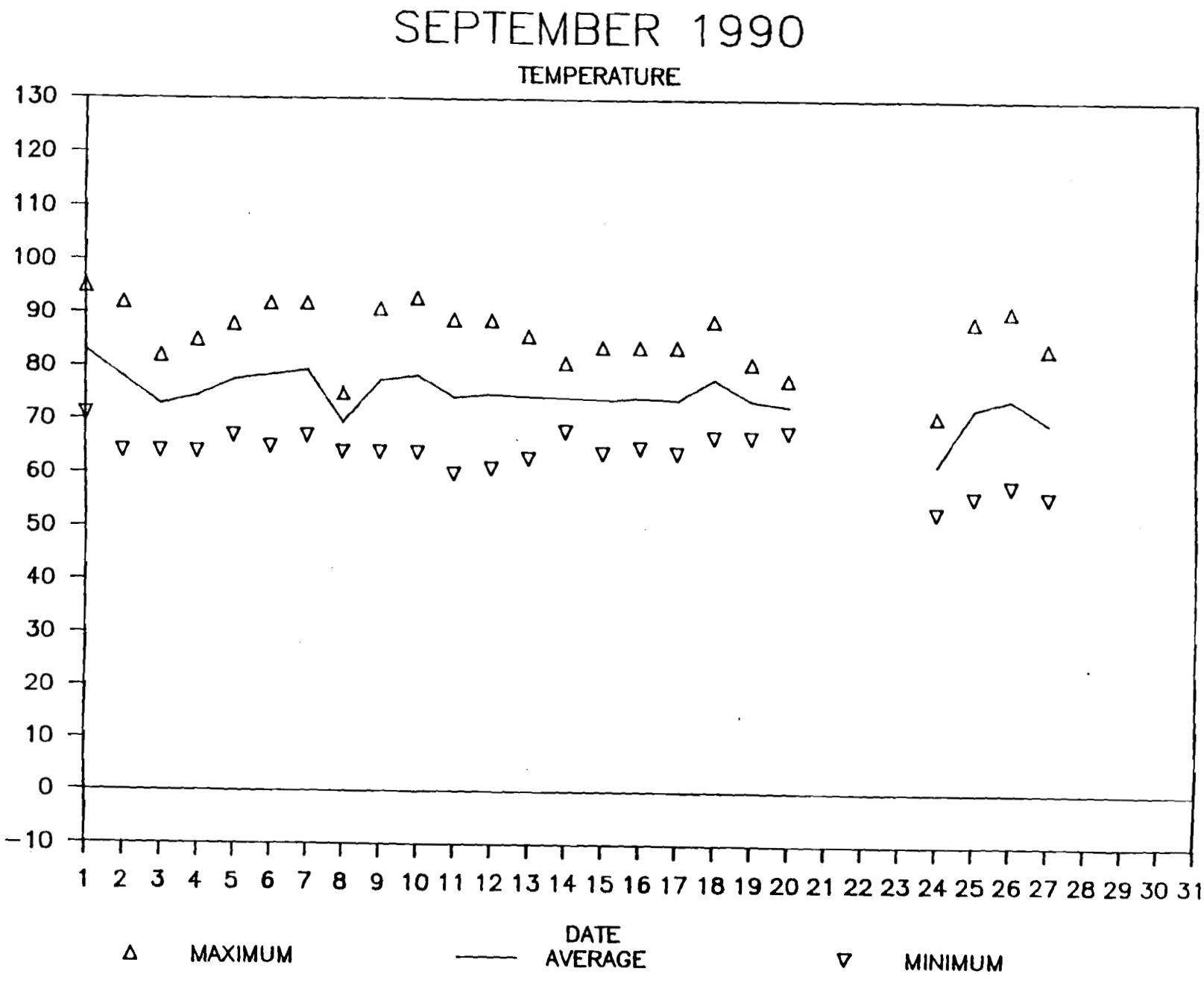


DOE/WIPP 91-001

AUGUST 1990

TEMPERATURE




SEPTEMBER 1990
TEMPERATURE
DEGREE FARENHEIT
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120
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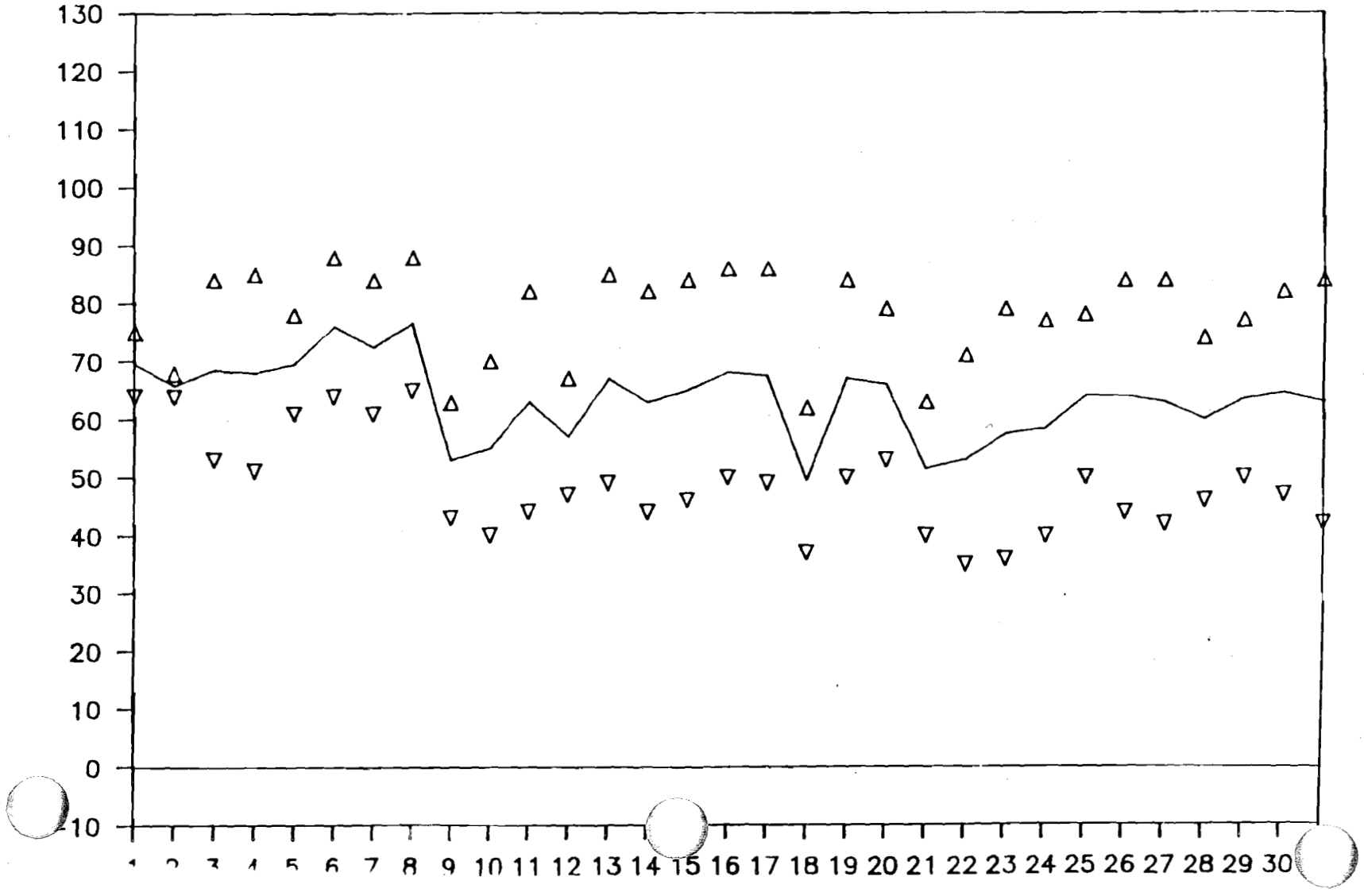
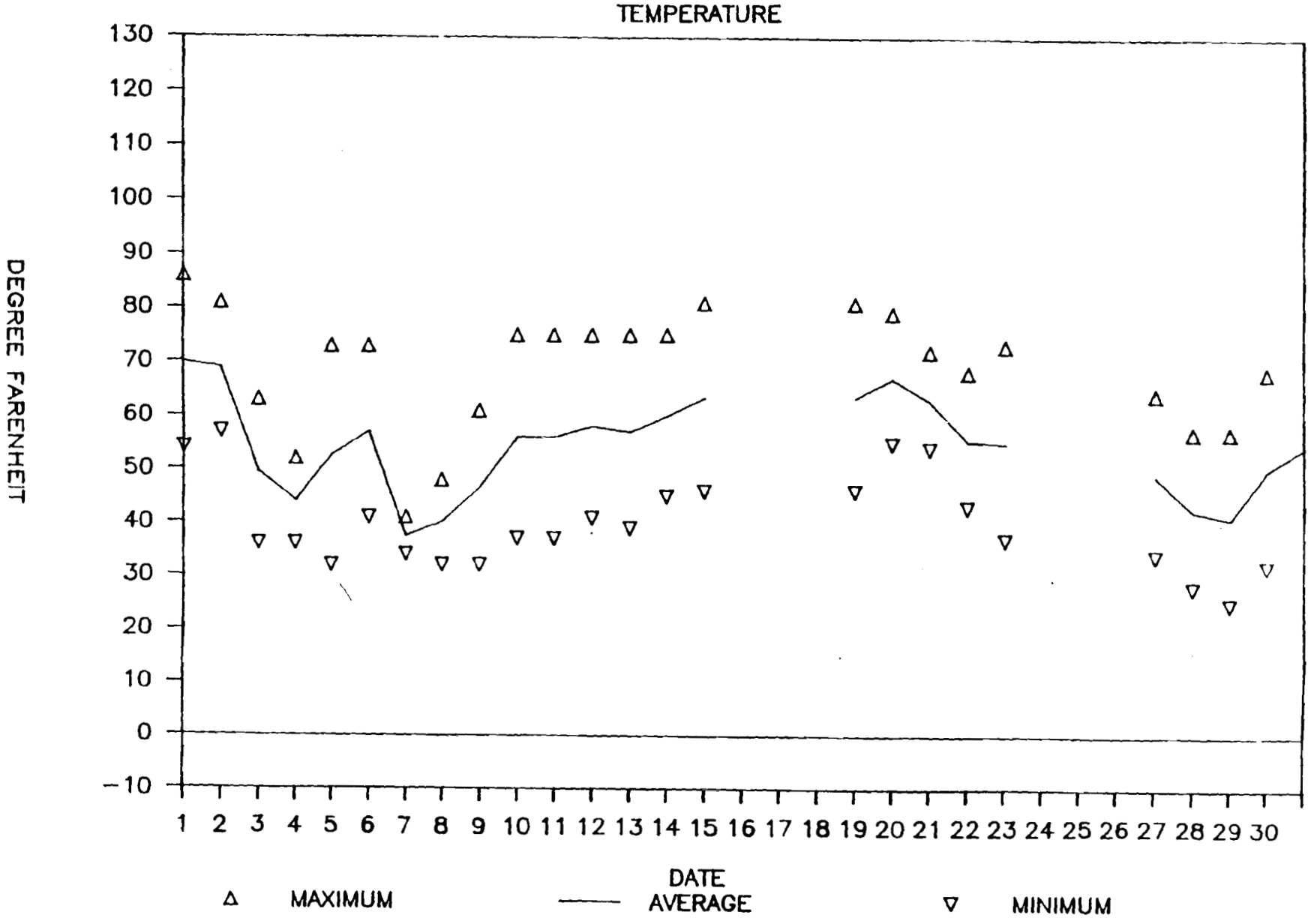
90
80
70
60
50
40
30
20
10
0
-10
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
DATE
MAXIMUM
AVERAGE
MINIMUM

OCTOBER 1990

TEMPERATURE

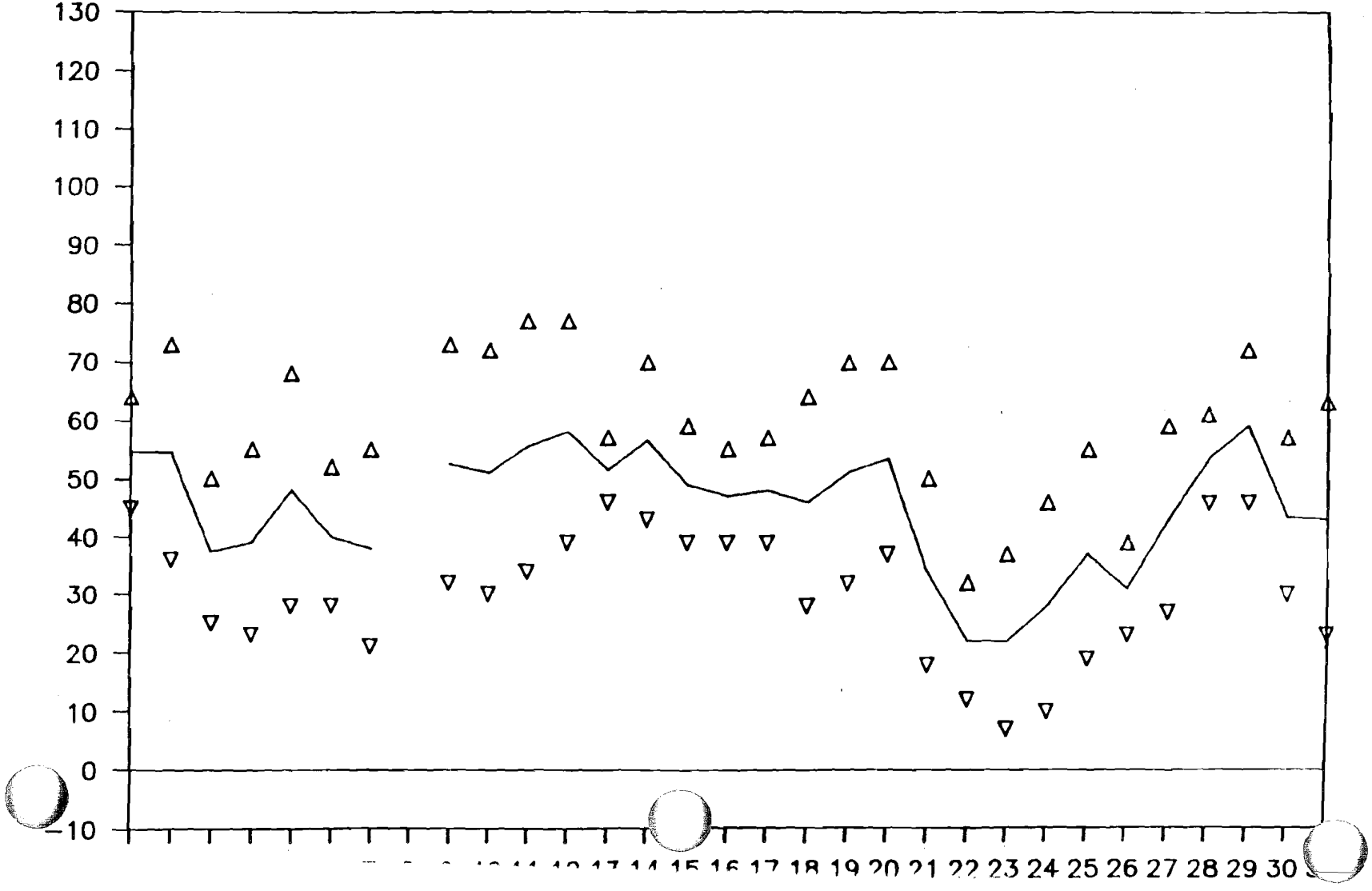


NOVEMBER 1990



DECEMBER 1990

TEMPERATURE



APPENDIX IV

SUMMARIES OF EACH WELL SAMPLED IN 1990

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SUMMARY OF H-09b, CULEBRA, ROUND-4

WELL CHARACTERISTICS

H-09b drill hole is located T24S, R31E, Section 4, 2391.04 FNL and 238.63 FWL southeast Eddy County, New Mexico. The monument elevation at H-09b is 3406.20 feet amsl. Top Of Casing (TOC) elevation is 3406.86 feet amsl. (SAND88-1065) The well bore was completed on August 28, 1979 to a total depth of 708 feet below ground surface (BGS). Seven inch outside diameter J-55 23 lb/ft casing was installed to a depth of 638 feet BGS leaving the Culebra dolomite member of the Rustler formation exposed to the open bore hole (Winstanley-Carrasco 1985). H-09b has been used for hydrological testing in the WIPP area first for site characterization and most recently for water quality sampling. Well bore caving of the open portion of the wellbore was detected in 1987 bringing the total depth of the well bore up to 670 feet BTOC (Crawley 1987). Westinghouse personnel measured the bottom of the well bore in January 1990 to a depth of 650 ft BTOC with an accuracy deviation of +/- 4 ft.

SAMPLING PROCESS

A Bennett sample pump model 1800-6 Sn 1806-21 and a 3.5 inch Baski sliding end inflatable packer with a 4.5 inch packer sleeve installed over the packer gland was utilized for sampling during this sampling period. A 3.5 X 1.5 inch packer feed through nipple was utilized to facilitate monitoring of formation pressures during the sampling period. The total length of the assembly was approximately 8 feet.

Two Geokon model 4500H vibrating wire transducers were utilized to monitor down hole pressures. The first, 0-100 psi range (Sn 3425) was attached to the tubing bundle at a depth of 600 feet BTOC in order to monitor the integrity of the packer seal. The second transducer Sn (3428), 0-150 psi range was attached to the packer feed through nipple and utilized to monitor pressures below the packer in the formation. Data was collected and stored at regular intervals utilizing a Geokon micro-10 data logger (Sn-18).

The pump/packer assembly was installed on 01-15-90 to a depth of 632 ft BTOC. Static water level was measured just prior to installation at a depth of 417.15 ft BTOC (Solinst # 75-CG-0102). Actual down hole working pressures just prior to the start of pumping was 87 psi. Total drawdown through out the testing period was less than 2.5 feet. The average pumping rate through out the testing period was 33 gallons per hour.

Four serial samples were collected; the first on 01-16-90 after approximately 593 gallons of water had been pumped from the well. Final samples were collected on 01-19-90 after approximately 3058 gallons of water had been pumped from the well. Samples were collected for International Technology Analytical Services Laboratory (ITAS), Westinghouse Advanced Energy Systems Division Analytical Laboratory (WAESD), Sandia National Laboratories (SNL), and the New Mexico Environmental Evaluation Group (EEG). Archival samples were collected for the WIPP project.

ROUND-4 SERIAL SAMPLING RESULTS:

Eh measured +261 mv, +245 mv, +238 mv and +197 mv respectively.

pH remained relatively stable during the testing period measuring 7.31 S.U., 7.31 S.U., 7.35 S.U. and 7.36 S.U. respectively.

Temperature measured 21.1 C on day 1, 21.0 C on day two 21.5 C on day three and 21.0 C on day four.

Specific Gravity and Specific Conductivity were each measured on the first and forth day of sampling, each remained relatively stable. Specific gravity measured 1.004 @21.0 C, and 1.004 @ 21.1 C respectively. Specific conductivity measured 3,460 umhos/cm @ 25.0 C and 3,430 umhos/cm @ 25 C respectively.

Alkalinity averaged 112.9 mg/l, 115.1 mg/l, 115.1 mg/l and 116.2 mg/l.

Chlorides averaged 170.5 mg/l, 169.0 mg/l, 169.5 mg/l and 169.0 mg/l.

Divalent Cations measured 42.9 mg/l, 42.6 mg/l, 42.7 mg/l and 43.0 mg/l.

Total Iron averaged 0.08 mg/l, 0.09 mg/l, 0.08 mg/l and 0.09 mg/l.

Ferrous Iron averaged 0.06 mg/l, 0.05 mg/l 0.06 mg/l and 0.05 mg/l consecutively.

COMPARISON OF ROUND-4 RESULTS WITH PREVIOUS ROUNDS

The amount of water pumped prior to final sampling for the three previous rounds is 9550 gallons, 4300 gallons and 5150 gallons respectively, 3058 gallons were pumped prior to final sampling during round-4. A comparison of the average final day data for the three previous rounds and final day data for round-4 is described in the following table for alkalinity, chlorides, dications, total iron and ferrous iron.

AVG. OF FINAL DAY RESULTS FOR LAST THREE ROUNDS	AVG. OF FINAL DAY FOR ROUND-4
Alkalinity 15.4 mg/l	Alkalinity116.2 mg/l
Chlorides 180.5 mg/l	Chlorides 169.0 mg/l
Dications 42.2 meq/l	Dications 43.0 meq/l
Total Iron 0.14 mg/l	Total Iron 0.09 mg/l
Ferrous Iron 0.05 mg/l	Ferrous Iron 0.05 mg/l

GENERAL OBSERVATIONS/COMMENTS:

A power outage occurred on 01-16-90 and lasted 30 minutes when on site generators were exchanged. The los of power had no apparent affect on the sampling process or the results obtained.

SUMMARY OF ENGLE WELL, CULEBRA, ROUND-3

WELL CHARACTERISTICS

Engle Well is located in T24S, R31E Section 4, 240 FSL and 1500 FEL in southeastern Eddy County, New Mexico. Top of casing elevation at EngleWell is 3420 feet amsl (SAND88-1065). Engle Well was drilled to a totaldepth of 682 feet below ground surface (BGS) and cased with 6.625" O.D. casing to a depth of 659 feet. The Culebra dolomite member of the RustlerFormation occurring from 659 to 682 feet was left open to the bore holeDOE/WIPP 86-004).

SAMPLING PROCESS

Sampling was performed on 01-30-90 by Gordon Tatro (Westinghouse) and Jim Kinney (New Mexico EEG). A ten gallon water sample was taken from a valve mounted on the discharge pipe at the well-head. The sample was then transported to a mobile field laboratory and filtered through a .45 micronfilter utilizing a peristaltic pump. Samples were collected for ITAS, EEG, SNL, WAESD, and the field chemistry lab.

FIELD ANALYTICAL RESULTS

Round-3 analytical results for Engle Well were as follows; pH 7.46 SU, specific gravity 1.003 at 20.2 C., and specific conductance 2990 umhos/cm at 25 C. Averages for alkalinity, chlorides, and di-valent cations were 79 mg/l, 232 mg/l, and 42 meq/l respectively.

COMPARISON OF ROUND-3 RESULTS WITH PREVIOUS ROUNDS

Round-3 results compare favorably with the results of the previous sampling rounds. Round-1 data for alkalinity was not in agreement andwas omitted from the averages. The results are presented below.

AVERAGE OF PREVIOUS ROUNDS	ROUND-3
Alkalinity 75 mg/l	Alkalinity 79 mg/l
Chlorides 230 mg/l	Chlorides 232 mg/l
Di-Cats 43 meq/l	Di-Cats 42 meq/l

GENERAL OBSERVATIONS/COMMENTS

Engle Well is used primarily to provide water to livestock. A light oil film was noted on some of the samples.

SUMMARY OF H-09b, CULEBRA, ROUND-4

WELL CHARACTERISTICS

H-09b drill hole is located T24S, R31E, Section 4, 2391.04 FNL and 238.63 FWL southeast Eddy County, N Mexico. The monument elevation at H-09b is 3406.20 feet amsl. Top Of Casing (TOC) elevation is 3406.8 amsl. (SAND88-1065) The well bore was completed on August 28, 1979 to a total depth of 708 feet below ground surface (BGS). Seven inch outside diameter J-55 23 lb/ft casing was installed to a depth of 638 fee BGS leaving the Culebra dolomite member of the Rustler formation exposed to the open bore hole (Winstanley-Carrasco 1985). H-09b has been used for hydrological testing in the WIPP area first for site characterization and most recently for water quality sampling. Well bore caving of the open portion of the wellbore was detected in 1987 bringing the total depth of the well bore up to 670 feet BTOC (Crawley 198 Westinghouse personnel measured the bottom of the well bore in January 1990 to a depth of 650 ft BTOC an accuracy deviation of +/- 4 ft.

SAMPLING PROCESS

A Bennett sample pump model 1800-6 Sn 1806-21 and a 3.5 inch Baski sliding end inflatable packer with a inch packer sleeve installed over the packer gland was utilized for sampling during this sampling period. . X 1.5 inch packer feed through nipple was utilized to facilitate monitoring of formation pressures during t sampling period. The total length of the assembly was approximately 8 feet.

Two Geokon model 4500H vibrating wire transducers were utilized to monitor down hole pressures. The 0-100 psi range (Sn 3425) was attached to the tubing bundle at a depth of 600 feet BTOC in order to mon the integrity of the packer seal. The second transducer Sn (3428), 0-150 psi range was attached to the pac feed through nipple and utilized to monitor pressures below the packer in the formation. Data was collec and stored at regular intervals utilizing a Geokon micro-10 data logger (Sn-18).

The pump/packer assembly was installed on 01-15-90 to a depth of 632 ft BTOC. Static water level was measured just prior to installation at a depth of 417.15 ft BTOC (Solinst # 75-CG-0102). Actual down h working pressures just prior to the start of pumping was 87 psi. Total drawdown through out the testing was less than 2.5 feet. The average pumping rate through out the testing period was 33 gallons per hour.

Four serial samples were collected; the first on 01-16-90 after approximately 593 gallons of water had bee pumped from the well. Final samples were collected on 01-19-90 after approximately 3058 gallons of wat been pumped from the well. Samples were collected for International Technology Analytical Services Laboratory (ITAS), Westinghouse Advanced Energy Systems Division Analytical Laboratory (WAESD Sandia National Laboratories (SNL), and the New Mexico Environmental Evaluation Group (EEG). A samples were collected for the WIPP project.

ROUND-4 SERIAL SAMPLING RESULTS:

Eh measured +261 mv, +245 mv, +238 mv and +197 mv respectively.

pH remained relatively stable during the testing period measuring 7.31 S.U., 7.31 S.U., 7.35 S.U. and 7.3 respectively.

Temperature measured 21.1 C on day 1, 21.0 C on day two 21.5 C on day three and 21.0 C on day four.

Specific Gravity and Specific Conductivity were each measured on the first and forth day of sampling, e remained relatively stable. Specific gravity measured 1.004 @21.0 C, and 1.004 @ 21.1 C respe Sp conductivity measured 3,460 umhos/cm @ 25.0 C and 3,430 umhos/cm @ 25 C respectively.

Divalent cations averaged 198.1 mg/l, 196.1 mg/l, 195.3 mg/l, 196.3 mg/l, 194.6 mg/l, 195.3 mg/l and 196.5 mg/l consecutively from day one through day seven of testing.

Total Iron and Ferrous Iron decreased with only slight fluctuations over the sampling period. Total Iron averaged 0.79mg/l, 0.45 mg/l, 0.41 mg/l, 0.43 mg/l, 0.42 mg/l, 0.41 mg/l and 0.36 mg/l. Ferrous Iron averaged 0.71 mg/l, 0.36 mg/l, 0.35 mg/l, 0.39 mg/l, 0.34 mg/l, 0.33 mg/l and 0.29 mg/l respectively.

COMPARISON OF ROUND-5 RESULTS WITH PREVIOUS ROUNDS:

The amount of water pumped prior to final sampling for the four previous rounds is 79,744 gallons, 126,100 gallons, 87,500 gallons and 5142 gallons respectively. 6127 gallons were pumped prior to final sampling during round-5. A comparison of the average final day data for the four previous rounds and final day data for round-5 is described in the following table for alkalinity, chlorides, dications, total iron and ferrous iron.

AVG. OF FINAL DAY RESULTS FOR LAST FOUR ROUNDS	AVG .OF FINAL DAY RESULTS FOR ROUND-5
Alkalinity 94.04 mg/l	Alkalinity 95.40 mg/l
Chlorides 32,040 mg/l	Chlorides 32,218 mg/l
Dications 190.5 meq/l	Dications 196.5 meq/l
Total Iron 0.20 mg/l	Total Iron 0.36 mg/l
Ferrous Iron 0.29 mg/l	Ferrous Iron 0.29 mg/l

GENERAL OBSERVATIONS/COMMENTS:

Approximately seven minutes into the pumping period at 13:43 on 02-05-90 the pump failed and had to be replaced. No other problems or equipment failures occurred duing the period.

SUMMARY FOR H-06c, MAGENTA, ROUND-5

WELL CHARACTERISTICS

H-06c drill hole is located at T22S R31E Section 18 281.06FNL and 374.47FWL in southeastern Eddy Cou New Mexico. Ground elevation at H-06c is 3347.93 ft amsl and the well casing stick up elevation is 3348.52 amsl. The well bore was completed 06-26-78 to a total depth of 741 feet BGS (Below Ground Surface). C 5.5 inch O.D. type J-55 15.5 lb/ft, was set in the borehole to a depth of 699 ft BGS leaving the Rustler Salad interval open from 700 to 741 ft BGS. After hydrologic testing of the Rustler formation was completed a b plug was set below the Culebra dolomite 641 ft BTOC (Below Top Of Casing). The Culebra interval was t perforated from 604-627 ft BTOC. The well bore was left undisturbed until 8-20-86 when a second bridge was installed 534 ft BTOC and the casing was again perforated from 490-514 ft BTOC exposing the Mager Dolomite to facilitate water quality sampling for the WIPP site.

SAMPLING PROCESS

The sampling configuration for H-06c consisted of a Bennett Sample pump model 1800 (Sn 1802) and a 2. Ardvark sliding end packer (Sn 3690-435). A 3"X1-1/2" Packer feed through assembly was utilized to facil monitoring of formation pressures below the packer. The total length of the pump/packer assembly was approximately 8 ft. Two Geokon Model 4500H vibrating wire transducers were utilized to monitor format pressures. The first, 0-150 psi range (Sn 3428) was attached to the tubing bundle 25 ft. above the pump/pa assembly in order to monitor the integrity of the packer seal. The second 0-150 psi range (Sn-3431) was attached to the packer feed through assembly to monitor formation pressures in the Magenta dolomite. D was collected and stored at regular intervals utilizing a micro-10 Geokon data logger (Sn-20).

The pump/packer assembly was installed 03/12/90 to a depth of 483 feet BTOC to the bottom of the pump intake assembly. Static Water Level at H-06c was measured just prior to start of pumping at a de 29 feet BTOC. Actual working pressure at installation depth just prior to starting the pump was 82. T drawdown throughout the testing period was approximately 142 feet. During the testing period 14 gallo water were pumped from the wellbore at an average pumping rate of 20.05 gallons per hour.

Three serial samples were collected; the first was collected on 03-13-90 after approximately 326 gallons of were pumped and final samples were collected on 03-15-90 after approximately 1308 gallons had been pu from the well. Samples were collected for International Technology

Analytical Sampling Laboratory (ITAS), Westinghouse Advanced Energy Systems Division Analytical Laboratory (WAESD), Sandia National Laboratory (SNL), and the New Mexico Environmental Evaluat Group (EEG). Archival samples were collected for the WIPP project.

ROUND-5 SERIAL SAMPLING RESULTS:

Eh remained relatively stable from sample 1 to sample 3 measuring +183 mv, +221 mv and +224 mv respectively.

pH remained stable throughout the sampling period measuring 7.82 S.U. at 21.0 C, 7.80 S.U. at 20.0 C an S.U. at 21.2 C respectively

Specific gravity was measured at 1.0032 at 20.8 C. for sample number 1 and 1.0034 at 21.2 C. for sample n 3.

Specific conductivity on day 1 measured 4,900 umhos/cm at 25 C. and 5,200 umhos/cm at 25 C. hr the testing period.

Daily averages for Alkalinity were 54.0 mg/l, 52.5 mg/l and 51.0 mg/l respectively.

Chlorides averaged 407 mg/l, 408 mg/l and 404 mg/l respectively

Divalent Cations averaged 42.0 meq/l, 42.0 meq/l and 41.5 meq/l.

Total iron averaged 0.15 mg/l, 0.15 mg/l and 0.10 mg/l respectively.

Ferrous iron averaged 0.13 mg/l, 0.11 mg/l and 0.07 mg/l respectively.

COMPARISON OF ROUND-5 RESULTS WITH PREVIOUS ROUNDS:

The average number of gallons pumped prior to final sampling during the previous four rounds was 4073 gallons. A total of 1308 gallons were pumped prior to collecting final samples during round-5. A comparison of the average final day data for the four previous rounds and the final day data for round-5 is described in the following table for alkalinity, chlorides, di-cats, total iron and ferrous iron.

AVG. OF FINAL DAY RESULTS FOR PREVIOUS FOUR ROUNDS	AVERAGE OF FINAL DAY FOR ROUND-5
Alkalinity 51.8 mg/l	Alkalinity 51.0 mg/l
Chlorides 412.5 mg/l	Chlorides 404.0 mg/l
Di-Cats 41.0 meq/l	Di-Cats 41.5 meq/l
Total Iron 0.31 mg/l	Total Iron 0.10 mg/l
Ferrous Iron 0.20 mg/l	Ferrous Iron 0.07 mg/l

GENERAL OBSERVATIONS/COMMENTS

No unusual occurrences or delays to pumping were noted during the testing period.

SUMMARY OF H-18,CULEBRA, ROUND-3

Well Characteristics

Well H-18 is located T22s R31E Section 20 964.8 FNL and 445.6 FWL in south eastern Eddy County, New Mexico, at an elevation of 3,414.21 feet above mean sea level(MSL), to the top of casing. The total depth c drilled hole was 831 feet below ground surface (BGS). The drill hole was later plugged back to 766 feet BC The well is cased to a depth of 673 feet BGS, with 7 inch casing and completed open hole. The source of w sampled from this well is the Culebra Dolomite Member of the Rustler formation located at a depth interv 689 to 713 feet BGS (Beauhiem, 1987).

Sampling process

The sampling configuration for H-18 consisted of a model 1800 Bennett sample pump (Sn 1806-21) and a 3 inch Baski sliding end packer with a 4.5 inch packer sleeve installed over the packer gland. The pump and packer were connected via a specially fabricated packer feed through nipple. The total length of the pump/packer assembly was 7.66 feet. Two geokon transducers were utilized to monitor the pressures in th bore during testing. The first (Sn 3428) 0-150 psi range was placed at a depth of 625 feet below top of casi (BTOC) to monitor the integrity of the packer seal. The second (Sn 3431) 0-150 psi range was attached to packer feed through nipple in order to monitor the pressure in the Culebra Dolomite. Data from the transducers was collected and stored at regular intervals utilizing a micro-10 datalogger (Sn-20).

The pump/packer assembly was installed on 03-30-90 to a depth of 658 feet BTOC to the bottom of the pu intake. Static water level was measured just prior to installation at 368.45 ft. BTOC. Actual down hole wo pressure prior to the start of pumping was 127.30 psi at the pump intake. Total draw down throughout the testing period was approximately 110 feet. During the testing period 7098 gallons of water were pumped f the well bore at an average pumping rate of 25 gallons per hour.

Eight serial samples were collected; the first was collected on 04-02-90 after approximately 1336 gallons of water were pumped and final samples were collected on 04-10-90 after 6933 gallons of water had been pur from the well. Samples were collected for International Technology Analytical Services Laboratory (ITAS Westinghouse Advanced Energy Systems Division Analytical Laboratory (WAESD), Sandia National Laboratory (SNL), and the New Mexico Environmental Evaluation Group (EEG). Archival samples were collected for the WIPP project.

ROUND-3 SERIAL SAMPLING RESULTS:

Eh Measured +235 MV, +208 MV, +208 MV, +239 MV, +227 MV, +171 MV, +169 MV AND +23 Respectively.

pH measured 7.83 S.U., 7.83 S.U., 7.79 S.U., 7.78 S.U., 7.72 S.U., 7.75 S.U., 7.70 S.U. and 7.72 S.U. respec

Temperature for the eight samples measured; 21.2 C, 20.8 C, 21.2 C, 22.0 C, 21.4 C, 21.4 C, 22.1 C and 21. respectively.

Specific gravity measured 1.0232 at 21.3 C for sample one, 1.0220 at 21.5 C for sample number six and 1.0 21.5 C for sample number eight.

Specific conductance measured 44,500 umhos/cm at 25 C. for sample one, 39,800 umhos/cm at 25 C. for s six, and 39,300 umhos/cm at 25 C. for samle eight.

Alkalinity average readings over the eight day sampling period were 55.4 mg/l, 53.5 mg/l, 52.0 mg/l, 51.4 mg/l, 52.6 mg/l, 51.2 mg/l 51.3 mg/l and 51.6 mg/l respectively.

Chlorides dropped steadily until the fifth day of sampling, then stabilized, fluctuating only slightly after the fifth day. Average measurements were; 16,619 mg/l, 14,862 mg/l, 14,566 mg/l, 14,186 mg/l, 13,952 mg/l, 13883 mg/l, 13,841 mg/l and 13,966 mg/l respectively.

Di-valent cations averaged 104.2 meq/l, 102.5 meq/l, 100.2 meq/l, 101.4 meq/l, 100.5 meq/l, 100.6 meq/l, 101.6 meq/l and 100.7 meq/l.

Total and Ferrous Iron dropped steadily through the seventh day of testing then increased slightly on the eighth day. Total Iron measured 1.53 mg/l, 0.67 mg/l, 0.51 mg/l, 0.47 mg./l, 0.43 mg/l, 0.37 mg/l, 0.36 mg/l and 0.38 mg/l. Ferrous Iron measured 1.39 mg/l, 0.54 mg/l, 0.38 mg/l, 0.34 mg/l, 0.33 mg/l, 0.30 mg/l, 0.29 mg/l, and 0.33 mg/l respectively.

COMPARISON OF ROUND-3 RESULTS WITH PREVIOUS ROUNDS:

The amount of water pumped prior to final sampling for the two previous rounds were 9,000 gallons and 33,000 gallons respectively. 6,933 gallons were pumped prior to final sampling during round three. A comparison of the average final day data for the two previous rounds and final day data for round-3 is described in the following table for alkalinity, chlorides, di-cats, total iron and ferrous iron.

AVG. OF FINAL DAY RESULTS FOR LAST TWO ROUNDS	AVG. OF FINAL DAY RESULTS FOR ROUND-3
Alkalinity 51.95 mg/l	Alkalinity 51.6 mg/l
Chlorides 12,375 mg/l	Chlorides 13,966 mg/l
Di-cats 98.8 meq/l	Di-cats 100.7 meq/l
Total Iron 0.22 mg/l	Total Iron 0.38 mg/l
Ferrous Iron 0.18 mg/l	Ferrous Iron 0.33 mg/l

GENERAL OBSERVATIONS/COMMENTS

During the evening hours on 04-01-90 at approximately 22:30 hours a failure of the main power generator caused a pump failure that lasted approximately 10 hours. No other problems were encountered during the testing period.

SUMMARY OF H-05b, CULEBRA, ROUND-5

WELL CHARACTERISTICS

H-05b is located approximately 2.7 miles northeast of the center of the WIPP site (1008.30 FNL and 236 FEL, Section 15, Township 22S, Range 31E). The ground monument elevation is 3505.38 feet amsl, and casing (TOC) is at an elevation of 3506.04 feet amsl, (SAND88-1065).

H-05b was completed on 06-13-78 to a total depth of 925 feet. Well casing (J55 15.5 lb/ft, 5" ID) is instal depth of 881 feet below ground surface (BGS). The well is completed open hole in the Culebra which li depth from 897-920 feet BGS.

SAMPLING PROCESS

A Bennett pump/packer assembly was used for this sampling round. The assembly consisted of a model Bennett Sample Pump (SN 1806-25) and a 2.8 inch Ardvark sliding end packer (SN 3690-435). A 3" to 1 packer feed through was utilized to facilitate the monitoring of formation pressures below the packer. T length of the assembly was 7.54 feet.

Two geokon 4500H vibrating wire transducers were utilized to monitor formation pressures. A 0-250 ps pressure range (SN 8317) transducer was attached to the tubing bundle 25 ft above the top of the pump depth of 825 feet below top of casing (BTOC) in order to monitor the integrity of the packer seal. A sec transducer (0-250 psi, SN 8319) was attached to the packer feed through assembly in order to monitor p below the packer. Data was collected and stored on a continuous basis by a Geokon Micro-10 data log (SN-87).

On 04-23-90 the pump/packer assembly was installed in H-05b. The bottom of the assembly w tic depth of 858 feet BTOC. Static water level just prior to installation measured 485.77 feet BTO olin 75-CG-0101). The well was pumped for a total of 9 days at an average rate of approximately 9.53 gallo hour. It was determined that three wellbore volumes was equivalent to 1114 gallons of water.

Four serial samples were collected; the first on 04-24-90 after approximately 278 gallons of water had b pumped from the well. Final samples were collected on 05-02-90 after approximately 2,253 gallons of w been pumped from the well. Final samples were sent to International Technology Analytical Sampling Laboratory (ITAS) and Westinghouse Advanced Energy Systems Division Analytical Lab (WAESD) f analysis. Samples were also provided to Sandia National Laboratories (SNL) and the New Mexico Environmental Evaluation Group (EEG) for independent analysis. Archival samples were collected fo WIPP Project.

ROUND-5 SERIAL SAMPLING RESULTS:

Eh fluctuated during the 4 days of sampling measuring +140 mv, +62 mv, +134 mv, +144 mv, respec

pH remained fairly stable during the 4 days of sampling measuring 7.47 S.U., 7.41 S.U., 7.29 S.U.,7.29 S respectively.

Temperature measured 21.2 C., 20.5 C., 19.8 C., 20.3 C. respectively.

Specific Gravity measured 1.1040 at 21.1 C. for sample 1, 1.1028 at 20.6 C. for sample 2, 1.1040 at 19.4 (sample 3, and 1.104 at 20.2 C. for sample 4.

Specific Conductance measured 151,900 umhos/cm at 25 C. for sample 1, 153,700 umhos/cm @25 C. for sample 2, and 155,900 umhos/cm at 25 C. for sample 4.

Alkalinity, chlorides and divalent cations fluctuated slightly from sample 1 to sample 4. Alkalinity averaged 55.1 mg/l, 52.2 mg/l, 51.2 mg/l,and 50.9 mg/l respectively. Chlorides averaged 85,027 mg/l, 85,288 mg/l, 85,635 mg/l,and 86,330 mg/l respectively. Divalent cations averaged 264.4 meq/l, 262.4 meq/l, 261.2 meq/l and 262.8 meq/l respectively.

Both iron parameters, (total-iron and ferrous-iron) decreased from sample one to sample four. Total-iron averaged 4.44 mg/l, 2.69 mg/l, 2.25 mg/l and 2.76 mg/l respectively. Ferrous iron averaged 3.97 mg/l, 2.42 mg/l, 2.07 mg/l, 2.44 mg/l respectively. A slight increase in both iron parameters for sample four was caused by packer slippage in the early morning hours of the last day of sampling.

COMPARISON OF ROUND-5 RESULTS WITH PREVIOUS ROUNDS:

The amount of water pumped prior to final sampling for each of the five rounds is as follows; 1,100 gallons, 2,000 gallons, 1,450 gallons, 1,996 and 2,253 gallons respectively. Round 5 results are in good agreement with results obtained from the first four sampling rounds. This comparison was made by comparing chemical parameter averages for the final day of round-5 sampling with the average of the chemical parameter values obtained for the last day of sampling for each of the previous four rounds. The results are presented below.

AVG. OFFINAL DAY RESULTS FOR LAST FOUR ROUNDS	AVG. OF FINAL DAY FOR ROUND-5
Alkalinity 50.0 mg/l	Alkalinity50.9mg/l
Chlorides 84,571 mg/l	Chlorides 84330 mg/l
Di-Cats 256.8 meq/l	Di-Cats 262.8 meq/l
Total Iron 3.01 mg/l	Total Iron 2.76 mg/l
Ferrous Iron 2.73 mg/l	Ferrous Iron 2.44 mg/l

GENERAL OBSERVATIONS/PROBLEMS:

On 04/24/90 at approximately 16:30 hours the pump failed and was replaced on 04/25/90 and pumping resumed at 09:45 am on that date. On 04/27/90 the pressure above the packer began to rise until finally on the morning of 05/02/90 the maximum differential pressure rating of the packer was overcome and the packer was pushed down approximately 25 feet. The lower transducer cable was pulled in two, however the pump continued to operate. After running parameters on Iron and turbidity the decision was made to collect final samples. After the pump had been pulled a post-operational test was preformed on the pump. The cause of the pressure rise above the packer was determined to be a faulty lower-discharge check valve in the pump which caused water to leak from the pump to the well bore above the packer seal.

SUMMARY OF H-05c, MAGENTA, ROUND-5

WELL CHARACTERISTICS

H-O5c is located 2.7 miles northeast of the center of the WIPP site, (1005.55 FNL, 134.95 FEL, Section 1: Township 22S, Range 31 E). Ground monument elevation is 3505.78 feet amsl, and top of casing (TOC) i elevation of 3506.04 feet amsl, (SAND88-1065).

H-05c was completed on 06-03-78 to a total depth of 1076 feet BGS. Well casing (J-55, 15.5#/ft.) is instal a depth of 1024 feet. The well was originally completed open hole in the Rustler/Salado Contact (1041 to ft) below ground surface (BGS). After testing of the Rustler/Salado Contact was completed, a bridge plu installed at a depth of 935 ft. BTOC. The well was re-completed in the Culebra from 895 to 925 ft BGS. Culebra at this location is situated at a depth from 899 to 924 ft. BTOC. On 08-20-86, a bridge plug was installed at a depth of 836 ft BTOC, and the well was re-completed, in the Magenta Dolomite, from 788 tc feet BTOC,(SAND85-7206).

SAMPLING PROCESS

A pump/packer assembly was used to sample this well. The assembly consisted of a model 1800 Bennett Sample Pump (SN 1802) and a 2.8 inch Ardvark sliding end packer (SN 3685-133). A 3" X 1-1/2" packer through nipple was used to facilitate monitoring of formation pressures. The total length of the assembly approximately 7.84 feet.

Two geokon 4500H vibrating wire transducers were utilized to monitor formation pressures. A 0-150 psi pressure range (SN 3428) transducer was attached to the tubing bundle and installed at a depth of 675 fe BTOC to monitor the integrity of the packer seal. A second transducer (0-250 psi, SN 9077) was attache packer feed through assembly in order to monitor pressures below the packer. Data was collect st on a continuous basis by a Geokon Micro-10 data logger (SN-20).

On 05-09-90 the pump/packer assembly was installed in the well. The bottom of the assembly was positio a depth of 783 feet BTOC. Static water level just prior to installation measured 353.05 feet BTOC, (Solin probe 75-CG-0101). The well was pumped for a total of 7 days at an average rate of 13.63 gallons per ho

Three serial samples were collected; the first on 05-14-90 after approximately 1497 gallons of water had b pumped from the well.

Final samples were collected on 05-16-90 after approximately 1940 gallons of water had been pumped fr well. Final samples were sent to International Technology Analytical Sampling Laboratory (ITAS) and Westinghouse Advanced Energy Systems Division Analytical Lab (WAESD) for analysis. Samples were provided to Sandia National Laboratories (SNL) and the New Mexico Environmental Evaluation Group for independent analysis. Archival samples were collected for the WIPP Project.

ROUND-5 SERIAL SAMPLING RESULTS:

Eh fluctuated during the 3 days of sampling measuring 0 mv, -2 mv, and -4 mv respectively.

pH remained fairly stable during the 4 days of sampling measuring 7.91 S.U., 7.92 S.U. and 7.95 S.U. respectively.

Temperature measured 21.7 C. on day 1, 21.8 C. on day 2 and 21.8 C. on day 3 .

Specific Gravity measured 1.0070 at 21.5 C. on day 1, and 1.0062 at 21.8 C. on day 3.

Specific Conductance measured 8500 umhos/cm at 25 C. on day 1, and 8480 umhos/cm at 25 C. on day 3.

Alkalinity, chlorides and divalent cations remained fairly stable throughout the 4 day sampling period. Alkalinity averaged 57.6 mg/l, 58.2 mg/l and 59.2 mg/l respectively. Chlorides averaged 1037 mg/l, 1031 mg/l and 1028 mg/l respectively. Divalent cations averaged 42.8 meq/l, 42.7 meq/l and 42.6 meq/l respectively.

Both iron parameters, (total-iron and ferrous-iron) decreased from day one to day three during the 3 day sampling period. Total-iron averaged 0.22 mg/l, 0.20 mg/l and 0.18 mg/l respectively. Ferrous iron averaged 0.15 mg/l, 0.13 mg/l and 0.10 mg/l respectively.

COMPARISON OF ROUND-5 RESULTS WITH PREVIOUS ROUNDS:

The amount of water pumped prior to final sampling for each of the five rounds is as follows; 5,800 gallons, 1,900 gallons, 2,500 gallons, 1,997 and 1940 gallons respectively. Comparison of round-5 results with results obtained from the first four rounds, indicate that a representative sample was obtained. This comparison was made by comparing chemical parameter averages for the final day of round-5 sampling with the average of the chemical parameter values obtained for the last day of sampling for each of the previous four rounds. The results are presented below.

AVG. OF FINAL DAY RESULTS FOR LAST FOUR ROUNDS	AVG. OF FINAL DAY FOR ROUND-5
Alkalinity 57.3 mg/l	Alkalinity 59.2 mg/l
Chlorides 1035 mg/l	Chlorides 1028 mg
Di-Cats 42.1 meq/l	Di-Cats 42.6 meq/l
Total Iron 0.86 mg/l	Total Iron 0.18 mg/
Ferrous Iron 0.61 mg/l	Ferrous Iron 0.10 mg/l

The averages for Total iron and Ferrous iron from the first three rounds is misleading because the first round averages are much higher than the other two rounds. Round-5 iron results compare most favorably with round-2 and round-4 results. Iron during rounds-1 and 3 was considerably higher than rounds-2, 4 and 5.

GENERAL OBSERVATIONS/PROBLEMS:

Water from the Magenta at this location is extremely gaseous. On 05-15-90, the second day of sampling the pump began to show early warning signs of failure, running intermittently. Based on the symptoms of the pump final sampling was moved up one day from 05-17-90 to 05-16-90.

SUMMARY OF TWIN WELL (PASTURE), DEWEY LAKE, ROUND-4

WELL CHARACTERISTICS

Twin Well(Pasture) is located approximately ten miles south of the center of the WIPP site. Twin wells c of two wells in close proximity, the House well and the Pasture well. This sampling was performed in the pasture well. Surface elevation is 3,523 feet above mean sea level (amsl). The total depth of the well is 15 below the ground surface (BGS)(Winstanley and Carrasco, 1986). Water is pumped to the surface by a windmill. The well is completed in the Dewey Lake Redbeds.

SAMPLING PROCESS

Samples were collected on 05-30-90, from a discharge pipe at the base of the windmill. Samples were filt with a portable peristaltic pump. Samples were collected for International Technology Analytical Servic (ITAS) and Westinghouse Advanced Energy Systems Division (WAESD) for analysis. Samples were als provided to Sandia National Laboratories (SNL) and the New Mexico Environmental Evaluation Group

FIELD ANALYTICAL RESULTS

Round-4 analytical results for Twin Pasture Well were as follows; pH 7.7 SU, secific gravity 1.0028 @ 23. degrees C, and specific conductance 614 umhos/cm @ 25 degrees C. Averages for Alkalinity, Chloride a Divalent Cations were 218.9 mg/l, 56 mg/l and 5.5 meq/l respectively.

COMPARISON OF ROUND-4 RESULTS WITH PREVIOUS ROUNDS:

Round-4 results compare favorably with results obtained from the previous sampling rounds. R 2 c not in agreement and was not included in the averages. The results are presented below:

AVERAGE OF PREVIOUS ROUNDS	ROUND-4
Alkalinity 222.9 mg/l	Alkalinity 218.9 mg/l
Chlorides 41.5 mg/l	Chlorides 56 mg/l
Di-Cats 7.9 meq/l	Di-Cats 5.5 meq/l

GENERAL OBSERVATIONS/COMMENTS:

This well supplies water for livestock.

SUMMARY OF WIPP-19, CULEBRA, ROUND-5

WELL CHARACTERISTICS

WIPP-19 is located approximately 0.5 miles north of the center of the WIPP site (2286.5 FNL and 12.7 FEL, Section 20, Township 22S, Range 31E). The ground monument elevation is 3433.08 feet amsl, and top of casing (TOC) is at an elevation of 3435.14 feet amsl. (SAND88-1065).

WIPP-19 was drilled in May of 1978 to a total depth of 1038 feet below ground surface (BGS). Following investigations to further characterize the WIPP site geology the well was filled with brine mud and abandoned until October 1985. In October of 1985, the well bore was reamed to 7.875 inches and a 5.5 inch well casing was installed to a depth of 1037 feet BGS. The well casing was perforated in the Culebra Dolomite Member of the Rustler Formation from 754 to 780 feet BGS. The Culebra at this location is located from 756 to 779 feet BGS (SAND87-0039).

SAMPLING PROCESS

A Bennett pump/packer assembly was used for this sampling round. The assembly consisted of a model 1800 Bennett Sample Pump (SN 1806-21) and a 2.8 inch Ardvark sliding end packer (SN 3690-435). A 3" to 1-1/2" packer feed through was utilized to facilitate the monitoring of formation pressures below the packer. The total length of the assembly was 7.52 feet.

Two geokon 4500H vibrating wire transducers were utilized to monitor formation pressures. A 0-150 psi pressure range (SN 3428) transducer was attached to the tubing bundle 25 ft above the top of the pump at a depth of 700 feet below top of casing (BTOC) in order to monitor the integrity of the packer seal. A second transducer (0-150 psi, SN 9075) was attached to the packer feed through assembly in order to monitor pressures below the packer. Data was collected and stored on a continuous basis by a Geokon Micro-10 data logger (SN-20).

On 05-30-90 the pump/packer assembly was installed in WIPP-19. The bottom of the assembly was positioned at a depth of 733 feet BTOC. Static water level just prior to installation measured 434.28 feet BTOC, (Solinst probe 75-CG-0101). The well was pumped for a total of 14 days at an average rate of approximately 17.16 gallons per hour.

Six serial samples were collected; the first on 06-04-90 after approximately 2512 gallons of water had been pumped from the well. Final samples were collected on 06-12-90 after approximately 5516 gallons of water had been pumped from the well. Final samples were sent to International Technology Analytical Sampling Laboratory (ITAS) and Westinghouse Advanced Energy Systems Division Analytical Lab (WAESD) for analysis. Samples were also provided to Sandia National Laboratories (SNL) and the New Mexico Environmental Evaluation Group (EEG) for independent analysis. Archival samples were collected for the WIPP Project.

ROUND-5 SERIAL SAMPLING RESULTS:

Eh fluctuated widely throughout the sampling period from a maximum of +210 to a low of -53. Serial sampling values were +157, +13, -53, +85, +210 and +204 respectively.

pH remained fairly stable during the 6 days of sampling measuring 7.46 S.U., 7.56 S.U., 7.50 S.U. 7.38 S.U., 7.48 S.U. and 7.31 S.U. respectively.

Temperature measured 23.0 C., 22.9 C., 22.8 C., 23.0 C., 22.5 C. and 23.1 C. respectively.

Specific Gravity measured 1.0570 @ 23.4 C. for sample 1, 1.0560 @ 22.9 C. for sample 4 and 1.0546 @ 23 on day 3.

Specific Conductance measured 94,800 umhos/cm @25 C. for sample 1, and 91,800 umhos/cm @ 25C. for sample 6.

Alkalinity, chlorides and divalent cations decreased from sample 1 to sample 6. Alkalinity averaged 75.2 mg/l, 65.3 mg/l and 63.0 mg/l, 58.1 mg/l, 57.8 mg/l and 59.4 mg/l respectively. Chlorides averaged 41303 mg/l, 40681 mg/l, 41061 mg/l, 40438 mg/l, 40370 mg/l and 40508 mg/l respectively. Divalent cations averaged 191.8 meq/l, 188.2 meq/l, 181.3 meq/l, 184.9 meq/l 178.3 meq/l and 178.9 meq/l respectively.

Both iron parameters, (total-iron and ferrous-iron) decreased dramatically from sample 1 to sample 3. Total-iron averaged 2.19 mg/l, 2.51 mg/l, 2.33 mg/l, 1.08 mg/l, 1.05 mg/l, and 0.83 mg/l respectively. Ferrous iron averaged 2.16 mg/l, 2.43 mg/l, 2.22 mg/l, 1.01 mg/l 0.99 mg/l and 0.72 mg/l respectively.

COMPARISON OF ROUND-5 RESULTS WITH PREVIOUS ROUNDS:

The amount of water pumped prior to final sampling for each of the five rounds is as follows; 2,400 gallons, 3,050 gallons, 5,300 gallons, 6292 and 5,516 gallons respectively. Round-5 final day results are slightly lower than results obtained from the final day average from the first four sampling rounds. This comparison was made by comparing chemical parameter averages for the final day of round-5 sampling with the average of the chemical parameter values obtained for the last day of sampling for each of the previous four rounds. The results are presented below.

AVG. OF FINAL DAY RESULTS FOR LAST FOUR ROUNDS	AVG. OF FINAL DAY FOR ROUND-5
Alkalinity 68.5 mg/l	Alkalinity 59.4 mg/l
Chlorides 48,848 mg/l	Chlorides 40,508 mg/l
Di-Cats 230.6 meq/l	Di-Cats 178.9 meq/l
Total Iron 1.41 mg/l	Total Iron 0.83 mg/l
Ferrous Iron 1.25 mg/l	Ferrous Iron 0.7

GENERAL OBSERVATIONS/PROBLEMS:

During the sampling period a full packer seal was probably not achieved. On 06-04-90 the packer assembly was raised to a total depth of 723 feet BTOC from 733 Btoc in an unsuccessful attempt to seat the packer because o the high iron content of the water samples. During the early morning hours of 06-06-90 at approximately 03:00 pumping was interrupted due to a faulty fuel injector pump on generator # 75-PE-001 pumping was resumed a 05:55. On 06-08-90 pumping was again interrupted when the alternator in generator 75-PE-002 failed at approximately 21:00. Attempts to restart the pump ,after replacing the generator were unsuccessful and the pump was pulled from the wellbore and replaced with and alternate pump. The packer assembly was reinstalle on 06-09-90 to a depth of 745 feet btoc to the bottom of the pump intake. The attempt to achieve a packer seal at this depth was again believed to be unsuccessful however, the iron content of the samples showed favorable trends.

SUMMARY OF BARN WELL, DEWEY LAKE, ROUND-4

WELL CHARACTERISTICS

Barn Well is located approximately three and four tenths of mile south southwest of the center of the WIPP site. Surface elevation is 3,315 feet above mean sea level (amsl). The total depth (TD) of this well is 138 feet below the ground surface (BGS) (Cooper and Glanzman, 1971). Water is pumped using an electric submersible pump.

SAMPLING PROCESS

Water samples were collected on 06-21-90 from a running stream of water from a spigot located in the owner's yard. Samples were filtered (0.45 micron) with a portable peristaltic pump. Samples were collected for International Technology Analytical Services (ITAS), and Westinghouse Advanced Energy System Division (WAESD) for analysis. Samples were also provided to Sandia National Laboratories (SNL) and the New Mexico Environmental Evaluation Group (EEG).

FIELD ANALYTICAL RESULTS

Round four analytical results for Barn Well were as follows: pH 7.58, Specific Gravity 1.0008 @ 25.2 C, Specific Conductivity 1070 umhos/cm @ 25 C. Average readings for Alkalinity, Chlorides and Divalent Cations were 284.1 mg/l, 56 mg/l and 5 meq/l respectively.

COMPARISON OF ROUND-5 RESULTS WITH PREVIOUS ROUNDS:

Round-5 results compare favorably with results obtained from the previous four sampling rounds. This comparison was made by comparing chemical parameter averages for round-5 with the average of the chemical parameter values obtained for the previous rounds. The results are presented below:

AVERAGE OF PREVIOUS FOUR ROUNDS	AVERAGE OF ROUND-5
Alkalinity 281.7 mg/l	Alkalinity 284.1 mg/l
Chlorides 47.2 mg/l	Chlorides 56.0 mg/l
Di-Cats 6.8 meq/l	Di-Cats 5.0 meq/l

GENERAL OBSERVATIONS/COMMENTS:

This well supplies drinking water for a residence located approximately one mile northwest of the well site.

SUMMARY OF RANCH WELL, DEWEY LAKE, ROUND-5

WELL CHARACTERISTICS

Ranch Well is located approximately three and two tenths miles south southeast of the center of the WIPP Surface elevation is 3,310 feet above mean sea level (amsl). The total depth of the well is 156 feet below th ground surface (BGS). Water is pumped to the surface by an electric submersible pump (Cooper and Glanzman, 1971).

SAMPLING PROCESS

Samples were collected on 06-19-90, from a discharge pipe above a storage tank located approximately tw feet north of the well. Samples were filtered with a portable peristaltic pump. Samples were collected for International Technology Analytical Services (ITAS) and Westinghouse Advanced Energy Systems Divisic (WAESD) for analysis. Samples were also provided to Sandia National Laboratories (SNL) and the New Mexico Environmental Evaluation Group (EEG).

FIELD ANALYTICAL RESULTS

Round-5 analytical results for Ranch Well were as follows; pH 7.24 SU, Specific Gravity 1.0014 @ 23.7 de C, Specific Conductivity 3020 umhos/cm @ 25 degrees C. Average readings for Alkalinity , Chlorides and Divalent Cations were; 247.7 mg/l, 358 mg/l, and 38.5 meq/l respectively.

COMPARISON OF ROUND-5 RESULTS WITH PREVIOUS ROUNDS:

Round-5 results compare favorably with results obtained from the previous four sampling round is comparison was made by comparing chemical parameter averages for round-5 with the average the parameter values obtained for previous four rounds. The results are presented below:

AVERAGE OF PREVIOUS FOUR ROUNDS	AVERAGE OF ROUND-5
Alkalinity 241.8 mg/l	Alkalinity 247.7 mg/l
Chlorides 383.8 mg/l	Chlorides 358 mg/l
Di-Cats 35.2 meq/l	Di-cats 38.5 meq/l

Round-2 alkalinity was measured at 39.8 mg/l. This value was not included in the average above because it is considered to be a suspect value and not representative of other sampling rounds.

GENERAL OBSERVATIONS/COMMENTS

This well supplies water for livestock.

SUMMARY OF H-02c, CULEBRA, ROUND-2

WELL CHARACTERISTICS

H-02c is located approximately 0.5 miles west of the center of the WIPP site (637.15 FNL and 1708.62 FWL, Section 29, Township 22S, Range 31E). The ground monument elevation is 3377.69 feet amsl, and top of casing (TOC) is at an elevation of 3378.41 feet amsl, (SAND88-1065).

H-02c was completed on 02-05-77 to a total depth of 795 feet below ground surface (BGS). Well casing (J55, 24 lb/ft, 6.625" OD) is installed to a depth of 742 feet BGS. The well was originally completed open hole in the Rustler/Salado contact which occurs from 743-795 feet BGS. The well was recompleted to the Culebra through casing perforations (3-holes per foot) from 624-654 feet BGS. A production inflation packer (PIP) was initially installed to isolate the Culebra from the Rustler/Salado. The PIP was later removed and a retrievable bridge plug was installed at a depth of 731 feet BGS, (SAND85-7206).

SAMPLING PROCESS

A Bennett pump/packer assembly was used for this sampling round. The assembly consisted of a model 1800 Bennett Sample Pump and a 3.5 inch Baski sliding end inflatable packer (SN 1981). A 3-1/2" to 1-1/2" packer feed through was utilized to facilitate the monitoring of formation pressures below the packer. A 4-1/2" packer sleeve was installed over the packer gland. The total length of the configuration was 7.7 feet.

Two geokon 4500H vibrating wire transducers were utilized to monitor formation pressures. A 0-150 psi pressure range (SN 3428) transducer was attached to the tubing and installed at a depth of 575 feet BTOC in order to monitor the integrity of the packer seal. A second transducer (0-150 psi, SN 9075) was attached to the packer feed through assembly in order to monitor pressures below the packer. Data was collected and stored on a continuous basis by a Geokon Micro-10 data logger (SN-20).

On 07-09-90 the first pump/packer assembly (Bennett pump SN1806-11) was installed in H-02c. The bottom of the assembly was positioned at a depth of 613 feet BTOC. Static water level just prior to installation measured 376.45 feet BTOC, (Solinst probe 75-CG-0101). This pump operated for five days and then failed on 07-13-90, after pumping approximately 1141 gallons of water.

On 07-13-90 the second pump/packer assembly (Bennett pump 1802) was installed in H-02c. The bottom of the pump assembly was positioned at a depth of 613 BTOC. Pumping continued for a total of 17 days at an average rate of approximately 11.74 gallons per hour.

Final samples were sent to International Technology Analytical Sampling Laboratory (ITAS) and Westinghouse Advanced Energy Systems Division Analytical Lab (WAESD) for analysis. Samples were also provided to Sandia National Laboratories (SNL) and the New Mexico Environmental Evaluation Group (EEG) for independent analysis. Archival samples were collected for the WIPP Project.

ROUND-2 SERIAL SAMPLING RESULTS:

A total of five serial samples were collected during round-2. Five serial samples were collected from 07-19-90 to 07-24-90. The first sample was collected after approximately 2939 gallons of water had been pumped. The final sample was collected after approximately 4294 gallons of water had been pumped.

Eh fluctuated slightly during the sampling period. From 07-19-90 to 07-24-90 five measurements were taken. The measurements were +229 mv, +235 mv, +213 mv, +274 mv, and +245 mv, respectively.

pH remained fairly stable during the sampling period. The measurements were 7.71 S.U., 7.78 S.U 7.88 S.U., 7.72 S.U., respectively.

Temperature fluctuated during the two periods of sampling. From 07-19-90 to 07-24-90 five measuremen were taken. The measurements were 22.0 C., 21.0 C., 22.0 C., 21.6 C., 22.2 C. respectively.

Specific gravity measured 1.010 at 22.6 C. on 07-19-90, 1.010 at 20.0 C. on 07-20-90,and 1.010 at 22.3 C. on 07-24-90.

Specific conductance measured 12,600 umhos/cm on 07-19-90, and 12,510 umhos/cm on 07-24-90.

Alkalinity, chlorides and divalent cations remained relatively stable through out the sampling period. For five samples collected alkalinity averaged 59.6 mg/l, 59.1 mg/l, 60.0 mg/l, 60.5 mg/l,and 60.9 mg/l, respectiv Chlorides averaged 3,037 mg/l, 2,982 mg/l, 2,992 mg/l, 2,975 mg/l,and 2,999 mg/l, respectively. Divalent ca averaged 48.4 meq/l, 48.6 meq/l, 48.6 meq/l, 48.2 meq/l, and 48.7 meq/l respectively.

Both iron parameters, (total-iron and ferrous-iron) remained relatively stable during the sampling period. spike in the iron parameters occurred on 07-23-90, when the pump stopped for several hours. Total iron averaged 1.46 mg/l, 1.29 mg/l, 1.50 mg/l, 2.06 mg/l, and 1.19 mg/l, respectively. Ferrous iron averaged 1.12 1.05 mg/l, 1.35 mg/l, 1.72 mg/l, and 1.07 mg/l respectively.

COMPARISON OF ROUND-1 RESULTS WITH ROUND-2 RESULTS

The amount of water pumped prior to final sampling during round-1 was 6,660 gallons compare 4 gallons for round-2. Alkalinity, Chlorides and Divalent Cations compared favorably with round one final averages. Both Iron parameters, however, were slightly higher than in round one.

AVERAGE OF FINAL DAY RESULTS FOR ROUND-1	AVERAGE OF FINAL DAY FOR ROUND-2
Alkalinity 58.3 mg/l	Alkalinity 60.9 mg/l
Chlorides 3836 mg/l	Chlorides 2999 mg/l
Di-cats 52.4 meq/l	Di-cats 48.7 meq/l
Total Iron 0.79 mg/l	Total Iron 1.19 mg/l
Ferrous Iron 0.57 mg/l	Ferrous Iron 1.07 mg/l

GENERAL OBSERVATIONS/COMMENTS:

Water at this location is mildly effervescent and exhibits a greenish color tint. Two pump failures occurre during the testing period. The first occurred on 07-13-90 and resulted in pump Sn # 1806-11 being replac pump Sn # 1802. The second pump failed the evening of 07-22-90 but technical personnel were able to re the pump on 07-23-90 and keep it running until final samples had been collected. The pump was left in operation for and extra day to facilitate collection of samples by the University of New Mexico Geology Department. The total gallons of water purged from the well from 07-09-90 until 07-25-90 were approxim 4800.

SUMMARY OF WELL H-3b3, CULEBRA, ROUND-5

WELL CHARACTERISTICS

Well H-3b3 is located approximately 0.8 miles south of the WIPP site, (2022.35 FSL, 217.30 FEL, Section 29, Township 22S, Range 31 E). Surface elevation is 3389.42 feet amsl, and top of casing TOC is at an elevation of 3388.67 feet amsl, (SAND88-1065). A casing stick up is located 0.5 feet above ground surface. The well was completed on 01-30-84 to a total depth of 730 feet below ground surface, (BGS). J-55, (15.5 lb/ft, 5.5 O.D) well casing is installed to a depth of 670.5 feet BGS, leaving the Culebra Dolomite, which is located at a depth of 673 to 696 feet BGS, open hole.

SAMPLING PROCESS

Bennett pump/packer assembly was used for this sampling round. The assembly consisted of a model 1800 Bennett sample pump (Sn 1806-21) and an ardvark 2.8 inch sliding end packer inflatable packer (Sn 3690-435). The total length of the assembly was 7.53 feet.

Two geokon 4500H vibrating wire transducers were utilized to monitor formation pressures. A 0-150 psi transducer (SN 3428) was attached to the tubing bundle 25 feet above the top of the pump/packer assembly. A second 0-150 psi transducer (SN 9075) was attached to the packer feed through assembly in order to monitor pressures below the packer. Data was collected and stored on a continuous basis by a micro-10 geokon data logger (SN-18).

On 08-07-90 the pump/packer assembly was installed in the well. The bottom of the assembly was positioned at a depth of 658 feet BTOC. Static water level just prior to installation measured 404.75 feet BTOC. The well was pumped for a total of 9 days at an average rate of 28.91 gallons per hour.

Four serial samples were collected; the first on 08-12-90 after approximately 3403 gallons of water had been pumped from the well. Final samples were collected on 08-15-90 after approximately 5466 gallons of water had been pumped from the well. Final samples were sent to International Technology Analytical Sampling Laboratory (ITAS), and Westinghouse Advanced Energy Systems Division Analytical Lab (WAESD) for analysis. Samples were also provided to Sandia National Laboratories (SNL) and the New Mexico Environmental Evaluation Group (EEG) for independent analysis. Archival samples were collected for the WIPP Project.

ROUND-5 SERIAL SAMPLING RESULTS:

From day 1 to day 4 Eh measured 206 mv, 190 mv, 212 mv, and 175 mv, respectively.

From day 1 to day 4 pH measured 7.51 S.U., 7.41 S.U., 7.44 S.U., and 7.45 S.U., respectively.

From day 1 to day 4, temperature measured 22.1 C., 22.1 C., 22.2 C., and 22.2 C. respectively.

Specific Gravity measured 1.0420 at 22.3 C. on day 1, and 1.0400 at 22.4C. on day 4.

Specific Conductance measured 69,300 umhos/cm at 25 C. on day 1, and 69,300 umhos/cm at 25 C. on day 4.

Alkalinity remained fairly stable throughout round-5. From day 1 to day 4, alkalinity averaged 50.5 mg/l, 50.6 mg/l, 50.5 mg/l, and 50.5 mg/l, respectively.

Chlorides fluctuated slightly. From day 1 to day 4 chlorides averaged 27,747 mg/l, 27,677 mg/l, 27,781 mg/l, and 27,695 mg/l respectively.

Divalent Cations remained fairly stable throughout round-5. From day 1 to day 4 divalent cations averagec 137.6 meq/l, 136.7 meq/l, 136.7 meq/l, and 137.9 meq/l respectively.

For the four days of sampling total iron averaged 0.22 mg/l, 0.20 mg/l, 0.21 mg/l, and 0.24 mg/l respectively.

From day 1 to day 4 ferrous iron averaged 0.19 mg/l, 0.15 mg/l, 0.19 and 0.19 mg/l respectively.

COMPARISON OF ROUND-5 RESULTS WITH PREVIOUS ROUNDS:

The amount of water pumped prior to final sampling for each of the five rounds is as follows; 16,300 gallor 40,000 gallons, 94,000 gallons, 101,919 and 5,466 gallons respectively. Round-5 parameters compare favora to all of the previous rounds. This comparison was made by comparing chemical parameter averages for tl final day of round-5 sampling with the average of the chemical parameter values obtained for the last day c sampling for each of the previous four rounds. The results are presented below.

AVG. OF FINAL DAY RESULTS FOR LAST FOUR ROUNDS	AVG. OF FINAL DAY FOR ROUND-5
Alkalinity 50.9 mg/l	Alkalinity 50.5 mg/l
Chlorides 28,083 mg/l	Chlorides 27,695 mg/l
Di-Cats 145.1 meq/l	Di-Cats 137.9 meq/l
Total iron 0.17 mg/l	Total Iron 0.24 mg/l
Ferrous Iron 0.14 mg/l	Ferrous Iron 0.19 mg/l

GENERAL OBSERVATIONS/COMMENTS:

This was the first round of sampling where a Bennett sample pump was utilized for the sampling process. parameters with the exception of the Iron parameters the results were comparable to other test round parameters. Iron parameters were probably elevated due to the lesser volume of water withdrawn from th aquifer.

SUMMARY OF WELL H-03b1, MAGENTA, ROUND-5

WELL CHARACTERISTICS

Well H-03b1 is located approximately 0.8 miles south of the WIPP

site, (2085.31 FSL, 138.10 FEL, Section 29, Township 22S, Range 31 E).

Surface elevation is 3389.42 feet amsl, and top of casing (TOC) is at an elevation of 3390.64 feet amsl, (SAND88-1065). The well was completed on 08-12-76 to a total depth of 902 feet below ground surface, (BGS).

J-55, (24#/ft., 6.625 O.D.) well casing is installed to a depth of 891 feet BGS. Initial completion was in the Rustler/Salado Contact (813 to 837 feet BGS). The well was next completed in the Magenta and Culebra. A bridge packer was installed at approximately 795 feet BGS. The casing was perforated in the Magenta (562 to 590 feet BGS) and in the Culebra (675 to 703 feet BGS). A Production Inflation Packer (PIP) was installed at a depth of approximately 652 feet BGS, providing access to both intervals.

On 07-08-86 the PIP was removed and a 4.25 inch bridge packer was installed to provide permanent access to the Magenta.

SAMPLING PROCESS

A pump/packer assembly was used to sample H-3b1. The assembly consisted of a Model 1800 Bennett sample pump (SN 1806-25) and a Baski 3.5 inch sliding end packer (SN 1981), with a 4.5 inch packer sleeve (SN 1922) installed over the packer element. The total length of the assembly was 7.66 feet.

Two Geokon 4500h vibrating wire transducers were utilized to monitor formation pressures. The first transducer (SN 3428) was attached to the tubing bundle 25 feet above the pump/packer assembly at a depth of 515 feet BTOC. A second transducer (SN 9075) was attached to the packer feed through assembly in order to monitor pressures below the packer. Data was collected and stored on a continuous basis by a Micro-10 Geokon datalogger (SN 18).

On 08-21-90 the pump/packer assembly was installed in the well. The bottom of the assembly was positioned at a depth of 548 feet BTOC.

Static water level just prior to installation measured 251.49 feet BTOC, (Solinst Probe 75-CG 0102). The well was pumped for a total of seven days at an average rate of 10.86 gallons per hour. Readings from the lower transducer slowly decreased from 130 psi to less than 30 psi.

Five serial samples were collected; the first on 08-23-90 after approximately 475 gallons of water had been pumped from the well.

Final samples were collected on 08-28-90 after approximately 1795 gallons of water had been pumped from the well. Final samples were sent to International Technology Analytical Sampling Laboratory (ITAS), and Westinghouse Advanced Energy Systems Division Analytical Lab (WAESD) for analysis. Samples were also provided to Sandia National Laboratories (SNL) and the New Mexico Environmental Evaluation Group (EEG) for independent analysis. Archival samples were collected for the WIPP Project.

ROUND-5 SERIAL SAMPLE RESULTS

From sample 1 to sample 5 Eh measured +48 mv, -78 mv, -62 mv, -24 mv and -5 mv respectively.

pH remained fairly stable throughout the testing period. From sample 1 to 5 pH measured 7.86 S.U., 7.7 7.76 S.U., 7.81 S.U., and 7.75 S.U. respectively.

From sample 1 to sample 5 temperature measured 22.9 C, 24.4 C, 24.3 C, 23.0 C, and 23.6 C respectively.

Specific gravity measured 1.0084 at 22.9 C on day 1 and 1.0080 at 23.2 C for sample 5.

Specific conductance measured 12,200 umhos/cm at 25 C. on day 1 and 12,200 umhos/cm at 25 C. on day

Alkalinity remained fairly stable throughout round-5. From sample 1 to 5 alkalinity averaged 46.4 mg/l, 4 mg/l, 46.9 mg/l, 46.5 mg/l and 45.9 mg/l respectively.

Chlorides for round-5 averaged 3426 mg/l, 3387 mg/l, 3447 mg/l, 3462 mg/l, and 3458 mg/l respectively.

Divalent cations were relatively stable from sample 1 to sample 5. Divalent cations averaged 74.7 meq/l, meq/l, 73.8 meq/l, 73.5 meq/l, and 73.7 meq/l respectively.

Both iron parameters (total iron and ferrous iron) were very low. The lower detection limit for measurin in the field lab is 0.02 mg/l.

All but the first day of measurements could only be reported as less than 0.02 mg/l. Average iron measu for the first day were 0.07 mg/l for total iron and 0.05 mg/l for ferrous iron.

COMPARISON OF ROUND-5 RESULTS WITH PREVIOUS ROUNDS:

The amount of water pumped prior to final sampling for each of the five rounds is as follows; 3, lo 1,500 gallons, 1,700 gallons, 2,280 gallons, and 1,795 gallons respectively. Round-5 parameters compare favorably to all of the previous rounds. This comparison was made by comparing chemical parameter av for the final day of round-5 sampling with the average of the chemical parameter values obtained for the of sampling for each of the previous four rounds. The results are presented below.

AVG. OF FINAL DAY RESULTS FOR LAST FOUR ROUNDS	AVG. OF FINAL DAY FOR ROUND-5
Alkalinity 46.1 mg/l	Alkalinity 45.9 mg/l
Chlorides 3316 mg/l	Chlorides 3458 mg/l
Di-Cats 73.6 meq/l	Di-Cats 73.7 meq/l
Total Iron 0.32 mg/l	Total Iron mg/l
Ferrous Iron 0.21 mg/l	Ferrous Iron mg/l

GENERAL OBSERVATIONS/COMMENTS:

Formation water from the Magenta at this location is slightly effervescent and has a hydro-carbon odor. water contains a small amount of black particulate matter that can be observed on a 0.45 umfilter.

REFERENCES CITED:

SAND88-1065 Compilation and Comparison fo Test-Hole Location Surveys in the Vicinity of the Waste Isolation Pilot Plant Site, 1989, Mary M. Gonzales, Earth Sciences Division, Sandia National L ori Albuquerque, New Mexico.

SUMMARY OF WELL H-4b CULEBRA, ROUND-5

WELL CHARACTERISTICS

Well H-04b is located two and four tenths miles south southwest of the WIPP site, (498.47 FNL, 632.54 FWL, Section 5, Township 23S, Range 31 E). Surface elevation is 3332.67 feet above mean sea level (amsl), and the top of casing (TOC) is at an elevation of 3333.35 feet amsl, (SAND88-1065). The well was completed on 05-15-78 to a total depth of 529 feet below ground surface, (BGS), (Winstanley/Carrasco, 1986). Well casing (J-55, 15.5 lb/ft) is installed to a depth of 476 feet BGS, with the remaining depth completed open hole. The entire thickness of the Culebra is exposed in the open hole section. At this location the Culebra lies from 498-522 feet BGS (SAND85-7206).

SAMPLING PROCESS

A pump/packer assembly was used to sample H-04b. The assembly consisted of a model 1800 Bennett Sample Pump (SN 1806-11) and a 2.8 inch Ardvark sliding end packer (SN 3690-435). The total length of the assembly was 7.56 feet.

Two geokon 4500H vibrating wire transducers were utilized to monitor formation pressures. A 0-150 psi pressure range (SN 3431) transducer was attached to the tubing bundle 25 feet above the top of the pump/packer assembly at a depth of 425 feet BTOC. A second transducer (0-150 psi, SN 3432) was attached to the packer feed through assembly in order to monitor pressures below the packer. Data was collected and stored on a continuous basis by a CR-10 geokon data logger (SN-22).

On 09-06-90 the pump/packer assembly was installed in the well. The bottom of the assembly was positioned at a depth of 457.56 feet BTOC. Static water level just prior to installation measured 334.80 feet BTOC, (Solinst probe 75-CG-0102). The well was pumped for a total of 7 days at an average rate of 10.81 gallons per hour.

Four serial samples were collected; the first on 09-09-90 after approximately 522 gallons of water had been pumped and final samples were collected on 09-12-90 after approximately 1286 gallons of water had been pumped from the well. Final samples were sent to International Technology Analytical Sampling Laboratory (ITAS), United Nuclear Corporation (UNC), and Westinghouse Advanced Energy Systems Division Analytical Lab (WAESD) for analysis. Samples were also provided to Sandia National Laboratories (SNL) and the New Mexico Environmental Evaluation Group (EEG). Archival samples were collected for the WIPP Project.

ROUND-5 SERIAL SAMPLING RESULTS:

All parameters remained relatively stable throughout the testing period with the exception of the Iron parameters which continued to decrease troughout the period.

Eh measured +95 mv, +113 mv, +112 mv and +114 mv.

pH measured 7.81 S.U., 7.74 S.U., 7.77 S.U. and 7.76 S.U. respectively.

Temperature measured 22.2 C, 21.8 C, 21.5 C and 22.1 C.

Specific gravity measured 1.0168 at 22.3 C on day one and 1.0164 at 21.5 C on day four.

Specific conductivity measured 24,400 umhos at 25 C. on day one and 26,400 umhos at 25 C. on day four.

Alkalinity measurements for each of the four days were 67.8 mg/l, 68.5 mg/l, 68.3 mg/l and 69.1 mg/l respectively.

Chlorides averaged 7,657 mg/l, 7,515 mg/l, 7,568 mg/l and 7,577 mg/l respectively.

Divalent cation from day one to day four 70.8 mg/l, 71.7 mg/l, 71.9 mg/l and 71.4 mg/l respectively.

Both Iron parameters decreased steadily over the four day period. Total Iron averaged 1.26 mg/l, 1.06 m 1.03 mg/l and 1.01 mg/l. Ferrous Iron Averaged 1.21 mg/l 1.00 mg/l, 0.96 mg/l and 0.89 mg/l respectively.

COMPARISON OF ROUND-5 RESULTS WITH PREVIOUS ROUNDS:

The amount of water pumped prior to final sampling for each of the five rounds is as follows; 4700 gallor gallons, 2500 gallons, 1048 gallons, and 1286 respectively. Round-5 parameters compare favorably to all (previous rounds of testing. This comparison was made by comparing chemical parameter averages for th day of round-5 sampling with the average of the chemical parameter values obtained for the last day of sampling for each of the previous four rounds. The results are presented below.

AVG. OF FINAL DAY RESULTS FOR LAST FOUR ROUNDS	AVG. OF FINAL DAY FOR ROUND-5
Alkalinity 69.1 mg/l	Chlorides 7445 mg/l
Chlorides 7577mg/l	Di-Cats 71.5 meq/l
Di-Cats 71.4 meq/l	Total iron 0.83 mg/l
Total Iron 1.01 mg/l	Ferrous Iron 0.41 mg/l
Ferrous Iron 0.89 mg/l	

SUMMARY OF WELL H-4c, MAGENTA, ROUND-5

WELL CHARACTERISTICS

Well H-04c is located two and four tenths miles south southwest of the WIPP site, (446.36 FNL, 717.89 FWL, Section 5, Township 23S, Range 31 E). Surface elevation is 3333.45 feet above mean sea level (amsl), and the top of casing (TOC) is at an elevation of 3334.04 feet amsl, (SAND88-1065). The well was completed on 05-09-78 to a total depth of 661 feet below ground surface, (BGS), (Winstanley/Carrasco, 1986). J-55, (15.5 lb/ft, 5.5 O.D) well casing is installed to a depth of 610 feet BGS. Initial completion was in the Culebra. A Lynes bridge packer was installed at a depth of 530 feet BTOC, and the casing was shot perforated from 496 to 520 feet BGS, (SAND85-7206). In August of 1986 the well was recompleted to the Magenta. A second Lynes bridge packer was installed at a depth of 435 feet BTOC and the well casing was shot perforated from 377 to 403 feet BTOC.

SAMPLING PROCESS

A pump/packer assembly was used to sample H-04c. The assembly consisted of a model 1800 Bennett Sample Pump (SN 1802) and a 2.8 inch Ardvark sliding end packer (SN 3690-435). The total length of the assembly was 7.53 feet.

Two geokon 4500H vibrating wire transducers were utilized to monitor formation pressures. A 0-150 psi pressure range (SN 3428) transducer was attached to the tubing bundle 25 feet above the top of the pump/packer assembly at a depth of 340 feet BTOC. A second transducer (0-150 psi, SN 9075) was attached to the packer feed through assembly in order to monitor pressures below the packer. Data was collected and stored on a continuous basis by a CR-10 geokon data logger (SN-20).

On 09-25-90 the pump/packer assembly was installed in the well. The bottom of the assembly was positioned at a depth of 372.53 feet BTOC. Static water level just prior to installation measured 192.31 feet BTOC, (Solinst probe 75-CG-0102). The well was pumped for a total of 7 days at an average rate of 3.72 gallons per hour.

Five serial samples were collected; the first on 09-27-90 after approximately 161 gallons of water had been pumped and final samples were collected on 10-02-90 after approximately 585 gallons of water had been pumped from the well. Final samples were sent to International Technology Analytical Sampling Laboratory (ITAS), United Nuclear Corporation (UNC), and Westinghouse Advanced Energy Systems Division Analytical Lab (WAESD) for analysis. Samples were also provided to Sandia National Laboratories (SNL). The New Mexico Environmental Evaluation Group (EEG) was notified of sampling and elected not to take a sample for analysis. Archival samples were collected for the WIPP Project.

ROUND FIVE SERIAL SAMPLING RESULTS:

Eh measured -86 mv, -82 mv, -58 mv, -81 mv and -61 mv respectively

pH measured 7.98 S.U., 8.00 S.U., 8.03 S.U., 8.00 S.U. and 8.01 S.U.

Temperature measured form day one to day five 23.9 C, 21.7 C, 21.0 C, 21.6 C and 20.6 C.

Specific gravity and Specific Conductivity were measured on day one and day five of the sampling period.

Specific gravity measured 1.02 at 24.1 C. on day one and 1.0202 at 20.4 C. on day five.

Specific conductivity measured 30,900 umhos/cm at 25.0 C. on day one and 30,900 umhos/cm at 25 C. on day five.

Alkalinity averaged 80.6 mg/l, 79.5 mg/l, 82.5 mg/l, 80.9 mg/l and 80.9 mg/l respectively.

Chlorides averaged 8,431 mg/l, 8,516 mg/l, 8,502 mg/l, 8,501 mg/l and 8,492 mg/l respectively.

Divalent Cations reamained relitively stable measureing 70.35 mg/l, 69.25 mg/l, 70.30 mg/l, 70.10 mg/l and mg/l daily average readings.

Both iron parameters remained fairly stable throughout the sampling period. Total Iron averaged 0.145 m 0.165 mg/l, 0.175 mg/l, 0.165 mg/l and 0.165 mg/l. Ferrous Iron averaged 0.125 mg/l, 0.105 mg/l, 0.06 mg/l, mg/l and 0.095 mg/l respectively.

COMPARISON OF ROUND-5 RESULTS WITH PREVIOUS ROUNDS:

The amount of water pumped prior to final sampling for each of the our rounds is as follows; 700 gallons. gallons, 700 gallons, and 450 gallons and 585 gallons respectively. Round-5 parameters compare favorabl of the previous rounds even though a smaller amount of water was pumped. This comparison was made comparing chemical parameter averages for the final day of round-5 sampling with the average of the che parameter values obtained for the last day of sampling for each of the previous four rounds. The results a presented below.

AVG. OF FINAL DAY RESULTS FOR LAST FOUR ROUNDS	AVG. OF FINAL DAY FOR ROUND-5
Alkalinity 80.7 mg/l	Alkalinity 80.9 mg/l
Chlorides 8368 mg/l	Chlorides 8493 mg/l
Di-Cats 68.7 meq/l	Di-Cats 70.1 meq/l
Total Iron 0.61 mg/l	Total Iron 0.17 mg/
Ferrous Iron 0.38 mg/l	Ferrous Iron 0.10 mg/l

GENERAL OBSERVATIONS/COMMENTS:

Formation water from the Magenta at this location is slightly effervescent and has a strong sulfurous odor water contains a large amount of black particulate matter that can be observed on 0.45 um filters. The M can easily be de-watered at this location so pumping rates must be kept low (i.e., 3.72 gph).

SUMMARY OF WELL H-11b3, CULEBRA, ROUND-5

WELL CHARACTERISTICS

Well H-11B3 is located two and two tenths miles south-southeast of the WIPP site, (1501.7 FSL, 105.2 FEL, Section 33, Township 22S, Range 31 E). Surface elevation is 3412.07 feet above mean sea level (amsl), and the top of casing (TOC) is at an elevation of 3412.42 feet amsl, (SAND88-1065). The well was completed on 12-18-83 to a total depth (TD) of 787 feet below ground surface, (BGS), (Winstanley/Carrasco, 1985). Well casing (J55 15.5 lb/ft, 5 inch I.D.) is installed to a depth of 733 feet BGS. The well is completed open hole in the Culebra which lies at a depth from 734-759 feet BGS (SAND85-7206, Winstanley and Carrasco,1985).

SAMPLING PROCESS

A Bennett pump/packer assembly was used to sample H-11b3. The assembly consisted of a model 1800 Bennett Sample Pump (SN 1806-21) and a 2.8 inch Ardvark sliding end packer (SN 3690-435). The total length of the assembly was 7.54 feet.

Two geokon 4500H vibrating wire transducers were utilized to monitor formation pressures. A 0-150 psi pressure range (SN 3428) transducer was attached to the tubing bundle 25 feet above the top of the pump/packer assembly at a depth of 695 feet BTOC. A second transducer (0-150 psi, SN 9075) was attached to the packer feed through assembly in order to monitor pressures below the packer. Data was collected and stored on a continuous basis by a CR-10 geokon data logger (SN-20).

On 10-10-90 the pump/packer assembly was installed in the well. The bottom of the assembly was positioned at a depth of 727.54 feet BTOC. Static water level just prior to installation measured 436.53 feet BTOC, (Solinst probe 75-CG-0102). The well was pumped for a total of 8 days at an average rate of 26.59 gallons per hour.

Four serial samples were collected; the first on 10-14-90 after approximately 2454 gallons of water had been pumped and final samples were collected on 10-17-90 after approximately 4368 gallons of water had been pumped from the well. Final samples were sent to International Technology Analytical Sampling Laboratory (ITAS), United Nuclear Corporation (UNC), and Westinghouse Advanced Energy Systems Division Analytical Lab (WAESD) for analysis. Samples were also provided to Sandia National Laboratories (SNL). The New Mexico Environmental Evaluation Group (EEG) was notified of sampling and elected not to take a sample for analysis. Archival samples were collected for the WIPP Project.

ROUND-5 SERIAL SAMPLING RESULTS:

Eh measurments fluctuated slightly from sample one thruogh sample 4, measurement were + 118 mv, + 144 mv, + 102 mv and + 119 mv respectively.

pH measurements were 7.37 S.U., 7.38 S.U., 7.36 S.U. and 7.38 S.U. respectively.

Specicic gravity remained constant two measurements were taken the first on day one 1.0804 at 21.6 C. and the second on day four 1.0804 at 21.3 C.

Specific Conductivity measured 133,400 umhos/cm at 25 C. on day one and 133,800 umhos/cm at 25 C. on day four.

Alkalinity average readings were 55.8 mg/l, 55.0 mg/l, 55.3 mg/l and 54.1 mg/l respectively.

Chlorides were relatively stable averaging 66,340 mg/l, 65,184 mg/l, 65,540 mg/l and 65,451 mg/l respectively.

Divalent Cations averaged 186.8 meq/l, 186.2 meq/l, 185.8 meq/l and 185.2 meq/l respectively.

Total Iron and Ferrous Iron remained relatively stable during the four days of testing averaging 0.48 mg/l, mg/l, 0.46 mg/l and 0.47 mg/l for Total Iron and 0.37mg/l, 0.35 mg/l, 0.34 mg/l and 0.38 mg/l respectively fc Ferrous Iron.

COMPARISON OF ROUND-5 RESULTS WITH PREVIOUS ROUNDS:

The amount of water pumped prior to final sampling for each of the five rounds is as follows; 126,000 ga. 30,800 gallons, 27,500 gallons, 4,751 gallons and 4,368 gallons respectively. Round five parameters compa favorably to all of the previous rounds. This comparison was made by comparing chemical parameter ave for the final day of round five sampling with the average of the chemical parameter values for the last day sampling for each of the previous four rounds. The results are presented below.

AVG. OF FINAL DAY RESULTS FOR LAST FOUR ROUNDS	AVG. OF FINAL DAY FOR ROUND-5
Alkalinity 55.3 mg/l	Alkalinity 54.1 mg/l
Chlorides 65,570 mg/l	Chlorides 65,451 mg/l
Di-Cats 187.0 meq/l	Di-Cats 185.2 meq/l
Total Iron 0.36 mg/l	Total Iron 0.47 mg/l
Ferrous Iron 0.24 mg/l	Ferrous Iron 0.38 mg/l

GENERAL OBSERVATIONS/COMMENTS:

Formation water from the Culebra at this location is slightly effervescent.

SUMMARY OF WELL H-7b, CULEBRA, ROUND-5

WELL CHARACTERISTICS

Well H-7b is located 6 miles southwest of the WIPP site, (2565.80 FNL, 2563.45 FWL, Section 14, Township 23S, Range 30 E). Surface elevation is 3163.56 feet amsl, and top of casing (TOC) is at an elevation of 3164.17 feet amsl, (SAND88-1065). The well was completed on 09-18-79 to a total depth of 286 feet below ground surface, (BGS). Well casing (J-55, 23 lb/ft, 7 inch O.D) extends to a depth of 230 feet BGS. The Culebra at this location lies at a depth of 232 feet to 280 feet BTOC, (Winstanley/Carrasco, 1986). The well appears to be obstructed at a depth of 208 feet BTOC. The cause of this obstruction is unknown.

SAMPLING PROCESS

A pump/packer assembly was used to sample H-7b. The assembly consisted of a model 1800 Bennett Sample Pump (SN 1806-25) and a 3.5 inch Baski sliding end packer (SN 1981) with a Baski 4 inch packer sleeve installed around the packer gland (SN 1922). The total length of the assembly was 7.7 feet.

Two geokon 4500H vibrating wire transducers were utilized to monitor formation pressures. A 0-150 psi pressure range (SN 3431) transducer was attached to the tubing bundle and positioned at a depth of 175 feet BTOC to monitor the integrity of the packer seal. A second transducer (0-150 psi, SN 3432) was attached to the packer feed through assembly in order to monitor pressures below the packer. Data was collected and stored on a continuous basis by a micro-10 geokon data logger (SN-20).

On 10-31-90 the pump/packer assembly was installed in the well. The bottom of the assembly was positioned at a depth of 198 feet BTOC. Static water level just prior to installation measured 168.85 feet BTOC, (Solinst probe 75-CG-0101). The well was pumped for a total of 9 days at an average rate of 47.2 gallons per hour. Approximately 9287 gallons were pumped from the well bore through out the pumping period.

Six serial samples were collected; the first on 11-02-90 after approximately 2008 gallons of water had been pumped from the well. Final samples were collected on 11-08-90 after approximately 8878 gallons of water had been pumped from the well. Final samples were sent to International Technology Analytical Services Laboratory (ITAS) and Westinghouse Advanced Energy Systems Division Analytical Lab (WAESD) for analysis. Samples were also provided to Sandia National Laboratories (SNL). New Mexico Environmental Evaluation Group (EEG) were offered samples for independent analysis, however they declined the samples. Archival samples were collected for the WIPP Project.

ROUND-5 SERIAL SAMPLING RESULTS:

Parameters for H-7b, round-5 stabilized very quickly. A total of six samples were collected. Results of daily serial sampling parameters are given below.

Eh fluctuated during the 6 days of sampling measuring +356, +337, +334, +311, +353 and +335 respectively.

pH remained fairly stable during the 6 days of sampling measuring 7.35 S.U., 7.38 S.U., 7.35 S.U.,7.36 S.U., 7.32 S.U. and 7.34 S.U. respectively.

Temperature measured 21.9 C. on day 1, 21.2 C. on day 2, 21.6 C on day 3, 21.4 C on day 4, 20.6 C on day 5 and 20.8 C. on day 6.

Specific Gravity measured 1.0042 at 22.0 C on day 1, and 1.0026 at 20.8 C on day 6.

Specific Conductance measured 3520 at 25 C on day 1, and 3620 at 25 C on day 6.

Alkalinity, chlorides and divalent cations remained fairly stable throughout the 6 day sampling peri
Alkalinity averaged 112.6 mg/l, 111.0 mg/l, 113.5 mg/l, 113.3 mg/l, 113.3 mg/l and 112.8 mg/l respect
Chlorides averaged 278 mg/l, 275 mg/l, 276 mg/l, 276 mg/l, 277 mg/l, and 276 mg/l respectively. Divalent c
averaged 48.7 meq/l, 48.0 meq/l, 46.5 meq/l, 47.6 meq/l, 47.9 meq/l and 47.6 meq/l respectively.

Both iron parameters, (total-iron and ferrous-iron) fluctuated slightly during the 6 day sampling period. Total-iron averaged 0.27 mg/l, 0.60 mg/l, 0.18 mg/l, 0.20 mg/l, 0.18 mg/l, and 0.21 mg/l respectively. Ferrou averaged 0.22 mg/l, 0.56 mg/l, 0.15 mg/l, 0.13 mg/l, 0.15 mg/l, and 0.17 mg/l respectively.

COMPARISON OF ROUND-5 RESULTS WITH PREVIOUS ROUNDS:

The amount of water pumped prior to final sampling for each of the five rounds is as follows; 38,900 gallo 62,600 gallons, 112,400 gallons, 3,909 gallons and 8878 gallons respectively. Round five parameters comp favorably to all of the previous rounds . This comparison was made by comparing chemical parameter ave for the final day of round-5 sampling with the average of the chemical parameter values obtained for the l of sampling for each of the previous four rounds. The results are presented below.

AVG. OF FINAL DAY RESULTS FOR LAST FOUR ROUNDS	AVG. OF FINAL DAY FOR ROUND-5
Alkalinity 120.5 mg/l	Alkalinity 112.8 mg/l
Chlorides 298 mg/l	Chlorides 276 mg/l
Di-Cats 42.9 meq/l	Di-Cats 47.6 meq/l
Total Iron 0.10 mg/l	Total Iron 0.21 mg/l
Ferrous Iron 0.05 mg/l	Ferrous Iron 0.17 mg/l

GENERAL OBSERVATIONS/COMMENTS:

A spike in the Iron parameters on day two of the serial sampling process was attributable to a pump failur which occurred during the early morning hours of 11/04/90. However there appears to be a long term upv trend in both iron parameters. Given the obstruction in casing discovered during round four this upward might be attributed to the continuing deterioration of the well casing.

APPENDIX V

LAST DAY SERIAL SAMPLING RESULTS FROM PREVIOUS ROUNDS

SAMPLED IN 1989

WELL	ZONE	ROUND	DATE SAMPLED	Eh (mv)	pH (S.U.)	TEMP (C)	SPECIFIC GRAVITY	SPECIFIC CONDUCTANCE (umhos)	ALKALINITY (mg/l)	CHLORIDES (mg/l)	DICATIONS (meq/l)	TOTAL IRON (mg/l)	FERROUS IRON (mg/l)
H-02a	Culebra	3	01-19-89	83.90	7.88	19.2	1.0142 @ 19.4 C	14100	56.9	4129	50.4	1.15	0.99
H-14	Culebra	3	02-14-89	270.00	7.76	20.5	1.0142 @ 20.5 C	24300	38.1	8502	132.9	0.44	0.37
H-03b3	Culebra	4	03-02-89	362.00	7.46	22.2	1.036 @ 22.2 C	68100	50.4	27639	139.1	0.15	0.13
H-04B	Culebra	4	04-06-89	194.00	7.81	21.5	1.0160 @ 21.4 C	24500	68.1	7403	72.5	0.48	0.43
H-07b1	Culebra	4	05-19-89	233.00	7.28	22.0	1.0030 @ 22.0 C	3640	117.8	290	40.6	0.14	0.09
WIPP-25	Culebra	4	06-27-89	188.00	7.28	22.4	1.0110 @ 22.7 C	22000	129.8	6933	89.3	0.72	0.63
H-06b	Culebra	4	07-24-89	284.00	7.01	22.2	1.0444 @ 22.3 C	75000	97.4	31615	188.6	0.44	0.38
H-05b	Culebra	4	08-23-89	182.00	7.35	22.3	1.1022 @ 23.0 C	153000	52.5	84385	258.5	3.06	2.88
WIPP-19	Culebra	4	10-18-89	168.00	7.28	21.2	1.0564 @ 20.9 C	92400	61.1	40440	187.2	1.71	1.49
H-11b3	Culebra	4	10-25-89	187.00	7.34	23.1	1.0804 @ 23.1 C	128900	58.5	63473	192.4	0.46	0.31
H-02c	Culebra	1	12-13-89	173.00	7.84	18.4	1.0202 @ 22.0 C	13500	58.3	3836	52.4	0.79	0.57
H-03b1	Magenta	4	03-16-89	24.00	7.93	22.4	1.0085 @ 21.4 C	12204	46.6	3299	73.9	0.03	LD
H-04c	Magenta	4	04-21-89	-63.00	7.95	19.8	1.0200 @ 26.8 C	30400	79.7	8407	68.9	0.2	0.14
H-06c	Magenta	4	08-04-89	209.00	7.81	22.7	1.0046 @ 22.6 C	5230	52.5	404	40.6	0.31	0.21
H-05c	Magenta	4	09-14-89	206.00	7.95	22.0	1.0080 @ 22.1 C	8460	57.2	1023	42.8	0.21	0.18
Barn Well	Dewey Lake	3	07-13-89	NT	7.71	22.4	1.008 @ 27.8 C	1113	283.4	46.8	6.5	NT	NT
Ranch Well	Dewey Lake	4	07-12-89	NT	7.42	21.2	1.0018 @ 27.8 C	3550	250.8	328	31.8	NT	NT
Twin Wells Pasture	Dewey Lake	3	09-28-89	NT	7.71	NT	1.0016 @ 23.6 C	612	221.0	38.5	4.1	NT	NT

NOTE: DEWEY LAKE WELLS WERE NOT SERIALLY SAMPLED.
ALKALINITY, CHLORIDE, DICATIONS, TOTAL IRON AND FERROUS IRON ARE AVG. VALUES

LAST DAY SAMPLING RESULTS FOR EACH WELL
SAMPLED IN 1985

WELL	ZONE	ROUND	DATE SAMPLED	Eh (mv)	pH (S.U.)	TEMP (C)	SPECIFIC GRAVITY	SPECIFIC CONDUCTANCE (umhos)	ALKALINITY (mg/l)	CHLORIDES (mg/l)	DICATIONS (meq/l)	TOTAL IRON (mg/l)	FERROUS IRON (mg/l)
H-03b3	Culebra	1	02-04-85	62.00	7.40	21.6	NT	63600	51.6	29330	167.8	0.17	0.13
ENGLE	Culebra	1	03-05-85	NT	7.40	20.9	NT	3400	108.1	224	41.8	0.53	0.24
DOE-02	Culebra	1	03-12-85	444.00	7.00	20.7	NT	68000	67.5	32338	186.3	LD	LD
DOE-1	Culebra	1	04-25-85	224.00	7.10	22.6	NT	143000	44.6	73173	208.9	0.35	0.29
H-11b3	Culebra	1	06-04-85	200.00	7.20	23.5	1.0910 @ 22.6 C	116000	53.4	67922	187.6	0.15	0.11
H-04b	Culebra	1	07-25-85	189.00	7.70	21.5	1.0150 @ 21.1 C	26400	70.0	7456	71.4	1.04	0.31
H-12	Culebra	1	08-09-85	229.00	7.20	23.2	1.0960 @ 24.0 C	149000	52.5	80452	242.7	1.18	0.22
H-05b	Culebra	1	08-27-85	91.00	7.40	22.3	1.1050 @ 21.6 C	157000	48.9	83413	256.4	2.81	2.55
H-06b	Culebra	1	09-16-85	290.00	6.90	22.0	1.0420 @ 23.5 C	73300	94.1	32295	190.7	0.21	0.16
H-09b	Culebra	1	11-14-85	280.00	7.50	23.3	1.0030 @ 22.6 C	3300	116.1	194	41.2	0.13	0.05
WIPP-26	Culebra	1	11-25-85	364.00	7.10	21.5	1.0120 @ 21.8 C	26600	118.8	8575	100.4	0.10	LD
WIPP-29	Culebra	1	12-15-85	349.00	5.90	19.9	1.2160 @ 20.8 C	NT	153.9	176019	615.5	1.21	0.89
H-03b1	Magenta	1	07-02-85	-29.00	8.00	24.4	1.0060 @ 21.4 C	12300	46.4	3363	74.3	0.65	0.34
DOE-02	Bell Canyon	1	07-13-89	NT	6.70	NT	NT	NT	NT	89800	397.0	NT	NT

ALKALINITY, CHLORIDE, DICATIONS, TOTAL IRON AND FERROUS IRON ARE AVG. VALUES

LAST DAY SAMPLING RESULTS FOR EACH WELL
SAMPLED IN 1986

WELL	ZONE	ROUND	DATE SAMPLED	Eh (mv)	pH (S.U.)	TEMP (C)	SPECIFIC GRAVITY	SPECIFIC CONDUCTANCE (umhos)	ALKALINITY (mg/l)	CHLORIDES (mg/l)	DICATIONS (meq/l)	TOTAL IRON (mg/l)	FERROUS IRON (mg/l)
H-08b	Culebra	1	01-23-86	338.00	7.60	20.9	1.0020 @ 21.8 C	2900	95.3	33	41.7	0.09	0.02
WIPP-25	Culebra	1	02-13-86	194.00	7.20	21.8	1.0100 @ 21.9 C	20300	126.5	6191	81.5	0.49	0.39
P-14	Culebra	1	02-27-86	174.00	6.80	21.6	1.0190 @ 21.3 C	37400	105.8	15294	254.9	2.08	2.04
P-17	Culebra	1	03-17-86	71.00	7.50	21.7	1.0650 @ 21.2 C	107000	61.1	47482	211.1	4.78	4.18
H-07b1	Culebra	1	03-27-86	261.00	7.20	22.2	1.0010 @ 21.5 C	3700	120.7	309	46.4	0.12	0.06
H-02a	Culebra	1	04-21-86	24.00	8.00	22.0	1.0090 @ 21.7 C	19100	56.3	5243	53.4	1.02	0.80
H-03b3	Culebra	2	05-05-86	160.00	7.40	23.5	1.0380 @ 22.1 C	71900	50.7	27361	136.3	0.23	0.18
H-05b	Culebra	2	05-21-86	53.00	7.60	25.1	1.1050 @ 23.7 C	162200	51.0	84884	253.4	4.01	3.53
H-11b3	Culebra	2	06-04-86	124.00	7.30	23.7	1.0810 @ 24.0 C	140400	54.0	65886	182.8	0.30	0.28
DOE-01	Culebra	2	07-03-86	132.00	7.10	24.2	1.0910 @ 23.0 C	152000	45.3	75335	216.2	1.36	1.24
H-06b	Culebra	2	07-28-86	123.00	7.00	23.3	1.0400 @ 25.6 C	80100	90.7	32228	191.8	0.10	0.07
DOE-02	Culebra	2	08-27-86	336.00	6.20	22.6	1.0430 @ 22.7 C	77900	149.9	32183	187.9	0.21	0.19
H-04b	Culebra	2	11-13-86	126.00	7.60	19.8	1.0210 @ 18.2 C	27800	68.1	7522	72.3	1.22	0.49
P-17	Culebra	2	12-18-86	75.00	7.50	21.1	1.0630 @ 20.9 C	109000	60.9	48033	222.4	4.17	2.21
H-03b1	Magenta	2	09-16-86	-74.00	7.60	21.4	1.0060 @ 21.2 C	12050	45.0	3302	73	0.46	0.40
H-06c	Magenta	1	10-01-86	110.00	7.70	21.3	1.0030 @ 21.4 C	5440	50.5	418	41.1	0.38	0.29
H-05c	Magenta	1	10-24-86	-8.00	8.10	21.9	1.0080 @ 23.1 C	8760	57.3	1045	41.9	2.26	1.42
H-04c	Magenta	1	11-04-86	-47.00	8.30	20.7	1.0190 @ 21.2 C	31600	76.5	8361	69.2	1.85	1.12
Twin Wells	Dewey Lake	1	01-31-86	433.00	7.70	20.6	0.9980 @ 21.6 C	650	224.7	44	5.9	0.03	LD
Pasture Ranch Well	Dewey Lake	1	06-18-86	405.00	6.90	22.1	1.0020 @ 22.1 C	3913	217.3	397	37.8	0.12	0.06

NOTE: DEWEY LAKE WELLS WERE SERIALLY SAMPLED ROUND ONE ONLY.
ALKALINITY, CHLORIDE, DICATIONS, TOTAL IRON AND FERROUS IRON ARE AVG. VALUES

LAST DAY SAMPLING RESULTS FOR EACH WELL
SAMPLED IN 1987

WELL	ZONE	ROUND	DATE SAMPLED	Eh (mv)	pH (S.U.)	TEMP (C)	SPECIFIC GRAVITY	SPECIFIC CONDUCTANCE (umhos)	ALKALINITY (mg/l)	CHLORIDES (mg/l)	DICATIONS (meq/l)	TOTAL IRON (mg/l)	FERROUS IRON (mg/l)
H-12	Culebra	2	01-16-87	70.00	7.50	17.8	1.1000 @ 18.5 C	157300	62.0	80000	260.0	2.44	1.54
H-09b	Culebra	2	01-28-87	250.00	7.30	22.1	1.0020 @ 21.9 C	3500	112.0	175	44.0	0.16	LD
H-08b	Culebra	2	02-11-87	220.00	7.20	21.9	1.0020 @ 21.7 C	3060	93.1	36	42.0	0.13	LD
WIPP-13	Culebra	1	02-16-87	280.00	6.70	NT	1.0480 @ 21.4 C	87700	124.0	36000	170.0	NT	NT
H-07b1	Culebra	2	02-25-87	250.00	7.40	21.6	1.0010 @ 20.2 C	3300	121.0	301	44.0	0.08	LD
WIPP-29	Culebra	2	03-11-87	200.00	6.20	20.0	1.1870 @ 21.4 C	223000	162.0	152500	523.5	0.93	0.32
WIPP-26	Culebra	2	04-01-87	320.00	7.00	21.2	1.0100 @ 21.0 C	27800	112.0	5750	85.0	0.06	LD
H-15	Culebra	1	05-11-87	140.00	6.90	20.9	1.1560 @ 22.2 C	300000	41.7	132000	287.0	2.99	2.84
H-14	Culebra	1	05-26-87	70.00	7.70	21.5	1.0120 @ 22.0 C	24600	40.3	8500	126.0	0.53	0.48
Mobely Well	Culebra	1	06-16-87	NT	7.50	25.2	NT	4300	135.5	463	43.5	NT	NT
P-14	Culebra	2	06-18-87	40.00	6.90	21.7	1.0200 @ 21.9 C	38000	103.0	14300	250.5	2.50	2.35
WIPP-19	Culebra	1	07-14-87	150.00	7.00	22.0	1.0720 @ 22.1 C	143500	84.0	62000	286.0	1.75	1.60
DOE-1	Culebra	3	07-28-87	130.00	7.20	23.7	1.0910 @ 23.2 C	148000	44.8	74000	214.0	0.87	0.76
H-02a	Culebra	2	08-12-87	60.00	7.80	22.5	1.0080 @ 22.4 C	15400	53.6	4400	50.0	0.42	0.34
H-03b3	Culebra	3	08-24-87	200.00	7.30	23.2	1.0370 @ 22.4 C	71000	50.8	28000	137.0	0.14	0.10
H-11b3	Culebra	3	09-15-87	70.00	7.30	23.5	1.0800 @ 23.2 C	130900	55.1	65000	185.0	0.43	0.27
H-04b	Culebra	3	09-25-87	100.00	7.60	21.7	1.0150 @ 20.9 C	27200	69.1	7400	70.0	0.60	0.42
P-17	Culebra	3	10-21-87	60.00	7.50	21.0	1.0620 @ 17.6 C	108000	63.1	49000	216.0	3.51	3.25
H-17	Culebra	3	10-27-87	NT	7.00	NT	1.1030 @ 21.3 C	165000	49.8	88500	223.5	0.98	0.78
H-18	Culebra	1	11-10-87	NT	7.60	NT	1.0180 @ 19.0 C	35000	53.4	11750	96.0	0.15	0.10
H-06b	Culebra	3	11-16-87	350.00	6.90	22.2	1.0404 @ 20.9 C	76500	94.0	32000	191.0	0.05	LD
Engle Well	Culebra	2	12-08-87	NT	7.20	NT	1.0020 @ 21.5 C	4330	74.5	237	43.7	NT	NT
Poker Trap	Culebra	1	12-19-87	NT	NT	NT	1.0010 @ 20.0 C	2490	92.2	29	30.4	NT	NT
H-03b1	Magenta	3	09-02-87	-93.00	7.70	23.8	1.0060 @ 23.4 C	12300	46.4	3300	73.0	0.13	0.09
H-04c	Magenta	2	10-05-87	-120.00	8.00	22.6	1.0180 @ 22.6 C	30800	84.6	8400	68.0	0.22	0.15
H-06c	Magenta	2	11-04-87	100.00	7.90	22.1	1.0020 @ 22.1 C	5300	51.9	420	41.0	0.19	0.14
Barn Well	Dewey Lake	1	11-04-87	NT	8.00	18.5	1.0010 @ 21.8 C	983	276.0	52	6.4	NT	NT
Fairview	Dewey Lake	1	11-16-87	NT	6.70	22.8	1.0020 @ 20.4 C	3545	78.9	121	41.6	NT	NT
Unger Well	Dewey Lake	2	11-18-87	NT	7.40	19.2	1.0010 @ 21.6 C	3320	129.0	274	44.9	NT	NT
Ranch Well	Dewey Lake	2	12-20-87	NT	7.50	NT	1.0010 @ 20.2 C	4410	39.8	470	39.1	NT	NT
Commanche	Dockum	1	10-26-87	NT	7.80	20.4	NT	544	228.0	25	3.1	NT	NT
Clifton	Dockum	1	10-28-87	NT	7.70	19.8	1.0020 @ 21.6 C	1510	167.0	52	2.8	NT	NT

NOTE: DEWEY LAKE AND DOCKUM WELLS WERE NOT SERIALLY SAMPLED.
ALKALINITY, CHLORIDE, DICATIONS, TOTAL IRON AND FERROUS IRON ARE AVG. VALUES

LAST DAY SAMPLING RESULTS FOR EACH WELL
SAMPLED IN 1988

WELL	ZONE	ROUND	DATE SAMPLED	Eh (mv)	pH (S.U.)	TEMP (C)	SPECIFIC GRAVITY	SPECIFIC CONDUCTANCE (umhos)	ALKALINITY (mg/l)	CHLORIDES (mg/l)	DICATIONS (meq/l)	TOTAL IRON (mg/l)	FERROUS IRON (mg/l)
H-15	Culebra	2	01-13-88	108.00	7.01	14.2	1.1526 @ 21.4 C	225000	41.3	133697	298.8	3.60	3.19
H-14	Culebra	2	01-27-88	192.00	7.62	20.8	1.0122 @ 19.7 C	27200	37.0	8510	129.5	0.16	0.09
WIPP-19	Culebra	2	02-12-88	112.00	7.17	21.1	1.0608 @ 21.1 C	113000	68.2	48797	240.8	1.31	1.10
H-05b	Culebra	3	02-24-88	112.00	7.25	19.1	1.1022 @ 19.3 C	172000	47.6	85634	258.7	2.15	1.94
WIPP-30	Culebra	1	03-04-88	NT	7.70	NT	1.0204 @ 19.1 C	NT	37.0	13271	95.9	2.19	1.60
P-14	Culebra	3	03-16-88	182.00	6.90	21.8	1.0200 @ 21.0 C	39500	107.0	14650	256.0	2.00	1.88
WIPP-25	Culebra	3	03-28-88	169.00	7.22	23.2	1.0104 @ 22.0 C	21400	124.7	6407	82.8	0.73	0.69
H-18	Culebra	2	04-07-88	NT	7.49	NT	1.0204 @ 20.2 C	38150	50.5	12962	101.4	0.28	0.25
USGS-1	Culebra	1	04-12-88	NT	7.80	NT	1.0030 @ 20.8 C	4850	107.0	672	41.3	NT	NT
Mobely Well	Culebra	2	04-14-88	NT	7.30	NT	1.0000 @ 25.2 C	4340	133.5	480	43.3	NT	NT
WIPP-26	Culebra	3	04-14-88	428.00	7.11	21.1	1.0092 @ 21.3 C	18500	113.9	5695	87.3	0.04	LD
H-07b1	Culebra	3	04-25-88	343.00	7.21	21.8	1.0015 @ 21.2 C	3680	122.5	293	40.4	0.07	0.04
DOE-2	Culebra	3	05-19-88	307.00	6.68	22.8	1.0442 @ 23.3 C	75500	130.8	31580	184.0	0.35	0.26
H-08b	Culebra	3	06-08-88	297.00	7.30	22.7	1.0014 @ 22.1 C	3000	97.0	39	40.6	0.05	LD
H-09b	Culebra	3	06-21-88	213.00	7.27	22.8	1.0022 @ 22.8 C	3400	117.6	172	41.3	0.12	0.08
USGS-1	Culebra	2	07-07-88	NT	7.50	NT	1.0060 @ 22.8 C	4800	102.5	730	41.1	NT	NT
Poker Trap	Culebra	2	07-07-88	NT	7.70	NT	1.0040 @ 22.7 C	2320	79.8	31	30.3	NT	NT
WIPP-19	Culebra	3	08-29-88	95.00	7.19	21.5	1.0610 @ 22.1 C	98000	60.9	44115	207.6	0.80	0.80
H-01	Culebra	1	10-07-88	42.00	7.79	21.5	1.0242 @ 22.4 C	38900	99.0	12142	83.9	3.22	2.77
AIS	Culebra	1	10-28-88	NT	7.80	NT	1.0370 @ 24.6 C	55100	108.5	19350	92.1	NT	NT
H-15	Culebra	3	11-07-88	131.00	6.86	23.3	1.1596 @ 23.4 C	198800	40.9	134550	281.9	2.88	2.47
H-12	Culebra	3	12-14-88	109.00	7.30	21.5	1.0880 @ 21.2 C	14700	51.1	80100	249.5	2.11	1.95
H-05c	Magenta	2	03-03-88	46.00	7.91	18.8	1.0078 @ 18.1 C	9220	57.2	1037	41.5	0.29	0.25
H-04c	Magenta	3	07-19-88	-63.00	8.08	21.0	1.0202 @ 21.9 C	30600	82.1	8304	68.5	0.18	0.11
H-06c	Magenta	3	07-26-88	111.00	7.84	21.4	1.0026 @ 21.3 C	5300	52.4	408	41.3	0.34	0.16
H-05c	Magenta	3	08-18-88	45.00	8.05	22.0	1.0082 @ 22.1 C	8450	57.5	1030	42.1	0.69	0.57
Barn Well	Dewey Lake	2	4-20-88	NT	8.00	NT	1.0010 @ 25.1 C	1060	283.5	43	7.5	NT	NT
Ranch Well	Dewey Lake	3	04-20-88	NT	7.30	NT	1.0010 @ 25.1 C	4060	248.5	453	38.9	NT	NT
Unge[illegible] Well	Dewey Lake	2	07-06-88	NT	7.30	NT	1.0040 @ 22.7 C	3390	134.0	282	41.1	NT	NT
F[illegible]	Dewey Lake	2	07-06-88	NT	6.70	NT	1.004[illegible].7 C	3450	115.5	121	41.7	NT	NT
Tw[illegible]ell Pasture	Dewey Lake	2	08-03-88	NT	7.10	NT	1.002[illegible].9 C	600	215.5	399	39.8	NT	[illegible]T

DOE/AW

LAST DAY SAMPLING RESULTS FOR EACH WELL
SAMPLED IN 1989

WELL	ZONE	ROUND	DATE SAMPLED	Eh (mv)	pH (S.U.)	TEMP (C)	SPECIFIC GRAVITY	SPECIFIC CONDUCTANCE (umhos)	ALKALINITY (mg/l)	CHLORIDES (mg/l)	DICATIONS (meq/l)	TOTAL IRON (mg/l)	FERROUS IRON (mg/l)
H-02a	Culebra	3	01-19-89	83.90	7.88	19.2	1.0142 @ 19.4 C	14100	56.9	4129	50.4	1.15	0.99
H-14	Culebra	3	02-14-89	270.00	7.76	20.5	1.0142 @ 20.5 C	24300	38.1	8502	132.9	0.44	0.37
H-03b3	Culebra	4	03-02-89	362.00	7.46	22.2	1.036 @ 22.2 C	68100	50.4	27639	139.1	0.15	0.13
H-04B	Culebra	4	04-06-89	194.00	7.81	21.5	1.0160 @ 21.4 C	24500	68.1	7403	72.5	0.48	0.43
H-07b1	Culebra	4	05-19-89	233.00	7.28	22.0	1.0030 @ 22.0 C	3640	117.8	290	40.6	0.14	0.09
WIPP-25	Culebra	4	06-27-89	188.00	7.28	22.4	1.0110 @ 22.7 C	22000	129.8	6933	89.3	0.72	0.63
H-06b	Culebra	4	07-24-89	284.00	7.01	22.2	1.0444 @ 22.3 C	75000	97.4	31615	188.6	0.44	0.38
H-05b	Culebra	4	08-23-89	182.00	7.35	22.3	1.1022 @ 23.0 C	153000	52.5	84385	258.5	3.06	2.88
WIPP-19	Culebra	4	10-18-89	168.00	7.28	21.2	1.0564 @ 20.9 C	92400	61.1	40440	187.2	1.71	1.49
H-11b3	Culebra	4	10-25-89	187.00	7.34	23.1	1.0804 @ 23.1 C	128900	58.5	63473	192.4	0.46	0.31
H-02c	Culebra	1	12-13-89	173.00	7.84	18.4	1.0202 @ 22.0 C	13500	58.3	3836	52.4	0.79	0.57
H-03b1	Magenta	4	03-16-89	24.00	7.93	22.4	1.0085 @ 21.4 C	12204	46.6	3299	73.9	0.03	LD
H-04c	Magenta	4	04-21-89	-63.00	7.95	19.8	1.0200 @ 26.8 C	30400	79.7	8407	68.9	0.2	0.14
H-06c	Magenta	4	08-04-89	209.00	7.81	22.7	1.0046 @ 22.6 C	5230	52.5	404	40.6	0.31	0.21
H-05c	Magenta	4	09-14-89	206.00	7.95	22.0	1.0080 @ 22.1 C	8460	57.2	1023	42.8	0.21	0.18
Barn Well	Dewey Lake	3	07-13-89	NT	7.71	22.4	1.008 @ 27.8 C	1113	283.4	46.8	6.5	NT	NT
Ranch Well	Dewey Lake	4	07-12-89	NT	7.42	21.2	1.0018 @ 27.8 C	3550	250.8	328	31.8	NT	NT
Twin Wells Pasture	Dewey Lake	3	09-28-89	NT	7.71	NT	1.0016 @ 23.6 C	612	221.0	38.5	4.1	NT	NT

NOTE: DEWEY LAKE WELLS WERE NOT SERIALLY SAMPLED.
ALKALINITY, CHLORIDE, DICATIONS, TOTAL IRON AND FERROUS IRON ARE AVG. VALUES

LAST DAY SAMPLING RESULTS FOR EACH WELL
SAMPLED IN 1990

WELL	ZONE	ROUND	DATE SAMPLED	Eh (mv)	pH (S.U.)	TEMP (C)	SPECIFIC GRAVITY	SPECIFIC CONDUCTANCE (umhos)	ALKALINITY (mg/l)	CHLORIDES (mg/l)	DICATIONS (meq/l)	TOTAL IRON (mg/l)	FERROUS IRON (mg/l)
H-09b	Culebra	4	01-19-90	197.00	7.36	21.0	1.0040 @ 21.1 C	3430	116.2	169	43.0	0.09	0.05
Engle	Culebra	3	01-31-90	NT	7.46	NT	1.0033 @ 20.2 C	2990	79.0	232	42.7	NT	NT
H-06b	Culebra	5	02-12-90	213.00	7.04	21.5	1.0448 @ 21.5 C	75300	95.4	32218	196.5	0.36	0.29
H-18	Culebra	3	04-10-90	233.00	7.72	21.5	1.0200 @ 21.5 C	39300	51.6	13966	100.7	0.38	0.33
H-05b	Culebra	5	05-02-90	144.00	7.29	20.3	1.1040 @ 20.2 C	155900	50.9	86330	262.8	2.76	2.44
WIPP-19	Culebra	5	06-12-90	204.00	7.31	23.1	1.0546 @ 23.2 C	91800	59.4	40508	178.9	0.83	0.72
H-02c	Culebra	2	07-24-90	245.00	7.72	22.2	1.0100 @ 22.3 C	12510	60.9	2999	48.7	1.19	1.07
H-03b3	Culebra	5	08-15-90	175.00	7.45	22.2	1.0400 @ 22.4 C	69300	50.5	27695	137.9	0.24	0.19
H-04b	Culebra	5	09-12-90	114.00	7.76	22.1	1.0164 @ 21.5 C	26400	69.1	7577	71.4	1.01	0.89
H-11b3	Culebra	5	10-17-90	119.00	7.38	21.8	1.0804 @ 21.3 C	133800	54.1	65451	185.2	0.47	0.38
H-07b1	Culebra	5	11-08-90	335.00	7.34	20.8	1.0026 @ 20.8 C	3620	112.8	276	47.6	0.21	0.17
H-06c	Magenta	5	03-15-90	224.00	7.83	21.2	1.0034 @ 21.2	5200	51.0	404	41.5	0.10	0.07
H-05c	Magenta	5	05-16-90	-4.00	7.95	21.8	1.0062 @ 21.8 C	8480	59.2	1028	42.6	0.18	0.10
H-03b1	Magenta	5	08-28-90	-5.00	7.75	23.6	1.0080 @ 23.2 C	12200	45.9	3458	73.7	LD	LD
H-04c	Magenta	5	10-02-90	-61.00	8.01	20.6	1.0202 @ 20.4 C	30900	80.9	8493	70.1	0.17	0.10
Twin Well	Dewey Lake	4	06-01-90	NT	7.70	NT	1.0028 @ 23.2 C	614	218.9	56	5.5	NT	NT
Pasture Ranch Well	Dewey Lake	5	06-20-90	NT	7.24	NT	1.0014 @ 23.7 C	3020	247.7	358	38.5	NT	NT
Barn Well	Dewey Lake	4	06-21-90	NT	7.58	NT	1.0008 @ 25.2 C	1070	284.1	56	5.0	NT	NT

NOTE: DEWEY LAKE WELLS WERE NOT SERIALLY SAMPLED.
ALKALINITY, CHLORIDE, DICATIONS, TOTAL IRON AND FERROUS IRON ARE AVG. VALUES

DOE/WI

APPENDIX VI

TABULATED RESULTS

OF

CONTRACT LABORATORY ANALYSIS

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CONTRACT LABORATORY ANALYSIS

H-09b, CULEBRA, ROUND 4

GENERAL CHEMISTRY

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
pH		7.4100		7.4200				01-19-90
Specific Conductance		3590.0000		3590.0000			uMhos/cm@25C	01-19-90
Alkalinity (HCO3)		120.0000		0.0000			mg/l	01-19-90
Bromide	<	2.0000	<	2.0000			mg/l	01-19-90
Chloride		160.0000		160.0000			mg/l	01-19-90
Alkalinity (CO3)		0.0000	NA	0.0000			mg/l	01-19-90
Cyanide	<	0.0100	NA	0.0000			mg/l	01-19-90
Fluoride		3.5000	NA	0.0000			mg/l	01-19-90
Iodide	<	2.0000	<	2.0000			mg/l	01-19-90
Nitrate		0.1100		0.1100			mg/l	01-19-90
Total Phenolics		0.0060	NA	0.0000			mg/l	01-19-90
Phosphorus	<	0.0100	<	0.0100			mg/l	01-19-90
Residue, Filterable @ 180 c		3300.0000		3300.0000			mg/l	01-19-90
Residue, Nonfilterable @ 105 c	<	4.0000	<	4.0000			mg/l	01-19-90
Silica		12.0000		12.0000			mg/l	01-19-90
Sulfate		1800.0000		1900.0000			mg/l	01-19-90
Total Organic Carbon		1.0000	<	1.0000			mg/l	01-19-90
Total Organic Halides	<	0.0500	<	0.0500			mg/l	01-19-90

CONTRACT LABORATORY ANALYSIS

H-09b, CULEBRA, ROUND 4

METALS ANALYSIS

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DA
Calcium		650.0000		580.0000			mg/l	01-1
Magnesium		160.0000		130.0000			mg/l	01-1
Potassium		8.3000		8.2000			mg/l	01-1
Sodium		100.0000		100.0000			mg/l	01-1
Aluminum	<	0.2000	<	0.2000	< .2	< .2	mg/l	01-1
Antimony		0.0900		0.1200	< .06	< .06	mg/l	01-1
Arsenic	<	0.0100	NA	0.0000	< .01	< .01	mg/l	01-1
Barium	<	0.2000	<	0.2000	< .2	< .2	mg/l	01-1
Beryllium	<	0.0050	<	0.0500	< .005	< .005	mg/l	01-1
Boron		0.6000		0.5300	< .02	< .02	mg/l	01-1
Cadmium		0.0090		0.0140	< .005	< .005	mg/l	01-1
Cesium	<	0.2000	<	0.2000	< .2	< .2	mg/l	01-1
Chromium		0.0200		0.0400	< .01	< .01	mg/l	01-1
Cobalt	<	0.0500	<	0.0500	< .05	< .05	mg/l	01-1
Copper	<	0.0250	<	0.0250	< .025	< .025	mg/l	01-1
Iron	<	0.1000	<	0.1000	< .1	< .1	mg/l	-1
Lead		0.0600		0.1100	< .05	< .05	mg/l	01-1
Lithium		0.2000		0.2000	< .01	< .01	mg/l	01-1
Manganese		0.2100		0.0330	< .015	< .015	mg/l	01-1
Mercury	<	0.0002	<	0.0002	< .0002	< .0002	mg/l	01-
Molybdenum		0.0500		0.0500	< .02	< .02	mg/l	01-
Nickel	<	0.0400	<	0.0400	< .04	< .04	mg/l	01-
Selenium	<	0.0500	NA	0.0000	< .005	< .005	mg/l	01-
Silver		0.0200		0.0300	< .01	< .01	mg/l	01-
Strontium		7.5000		6.4000	< .01	< .01	mg/l	01-
Thallium	<	10.0000	NA	0.0000	< .01	< .01	mg/l	01-
Titanium		0.0100	<	0.0100	< .01	< .01	mg/l	01-
Vanadium	<	0.0500	<	0.0500	< .05	< .05	mg/l	01-
Zinc	<	0.0200	<	0.0200	< .02	< .02	mg/l	01-

CONTRACT LABORATORY ANALYSIS

H-09b, CULEBRA, ROUND 4

VOLATILE HAZARDOUS SUBSTANCES

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
Chloromethane	<	10.0000	NA	0.0000	< 10 T	< 10 M	ug/l	01-19-90
Bromomethane	<	10.0000	NA	0.0000	< 10 T	< 10 M	ug/l	01-19-90
Vinyl chloride	<	10.0000	NA	0.0000	< 10 T	< 10 M	ug/l	01-19-90
Chloroethane	<	10.0000	NA	0.0000	< 10 T	< 10 M	ug/l	01-19-90
Methylene chloride	<	6.0000	NA	0.0000	15 T	< 5 M	ug/l	01-19-90
Acetone	<	10.0000	NA	0.0000	< 10 T	< 10 M	ug/l	01-19-90
Carbon disulfide	<	5.0000	NA	0.0000	< 5 T	< 5 M	ug/l	01-19-90
1,1-Dichloroethene	<	5.0000	NA	0.0000	< 5 T	< 5 M	ug/l	01-19-90
1,1-Dichloroethane	<	5.0000	NA	0.0000	< 5 T	< 5 M	ug/l	01-19-90
1,2-Dichloroethene	<	5.0000	NA	0.0000	< 5 T	< 5 M	ug/l	01-19-90
Chloroform	<	5.0000	NA	0.0000	< 5 T	< 5 M	ug/l	01-19-90
1,2-Dichloroethane	<	5.0000	NA	0.0000	< 5 T	< 5 M	ug/l	01-19-90
2-Butanone	<	10.0000	NA	0.0000	< 10 T	< 10 M	ug/l	01-19-90
1,1,1-Trichloroethane	<	5.0000	NA	0.0000	< 5 T	< 5 M	ug/l	01-19-90
Carbon tetrachloride	<	5.0000	NA	0.0000	< 5 T	< 5 M	ug/l	01-19-90
Vinyl acetate	<	10.0000	NA	0.0000	< 10 T	< 10 M	ug/l	01-19-90
Bromodichloromethane	<	5.0000	NA	0.0000	< 5 T	< 5 M	ug/l	01-19-90
FREON 113	<	50.0000	NA	0.0000	< 50 T	< 50 M	ug/l	01-19-90
1,2-Dichloropropane	<	5.0000	NA	0.0000	< 5 T	< 5 M	ug/l	01-19-90
cis-1,3-Dichloropropene	<	5.0000	NA	0.0000	< 5 T	< 5 M	ug/l	01-19-90
Trichloroethene	<	5.0000	NA	0.0000	< 5 T	< 5 M	ug/l	01-19-90
Dibromochloromethane	<	5.0000	NA	0.0000	< 5 T	< 5 M	ug/l	01-19-90

T" IN ACID BLANK COLUMN INDICATES TRIP BLANK

M" IN WATER BLANK COLUMN INDICATES METHOD BLANK

1,1,2-TRICHLORO-1,2,2-TRIFLUORETHANE IS FREON 113

CONTRACT LABORATORY ANALYSIS

H-09b, CULEBRA, ROUND 4

VOLATILE HAZARDOUS SUBSTANCES

(CONTINUED)

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DA
1,1,2-Trichloroethane	<	5.0000	NA	0.0000	< 5 T	< 5 M	ug/l	01-1
Benzene	<	5.0000	NA	0.0000	< 5 T	< 5 M	ug/l	01-1
trans-1,3-Dichloropropene	<	5.0000	NA	0.0000	< 5 T	< 5 M	ug/l	01-1
Bromoform	<	5.0000	NA	0.0000	< 5 T	< 5 M	ug/l	01-1
4-Methyl-2-pentanone	<	10.0000	NA	0.0000	< 10 T	< 10 M	ug/l	01-1
2-Hexanone	<	10.0000	NA	0.0000	< 10 T	< 10 M	ug/l	01-1
Tetrachloroethene	<	5.0000	NA	0.0000	< 5 T	< 5 M	ug/l	01-1
1,1,2,2-Tetrachloroethane	<	5.0000	NA	0.0000	< 5 T	< 5 M	ug/l	01-1
Toluene	<	5.0000	NA	0.0000	< 5 T	< 5 M	ug/l	01-1
Chlorobenzene	<	5.0000	NA	0.0000	< 5 T	< 5 M	ug/l	01-1
Ethylbenzene	<	5.0000	NA	0.0000	< 5 T	< 5 M	ug/l	01-1
Styrene	<	5.0000	NA	0.0000	< 5 T	< 5 M	ug/l	01-1
Xylene (total)	<	5.0000	NA	0.0000	< 5 T	< 5 M	ug/l	01-1

T" IN ACID BLANK COLUMN INDICATES TRIP BLANK

M" IN WATER BLANK COLUMN INDICATES METHOD BLANK

CONTRACT LABORATORY ANALYSIS

H-09b, CULEBRA, ROUND 4

SEMIVOLATILE HAZARDOUS SUBSTANCES

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
Phenol	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
bis(2-Chloroethyl)ether	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
2-Chlorophenol	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
1-3-Dichlorobenzene		20.0000	NA	0.0000		13 M	ug/l	01-19-90
1-4-Dichlorobenzene	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
Benzyl alcohol	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
1,2-Dichlorobenzene	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
2-Methylphenol	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
bis(2-Chlorisopropyl)ether	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
4-Methylphenol	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
N-Nitroso-di-n-propylamine	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
Hexachloroethane	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
Nitrobenzene	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
Isophorone	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
2-Nitrophenol	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
2,4-Dimethylphenol	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
Benzoic acid	<	50.0000	NA	0.0000		< 50 M	ug/l	01-19-90
bis(2-Chloroethoxy)methane	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
2,4-Dichlorophenol	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
1,2,4-Trichlorobenzene	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
Naphthalene	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
4-Chloroaniline	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
Hexachlorobutadiene	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
4-Chloro-3-methylphenol	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
2-Methylnaphthalene	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
Hexachlorocyclopentadiene	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
2,4,6-Trichlorophenol	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
2,4,5-Trichlorophenol	<	50.0000	NA	0.0000		< 50 M	ug/l	01-19-90

T" IN ACID BLANK COLUMN INDICATES TRIP BLANK

M" IN WATER BLANK COLUMN INDICATES METHOD BLANK

CONTRACT LABORATORY ANALYSIS

H-09b, CULEBRA, ROUND 4

SEMIVOLATILE HAZARDOUS SUBSTANCES

(CONTINUED)

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
2-Chloronaphthalene	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-
2-Nitroaniline	<	50.0000	NA	0.0000		< 50 M	ug/l	01-19-
Dimethylphthalate	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-
Acenaphthylene	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-
2,6-Dinitrotoluene	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-
3-Nitroaniline	<	50.0000	NA	0.0000		< 50 M	ug/l	01-19-
Acenaphthene	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19
2,4-Dinitrophenol	<	50.0000	NA	0.0000		< 50 M	ug/l	01-19
4-Nitrophenol	<	50.0000	NA	0.0000		< 50 M	ug/l	01-19
Dibenzofuran	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19
2,4-Dinitrotoluene	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19
Diethylphthalate	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19
4-Chlorophenyl-phenylether	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19
Fluorene	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19
4-Nitroaniline	<	50.0000	NA	0.0000		< 50 M	ug/l	01-19
4,6-Dinitro-2-methylphenol	<	50.0000	NA	0.0000		< 50 M	ug/l	-19
N-Nitrosodiphenylamine	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19
4-Bromophenyl-phenylether	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19
Hexachlorobenzene	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19
Pentachlorophenol	<	50.0000	NA	0.0000		< 50 M	ug/l	01-19
Phenanthrene	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19
Anthracene	<	10.0000	NA	0.0000		< 10 M	ug/l	01-1
Di-n-butylphthalate	<	10.0000	NA	0.0000		< 10 M	ug/l	01-1
Fluoranthene	<	10.0000	NA	0.0000		< 10 M	ug/l	01-1
Pyrene	<	10.0000	NA	0.0000		< 10 M	ug/l	01-1
Butylbenzylphthalate	<	10.0000	NA	0.0000		< 10 M	ug/l	01-1
3,3'-Dichlorobenzidine	<	20.0000	NA	0.0000		< 20 M	ug/l	01-1
Benzo(a)anthracene	<	10.0000	NA	0.0000		< 10 M	ug/l	01-1

T" IN ACID BLANK COLUMN INDICATES TRIP BLANK

M" IN WATER BLANK COLUMN INDICATES METHOD BLANK

CONTRACT LABORATORY ANALYSIS

H-09b, CULEBRA, ROUND 4

SEMIVOLATILE HAZARDOUS SUBSTANCES

(CONTINUED)

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
Chrysene	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
bis(2-Ethylhexyl)phthalate	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
Di-n-octylphthalate	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
Benzo(b)fluoranthene	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
Benzo(k)fluoranthene	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
Benzo(a)pyrene	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
Indeno(1,2,3-cd)pyrene	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
Dibenzo(a,h,)anthracene	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90
Benzo(g,h,i)perylene	<	10.0000	NA	0.0000		< 10 M	ug/l	01-19-90

T" IN ACID BLANK COLUMN INDICATES TRIP BLANK

M" IN WATER BLANK COLUMN INDICATES METHOD BLANK

CONTRACT LABORATORY ANALYSIS

H-09b, CULEBRA, ROUND 4

POLYCHLORINATED BIPHENYLS

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	D/
Aroclor 1016	<	0.5000	NA	0.0000		< .5 M	ug/l	01-
Aroclor 1221	<	0.5000	NA	0.0000		< .5 M	ug/l	01-
Aroclor 1232	<	0.5000	NA	0.0000		< .5 M	ug/l	01-
Aroclor 1242	<	0.5000	NA	0.0000		< .5 M	ug/l	01-
Aroclor 1248	<	0.5000	NA	0.0000		< .5 M	ug/l	01-
Aroclor 1254	<	1.0000	NA	0.0000		<1.0 M	ug/l	01-
Aroclor 1260	<	1.0000	NA	0.0000		<1.0 M	ug/l	01-

T" IN ACID BLANK COLUMN INDICATES TRIP BLANK

M" IN WATER BLANK COLUMN INDICATES METHOD BLANK

CONTRACT LABORATORY ANALYSIS

ENGLE WELL, CULEBRA, ROUND 3

GENERAL CHEMISTRY

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
pH		7.1000		7.1100				01-31-90
Specific Conductance		4060.0000		4060.0000			uMhos/cm@25C	01-31-90
Alkalinity (HCO3)		110.0000		110.0000			mg/l	01-31-90
Bromide	<	2.0000	<	2.0000			mg/l	01-31-90
Calcium Hardness		1500.0000		1500.0000			mg/l	01-31-90
Total Hardness		2200.0000	NA	0.0000			mg/l	01-31-90
Chloride		190.0000	NA	0.0000			mg/l	01-31-90
Alkalinity (CO3)		0.0000	NA	0.0000			mg/l	01-31-90
Cyanide	<	0.0100	NA	0.0000			mg/l	01-31-90
Fluoride		2.8000	NA	0.0000			mg/l	01-31-90
Iodide	<	2.0000	<	2.0000			mg/l	01-31-90
Nitrate		0.1100		0.1200			mg/l	01-31-90
Total Phenolics		0.0060		0.0000			mg/l	01-31-90
Phosphorus	<	0.0100	NA	0.0000			mg/l	01-31-90
Residue, Filterable @ 180 c		3600.0000		3600.0000			mg/l	01-31-90
Residue, Nonfilterable @ 105 c	<	4.0000	<	4.0000			mg/l	01-31-90
Silica		12.0000		12.0000			mg/l	01-31-90
Sulfate		1900.0000		2000.0000			mg/l	01-31-90
Total Organic Carbon	<	1.0000	<	1.0000			mg/l	01-31-90
Total Organic Halides	<	0.0500	<	0.0500			mg/l	01-31-90

CONTRACT LABORATORY ANALYSIS

ENGLE WELL, CULEBRA, ROUND 3

METALS ANALYSIS

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DA
Calcium		610.0000		610.0000	< 0.1	< 0.1	mg/l	01-3
Magnesium		150.0000		150.0000	< 0.1	< 0.1	mg/l	01-3
Potassium		7.6000		7.5000	< 0.1	< 0.1	mg/l	01-3
Sodium		220.0000		220.0000	< 0.1	< 0.1	mg/l	01-3
Aluminum		0.2000		0.2000	< 0.1	< 0.1	mg/l	01-
Antimony		0.1200		0.1000	< .05	< .05	mg/l	01-
Arsenic	<	0.0020	NA	0.0000	< .002	< .002	mg/l	01-
Barium	<	0.0500	<	0.0500	< .005	< .005	mg/l	01-
Beryllium	<	0.0050	<	0.0050	< .005	< .005	mg/l	01-
Boron		1.2000		1.3000	< 0.02	< 0.02	mg/l	01-
Cadmium		0.0130		0.0110	< .005	< .005	mg/l	01-
Cesium	<	0.2000	<	0.2000	< 0.2	< 0.2	mg/l	01-
Chromium		0.0600		0.0600	< .02	< .01	mg/l	01-
Cobalt		0.0200		0.0200	< .01	< .01	mg/l	01-
Copper	<	0.1000	<	0.1000	< .01	< .01	mg/l	01-
Iron	<	0.0300	<	0.0300	< .03	< .03	mg/l	01-
Lead		0.0900		0.0800	< .05	< .05	mg/l	01
Lithium		0.1600		0.1600	< .01	< .01	mg/l	01
Manganese		0.0390		0.0360	< .005	< .005	mg/l	01
Mercury	<	0.0002	<	0.0002	< .0002	< .0002	mg/l	01
Molybdenum		0.0500		0.0500	< .02	< .02	mg/l	01
Nickel		0.0300	<	0.0300	< .03	< .03	mg/l	01
Selenium	<	0.2000	NA	0.0000	< .002	< .002	mg/l	01
Silver		0.0200		0.0200	< .01	< .01	mg/l	0
Strontium		7.9000		8.0000	< .01	< .01	mg/l	0
Thallium	<	0.0100	NA	0.0000	< .001	< .001	mg/l	0
Titanium	<	0.0100	<	0.0100	< .01	< .01	mg/l	0
Vanadium		0.0400		0.0400	< .01	< .01	mg/l	0
Zinc		2.2000		2.2000	< .02	< .02	mg/l	0

CONTRACT LABORATORY ANALYSIS

ENGLE WELL, CULEBRA, ROUND 3

VOLATILE HAZARDOUS SUBSTANCES

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
Chloromethane	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	01-31-90
Bromomethane	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	01-31-90
Vinyl chloride	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	01-31-90
Chloroethane	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	01-31-90
Methylene chloride	<	5.0000	NA	0.0000	T 6	M 6	ug/l	01-31-90
Acetone	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	01-31-90
Carbon disulfide	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	01-31-90
1,1-Dichloroethene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	01-31-90
1,1-Dichloroethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	01-31-90
1,2-Dichloroethene(Total)	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	01-31-90
Chloroform	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	01-31-90
1,2-Dichloroethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	01-31-90
2-Butanone	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	01-31-90
1,1,1-Trichloroethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	01-31-90
Carbon tetrachloride	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	01-31-90
Vinyl acetate	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	01-31-90
Bromodichloromethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	01-31-90
Freon-113	<	50.0000	NA	0.0000	T< 50	M< 50	ug/l	01-31-90
1,2-Dichloropropane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	01-31-90
cis-1,3-Dichloropropene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	01-31-90
Trichloroethene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	01-31-90
Dibromochloromethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	01-31-90
1,1,2-Trichloroethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	01-31-90
Benzene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	01-31-90
trans-1,3-Dichloropropene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	01-31-90
Bromoform	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	01-31-90
4-Methyl-2-pentanone	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	01-31-90
2-Hexanone	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	01-31-90
Tetrachloroethene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	01-31-90

CONTRACT LABORATORY ANALYSIS

ENGLE WELL, CULEBRA, ROUND 3

VOLATILE HAZARDOUS SUBSTANCES

(CONTINUED)

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DA
1,1,2,2-Tetrachloroethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	01-3
Toluene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	01-3
Chlorobenzene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	01-3
Ethylbenzene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	01-3
Styrene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	01-3
Xylene (total)	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	01-3

NOTE: "T" IN ASCID BLANK COLUMN INDICATES TRIP BLANK

"M" IN WATERBLANK COLUMN INDICATES METHOD BLANK

Freon-133 is 1,1,2-Trichloro-1,2,2-Trifluoroethane

CONTRACT LABORATORY ANALYSIS

ENGLE WELL, CULEBRA, ROUND 3

SEMIVOLATILE HAZARDOUS SUBSTANCES

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
Phenol	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
bis(2-Chloroethyl)ether	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
2-Chlorophenol	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
1-3-Dichlorobenzene	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
1-4-Dichlorobenzene	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
Benzyl alcohol	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
1,2-Dichlorobenzene	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
2-Methylphenol	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
bis(2-Chlorisopropyl)ether	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
4-Methylphenol	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
N-Nitroso-di-n-propylamine	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
Hexachloroethane	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
Nitrobenzene	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
Isophorone	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
2-Nitrophenol	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
2,4-Dimethylphenol	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
Benzoic acid	<	50.0000	NA	0.0000		M< 50	ug/l	01-31-90
bis(2-Chloroethoxy)methane	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
2,4-Dichlorophenol	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
1,2,4-Trichlorobenzene	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
Naphthalene	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
4-Chloroaniline	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
Hexachlorobutadiene	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
4-Chloro-3-methylphenol	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
2-Methylnaphthalene	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
Hexachlorocyclopentadiene	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
2,4,6-Trichlorophenol	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
2,4,5-Trichlorophenol	<	50.0000	NA	0.0000		M< 50	ug/l	01-31-90

CONTRACT LABORATORY ANALYSIS

ENGLE WELL, CULEBRA, ROUND 3

SEMIVOLATILE HAZARDOUS SUBSTANCES

(CONTINUED)

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DA
2-Chloronaphthalene	<	10.0000	NA	0.0000		M< 10	ug/l	01-3
2-Nitroaniline	<	50.0000	NA	0.0000		M< 50	ug/l	01-3
Dimethylphthalate	<	10.0000	NA	0.0000		M< 10	ug/l	01-3
Acenaphthylene	<	10.0000	NA	0.0000		M< 10	ug/l	01-3
2,6-Dinitrotoluene	<	10.0000	NA	0.0000		M< 10	ug/l	01-3
3-Nitroaniline	<	50.0000	NA	0.0000		M< 50	ug/l	01-3
Acenaphthene	<	10.0000	NA	0.0000		M< 10	ug/l	01-
2,4-Dinitrophenol	<	50.0000	NA	0.0000		M< 50	ug/l	01-
4-Nitrophenol	<	50.0000	NA	0.0000		M< 50	ug/l	01-
Dibenzofuran	<	10.0000	NA	0.0000		M< 10	ug/l	01-
2,4-Dinitrotoluene	<	10.0000	NA	0.0000		M< 10	ug/l	1-
Diethylphthalate	<	10.0000	NA	0.0000		M< 10	ug/l	01-
4-Chlorophenyl-phenylether	<	10.0000	NA	0.0000		M< 10	ug/l	01-
Fluorene	<	10.0000	NA	0.0000		M< 10	ug/l	01-
4-Nitroaniline	<	50.0000	NA	0.0000		M< 50	ug/l	01-
4,6-Dinitro-2-methylphenol	<	50.0000	NA	0.0000		M< 50	ug/l	01-
N-Nitrosodiphenylamine	<	10.0000	NA	0.0000		M< 10	ug/l	01-
4-Bromophenyl-phenylether	<	10.0000	NA	0.0000		M< 10	ug/l	01-
Hexachlorobenzene	<	10.0000	NA	0.0000		M< 10	ug/l	01-
Pentachlorophenol	<	50.0000	NA	0.0000		M< 50	ug/l	01-
Phenanthrene	<	10.0000	NA	0.0000		M< 10	ug/l	01-
Anthracene	<	10.0000	NA	0.0000		M< 10	ug/l	01-
Di-n-butylphthalate	<	10.0000	NA	0.0000		M< 10	ug/l	01
Fluoranthene	<	10.0000	NA	0.0000		M< 10	ug/l	01
Pyrene	<	10.0000	NA	0.0000		M< 10	ug/l	01
Butylbenzylphthalate	<	10.0000	NA	0.0000		M< 10	ug/l	01
3,3'-Dichlorobenzidine	<	20.0000	NA	0.0000		M< 20	ug/l	01
Benzo(a)anthracene	<	10.0000	NA	0.0000		M< 10	ug/l	01

CONTRACT LABORATORY ANALYSIS

ENGLE WELL, CULEBRA, ROUND 3

SEMIVOLATILE HAZARDOUS SUBSTANCES

(CONTINUED)

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
Chrysene	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
bis(2-Ethylhexyl)phthalate	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
Di-n-octylphthalate	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
Benzo(b)fluoranthene	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
Benzo(k)fluoranthene	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
Benzo(a)pyrene	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
Indeno(1,2,3-cd)pyrene	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
Dibenzo(a,h,)anthracene	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90
Benzo(g,h,i)perylene	<	10.0000	NA	0.0000		M< 10	ug/l	01-31-90

NOTE: "T" IN ASCID BLANK COLUMN INDICATES TRIP BLANK

"M" IN WATERBLANK COLUMN INDICATES METHOD BLANK

CONTRACT LABORATORY ANALYSIS

ENGLE WELL, CULEBRA, ROUND 3

PESTICIDE ANALYSIS

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DA
Lindane	<	0.0500	NA	0.0000		M< .05	ug/l	01-:
Endrin	<	0.1000	NA	0.0000		M< .10	ug/l	01-:
Methoxychlor	<	0.5000	NA	0.0000		M< .50	ug/l	01-:
Toxaphene	<	1.0000	NA	0.0000		M< 1.0	ug/l	01-:
2,4-D	<	12.0000	NA	0.0000		M< 12	ug/l	1-:
2,4,5-TP(Silvex)	<	1.7000	NA	0.0000		M< 1.7	ug/l	01-:

NOTE: "T" IN ASCID BLANK COLUMN INDICATES TRIP

"M" IN WATERBLANK COLUMN INDICATES METHO

CONTRACT LABORATORY ANALYSIS

H-06b, CULEBRA, ROUND 5

GENERAL CHEMISTRY

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
pH		6.9000		6.9000				02-12-90
Specific Conductance		77600.0000		77800.0000			uMhos/cm@25C	02-12-90
Alkalinity (HCO3)		93.0000	NA	0.0000			mg/l	02-12-90
Bromide	<	23.0000		22.0000			mg/l	02-12-90
Chloride		28000.0000	NA	0.0000			mg/l	02-12-90
Alkalinity (CO3)		0.0000	NA	0.0000			mg/l	02-12-90
Cyanide	<	0.0100	NA	0.0000			mg/l	02-12-90
Fluoride		1.4000		1.4000			mg/l	02-12-90
Iodide	<	2.0000	<	2.0000			mg/l	02-12-90
Nitrate		0.0800	NA	0.0000			mg/l	02-12-90
Total Phenolics		0.5500	NA	0.0000			mg/l	02-12-90
Total Phosphorus	<	0.0100	NA	0.0000			mg/l	02-12-90
Residue, Filterable @ 180 c		66000.0000		66000.0000			mg/l	02-12-90
Residue, Nonfilterable @ 105 c	<	8.0000		7.0000			mg/l	02-12-90
Silica		8.3000		8.3000			mg/l	02-12-90
Sulfate		3400.0000		3400.0000			mg/l	02-12-90
Total Organic Carbon		7.0000		7.0000			mg/l	02-12-90
Total Organic Halides		0.1800		0.1400			mg/l	02-12-90

CONTRACT LABORATORY ANALYSIS

H-06b, CULEBRA, ROUND 5

METALS ANALYSIS

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DAT
Calcium		2100.0000		2100.0000			mg/l	02-1
Magnesium		1000.0000		1000.0000			mg/l	02-1
Potassium		600.0000		500.0000			mg/l	02-1
Sodium		15000.0000		15500.0000			mg/l	02-1
Aluminum	<	2.0000	<	2.0000			mg/l	02-1
Antimony	<	0.6000	<	0.6000			mg/l	02-1
Arsenic	<	0.0100	NA	0.0000			mg/l	02-1
Barium	<	2.0000	<	2.0000			mg/l	02-1
Beryllium	<	0.0500	<	0.0500			mg/l	02-1
Boron		9.8000		9.7000			mg/l	02-1
Cadmium	<	0.0500	<	0.0500			mg/l	02-1
Cesium	<	0.1000	<	0.1000			mg/l	-1
Chromium		0.2000		0.3000			mg/l	02-1
Cobalt		0.5000	<	0.5000			mg/l	02-1
Copper	<	0.2500	<	0.2500			mg/l	02-1
Iron	<	1.0000	<	1.0000			mg/l	02-1
Lead	<	0.5000	<	0.5000			mg/l	02-1
Lithium		0.5000		0.5000			mg/l	02-1
Manganese		0.2500		0.2600			mg/l	02-1
Mercury	<	0.0002	<	0.0002			mg/l	02-1
Molybdenum	<	0.2000	<	0.2000			mg/l	02-1
Nickel	<	0.4000	<	0.4000			mg/l	02-
Selenium	<	0.5000	NA	0.0000			mg/l	02-
Silver	<	0.1000		0.1000			mg/l	02-
Strontium		30.0000		30.0000			mg/l	02-
Thallium	<	10.0000	NA	0.0000			mg/l	02-
Titanium	<	0.1000	<	0.1000			mg/l	02-
Vanadium	<	0.5000	<	0.5000			mg/l	02-
Zinc	<	0.2000	<	0.2000			mg/l	02-

CONTRACT LABORATORY ANALYSIS

H-06b, CULEBRA, ROUND 5

VOLATILE HAZARDOUS SUBSTANCES

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
Chloromethane	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	02-12-90
Bromomethane	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	02-12-90
Vinyl chloride	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	02-12-90
Chloroethane	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	02-12-90
Methylene chloride	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	02-12-90
Acetone	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	02-12-90
Carbon disulfide	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	02-12-90
1,1-Dichloroethene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	02-12-90
1,1-Dichloroethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	02-12-90
1,2-Dichloroethene(Total)	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	02-12-90
Chloroform	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	02-12-90
1,2-Dichloroethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	02-12-90
2-Butanone	<	10.0000	NA	0.0000	T< 10	16	ug/l	02-12-90
1,1,1-Trichloroethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	02-12-90
Carbon tetrachloride	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	02-12-90
Vinyl acetate	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	02-12-90
Bromodichloromethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	02-12-90
Freon-113	<	50.0000	NA	0.0000	T< 50	M< 50	ug/l	02-12-90
1,2-Dichloropropane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	02-12-90
cis-1,3-Dichloropropene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	02-12-90
Trichloroethene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	02-12-90
Dibromochloromethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	02-12-90

CONTRACT LABORATORY ANALYSIS

H-06b, CULEBRA, ROUND 5

VOLATILE HAZARDOUS SUBSTANCES

(CONTINUED)

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DA
1,1,2-Trichloroethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	02-1
Benzene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	02-1
trans-1,3-Dichloropropene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	02-1
Bromoform	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	02-1
4-Methyl-2-pentanone	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	02-1
2-Hexanone	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	02-1
Tetrachloroethene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	02-1
1,1,2,2-Tetrachloroethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	02-1
Toluene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	02-1
Chlorobenzene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	02-1
Ethylbenzene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	2-1
Styrene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	02-1
Xylene (total)	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	02-

NOTE: "T" IN ASCID BLANK COLUMN INDICATES TRIP

"M" IN WATERBLANK COLUMN INDICATES METHO

Freon-133 is 1,1,2-Trichloro-1,2,2-Trifluoroethane

CONTRACT LABORATORY ANALYSIS

H-06c, MAGENTA, ROUND 5

GENERAL CHEMISTRY

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
pH		7.4500		7.4600				03-15-90
Specific Conductance		6600.0000		6600.0000			uMhos/cm@25C	03-15-90
Alkalinity (HCO3)		51.0000		54.0000			mg/l	03-15-90
Bromide	<	2.0000	<	2.0000			mg/l	03-15-90
Calcium Hardness		0.0000		0.0000			mg/l	03-15-90
Total Hardness		0.0000	NA	0.0000			mg/l	03-15-90
Chloride		390.0000	NA	0.0000			mg/l	03-15-90
Alkalinity (CO3)		0.0000	NA	0.0000			mg/l	03-15-90
Cyanide	<	0.0100	<	0.0200			mg/l	03-15-90
Fluoride		1.9000		1.9000			mg/l	03-15-90
Iodide	<	2.0000	<	2.0000			mg/l	03-15-90
Nitrate	<	0.0200	<	0.0200			mg/l	03-15-90
Total Phenolics	<	0.0050		0.0000			mg/l	03-15-90
Phosphorus	<	0.0100	NA	0.0000			mg/l	03-15-90
Residue, Filterable @ 180 c		4800.0000		4800.0000			mg/l	03-15-90
Residue, Nonfilterable @ 105 c		10.0000		7.0000			mg/l	03-15-90
Silica		5.1000		5.1000			mg/l	03-15-90
Sulfate		2600.0000		2500.0000			mg/l	03-15-90
Total Organic Carbon		1.0000		1.0000			mg/l	03-15-90
Total Organic Halides	<	0.0500	<	0.0500			mg/l	03-15-90

CONTRACT LABORATORY ANALYSIS

H-06c, MAGENTA, ROUND 5

METALS ANALYSIS

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
Calcium		570.0000		570.0000			mg/l	03-15
Magnesium		170.0000		170.0000			mg/l	03-15
Potassium		20.0000		20.0000			mg/l	03-15
Sodium		570.0000		590.0000			mg/l	03-15
Aluminum	<	2.0000	<	2.0000			mg/l	03-15
Antimony	<	0.6000	<	0.6000			mg/l	03-15
Arsenic	<	0.0100	NA	0.0000			mg/l	03-15
Barium	<	2.0000	<	2.0000			mg/l	03-15
Beryllium	<	0.0500	<	0.0500			mg/l	03-15
Boron		2.3000		2.4000			mg/l	03-15
Cadmium	<	0.0500	<	0.0500			mg/l	03-15
Cesium	<	0.2000	<	0.2000			mg/l	15
Chromium	<	0.1000	<	0.1000			mg/l	03-15
Cobalt	<	0.5000	<	0.5000			mg/l	03-15
Copper	<	0.2500	<	0.2500			mg/l	03-15
Iron	<	1.0000	<	1.0000			mg/l	03-15
Lead	<	0.5000	<	0.5000			mg/l	03-15
Lithium		0.2100		0.2100			mg/l	03-15
Manganese	<	0.1500	<	0.1500			mg/l	03-1
Mercury	<	0.0004	<	0.0004			mg/l	03-1
Molybdenum	<	0.2000	<	0.2000			mg/l	03-1
Nickel	<	0.4000	<	0.4000			mg/l	03-1
Selenium	<	0.5000	NA	0.0000			mg/l	03-1
Silver	<	0.1000	<	0.1000			mg/l	03-1
Strontium		10.0000		10.0000			mg/l	03-1
Thallium	<	0.1000	NA	0.0000			mg/l	03-1
Titanium	<	0.1000	<	0.1000			mg/l	03-1
Vanadium	<	0.5000	<	0.5000			mg/l	03-1
Zinc	<	0.2000	<	0.2000			mg/l	03-1

CONTRACT LABORATORY ANALYSIS

H-06c, MAGENTA, ROUND 5

VOLATILE HAZARDOUS SUBSTANCES

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
Chloromethane	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	03-15-90
Bromomethane	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	03-15-90
Vinyl chloride	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	03-15-90
Chloroethane	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	03-15-90
Methylene chloride	<	5.0000	NA	0.0000	T < 5	M< 5	ug/l	03-15-90
Acetone	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	03-15-90
Carbon disulfide	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	03-15-90
1,1-Dichloroethene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	03-15-90
1,1-Dichloroethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	03-15-90
1,2-Dichloroethene(Total)	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	03-15-90
Chloroform	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	03-15-90
1,2-Dichloroethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	03-15-90
2-Butanone	<	10.0000	NA	0.0000	T< 10	M 13	ug/l	03-15-90
1,1,1-Trichloroethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	03-15-90
Carbon tetrachloride	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	03-15-90
Vinyl acetate	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	03-15-90
Bromodichloromethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	03-15-90
1,2-Dichloropropane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	03-15-90
cis-1,3-Dichloropropene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	03-15-90
Trichloroethene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	03-15-90
Dibromochloromethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	03-15-90

CONTRACT LABORATORY ANALYSIS

H-06c, MAGENTA, ROUND 5

VOLATILE HAZARDOUS SUBSTANCES

(CONTINUED)

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DAT
1,1,2-Trichloroethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	03-15
Benzene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	03-15
trans-1,3-Dichloropropene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	03-15
Bromoform	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	03-15
4-Methyl-2-pentanone	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	03-15
2-Hexanone	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	03-15
Tetrachloroethene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	03-15
1,1,2,2-Tetrachloroethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	03-15
Toluene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	03-15
Chlorobenzene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	15
Ethylbenzene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	03-15
Styrene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	03-15
Xylene (total)	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	03-15

NOTE: "T" IN ASCID BLANK COLUMN INDICATES TRIP

"M" IN WATERBLANK COLUMN INDICATES METHO

CONTRACT LABORATORY ANALYSIS

H-18, CULEBRA, ROUND 3

GENERAL CHEMISTRY

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
pH		7.5900		7.6000				04-10-90
Specific Conductance		39300.0000		39300.0000			uMhos/cm@25C	04-10-90
Alkalinity (HCO3)		56.0000	NA	0.0000			mg/l	04-10-90
Bromide		14.0000		14.0000			mg/l	04-10-90
Calcium Hardness		0.0000		0.0000			mg/l	04-10-90
Total Hardness		0.0000	NA	0.0000			mg/l	04-10-90
Chloride		13000.0000		13000.0000			mg/l	04-10-90
Alkalinity (CO3)		0.0000	NA	0.0000			mg/l	04-10-90
Cyanide	<	0.0100	NA	0.0000			mg/l	04-10-90
Fluoride		1.7000		1.7000			mg/l	04-10-90
Iodide	<	2.0000	<	2.0000			mg/l	04-10-90
Nitrate	<	0.2000	NA	0.0000			mg/l	04-10-90
Total Phenolics		0.1200	NA	0.0000			mg/l	04-10-90
Phosphorus	<	0.0100	NA	0.0000			mg/l	04-10-90
Residue, Filterable @ 180 c		31000.0000		31000.0000			mg/l	04-10-90
Residue, Nonfilterable @ 105 c	<	4.0000		7.0000			mg/l	04-10-90
Silica		5.1000	NA	0.0000			mg/l	04-10-90
Sulfate		5200.0000	NA	0.0000			mg/l	04-10-90
Total Organic Carbon		4.0000		5.0000			mg/l	04-10-90
Total Organic Halides		0.4300		0.4100			mg/l	04-10-90

CONTRACT LABORATORY ANALYSIS

H-18, CULEBRA, ROUND 3

METALS ANALYSIS

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DAT
Calcium		1200.0000		1200.0000			mg/l	04-10
Magnesium		520.0000		520.0000			mg/l	04-10
Potassium		300.0000		200.0000			mg/l	04-10
Sodium		8000.0000		8000.0000			mg/l	04-10
Aluminum	<	2.0000	<	2.0000			mg/l	04-10
Antimony	<	0.6000	<	0.6000			mg/l	04-10
Arsenic	<	0.1000	NA	0.0000			mg/l	04-10
Barium	<	2.0000	<	2.0000			mg/l	04-10
Beryllium	<	0.0500	<	0.0500			mg/l	04-10
Boron		16.0000		16.0000			mg/l	04-10
Cadmium	<	0.0500	<	0.0500			mg/l	04-10
Cesium		0.7000		0.8000			mg/l	10
Chromium		0.2000		0.2000			mg/l	04-1
Cobalt	<	0.5000	<	0.5000			mg/l	04-
Copper	<	0.2500	<	0.2500			mg/l	04-1
Iron	<	1.0000	<	1.0000			mg/l	04-1
Lead	<	0.5000	<	0.5000			mg/l	04-1
Lithium		0.2000		0.1000			mg/l	04-1
Manganese		0.2100		0.2000			mg/l	04-1
Mercury	<	0.0002	<	0.0002			mg/l	04-1
Molybdenum	<	0.2000	<	0.2000			mg/l	04-1
Nickel	<	0.4000	<	0.4000			mg/l	04-1
Selenium	<	0.5000	NA	0.0000			mg/l	04-1
Silver	<	0.1000	<	0.1000			mg/l	04-1
Strontium		15.0000		15.0000			mg/l	04-1
Thallium	<	0.5000	NA	0.0000			mg/l	04-
Titanium	<	0.1000	<	0.1000			mg/l	04-
Vanadium	<	0.5000	<	0.5000			mg/l	04-
Zinc	<	0.2000	<	0.2000			mg/l	04-

CONTRACT LABORATORY ANALYSIS
H-18, CULEBRA, ROUND 3
VOLATILE HAZADROUS SUBSTANCES

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
Chloromethane	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	04-10-90
Bromomethane	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	04-10-90
Vinyl chloride	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	04-10-90
Chloroethane	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	04-10-90
Methylene chloride	<	5.0000	NA	0.0000	T 6	M< 5	ug/l	04-10-90
Acetone	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	04-10-90
Carbon disulfide	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	04-10-90
1,1-Dichloroethene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	04-10-90
1,1-Dichloroethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	04-10-90
1,2-Dichloroethene(Total)	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	04-10-90
Chloroform	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	04-10-90
1,2-Dichloroethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	04-10-90
2-Butanone	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	04-10-90
1,1,1-Trichloroethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	04-10-90
Carbon tetrachloride	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	04-10-90
Vinyl acetate	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	04-10-90
Bromodichloromethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	04-10-90
1,2-Dichloropropane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	04-10-90
cis-1,3-Dichloropropene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	04-10-90
Trichloroethene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	04-10-90
Dibromochloromethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	04-10-90
1,1,2-Trichloroethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	04-10-90
Benzene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	04-10-90
trans-1,3-Dichloropropene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	04-10-90
Bromoform	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	04-10-90
4-Methyl-2-pentanone	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	04-10-90
2-Hexanone	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	04-10-90
Tetrachloroethene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	04-10-90
1,1,2,2-Tetrachloroethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	04-10-90
Toluene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	04-10-90
Chlorobenzene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	04-10-90
Ethylbenzene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	04-10-90
Styrene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	04-10-90
Xylene (total)	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	04-10-90

NOTE: "T" IN ACID BLANK COLUMN INDICATES TRIP
"M" IN WATERBLANK COLUMN INDICATES METHO

CONTRACT LABORATORY ANALYSIS

H-05b, CULEBRA, ROUND 5

GENERAL CHEMISTRY

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
pH		8.3300		8.3300				05-02
Specific Conductance		153000.0000		153000.0000			uMhos/cm@25C	05-02
Alkalinity (HCO3)		41.0000		41.0000			mg/l	05-02
Bromide		69.0000	NA	0.0000			mg/l	05-02
Chloride		92100.0000	NA	0.0000			mg/l	05-02
Alkalinity (CO3)		0.0000	NA	0.0000			mg/l	05-02
Cyanide	<	0.0100	NA	0.0000			mg/l	05-02
Fluoride		0.9000		0.9000			mg/l	05-02
Iodide	<	2.0000	<	2.0000			mg/l	05-02
Nitrate		0.0300		0.0400			mg/l	05-02
Total Phenolics		0.1600	NA	0.0000			mg/l	05-02
Phosphorus		0.0200	NA	0.0000			mg/l	05-02
Residue, Filterable @ 180 c		160000.0000		173000.0000			mg/l	05-02
Residue, Nonfilterable @ 105 c		38.0000		34.0000			mg/l	05-02
Silica		2.7000		3.2000			mg/l	05-02
Sulfate		7900.0000		7500.0000			mg/l	05-02
Total Organic Carbon		9.0000	NA	0.0000			mg/l	05-02
Total Organic Halides		0.8900	NA	0.0000			mg/l	05-02

CONTRACT LABORATORY ANALYSIS

H-05b, CULEBRA, ROUND 5

METALS ANALYSIS

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
Calcium		1500.0000		1500.0000			mg/l	05-02-90
Magnesium		1800.0000		1700.0000			mg/l	05-02-90
Potassium		1200.0000		1200.0000			mg/l	05-02-90
Sodium		55200.0000		55200.0000			mg/l	05-02-90
Aluminum	<	2.0000	<	2.0000	< .2	< .2	mg/l	05-02-90
Antimony		0.6000		0.6000	< .06	< .06	mg/l	05-02-90
Arsenic	<	0.1000	NA	0.0000	< .01	< .01	mg/l	05-02-90
Barium	<	2.0000	<	2.0000	< .2	< .2	mg/l	05-02-90
Beryllium	<	0.0500	<	0.0500	< .005	< .005	mg/l	05-02-90
Boron		30.0000		30.0000	< .02	< .02	mg/l	05-02-90
Cadmium		0.1000		0.1000	< .005	< .005	mg/l	05-02-90
Cesium	<	0.2000	<	2.0000	< .2	< .2	mg/l	05-02-90
Chromium		0.3000		0.3000	.01	.01	mg/l	05-02-90
Cobalt	<	0.5000	<	0.5000	< .05	< .05	mg/l	05-02-90
Copper	<	0.2500	<	0.2500	< .025	< .025	mg/l	05-02-90
Iron		2.0000		2.0000	< .1	< .1	mg/l	05-02-90
Lead	<	0.5000	<	0.5000	< .05	< .05	mg/l	05-02-90
Lithium		1.0000		1.0000	< .01	< .01	mg/l	05-02-90
Manganese		0.2300		0.2400	< .015	< .015	mg/l	05-02-90
Mercury	<	0.0002	<	0.0002	< .0002	< .0002	mg/l	05-02-90
Molybdenum		0.3000		0.3000	< .02	< .02	mg/l	05-02-90
Nickel	<	0.4000	<	0.4000	< .04	< .04	mg/l	05-02-90
Selenium	<	5.0000	NA	0.0000	< .005	< .005	mg/l	05-02-90
Silver		0.1000		0.1000	< .01	< .01	mg/l	05-02-90
Strontium		26.0000		26.0000	< .01	< .01	mg/l	05-02-90
Thallium	<	10.0000	NA	0.0000	< .01	< .01	mg/l	05-02-90
Titanium	<	0.1000	<	0.1000	< .01	< .01	mg/l	05-02-90
Vanadium	<	0.0500	<	0.0500	< .05	< .05	mg/l	05-02-90
Zinc		0.8000		0.8000	< .02	< .02	mg/l	05-02-90

CONTRACT LABORATORY ANALYSIS

H-05b, CULEBRA, ROUND 5

VOLATILE HAZARDOUS SUBSTANCES

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DAT
Chloromethane	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	05-0
Bromomethane	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	05-0
Vinyl chloride	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	05-0
Chloroethane	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	05-0
Methylene chloride		6.0000	NA	0.0000	T 10	M< 5	ug/l	05-0
Acetone	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	05-0
Carbon disulfide	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	05-0
1,1-Dichloroethene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	05-0
1,1-Dichloroethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	05-0
1,2-Dichloroethene (TOTAL)	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	05-0
Chloroform	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	05-0
1,2-Dichloroethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	05-0
2-Butanone	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	05-0
1,1,1-Trichloroethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	05-C
Carbon tetrachloride	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	05-C
Vinyl acetate	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	05-C
Bromodichloromethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	-C
1,2-Dichloropropane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	05-C
cis-1,3-Dichloropropene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	05-C
Trichloroethene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	05-C
Dibromochloromethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	05-C
1,1,2-Trichloroethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	05-C
Benzene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	05-C
trans-1,3-Dichloropropene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	05-C
Bromoform	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	05-C
4-Methyl-2-pentanone	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	05-C
2-Hexanone	<	10.0000	NA	0.0000	T< 10	M< 10	ug/l	05-C
Tetrachloroethene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	05-
1,1,2,2-Tetrachloroethane	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	05-
Toluene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	05-
Chlorobenzene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	05-
Ethylbenzene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	05-
Styrene	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	05-
Xylene (total)	<	5.0000	NA	0.0000	T< 5	M< 5	ug/l	05-

T" IN ACID BLANK COLUMN INDICATES TRIP BLANK

M" IN WATER BLANK COLUMN INDICATES METHOD BLANK

CONTRACT LABORATORY ANALYSIS

H-05c, MAGENTA, ROUND 5

GENERAL CHEMISTRY

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
pH		8.3300		8.3300				05-16-90
Specific Conductance		9100.0000		9100.0000			uMhos/cm@25C	05-16-90
Alkalinity (HCO3)		46.0000		49.0000			mg/l	05-16-90
Bromide	<	2.0000	<	2.0000			mg/l	05-16-90
Chloride		870.0000		860.0000			mg/l	05-16-90
Alkalinity (CO3)		0.0000	NA	0.0000			mg/l	05-16-90
Cyanide	<	0.0100	<	0.0100			mg/l	05-16-90
Fluoride		2.9000		0.0000			mg/l	05-16-90
Iodide	<	2.0000	<	2.0000			mg/l	05-16-90
Nitrate	<	0.0200	<	0.0200			mg/l	05-16-90
Total Phenolics		0.0100		0.0000			mg/l	05-16-90
Phosphorus	<	0.0100	NA	0.0000			mg/l	05-16-90
Residue, Filterable @ 180 c		7200.0000		0.0000			mg/l	05-16-90
Residue, Nonfilterable @ 105 c	<	4.0000		0.0000			mg/l	05-16-90
Silica		4.9000		4.4000			mg/l	05-16-90
Sulfate		3300.0000	NA	3300.0000			mg/l	05-16-90
Total Organic Carbon		2.0000		2.0000			mg/l	05-16-90
Total Organic Halides		0.0700	<	0.0500			mg/l	05-16-90

CONTRACT LABORATORY ANALYSIS

H-05c, MAGENTA, ROUND 5

METALS ANALYSIS

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DA
Calcium		560.0000		560.0000			mg/l	05-1
Magnesium		180.0000		180.0000			mg/l	05-1
Potassium		36.0000		36.0000			mg/l	05-1
Sodium		1000.0000		1000.0000			mg/l	05-1
Aluminum	<	2.0000	<	2.0000			mg/l	05-1
Antimony	<	0.6000	<	0.6000			mg/l	05-1
Arsenic	<	0.1000	NA	0.0000			mg/l	05-1
Barium	<	2.0000	<	2.0000			mg/l	05-1
Beryllium	<	0.0500	<	0.0500			mg/l	05-1
Boron		10.0000		10.0000			mg/l	05-1
Cadmium	<	0.0500	<	0.0500			mg/l	05-1
Cesium	<	0.2000	<	0.2000			mg/l	05-1
Chromium	<	0.1000	<	0.1000			mg/l	05-1
Cobalt	<	0.5000	<	0.5000			mg/l	05-
Copper	<	0.2500	<	0.2500			mg/l	05-
Iron	<	1.0000	<	1.0000			mg/l	05-
Lead	<	0.5000	<	0.5000			mg/l	5-
Lithium		0.2000		0.2000			mg/l	05-
Manganese	<	0.1500	<	0.1500			mg/l	05-
Mercury	<	0.0002	<	0.0002			mg/l	05-
Molybdenum	<	0.2000	<	0.2000			mg/l	05-
Nickel	<	0.4000	<	0.4000			mg/l	05-
Selenium	<	0.0050	NA	0.0000			mg/l	05-
Silver	<	0.1000	<	0.1000			mg/l	05-
Strontium		9.8000		9.8000			mg/l	05-
Thallium	<	0.2500	NA	0.0000			mg/l	05-
Titanium	<	0.1000	<	0.1000			mg/l	05-
Vanadium	<	0.5000	<	0.5000			mg/l	05-
Zinc	<	0.2000	<	0.2000			mg/l	05-

CONTRACT LABORATORY ANALYSIS

TWIN WELL, DEWEY LAKE, ROUND 4

GENERAL CHEMISTRY

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
pH		7.5400		7.5500				05-30-90
Specific Conductance		1030.0000		1030.0000			uMhos/cm@25C	05-30-90
Calcium Hardness (mg/L CaCO3)		268.0000	NA	0.0000			mg/l	05-30-90
Langelier Saturation Index		0.2600	NA	0.0000			NA	05-30-90
Alkalinity (HCO3)		210.0000		220.0000			mg/l	05-30-90
Bromide		3.0000		0.0000			mg/l	05-30-90
Chloride		35.0000		0.0000			mg/l	05-30-90
Alkalinity (CO3)		0.0000	NA	0.0000			mg/l	05-30-90
Cyanide	<	0.0100	<	0.0200			mg/l	05-30-90
Fluoride		0.6000		0.0000			mg/l	05-30-90
Iodide	<	2.0000	<	2.0000			mg/l	05-30-90
Nitrate		9.2000		0.0000			mg/l	05-30-90
Total Phenolics	<	0.0050		0.0000			mg/l	05-30-90
Phosphorus	<	0.0100	<	0.0100			mg/l	05-30-90
Residue, Filterable @ 180 c		410.0000		0.0000			mg/l	05-30-90
Residue, Nonfilterable @ 105 c	<	9.0000		6.0000			mg/l	05-30-90
Silica		18.0000		18.0000			mg/l	05-30-90
Sulfate		59.0000	NA	0.0000			mg/l	05-30-90
Total Organic Carbon		2.0000		2.0000			mg/l	05-30-90
Total Organic Halides	<	0.0500	<	0.0500			mg/l	05-30-90

CONTRACT LABORATORY ANALYSIS

TWIN WELL, DEWEY LAKE, ROUND 4

METALS ANALYSIS

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DAT
Calcium		77.0000		77.0000			mg/l	05-30
Magnesium		24.0000		24.0000			mg/l	05-30
Potassium	<	5.0000	<	5.0000			mg/l	05-30
Sodium		23.0000		22.0000			mg/l	05-30
Aluminum	<	0.2000	<	0.2000			mg/l	05-30
Antimony	<	0.0600	<	0.0600			mg/l	05-30
Arsenic	<	0.0100	NA	0.0000			mg/l	05-30
Barium	<	0.2000	<	0.2000			mg/l	05-30
Beryllium	<	0.0050	<	0.0050			mg/l	05-30
Boron		0.1500		0.1600			mg/l	05-30
Cadmium	<	0.0050	<	0.0050			mg/l	05-30
Cesium	<	0.2000	<	0.2000			mg/l	05-30
Chromium		0.0200		0.0200			mg/l	05-30
Cobalt		0.0500		0.0500			mg/l	05-30
Copper		0.0480		0.0470			mg/l	05-30
Iron	<	0.1000	<	0.1000			mg/l	05-30
Lead	<	0.0500	<	0.0500			mg/l	-30
Lithium	<	0.1000	<	0.1000			mg/l	05-30
Manganese		0.0190		0.0190			mg/l	05-30
Mercury		0.0002	<	0.0002			mg/l	05-3
Molybdenum	<	0.0200	<	0.0200			mg/l	05-3
Nickel	<	0.0400	<	0.0400			mg/l	05-3
Selenium	<	0.0500	NA	0.0000			mg/l	05-3
Silver	<	0.0100	<	0.0100			mg/l	05-3
Strontium		1.0000		1.0000			mg/l	05-3
Thallium	<	0.0100	NA	0.0000			mg/l	05-3
Titanium	<	0.0100	<	0.0100			mg/l	05-3
Vanadium	<	0.0500	<	0.0500			mg/l	05-3
Zinc		0.5200		0.5200			mg/l	05-3

CONTRAC LABORATORY ANALYSIS

WIPP-19, CULEBRA, ROUND 5

GENERAL CHEMISTRY

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
pH		7.2400		7.2400				06-13-90
Specific Conductance		90800.0000		91100.0000			uMhos/cm@25C	06-13-90
Alkalinity (HCO3)		56.0000	NA	0.0000			mg/l	06-13-90
Bromide		49.0000		48.0000			mg/l	06-13-90
Chloride		37900.0000	NA	0.0000			mg/l	06-13-90
Alkalinity (CO3)		0.0000	NA	0.0000			mg/l	06-13-90
Cyanide	<	0.0100	NA	0.0000			mg/l	06-13-90
Fluoride		1.0000		1.0000			mg/l	06-13-90
Iodide	<	2.0000	<	2.0000			mg/l	06-13-90
Nitrate	<	0.0200	<	0.0200			mg/l	06-13-90
Total Phenolics	<	0.0050	<	0.0100			mg/l	06-13-90
Phosphorus	<	0.0100	NA	0.0000			mg/l	06-13-90
Residue, Filterable @ 180 c		77200.0000		74500.0000			mg/l	06-13-90
Residue, Nonfilterable @ 105 c		19.0000		16.0000			mg/l	06-13-90
Silica		4.3000	NA	0.0000			mg/l	06-13-90
Sulfate		5000.0000	NA	0.0000			mg/l	06-13-90
Total Organic Carbon		7.0000		5.0000			mg/l	06-13-90
Total Organic Halides		0.5900		0.5400			mg/l	06-13-90

CONTRAC LABORATORY ANALYSIS

WIPP-19, CULEBRA, ROUND 5

METALS ANALYSIS

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATI
Calcium		1400.0000		1400.0000			mg/l	06-13
Magnesium		1000.0000		1000.0000			mg/l	06-13
Potassium		600.0000		580.0000			mg/l	06-13
Sodium		31000.0000		31000.0000			mg/l	06-13
Aluminum	<	0.2000	<	0.2000			mg/l	06-13
Antimony	<	0.6000	<	0.6000			mg/l	06-13
Arsenic	<	0.0200	NA	0.0000			mg/l	06-13
Barium	<	2.0000	<	2.0000			mg/l	06-13
Beryllium	<	0.0500	<	0.0500			mg/l	06-13
Boron		26.0000		26.0000			mg/l	06-13
Cadmium	<	0.0500	<	0.0500			mg/l	06-13
Cesium	<	0.2000	<	0.2000			mg/l	06-13
Chromium		0.1000		0.1000			mg/l	06-13
Cobalt	<	0.5000	<	0.5000			mg/l	06-13
Copper	<	0.2500	<	0.2500			mg/l	06-13
Iron	<	1.0000	<	1.0000			mg/l	06-13
Lead	<	0.5000	<	0.5000			mg/l	06-13
Lithium		0.6000		0.5000			mg/l	06-13
Manganese		0.8000		0.8000			mg/l	06-13
Mercury	<	0.0002	<	0.0002			mg/l	06-13
Molybdenum	<	0.2000	<	0.2000			mg/l	06-13
Nickel	<	0.4000	<	0.4000			mg/l	06-1
Selenium	<	0.5000	NA	0.0000			mg/l	06-13
Silver	<	0.1000	<	0.1000			mg/l	06-1
Strontium		22.0000		22.0000			mg/l	06-1
Thallium	<	0.1000	NA	0.0000			mg/l	06-1
Titanium	<	0.1000	<	0.1000			mg/l	06-1
Vanadium	<	0.5000	<	0.5000			mg/l	06-1
Zinc	<	0.2000	<	0.2000			mg/l	06-1

CONTRACT LABORATORY ANALYSIS

RANCH WELL, DEWEY LAKE, ROUND 5

GENERAL CHEMISTRY

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
pH		7.2000		7.2000				06-20-90
Specific Conductance		3650.0000		3670.0000			uMhos/cm@25C	06-20-90
Langelier Saturation Index		0.1700	NA	0.0000				06-20-90
Alkalinity (HCO3)		230.0000		230.0000			mg/l	06-20-90
Bromide	<	2.0000		0.0000			mg/l	06-20-90
Chloride		340.0000		0.0000			mg/l	06-20-90
Alkalinity (CO3)		0.0000	NA	0.0000			mg/l	06-20-90
Cyanide	<	0.0100		0.0000			mg/l	06-20-90
Fluoride		1.0000		0.0000			mg/l	06-20-90
Iodide	<	2.0000	<	2.0000			mg/l	06-20-90
Nitrate		71.0000		71.0000			mg/l	06-20-90
Total Phenolics	<	0.0050		0.0000			mg/l	06-20-90
Phosphorus	<	0.0100	<	0.0100			mg/l	06-20-90
Residue, Filterable @ 180 c		3000.0000		3000.0000			mg/l	06-20-90
Residue, Nonfilterable @ 105 c	<	4.0000	<	4.0000			mg/l	06-20-90
Silica		20.0000		0.0000			mg/l	06-20-90
Sulfate		1400.0000		1400.0000			mg/l	06-20-90
Total Organic Carbon		3.0000		2.0000			mg/l	06-20-90
Total Organic Halides	<	0.0500	<	0.0500			mg/l	06-20-90

CONTRACT LABORATORY ANALYSIS

RANCH WELL, DEWEY LAKE, ROUND 5

METALS ANALYSIS

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	D
Calcium		550.0000		550.0000			mg/l	06-2
Magnesium		150.0000		150.0000			mg/l	06-2
Potassium	<	5.0000	<	5.0000			mg/l	06-2
Sodium		220.0000		220.0000			mg/l	06-2
Aluminum	<	2.0000	<	2.0000			mg/l	06-2
Antimony		0.1100		0.1100			mg/l	06-2
Arsenic	<	0.0100	NA	0.0000			mg/l	06-2
Barium	<	0.2000	<	0.2000			mg/l	06-2
Beryllium	<	0.0050	<	0.0050			mg/l	06-2
Boron		0.3300		0.3200			mg/l	06-2
Cadmium		0.0090		0.0100			mg/l	06-2
Cesium	<	0.2000	<	0.2000			mg/l	06-2
Chromium	<	0.0100		0.0100			mg/l	06-2
Cobalt	<	0.0500	<	0.0500			mg/l	06-2
Copper	<	0.0250	<	0.0250			mg/l	06-2
Iron	<	0.1000	<	0.1000			mg/l	06-2
Lead		0.0600		0.0600			mg/l	06-2
Lithium	<	0.1000	<	0.1000			mg/l	06-2
Manganese	<	0.0150	<	0.0150			mg/l	06-2
Mercury	<	0.0002	<	0.0002			mg/l	06-
Molybdenum		0.0400		0.0400			mg/l	06-
Nickel	<	0.0400	<	0.0400			mg/l	06-
Selenium	<	0.0500	NA	0.0000			mg/l	06-
Silver		0.0200		0.0200			mg/l	06-
Strontium		5.1000		5.1000			mg/l	06-
Thallium	<	1.0000	NA	0.0000			mg/l	06-
Titanium		0.0100		0.0100			mg/l	06-
Vanadium		0.0500		0.0500			mg/l	06-
Zinc		0.0200		0.0200			mg/l	06-

CONTRACT LABORATORY ANALYSIS

BARN WELL, DEWEY LAKE, ROUND 4

GENERAL CHEMISTRY

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
pH		7.6900		7.6800				06-21-90
Specific Conductance		1048.0000		1049.0000			uMhos/cm@25C	06-21-90
Langelier Saturation Index		0.2500	NA	0.0000				06-21-90
Alkalinity (HCO3)		280.0000	NA	0.0000			mg/l	06-21-90
Bromide	<	2.0000	<	2.0000			mg/l	06-21-90
Calcium Hardness (CaCO3)		150	NA	0.0000			mg/l	06-21-90
Chloride		41.0000	NA	0.0000			mg/l	06-21-90
Alkalinity (CO3)		0.0000	NA	0.0000			mg/l	06-21-90
Cyanide	<	0.0100	NA	0.0000			mg/l	06-21-90
Fluoride		2.6000	NA	0.0000			mg/l	06-21-90
Iodide	<	2.0000	<	2.0000			mg/l	06-21-90
Nitrate		8.9000	NA	0.0000			mg/l	06-21-90
Total Phenolics	<	0.0050	NA	0.0000			mg/l	06-21-90
Phosphorus	<	0.0100	NA	0.0000			mg/l	06-21-90
Residue, Filterable @ 180 c		650.0000		650.0000			mg/l	06-21-90
Residue, Nonfilterable @ 105 c	<	4.0000	<	4.0000			mg/l	06-21-90
Silica		25.0000	NA	0.0000			mg/l	06-21-90
Sulfate		180.0000	NA	0.0000			mg/l	06-21-90
Total Organic Carbon	<	1.0000	<	1.0000			mg/l	06-21-90
Total Organic Halides		0.1800		0.1200			mg/l	06-21-90

CONTRACT LABORATORY ANALYSIS

BARN WELL, DEWEY LAKE, ROUND 4

METALS ANALYSIS

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	D/
Calcium		64.0000		64.0000			mg/l	06-2
Magnesium		33.0000		33.0000			mg/l	06-2
Potassium	<	5.0000	<	5.0000			mg/l	06-2
Sodium		120.0000		120.0000			mg/l	06-2
Aluminum	<	2.0000	<	2.0000			mg/l	06-2
Antimony	<	0.0600	<	0.0600			mg/l	06-2
Arsenic	<	0.0100	NA	0.0000			mg/l	06-2
Barium	<	0.2000	<	0.2000			mg/l	06-2
Beryllium	<	0.0050	<	0.0050			mg/l	06-2
Boron		0.3600		0.3600			mg/l	06-2
Cadmium	<	0.0050	<	0.0050			mg/l	06-2
Cesium	<	0.2000	<	0.2000			mg/l	06-2
Chromium	<	0.0100	<	0.0100			mg/l	06-
Cobalt	<	0.0500	<	0.0500			mg/l	06-
Copper	<	0.0250	<	0.0250			mg/l	06-
Iron	<	0.1000	<	0.1000			mg/l	06-
Lead	<	0.0500	<	0.0500			mg/l	06-
Lithium		0.0400		0.0400			mg/l	06-
Manganese	<	0.0150	<	0.0150			mg/l	06-
Mercury	<	0.0002	<	0.0002			mg/l	06-
Molybdenum	<	0.0200	<	0.0200			mg/l	06-
Nickel	<	0.0400	<	0.0400			mg/l	06-
Selenium	<	0.0500	NA	0.0000			mg/l	06-
Silver	<	0.0100	<	0.0100			mg/l	06-
Strontium		0.9400		0.9400			mg/l	06-
Thallium	<	0.0100	NA	0.0000			mg/l	06-
Titanium	<	0.0100	<	0.0100			mg/l	06-
Vanadium		0.0600		0.0600			mg/l	06-
Zinc	<	0.0200	<	0.0200			mg/l	06-

CONTRACT LABORATORY ANALYSIS

H-02c, CULEBRA, ROUND 2

GENERAL CHEMISTRY

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
pH		7.4400		7.4400				07-25-90
Specific Conductance		13900.0000		14000.0000			uMhos/cm@25C	07-25-90
Alkalinity (HCO3)		60.0000		0.0000			mg/l	07-25-90
Bromide		12.0000		12.0000			mg/l	07-25-90
Chloride		2700.0000		0.0000			mg/l	07-25-90
Alkalinity (CO3)		0.0000	NA	0.0000			mg/l	07-25-90
Cyanide	<	0.0100	NA	0.0000			mg/l	07-25-90
Fluoroscein		4.4000		4.6000			mg/l	07-25-90
Fluoride		2.5000		0.0000			mg/l	07-25-90
Iodide		4.0000		5.0000			mg/l	07-25-90
Nitrate	<	0.0200		0.0000			mg/l	07-25-90
Total Phenolics	<	0.0050		0.0000			mg/l	07-25-90
Phosphorus		0.0200		0.0000			mg/l	07-25-90
Residue, Filterable @ 180 c		9300.0000		0.0000			mg/l	07-25-90
Residue, Nonfilterable @ 105 c		62.0000		0.0000			mg/l	07-25-90
Silica		6.2000		0.0000			mg/l	07-25-90
Sulfate		2900.0000		0.0000			mg/l	07-25-90
Total Organic Carbon		2.0000		2.0000			mg/l	07-25-90
Total Organic Halides		0.1100		0.0700			mg/l	07-25-90

CONTRACT LABORATORY ANALYSIS

H-02c, CULEBRA, ROUND 2

METALS ANALYSIS

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DA
Calcium		680.0000		680.0000			mg/l	07-2
Magnesium		160.0000		160.0000			mg/l	07-2
Potassium		100.0000		100.0000			mg/l	07-2
Sodium		2000.0000		2000.0000			mg/l	07-2
Aluminum	<	2.0000	<	2.0000	< .2	< .2	mg/l	07-2
Antimony	<	0.6000	<	0.6000	< .06	< .06	mg/l	07-2
Arsenic	<	0.0100	NA	0.0000	< .01	< .01	mg/l	07-2
Barium	<	2.0000	<	2.0000	< .2	< .2	mg/l	07-2
Beryllium	<	0.0500	<	0.0500	< .005	< .005	mg/l	07-2
Boron		11.0000		11.0000	< .02	< .02	mg/l	07-2
Cadmium	<	0.0500	<	0.0500	< .005	< .005	mg/l	07-2
Cesium	<	0.2000	<	0.2000	< .2	< .2	mg/l	07-2
Chromium		0.1000		0.1000	< .01	< .02	mg/l	07-2
Cobalt	<	0.5000	<	0.5000	< .05	< .05	mg/l	07-2
Copper	<	0.2500	<	0.2500	< .025	< .025	mg/l	07-2
Iron		1.0000		1.0000	< .1	< .1	mg/l	07-2
Lead	<	0.5000	<	0.5000	< .05	< .05	mg/l	-2
Lithium		0.2000		0.2000	< .01	< .01	mg/l	07-2
Manganese	<	0.1500	<	0.1500	< .015	< .015	mg/l	07-2
Mercury	<	0.0002	<	0.0002	< .0002	< .0002	mg/l	07-2
Molybdenum	<	0.2000	<	0.2000	< .02	< .02	mg/l	07-2
Nickel	<	0.4000	<	0.4000	< .04	< .04	mg/l	07-2
Selenium	<	0.0500	NA	0.0000	< .005	< .005	mg/l	07-2
Silver	<	0.1000	<	0.1000	< .01	< .01	mg/l	07-2
Strontium		8.7000		8.8000	< .01	< .01	mg/l	07-2
Thallium	<	0.0100	NA	0.0000	< .01	< .01	mg/l	07-2
Titanium	<	0.1000	<	0.1000	< .01	< .01	mg/l	07-2
Vanadium	<	0.5000	<	0.5000	< .05	< .05	mg/l	07-2
Zinc	<	0.2000	<	0.2000	< .02	< .02	mg/l	07-

CONTRACT LABORATORY ANALYSIS

H-03b3, CULEBRA, ROUND 5

GENERAL CHEMISTRY

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
pH		7.1600		7.1600				08-15-90
Specific Conductance		66000.0000		66000.0000			uMhos/cm@25C	08-15-90
Alkalinity (HCO3)		49.0000	NA	0.0000			mg/l	08-15-90
Bromide		27.0000		27.0000			mg/l	08-15-90
Chloride		27000.0000		27000.0000			mg/l	08-15-90
Alkalinity (CO3)		0.0000	NA	0.0000			mg/l	08-15-90
Cyanide	<	0.0100		0.0000			mg/l	08-15-90
Fluoride		1.5000		0.0000			mg/l	08-15-90
Iodide	<	2.0000	<	2.0000			mg/l	08-15-90
Nitrate	<	0.0200		0.0000			mg/l	08-15-90
Total Phenolics	<	0.0050	<	0.0100			mg/l	08-15-90
Phosphorus	<	0.0100		0.0000			mg/l	08-15-90
Residue, Filterable @ 180 c		55000.0000		0.0000			mg/l	08-15-90
Residue, Nonfilterable @ 105 c		100.0000		0.0000			mg/l	08-15-90
Silica		4.5000		0.0000			mg/l	08-15-90
Sulfate		4700.0000		0.0000			mg/l	08-15-90
Total Organic Carbon	<	1.0000		1.0000			mg/l	08-15-90
Total Organic Halides		0.1300		0.1400			mg/l	08-15-90

CONTRACT LABORATORY ANALYSIS

H-03b3, CULEBRA, ROUND 5

METALS ANALYSIS

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DA
Calcium		1300.0000		1300.0000			mg/l	08-1
Magnesium		700.0000		710.0000			mg/l	08-1
Potassium		450.0000		450.0000			mg/l	08-1
Sodium		16000.0000		16000.0000			mg/l	08-1
Aluminum	<	2.0000	<	2.0000			mg/l	08-1
Antimony	<	0.6000	<	0.6000			mg/l	08-1
Arsenic	<	0.1000	NA	0.0000			mg/l	08-1
Barium	<	2.0000	<	2.0000			mg/l	08-1
Beryllium	<	0.0500	<	0.0500			mg/l	08-1
Boron		22.0000		22.0000			mg/l	08-1
Cadmium	<	0.0500	<	0.0500			mg/l	08-1
Cesium	<	0.2000	<	0.2000			mg/l	08-1
Chromium		0.1000		0.2000			mg/l	08-1
Cobalt	<	0.5000	<	0.5000			mg/l	08-1
Copper	<	0.2500	<	0.2500			mg/l	08-1
Iron	<	1.0000	<	1.0000			mg/l	08-1
Lead	<	0.5000	<	0.5000			mg/l	08-1
Lithium		0.4000		0.4000			mg/l	08-1
Manganese	<	0.1500	<	0.1500			mg/l	08-1
Mercury	<	0.0002	<	0.0002			mg/l	08-1
Molybdenum	<	0.2000	<	0.2000			mg/l	08-1
Nickel	<	0.4000	<	0.4000			mg/l	08-1
Selenium	<	0.5000	NA	0.0000			mg/l	08-1
Silver	<	0.1000	<	0.1000			mg/l	08-1
Strontium		23.0000		23.0000			mg/l	08-1
Thallium	<	10.0000	NA	0.0000			mg/l	08-1
Titanium	<	0.1000	<	0.1000			mg/l	08-1
Vanadium	<	0.5000	<	0.5000			mg/l	08-
Zinc	<	0.2000	<	0.2000			mg/l	08-

CONTRACT LABORATORY ANALYSIS

H-03b1, MAGENTA, ROUND 5

GENERAL CHEMISTRY

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
pH		6.5000		6.5100				08-28-90
Specific Conductance		10300.0000		10310.0000			uMhos/cm@25C	08-28-90
Alkalinity (HCO3)		36.0000		0.0000			mg/l	08-28-90
Bromide		6.0000		6.0000			mg/l	08-28-90
Chloride		3200.0000		3200.0000			mg/l	08-28-90
Alkalinity (CO3)		0.0000	NA	0.0000			mg/l	08-28-90
Cyanide	<	0.0100		0.0000			mg/l	08-28-90
Fluoride		2.2000		0.0000			mg/l	08-28-90
Iodide	<	2.0000	<	2.0000			mg/l	08-28-90
Nitrate	<	0.0200	<	0.0200			mg/l	08-28-90
Total Phenolics	<	0.0050		0.0000			mg/l	08-28-90
Phosphorus		0.0300		0.0000			mg/l	08-28-90
Residue, Filterable @ 180 c		9300.0000		0.0000			mg/l	08-28-90
Residue, Nonfilterable @ 105 c		18.0000		0.0000			mg/l	08-28-90
Silica		5.5000		0.0000			mg/l	08-28-90
Sulfate		2100.0000		0.0000			mg/l	08-28-90
Total Organic Carbon	<	1.0000	<	1.0000			mg/l	08-28-90
Total Organic Halides	<	0.0500	<	0.0500			mg/l	08-28-90

CONTRACT LABORATORY ANALYSIS

H-03b1, MAGENTA, ROUND 5

METALS ANALYSIS

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DAT
Calcium		1100.0000		1100.0000			mg/l	08-2E
Magnesium		270.0000		270.0000			mg/l	08-2E
Potassium		30.0000		30.0000			mg/l	08-2E
Sodium		1400.0000		1400.0000			mg/l	08-2E
Aluminum		0.3000		0.3000			mg/l	08-2E
Antimony		0.1100		0.1000			mg/l	08-2E
Arsenic	<	0.0100	NA	0.0000			mg/l	08-2E
Barium	<	0.2000	<	0.2000			mg/l	08-2E
Beryllium	<	0.0050	<	0.0050			mg/l	08-2E
Boron		3.3000		3.3000			mg/l	08-2E
Cadmium	<	0.0170	<	0.0180			mg/l	08-2E
Cesium	<	0.2000	<	0.2000			mg/l	08-2E
Chromium		0.1200		0.1200			mg/l	08-2E
Cobalt	<	0.0500	<	0.0500			mg/l	08-2E
Copper	<	0.0250	<	0.0250			mg/l	08-2E
Iron	<	0.1000	<	0.1000			mg/l	08-2E
Lead		0.1400		0.1400			mg/l	08-2E
Lithium		0.3000		0.3000			mg/l	08-2E
Manganese		0.0310		0.0300			mg/l	08-2E
Mercury	<	0.0004	<	0.0004			mg/l	08-2E
Molybdenum		0.0500		0.0500			mg/l	08-2E
Nickel		0.0600		0.0600			mg/l	08-2
Selenium	<	0.0500	NA	0.0000			mg/l	08-2
Silver		0.0300		0.0300			mg/l	08-2
Strontium		16.0000		16.0000			mg/l	08-2
Thallium	<	1.0000	NA	0.0000			mg/l	08-2
Titanium		0.0200		0.0200			mg/l	08-2
Vanadium		0.0700		0.0700			mg/l	08-2
Zinc	<	0.0200	<	0.0200			mg/l	08-2

CONTRACT LABORATORY ANALYSIS

H-04b, CULEBRA, ROUND 5

GENERAL CHEMISTRY

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
pH		6.6800		6.7100				09-11-90
Specific Conductance		21900.0000		22000.0000			uMhos/cm@25C	09-11-90
Alkalinity (HCO3)		54.0000		0.0000			mg/l	09-11-90
Bromide		44.0000		44.0000			mg/l	09-11-90
Chloride		650.0000		580.0000			mg/l	09-11-90
Alkalinity (CO3)		0.0000	NA	0.0000			mg/l	09-11-90
Cyanide	<	0.0100		0.0000			mg/l	09-11-90
Fluoride		2.1000		0.0000			mg/l	09-11-90
Iodide	<	2.0000	<	2.0000			mg/l	09-11-90
Nitrate	<	0.0200	<	0.0200			mg/l	09-11-90
Total Phenolics	<	0.0050		0.0000			mg/l	09-11-90
Phosphorus	<	0.0100		0.0000			mg/l	09-11-90
Residue, Filterable @ 180 c		21000.0000		0.0000			mg/l	09-11-90
Residue, Nonfilterable @ 105 c		48.0000		0.0000			mg/l	09-11-90
Silica		5.9000		0.0000			mg/l	09-11-90
Sulfate		4800.0000		0.0000			mg/l	09-11-90
Total Organic Carbon		5.0000		4.0000			mg/l	09-11-90
Total Organic Halides		0.0800		0.0600			mg/l	09-11-90

CONTRACT LABORATORY ANALYSIS

H-04b, CULEBRA, ROUND 5

METALS ANALYSIS

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DAT
Calcium		630.0000		640.0000			mg/l	09-11
Magnesium		390.0000		390.0000			mg/l	09-11
Potassium		170.0000		170.0000			mg/l	09-11
Sodium		6000.0000		6000.0000			mg/l	09-11
Aluminum	<	2.0000	<	2.0000			mg/l	09-11
Antimony	<	0.6000	<	0.6000			mg/l	09-11
Arsenic	<	0.1000	NA	0.0000			mg/l	09-11
Barium	<	2.0000	<	2.0000			mg/l	09-11
Beryllium	<	0.0500	<	0.0500			mg/l	09-11
Boron		17.0000		17.0000			mg/l	09-11
Cadmium	<	0.0500	<	0.0500			mg/l	09-11
Cesium	<	0.2000	<	0.2000			mg/l	09-11
Chromium		0.2000		0.2000			mg/l	09-11
Cobalt	<	0.5000	<	0.5000			mg/l	09-11
Copper	<	0.2500	<	0.2500			mg/l	09-11
Iron	<	1.0000	<	1.0000			mg/l	-11
Lead	<	0.5000	<	0.5000			mg/l	-11
Lithium		0.3000		0.3000			mg/l	09-11
Manganese	<	0.1900	<	0.1900			mg/l	09-11
Mercury	<	0.0004	<	0.0004			mg/l	09-11
Molybdenum	<	0.2000	<	0.2000			mg/l	09-11
Nickel	<	0.4000	<	0.4000			mg/l	09-11
Selenium	<	0.0500	NA	0.0000			mg/l	09-11
Silver	<	0.1000	<	0.1000			mg/l	09-11
Strontium		13.0000		13.0000			mg/l	09-11
Thallium	<	0.1000	NA	0.0000			mg/l	09-11
Titanium	<	0.1000	<	0.1000			mg/l	09-11
Vanadium	<	0.5000	<	0.5000			mg/l	09-11
Zinc	<	0.2000	<	0.2000			mg/l	09-11

CONTRACT LABORATORY ANALYSIS

H-04c, MAGENTA, ROUND 5

GENERAL CHEMISTRY

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
pH		7.4300		7.4300				10-2-90
Specific Conductance		28800.0000		28800.0000			uMhos/cm@25C	10-2-90
Alkalinity (HCO3)		62.0000		0.0000			mg/l	10-2-90
Bromide		6.0000		6.0000			mg/l	10-2-90
Chloride		9000.0000		8900.0000			mg/l	10-2-90
Alkalinity (CO3)		0.0000	NA	0.0000			mg/l	10-2-90
Cyanide	<	0.0100	NA	0.0000			mg/l	10-2-90
Fluoride		2.8000		0.0000			mg/l	10-2-90
Iodide	<	2.0000	<	2.0000			mg/l	10-2-90
Nitrate	<	0.0200	<	0.0200			mg/l	10-2-90
Total Phenolics		0.0290	NA	0.0000			mg/l	10-2-90
Phosphorus	<	0.0100	NA	0.0000			mg/l	10-2-90
Residue, Filterable @ 180 c		24600.0000	NA	0.0000			mg/l	10-2-90
Residue, Nonfilterable @ 105 c		59.0000	NA	0.0000			mg/l	10-2-90
Silica		4.7000	NA	0.0000			mg/l	10-2-90
Sulfate		7600.0000	NA	0.0000			mg/l	10-2-90
Total Organic Carbon	<	1.0000	<	1.0000			mg/l	10-2-90
Total Organic Halides	<	0.1000	<	0.0500			mg/l	10-2-90

CONTRACT LABORATORY ANALYSIS

H-04c, MAGENTA, ROUND 5

METALS ANALYSIS

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DA
Calcium		630.0000		630.0000			mg/l	10-2
Magnesium		400.0000		410.0000			mg/l	10-2
Potassium		70.0000		70.0000			mg/l	10-2
Sodium		3600.0000		3600.0000			mg/l	10-2
Aluminum	<	2.0000	<	2.0000			mg/l	10-2
Antimony	<	0.6000	<	0.6000			mg/l	10-2
Arsenic	<	0.1000	NA	0.0000			mg/l	10-2
Barium	<	0.2000	<	0.2000			mg/l	10-2
Beryllium	<	0.0500	<	0.0500			mg/l	10-2
Boron		12.0000		12.0000			mg/l	10-2
Cadmium	<	0.0500	<	0.0500			mg/l	10-2
Cesium	<	0.1000	<	0.1000			mg/l	10-2
Chromium	<	0.1000	<	0.1000			mg/l	10-2
Cobalt	<	0.5000	<	0.5000			mg/l	10-2
Copper	<	0.2500	<	0.2500			mg/l	10-2
Iron	<	1.0000	<	1.0000			mg/l	10-2
Lead	<	0.5000	<	0.5000			mg/l	10-2
Lithium		0.3900		0.3900			mg/l	10-2
Manganese	<	0.1500	<	0.1500			mg/l	10-2
Mercury	<	0.0002	<	0.0002			mg/l	10-2
Molybdenum	<	0.2000	<	0.2000			mg/l	10-2
Nickel	<	0.4000	<	0.4000			mg/l	10-2
Selenium	<	0.0500	NA	0.0000			mg/l	10-2
Silver	<	0.1000	<	0.1000			mg/l	10-2
Strontium		11.0000		11.0000			mg/l	10-2
Thallium	<	0.1000	NA	0.0000			mg/l	10-2
Titanium	<	0.1000	<	0.1000			mg/l	10-2
Vanadium	<	0.5000	<	0.5000			mg/l	10-2
Zinc	<	0.2000	<	0.2000			mg/l	10-2

CONTRACT LABORATORY ANALYSIS

H-11b3, CULEBRA, ROUND 5

GENERAL CHEMISTRY

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
pH		7.0600		7.0600				10-17-90
Specific Conductance		112000.0000		112000.0000			uMhos/cm@25C	10-17-90
Alkalinity (HCO3)		44.0000		0.0000			mg/l	10-17-90
Bromide		51.0000	NA	0.0000			mg/l	10-17-90
Chloride		56000.0000		56000.0000			mg/l	10-17-90
Alkalinity (CO3)		0.0000	NA	0.0000			mg/l	10-17-90
Cyanide	<	0.0100		0.0000			mg/l	10-17-90
Fluoride		1.1000		0.0000			mg/l	10-17-90
Iodide	<	2.0000	<	2.0000			mg/l	10-17-90
Nitrate	<	0.0200		0.0000			mg/l	10-17-90
Total Phenolics	<	0.0050		0.0000			mg/l	10-17-90
Phosphorus	<	0.0100		0.0000			mg/l	10-17-90
Residue, Filterable @ 180 c		113000.0000		0.0000			mg/l	10-17-90
Residue, Nonfilterable @ 105 c		640.0000		0.0000			mg/l	10-17-90
Silica		4.1000		0.0000			mg/l	10-17-90
Sulfate		7400.0000		0.0000			mg/l	10-17-90
Total Organic Carbon		3.0000		2.0000			mg/l	10-17-90
Total Organic Halides		0.0600	<	0.0500			mg/l	10-17-90

CONTRACT LABORATORY ANALYSIS

H-11b3, CULEBRA, ROUND 5

METALS ANALYSIS

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DAT
Calcium		1500.0000		1500.0000			mg/l	10-17
Magnesium		1100.0000		1100.0000			mg/l	10-17
Potassium		680.0000		670.0000			mg/l	10-17
Sodium		40000.0000		41000.0000			mg/l	10-17
Aluminum	<	2.0000	<	2.0000			mg/l	10-17
Antimony	<	0.6000	<	0.6000			mg/l	10-17
Arsenic	<	0.1000	NA	0.0000			mg/l	10-17
Barium	<	2.0000	<	2.0000			mg/l	10-17
Beryllium	<	0.0500	<	0.0500			mg/l	10-17
Boron		31.0000		31.0000			mg/l	10-17
Cadmium		0.0600		0.0600			mg/l	10-17
Cesium	<	0.1000	<	0.1000			mg/l	10-17
Chromium		0.4000		0.4000			mg/l	10-17
Cobalt	<	0.5000	<	0.5000			mg/l	10-17
Copper	<	0.2500	<	0.2500			mg/l	10-17
Iron	<	1.0000	<	1.0000			mg/l	10-17
Lead		0.6000		0.6000			mg/l	17
Lithium		0.5000		0.5000			mg/l	10-17
Manganese		0.2200		0.2300			mg/l	10-17
Mercury	<	0.0002	<	0.0002			mg/l	10-17
Molybdenum		0.3000		0.3000			mg/l	10-17
Nickel	<	0.4000	<	0.4000			mg/l	10-1
Selenium	<	0.0500	NA	0.0000			mg/l	10-1
Silver		0.1000		0.1000			mg/l	10-1
Strontium		21.0000		21.0000			mg/l	10-1
Thallium	<	10.0000	NA	0.0000			mg/l	10-1
Titanium		0.1000		0.1000			mg/l	10-1
Vanadium	<	0.5000	<	0.5000			mg/l	10-1
Zinc	<	0.2000	<	0.2000			mg/l	10-1

CONTRACT LABORATORY ANALYSIS

H-07b1, CULEBRA, ROUND 5

GENERAL CHEMISTRY

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DATE
pH		7.1400		7.1200				11-09-90
Specific Conductance		3760.0000		3760.0000			uMhos/cm@25C	11-09-90
Alkalinity (HCO3)		92.0000	NA	0.0000			mg/l	11-09-90
Bromide	<	2.0000	<	2.0000			mg/l	11-09-90
Chloride		280.0000		280.0000			mg/l	11-09-90
Alkalinity (CO3)		0.0000	NA	0.0000			mg/l	11-09-90
Cyanide	<	0.0100	NA	0.0000			mg/l	11-09-90
Fluoride		1.5000	NA	0.0000			mg/l	11-09-90
Iodide	<	2.0000	<	2.0000			mg/l	11-09-90
Nitrate		0.9000		0.9000			mg/l	11-09-90
Total Phenolics	<	0.0050	NA	0.0000			mg/l	11-09-90
Phosphorus	<	0.0100	NA	0.0000			mg/l	11-09-90
Residue, Filterable @ 180 c		3500.0000	NA	0.0000			mg/l	11-09-90
Residue, Nonfilterable @ 105 c	<	4.0000	NA	0.0000			mg/l	11-09-90
Silica		23.0000	NA	0.0000			mg/l	11-09-90
Sulfate		2100.0000		2100.0000			mg/l	11-09-90
Total Organic Carbon		8.0000		8.0000			mg/l	11-09-90
Total Organic Halides	<	0.0500		0.0600			mg/l	11-09-90

CONTRACT LABORATORY ANALYSIS

H-07b1, CULEBRA, ROUND 5

METALS ANALYSIS

PARAMETER	V	VALUE	S D	VALUE_DUP	ACIDBLANK	WATERBLANK	UNITS	DAT
Calcium		670.0000		660.0000			mg/l	11-09
Magnesium		140.0000		140.0000			mg/l	11-09
Potassium	<	50.0000	<	50.0000			mg/l	11-09
Sodium		100.0000		100.0000			mg/l	11-09
Aluminum	<	2.0000	<	2.0000	< .2	< .2	mg/l	11-09
Antimony	<	0.6000	<	0.6000	< .06	< .06	mg/l	11-09
Arsenic	<	0.0100	NA	0.0000	< .01	< .01	mg/l	11-09
Barium	<	2.0000	<	2.0000	< .2	< .2	mg/l	11-09
Beryllium	<	0.0500	<	0.0500	< .005	< .005	mg/l	11-09
Boron		0.9000		0.9000	0.04	0.03	mg/l	11-09
Cadmium	<	0.0500	<	0.0500	< .005	< .005	mg/l	11-09
Cesium	<	0.1000	<	0.1000	< .1	< .1	mg/l	11-09
Chromium		0.2000		0.2000	0.01	0.01	mg/l	11-09
Cobalt	<	0.5000	<	0.5000	< .05	< .05	mg/l	11-09
Copper	<	0.2500	<	0.2500	< .025	< .025	mg/l	11-09
Iron	<	1.0000		1.0000	< .1	< .1	mg/l	09
Lead	<	0.5000	<	0.5000	< .05	< .05	mg/l	11-09
Lithium	<	0.1000	<	0.1000	< .01	< .01	mg/l	11-09
Manganese	<	0.1500	<	0.1500	< .015	< .015	mg/l	11-09
Mercury	<	0.0020	<	0.0020	< .0002	< .0002	mg/l	11-09
Molybdenum	<	0.2000	<	0.2000	< .02	< .02	mg/l	11-09
Nickel	<	0.4000	<	0.4000	< .04	< .04	mg/l	11-09
Selenium	<	0.0500	NA	0.0000	< .005	< .005	mg/l	11-09
Silver	<	0.1000	<	0.1000	< .01	< .01	mg/l	11-09
Strontium		8.5000		8.5000	< .01	< .01	mg/l	11-09
Thallium	<	0.1000		0.0000	< .01	< .01	mg/l	11-09
Titanium	<	0.1000	<	0.1000	< .01	< .01	mg/l	11-09
Vanadium	<	0.5000	<	0.5000	< .05	< .05	mg/l	11-09
Zinc	<	0.2000	<	0.2000	< .02	< .02	mg/l	11-09

APPENDIX VII
TABULATED RESULTS
OF
SERIAL SAMPLING ANALYSIS

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SERIAL SAMPLE FIELD ANALYSIS
H-09b, CULEBRA
ROUND 4

NO	PARAMETER	V	VALUE	S D	VALUE_DUP	UNITS	DATE	FLOW
1	Eh		261.0000	NA	0.0000	mV	01-16-90	593
2	Eh		245.0000	NA	0.0000	mV	01-17-90	1416
3	Eh		238.0000	NA	0.0000	mV	01-18-90	2236
4	Eh		197.0000	NA	0.0000	mV	01-19-90	3058
1	pH		7.3100	NA	0.0000	S.U.	01-16-90	593
2	pH		7.3100	NA	0.0000	S.U.	01-17-90	1416
3	pH		7.3500	NA	0.0000	S.U.	01-18-90	2236
4	pH		7.3600	NA	0.0000	S.U.	01-19-90	3058
1	TEMPERATURE		21.1000	NA	0.0000	C	01-16-90	593
2	TEMPERATURE		21.0000	NA	0.0000	C	01-17-90	1416
3	TEMPERATURE		21.5000	NA	0.0000	C	01-18-90	2236
4	TEMPERATURE		21.0000	NA	0.0000	C	01-19-90	3058
1	Sp.GRAVITY		1.0040	NA	0.0000	@ 21.0 C	01-16-90	593
4	Sp.GRAVITY		1.0040	NA	0.0000	@ 21.1 C	01-19-90	3058
1	Sp.CONDUCTANCE		3460.0000	NA	0.0000	umhos/cm@25C	01-16-90	593
4	Sp.CONDUCTANCE		3430.0000	NA	0.0000	umhos/cm@25C	01-19-90	3058
1	ALKALINITY		112.4000		113.4000	mg/l	01-16-90	593
2	ALKALINITY		114.6000		115.6000	mg/l	01-17-90	1416
3	ALKALINITY		115.1000		115.1000	mg/l	01-18-90	2236
4	ALKALINITY		116.4000		115.9000	mg/l	01-19-90	3058
1	CHLORIDE		170.0000		171.0000	mg/l	01-16-90	593
2	CHLORIDE		169.0000		169.0000	mg/l	01-17-90	1416
3	CHLORIDE		170.0000		169.0000	mg/l	01-18-90	2236
4	CHLORIDE		169.0000		169.0000	mg/l	01-19-90	3058
1	DIVALENT CATIONS		42.9000		42.8000	meq/l	01-16-90	593
2	DIVALENT CATIONS		42.5000		42.7000	meq/l	01-17-90	1416
3	DIVALENT CATIONS		42.6000		42.7000	meq/l	01-18-90	2236
4	DIVALENT CATIONS		43.1000		42.9000	meq/l	01-19-90	3058
1	TOTAL IRON		0.0900		0.0700	mg/l	01-16-90	593
2	TOTAL IRON		0.1000		0.0800	mg/l	01-17-90	1416
3	TOTAL IRON		0.0700		0.0800	mg/l	01-18-90	2236
4	TOTAL IRON		0.0900		0.0800	mg/l	01-19-90	3058
1	FERROUS IRON		0.0600		0.0600	mg/l	01-16-90	593
2	FERROUS IRON		0.0600		0.0400	mg/l	01-17-90	1416
3	FERROUS IRON		0.0500		0.0600	mg/l	01-18-90	2236
4	FERROUS IRON		0.0500		0.0500	mg/l	01-19-90	3058

DC

SERIAL SAMPLE FIELD ANALYSIS
H-06b, CULEBRA
ROUND 5

NO	PARAMETER	V	VALUE	S D	VALUE_DUP	UNITS	DATE	FLOW
1	Eh		227.0000	NA	0.0000	mV	02-06-90	579
2	Eh		203.0000	NA	0.0000	mV	02-07-90	1452
3	Eh		217.0000	NA	0.0000	mV	02-08-90	2375
4	Eh		190.0000	NA	0.0000	mV	02-09-90	3282
5	Eh		208.0000	NA	0.0000	mV	02-10-90	4518
6	Eh		208.0000	NA	0.0000	mV	02-11-90	5326
7	Eh		213.0000	NA	0.0000	mV	02-12-90	6127
1	pH		6.9800	NA	0.0000	S.U.	02-06-90	579
2	pH		6.9600	NA	0.0000	S.U.	02-07-90	1452
3	pH		7.0100	NA	0.0000	S.U.	02-08-90	2375
4	pH		7.0000	NA	0.0000	S.U.	02-09-90	3282
5	pH		7.0100	NA	0.0000	S.U.	02-10-90	4518
6	pH		7.0400	NA	0.0000	S.U.	02-11-90	5326
7	pH		7.0400	NA	0.0000	S.U.	02-12-90	6127
1	TEMPERATURE		21.3000	NA	0.0000	C	02-06-90	579
2	TEMPERATURE		21.4000	NA	0.0000	C	02-07-90	1452
3	TEMPERATURE		21.3000	NA	0.0000	C	02-08-90	2375
4	TEMPERATURE		21.2000	NA	0.0000	C	02-09-90	3282
5	TEMPERATURE		21.3000	NA	0.0000	C	02-10-90	4518
6	TEMPERATURE		21.5000	NA	0.0000	C	02-11-90	5326
7	TEMPERATURE		21.5000	NA	0.0000	C	02-12-90	6127
1	Sp.GRAVITY		1.0422	NA	0.0000	@ 21.2 C	02-06-90	579
7	Sp.GRAVITY		1.0448	NA	0.0000	@ 21.5 C	02-12-90	6127
1	Sp.CONDUCTANCE		73400.0000	NA	0.0000	umhos/cm@25C	02-06-90	579
7	Sp.CONDUCTANCE		75300.0000	NA	0.0000	umhos/cm@25C	02-12-90	6127
1	ALKALINITY		96.0000		95.0000	mg/l	02-06-90	579
2	ALKALINITY		94.0000		93.1000	mg/l	02-07-90	1452
3	ALKALINITY		94.5000		94.5000	mg/l	02-08-90	2375
4	ALKALINITY		94.0000		94.5000	mg/l	02-09-90	3282
5	ALKALINITY		93.5000		94.3000	mg/l	02-10-90	4518
6	ALKALINITY		94.5000		94.5000	mg/l	02-11-90	5326
7	ALKALINITY		95.3000		95.5000	mg/l	02-12-90	6127
1	CHLORIDE		31835.0000		31974.0000	mg/l	02-06-90	579
2	CHLORIDE		32044.0000		31905.0000	mg/l	02-07-90	1452
3	CHLORIDE		32113.0000		31905.0000	mg/l	02-08-90	2375
4	CHLORIDE		31557.0000		31905.0000	mg/l	02-09-90	3282
5	CHLORIDE		31974.0000		32113.0000	mg/l	02-10-90	4518
6	CHLORIDE		32113.0000		32322.0000	mg/l	02-11-90	5326
7	CHLORIDE		32322.0000		32113.0000	mg/l	02-12-90	6127
1	DIVALENT CATIONS		197.3000		198.9000	meq/l	02-06-90	579
2	DIVALENT CATIONS		196.5000		195.7000	meq/l	02-07-90	1452
3	DIVALENT CATIONS		195.7000		194.8000	meq/l	02-08-90	2375
4	DIVALENT CATIONS		196.9000		195.7000	meq/l	02-09-90	3282
5	DIVALENT CATIONS		195.2000		194.0000	meq/l	02-10-90	4518
6	DIVALENT CATIONS		194.8000		195.7000	meq/l	02-11-90	5326
7	DIVALENT CATIONS		196.9000		196.1000	meq/l	02-12-90	6127
1	TOTAL IRON		0.8000		0.7800	mg/l	02-06-90	579
2	TOTAL IRON		0.4600		0.4300	mg/l	02-07-90	1452
3	TOTAL IRON		0.4200		0.4000	mg/l	02-08-90	2375
4	TOTAL IRON		0.4200		0.4400	mg/l	02-09-90	3282
5	TOTAL IRON		0.4300		0.4100	mg/l	02-10-90	4518
6	TOTAL IRON		0.4000		0.4100	mg/l	02-11-90	5326
7	TOTAL IRON		0.3400		0.3700	mg/l	02-12-90	6127
1	FERROUS IRON		0.7100		0.7000	mg/l	02-06-90	579
2	FERROUS IRON		0.3500		0.3600	mg/l	02-07-90	1452
3	FERROUS IRON		0.3400		0.3500	mg/l	02-08-90	2375
4	FERROUS IRON		0.4000		0.3700	mg/l	02-09-90	3282
5	FERROUS IRON		0.3400		0.3400	mg/l	02-10-90	4518
6	FERROUS IRON		0.3400		0.3200	mg/l	02-11-90	5326
7	FERROUS IRON		0.2900		0.2800	mg/l	02-12-90	6127

H-06c, MAGENTA
SERIAL SAMPLE FIELD ANALYSIS
H-06c, MAGENTA
ROUND 5

NO	PARAMETER	V	VALUE	S D	VALUE_DUP	UNITS	DATE	FLOW
1	Eh		183.0000	NA	0.0000	mV	03-13-90	326
2	Eh		221.0000	NA	0.0000	mV	03-14-90	811
3	Eh		224.0000	NA	0.0000	mV	03-15-90	1308
1	pH		7.8200	NA	0.0000	S.U.	03-13-90	326
2	pH		7.8000	NA	0.0000	S.U.	03-14-90	811
3	pH		7.8300	NA	0.0000	S.U.	03-15-90	1308
1	TEMPERATURE		21.0000	NA	0.0000	C	03-13-90	326
2	TEMPERATURE		20.0000	NA	0.0000	C	03-14-90	811
3	TEMPERATURE		21.2000	NA	0.0000	C	03-15-90	1308
1	Sp.GRAVITY		1.0032	NA	0.0000	@ 20.8 C	03-13-90	326
3	Sp.GRAVITY		1.0034	NA	0.0000	@ 21.2 C	03-15-90	1308
1	Sp.CONDUCTANCE		4900.0000	NA	0.0000	umhos/cm@25C	03-13-90	326
3	Sp.CONDUCTANCE		5200.0000	NA	0.0000	umhos/cm@25C	03-15-90	1308
1	ALKALINITY		54.3000		53.6000	mg/l	03-13-90	326
2	ALKALINITY		52.6000		52.3000	mg/l	03-14-90	811
3	ALKALINITY		51.4000		50.6000	mg/l	03-15-90	1308
1	CHLORIDE		405.0000		408.0000	mg/l	03-13-90	326
2	CHLORIDE		407.0000		408.0000	mg/l	03-14-90	811
3	CHLORIDE		405.0000		403.0000	mg/l	03-15-90	1308
1	DIVALENT CATIONS		42.1000		41.8000	meq/l	03-13-90	326
2	DIVALENT CATIONS		41.9000		42.0800	meq/l	03-14-90	811
3	DIVALENT CATIONS		41.5000		41.5000	meq/l	03-15-90	1308
1	TOTAL IRON		0.1400		0.1500	mg/l	03-13-90	326
2	TOTAL IRON		0.1500		0.1500	mg/l	03-14-90	811
3	TOTAL IRON		0.1000		0.0900	mg/l	03-15-90	1308
1	FERROUS IRON		0.1300		0.1200	mg/l	03-13-90	326
2	FERROUS IRON		0.1200		0.0900	mg/l	03-14-90	811
3	FERROUS IRON		0.0700		0.0600	mg/l	03-15-90	1308

SERIAL SAMPLE FIELD ANALYSIS
H-18, CULEBRA
ROUND 3

NO	PARAMETER	V	VALUE	S D	VALUE_DUP	UNITS	DATE	FLOW
1	Eh		235.0000	NA	0.0000	mV	04-02-90	1336
2	Eh		208.0000	NA	0.0000	mV	04-03-90	1987
3	Eh		208.0000	NA	0.0000	mV	04-04-90	2688
4	Eh		239.0000	NA	0.0000	mV	04-05-90	3408
5	Eh		227.0000	NA	0.0000	mV	04-06-90	4126
6	Eh		171.0000	NA	0.0000	mV	04-08-90	5609
7	Eh		169.0000	NA	0.0000	mV	04-09-90	6243
8	Eh		233.0000	NA	0.0000	mV	04-10-90	6933
1	pH		7.8300	NA	0.0000	S.U.	04-02-90	1336
2	pH		7.8300	NA	0.0000	S.U.	04-03-90	1987
3	pH		7.7900	NA	0.0000	S.U.	04-04-90	2688
4	pH		7.7800	NA	0.0000	S.U.	04-05-90	3408
5	pH		7.7200	NA	0.0000	S.U.	04-06-90	4126
6	pH		7.7500	NA	0.0000	S.U.	04-08-90	5609
7	pH		7.7000	NA	0.0000	S.U.	04-09-90	6243
8	pH		7.7200	NA	0.0000	S.U.	04-10-90	6933
1	TEMPERATURE		21.2000	NA	0.0000	C	04-02-90	1336
2	TEMPERATURE		20.8000	NA	0.0000	C	04-03-90	1987
3	TEMPERATURE		21.2000	NA	0.0000	C	04-04-90	2688
4	TEMPERATURE		22.0000	NA	0.0000	C	04-05-90	3408
5	TEMPERATURE		21.4000	NA	0.0000	C	04-06-90	4126
6	TEMPERATURE		21.4000	NA	0.0000	C	04-08-90	5609
7	TEMPERATURE		22.1000	NA	0.0000	C	04-09-90	6243
8	TEMPERATURE		21.5000	NA	0.0000	C	04-10-90	6933
1	Sp.GRAVITY		1.0232	NA	0.0000	@ 21.3 C	04-02-90	1336
6	Sp.GRAVITY		1.0220	NA	0.0000	@ 21.5 C	04-08-90	5609
8	Sp.GRAVITY		1.0200	NA	0.0000	@ 21.5 C	04-10-90	6933
1	Sp.CONDUCTANCE		44500.0000	NA	0.0000	umhos/cm@25C	04-02-90	1336
6	Sp.CONDUCTANCE		39800.0000	NA	0.0000	umhos/cm@25C	04-08-90	5609
8	Sp.CONDUCTANCE		39300.0000	NA	0.0000	umhos/cm@25C	04-10-90	6933
1	ALKALINITY		55.0000		55.7000	mg/l	04-02-90	1336
2	ALKALINITY		53.7000		53.2000	mg/l	04-03-90	1987
3	ALKALINITY		51.5000		52.5000	mg/l	04-04-90	2688
4	ALKALINITY		51.0000		51.8000	mg/l	04-05-90	3408
5	ALKALINITY		52.9000		52.2000	mg/l	04-06-90	4126
6	ALKALINITY		51.2000		51.2000	mg/l	04-08-90	5609
7	ALKALINITY		50.9000		51.7000	mg/l	04-09-90	6243
8	ALKALINITY		51.9000		51.2000	mg/l	04-10-90	6933
1	CHLORIDE		16567.0000		16671.0000	mg/l	04-02-90	1336
2	CHLORIDE		14792.0000		14931.0000	mg/l	04-03-90	1987
3	CHLORIDE		14513.0000		14618.0000	mg/l	04-04-90	2688
4	CHLORIDE		14228.0000		14144.0000	mg/l	04-05-90	3408
5	CHLORIDE		14007.0000		13896.0000	mg/l	04-06-90	4126
6	CHLORIDE		13924.0000		13841.0000	mg/l	04-08-90	5609
7	CHLORIDE		13813.0000		13868.0000	mg/l	04-09-90	6243
8	CHLORIDE		13924.0000		14007.0000	mg/l	04-10-90	6933
1	DIVALENT CATIONS		104.4000		104.0000	meq/l	04-02-90	1336
2	DIVALENT CATIONS		102.6000		102.4000	meq/l	04-03-90	1987
3	DIVALENT CATIONS		99.6000		100.8000	meq/l	04-04-90	2688
4	DIVALENT CATIONS		101.2000		101.6000	meq/l	04-05-90	3408
5	DIVALENT CATIONS		100.5000		100.5000	meq/l	04-06-90	4126
6	DIVALENT CATIONS		101.3000		100.9000	meq/l	04-08-90	5609
7	DIVALENT CATIONS		101.7000		101.5000	meq/l	04-09-90	6243
8	DIVALENT CATIONS		100.7000		100.7000	meq/l	04-10-90	6933
1	TOTAL IRON		1.5200		1.5300	mg/l	04-02-90	1336
2	TOTAL IRON		0.6900		0.6400	mg/l	04-03-90	1987
3	TOTAL IRON		0.5000		0.5200	mg/l	04-04-90	2688
4	TOTAL IRON		0.4800		0.4600	mg/l	04-05-90	3408
5	TOTAL IRON		0.4200		0.4400	mg/l	04-06-90	4126
6	TOTAL IRON		0.3800		0.3500	mg/l	04-08-90	5609
7	TOTAL IRON		0.3600		0.3600	mg/l	04-09-90	6243
8	TOTAL IRON		0.3700		0.3900	mg/l	04-10-90	6933
1	FERROUS IRON		1.3900		1.3800	mg/l	04-02-90	1336
2	FERROUS IRON		0.5300		0.5500	mg/l	04-03-90	1987
3	FERROUS IRON		0.3700		0.3800	mg/l	04-04-90	2688
4	FERROUS IRON		0.3200		0.3600	mg/l	04-05-90	3408
5	FERROUS IRON		0.3500		0.3100	mg/l	04-06-90	4126
6	FERROUS IRON		0.2800		0.3100	mg/l	04-08-90	5609
7	FERROUS IRON		0.2700		0.3000	mg/l	04-09-90	6243
8	FERROUS IRON		0.3400		0.3100	mg/l	04-10-90	6933

SERIAL SAMPLE FIELD ANALYSIS
WIPP-19, CULEBRA
ROUND 5

NO	PARAMETER	V	VALUE	S D	VALUE_DUP	UNITS	DATE	FLOW
1	Eh		157.0000	NA	0.0000	mV	06-04-90	2512
2	Eh		13.0000	NA	0.0000	mV	06-06-90	3156
3	Eh		-53.0000	NA	0.0000	mV	06-07-90	3579
4	Eh		85.0000	NA	0.0000	mV	06-10-90	4602
5	Eh		210.0000	NA	0.0000	mV	06-11-90	5050
6	Eh		204.0000	NA	0.0000	mV	06-12-90	5516
1	pH		7.4600	NA	0.0000	S.U.	06-04-90	2512
2	pH		7.5600	NA	0.0000	S.U.	06-06-90	3156
3	pH		7.5000	NA	0.0000	S.U.	06-07-90	3579
4	pH		7.3800	NA	0.0000	S.U.	06-10-90	4602
5	pH		7.4800	NA	0.0000	S.U.	06-11-90	5050
6	pH		7.3100	NA	0.0000	S.U.	06-12-90	5516
1	TEMPERATURE		23.0000	NA	0.0000	C	06-04-90	2512
2	TEMPERATURE		22.9000	NA	0.0000	C	06-06-90	3156
3	TEMPERATURE		22.8000	NA	0.0000	C	06-07-90	3579
4	TEMPERATURE		23.0000	NA	0.0000	C	06-10-90	4602
5	TEMPERATURE		22.5000	NA	0.0000	C	06-11-90	5050
6	TEMPERATURE		23.1000	NA	0.0000	C	06-12-90	5516
1	Sp.GRAVITY		1.0570	NA	0.0000	@ 23.4 C	06-04-90	2512
4	Sp.GRAVITY		1.0560	NA	0.0000	@ 22.9 C	06-10-90	4602
6	Sp.GRAVITY		1.0546	NA	0.0000	@ 23.2 C	06-12-90	5516
1	Sp.CONDUCTANCE		94800.0000	NA	0.0000	umhos/cm@25C	06-04-90	2512
6	Sp.CONDUCTANCE		91800.0000	NA	0.0000	umhos/cm@25C	06-12-90	5516
1	ALKALINITY		74.8000		75.5000	mg/l	06-04-90	2512
2	ALKALINITY		65.8000		64.8000	mg/l	06-06-90	3156
3	ALKALINITY		62.6000		63.3000	mg/l	06-07-90	3579
4	ALKALINITY		57.5000		58.7000	mg/l	06-10-90	4602
5	ALKALINITY		57.3000		58.2000	mg/l	06-11-90	5050
6	ALKALINITY		59.7000		59.0000	mg/l	06-12-90	5516
1	CHLORIDE		41130.0000		41475.0000	mg/l	06-04-90	2512
2	CHLORIDE		40784.0000		40577.0000	mg/l	06-06-90	3156
3	CHLORIDE		40922.0000		41199.0000	mg/l	06-07-90	3579
4	CHLORIDE		40438.0000		40438.0000	mg/l	06-10-90	4602
5	CHLORIDE		40231.0000		40508.0000	mg/l	06-11-90	5050
6	CHLORIDE		40438.0000		40577.0000	mg/l	06-12-90	5516
1	DIVALENT CATIONS		191.0000		192.6000	mg/l	06-04-90	2512
2	DIVALENT CATIONS		188.6000		187.8000	mg/l	06-06-90	3156
3	DIVALENT CATIONS		180.5000		182.1000	mg/l	06-07-90	3579
4	DIVALENT CATIONS		184.5000		185.3000	mg/l	06-10-90	4602
5	DIVALENT CATIONS		177.7000		178.9000	mg/l	06-11-90	5050
6	DIVALENT CATIONS		178.5000		179.3000	mg/l	06-12-90	5516
1	TOTAL IRON		2.1800		2.1900	mg/l	06-04-90	2512
2	TOTAL IRON		2.4900		2.5200	mg/l	06-06-90	3156
3	TOTAL IRON		2.3200		2.3400	mg/l	06-07-90	3579
4	TOTAL IRON		1.0600		1.0900	mg/l	06-10-90	4602
5	TOTAL IRON		1.0300		1.0600	mg/l	06-11-90	5050
6	TOTAL IRON		0.8200		0.8300	mg/l	06-12-90	5516
1	FERROUS IRON		2.1800		2.1300	mg/l	06-04-90	2512
2	FERROUS IRON		2.4500		2.4100	mg/l	06-06-90	3156
3	FERROUS IRON		2.2000		2.2300	mg/l	06-07-90	3579
4	FERROUS IRON		1.0200		1.0000	mg/l	06-10-90	4602
5	FERROUS IRON		0.9800		0.9900	mg/l	06-11-90	5050
6	FERROUS IRON		0.7100		0.7200	mg/l	06-12-90	5516

DC

SERIAL SAMPLE FIELD ANALYSIS
H-18, CULEBRA
ROUND 3

NO	PARAMETER	V	VALUE	S D	VALUE_DUP	UNITS	DATE	FLOW
1	Eh		235.0000	NA	0.0000	mV	04-02-90	1336
2	Eh		208.0000	NA	0.0000	mV	04-03-90	1987
3	Eh		208.0000	NA	0.0000	mV	04-04-90	2688
4	Eh		239.0000	NA	0.0000	mV	04-05-90	3408
5	Eh		227.0000	NA	0.0000	mV	04-06-90	4126
6	Eh		171.0000	NA	0.0000	mV	04-08-90	5609
7	Eh		169.0000	NA	0.0000	mV	04-09-90	6243
8	Eh		233.0000	NA	0.0000	mV	04-10-90	6933
1	pH		7.8300	NA	0.0000	S.U.	04-02-90	1336
2	pH		7.8300	NA	0.0000	S.U.	04-03-90	1987
3	pH		7.7900	NA	0.0000	S.U.	04-04-90	2688
4	pH		7.7800	NA	0.0000	S.U.	04-05-90	3408
5	pH		7.7200	NA	0.0000	S.U.	04-06-90	4126
6	pH		7.7500	NA	0.0000	S.U.	04-08-90	5609
7	pH		7.7000	NA	0.0000	S.U.	04-09-90	6243
8	pH		7.7200	NA	0.0000	S.U.	04-10-90	6933
1	TEMPERATURE		21.2000	NA	0.0000	C	04-02-90	1336
2	TEMPERATURE		20.8000	NA	0.0000	C	04-03-90	1987
3	TEMPERATURE		21.2000	NA	0.0000	C	04-04-90	2688
4	TEMPERATURE		22.0000	NA	0.0000	C	04-05-90	3408
5	TEMPERATURE		21.4000	NA	0.0000	C	04-06-90	4126
6	TEMPERATURE		21.4000	NA	0.0000	C	04-08-90	5609
7	TEMPERATURE		22.1000	NA	0.0000	C	04-09-90	6243
8	TEMPERATURE		21.5000	NA	0.0000	C	04-10-90	6933
1	Sp.GRAVITY		1.0232	NA	0.0000	@ 21.3 C	04-02-90	1336
6	Sp.GRAVITY		1.0220	NA	0.0000	@ 21.5 C	04-08-90	5609
8	Sp.GRAVITY		1.0200	NA	0.0000	@ 21.5 C	04-10-90	6933
1	Sp.CONDUCTANCE		44500.0000	NA	0.0000	umhos/cm@25C	04-02-90	1336
6	Sp.CONDUCTANCE		39800.0000	NA	0.0000	umhos/cm@25C	04-08-90	5609
8	Sp.CONDUCTANCE		39300.0000	NA	0.0000	umhos/cm@25C	04-10-90	6933
1	ALKALINITY		55.0000		55.7000	mg/l	04-02-90	1336
2	ALKALINITY		53.7000		53.2000	mg/l	04-03-90	1987
3	ALKALINITY		51.5000		52.5000	mg/l	04-04-90	2688
4	ALKALINITY		51.0000		51.8000	mg/l	04-05-90	3408
5	ALKALINITY		52.9000		52.2000	mg/l	04-06-90	4126
6	ALKALINITY		51.2000		51.2000	mg/l	04-08-90	5609
7	ALKALINITY		50.9000		51.7000	mg/l	04-09-90	6243
8	ALKALINITY		51.9000		51.2000	mg/l	04-10-90	6933
1	CHLORIDE		16567.0000		16671.0000	mg/l	04-02-90	1336
2	CHLORIDE		14792.0000		14931.0000	mg/l	04-03-90	1987
3	CHLORIDE		14513.0000		14618.0000	mg/l	04-04-90	2688
4	CHLORIDE		14228.0000		14144.0000	mg/l	04-05-90	3408
5	CHLORIDE		14007.0000		13896.0000	mg/l	04-06-90	4126
6	CHLORIDE		13924.0000		13841.0000	mg/l	04-08-90	5609
7	CHLORIDE		13813.0000		13868.0000	mg/l	04-09-90	6243
8	CHLORIDE		13924.0000		14007.0000	mg/l	04-10-90	6933
1	DIVALENT CATIONS		104.4000		104.0000	meq/l	04-02-90	1336
2	DIVALENT CATIONS		102.6000		102.4000	meq/l	04-03-90	1987
3	DIVALENT CATIONS		99.6000		100.8000	meq/l	04-04-90	2688
4	DIVALENT CATIONS		101.2000		101.6000	meq/l	04-05-90	3408
5	DIVALENT CATIONS		100.5000		100.5000	meq/l	04-06-90	4126
6	DIVALENT CATIONS		101.3000		100.9000	meq/l	04-08-90	5609
7	DIVALENT CATIONS		101.7000		101.5000	meq/l	04-09-90	6243
8	DIVALENT CATIONS		100.7000		100.7000	meq/l	04-10-90	6933
1	TOTAL IRON		1.5200		1.5300	mg/l	04-02-90	1336
2	TOTAL IRON		0.6900		0.6400	mg/l	04-03-90	1987
3	TOTAL IRON		0.5000		0.5200	mg/l	04-04-90	2688
4	TOTAL IRON		0.4800		0.4600	mg/l	04-05-90	3408
5	TOTAL IRON		0.4200		0.4400	mg/l	04-06-90	4126
6	TOTAL IRON		0.3800		0.3500	mg/l	04-08-90	5609
7	TOTAL IRON		0.3600		0.3600	mg/l	04-09-90	6243
8	TOTAL IRON		0.3700		0.3900	mg/l	04-10-90	6933
1	FERROUS IRON		1.3900		1.3800	mg/l	04-02-90	1336
2	FERROUS IRON		0.5300		0.5500	mg/l	04-03-90	1987
3	FERROUS IRON		0.3700		0.3800	mg/l	04-04-90	2688
4	FERROUS IRON		0.3200		0.3600	mg/l	04-05-90	3408
5	FERROUS IRON		0.3500		0.3100	mg/l	04-06-90	4126
6	FERROUS IRON		0.2800		0.3100	mg/l	04-08-90	5609
7	FERROUS IRON		0.2700		0.3000	mg/l	04-09-90	6243
8	FERROUS IRON		0.3400		0.3100	mg/l	04-10-90	6933

SERIAL SAMPLING FIELD ANALYSIS
H-05b, CULEBRA
ROUND 5

NO	PARAMETER	V	VALUE	S D	VALUE_DUP	UNITS	DATE	FLOW
1	Eh		140.0000	NA	0.0000	mV	04-24-90	278
2	Eh		62.0000	NA	0.0000	mV	04-30-90	1753
3	Eh		134.0000	NA	0.0000	mV	05-01-90	2010
4	Eh		144.0000	NA	0.0000	mV	05-02-90	2253
1	pH		7.4700	NA	0.0000	S.U.	04-24-90	278
2	pH		7.4100	NA	0.0000	S.U.	04-30-90	1753
3	pH		7.2900	NA	0.0000	S.U.	05-01-90	2010
4	pH		7.2900	NA	0.0000	S.U.	05-02-90	2253
1	TEMPERATURE		21.2000	NA	0.0000	C	04-24-90	278
2	TEMPERATURE		20.5000	NA	0.0000	C	04-30-90	1753
3	TEMPERATURE		19.8000	NA	0.0000	C	05-01-90	2010
4	TEMPERATURE		20.3000	NA	0.0000	C	05-02-90	2253
1	Sp.GRAVITY		1.1040	NA	0.0000	@ 21.1 C	04-24-90	278
2	Sp.GRAVITY		1.1028	NA	0.0000	@ 20.6 C	04-30-90	1753
3	Sp.GRAVITY		1.1040	NA	0.0000	@ 19.4 C	05-01-90	2010
4	Sp.GRAVITY		1.1040	NA	0.0000	@ 20.2 C	05-02-90	2253
1	Sp.CONDUCTANCE		151900.0000	NA	0.0000	umhos/cm@25C	04-24-90	278
2	Sp.CONDUCTANCE		153700.0000	NA	0.0000	umhos/cm@25C	04-30-90	1753
4	Sp.CONDUCTANCE		155900.0000	NA	0.0000	umhos/cm@25C	05-02-90	2253
1	ALKALINITY		54.6000		55.6000	mg/l	04-24-90	278
2	ALKALINITY		51.7000		52.7000	mg/l	04-30-90	1753
3	ALKALINITY		51.2000		51.2000	mg/l	05-01-90	2010
4	ALKALINITY		50.5000		51.2000	mg/l	05-02-90	2253
1	CHLORIDE		84593.0000		85461.0000	mg/l	04-24-90	278
2	CHLORIDE		85635.0000		84940.0000	mg/l	04-30-90	1753
3	CHLORIDE		85809.0000		85461.0000	mg/l	05-01-90	2010
4	CHLORIDE		86330.0000		86330.0000	mg/l	05-02-90	2253
1	DIVALENT CATIONS		265.8000		263.0000	meq/l	04-24-90	278
2	DIVALENT CATIONS		263.4000		261.4000	meq/l	04-30-90	1753
3	DIVALENT CATIONS		261.8000		260.6000	meq/l	05-01-90	2010
4	DIVALENT CATIONS		263.4000		262.2000	meq/l	05-02-90	2253
1	TOTAL IRON		4.3900		4.4900	mg/l	04-24-90	278
2	TOTAL IRON		2.7600		2.6100	mg/l	04-30-90	1753
3	TOTAL IRON		2.3200		2.1800	mg/l	05-01-90	2010
4	TOTAL IRON		2.7200		2.7900	mg/l	05-02-90	2253
1	FERROUS IRON		3.8300		4.1100	mg/l	04-24-90	278
2	FERROUS IRON		2.3800		2.4500	mg/l	04-30-90	1753
3	FERROUS IRON		2.1100		2.0200	mg/l	05-01-90	2010
4	FERROUS IRON		2.4700		2.4100	mg/l	05-02-90	2253

SERIAL SAMPLE FIELD ANALYSIS
H-05c, MAGENTA
ROUND 5

NO	PARAMETER	V	VALUE	S D	VALUE_DUP	UNITS	DATE	FLOW
1	Eh		0.0000	NA	0.0000	mV	05-14-90	1497
2	Eh		-2.0000	NA	0.0000	mV	05-15-90	1705
3	Eh		-4.0000	NA	0.0000	mV	05-16-90	1940
1	pH		7.9100	NA	0.0000	S.U.	05-14-90	1497
2	pH		7.9200	NA	0.0000	S.U.	05-15-90	1705
3	pH		7.9500	NA	0.0000	S.U.	05-16-90	1940
1	TEMPERATURE		21.7000	NA	0.0000	C	05-14-90	1497
2	TEMPERATURE		21.8000	NA	0.0000	C	05-15-90	1705
3	TEMPERATURE		21.8000	NA	0.0000	C	05-16-90	1940
1	Sp.GRAVITY		1.0070	NA	0.0000	@ 21.5 C	05-14-90	1497
3	Sp.GRAVITY		1.0062	NA	0.0000	@ 21.8 C	05-16-90	1940
1	Sp.CONDUCTANCE		8500.0000	NA	0.0000	umhos/cm@25C	05-14-90	1497
3	Sp.CONDUCTANCE		8480.0000	NA	0.0000	umhos/cm@25C	05-16-90	1940
1	ALKALINITY		58.0000		57.2000	mg/l	05-14-90	1497
2	ALKALINITY		58.0000		58.4000	mg/l	05-15-90	1705
3	ALKALINITY		59.7000		58.7000	mg/l	05-16-90	1940
1	CHLORIDE		1035.0000		1038.0000	mg/l	05-14-90	1497
2	CHLORIDE		1033.0000		1028.0000	mg/l	05-15-90	1705
3	CHLORIDE		1030.0000		1025.0000	mg/l	05-16-90	1940
1	DIVALENT CATIONS		42.9000		42.6000	meq/l	05-14-90	1497
2	DIVALENT CATIONS		42.9000		42.5000	meq/l	05-15-90	1705
3	DIVALENT CATIONS		42.6000		42.6000	meq/l	05-16-90	1940
1	TOTAL IRON		0.2200		0.2200	mg/l	05-14-90	1497
2	TOTAL IRON		0.1900		0.2100	mg/l	05-15-90	1705
3	TOTAL IRON		0.1800		0.1700	mg/l	05-16-90	1940
1	FERROUS IRON		0.1500		0.1400	mg/l	05-14-90	1497
2	FERROUS IRON		0.1300		0.1200	mg/l	05-15-90	1705
3	FERROUS IRON		0.1000		0.0900	mg/l	05-16-90	1940

SERIAL SAMPLE FIELD ANALYSIS
H-03b1, MAGENTA
ROUND 5

NO	PARAMETER	V	VALUE	S	D	VALUE_DUP	UNITS	DATE	FLOW
1	Eh		48.0000	NA		0.0000	mV	08-23-90	475
2	Eh		-78.0000	NA		0.0000	mV	08-24-90	741
3	Eh		-62.0000	NA		0.0000	mV	08-26-90	1298
4	Eh		-24.0000	NA		0.0000	mV	08-27-90	1530
5	Eh		-5.0000	NA		0.0000	mV	08-28-90	1795
1	pH		7.8600	NA		0.0000	S.U.	08-23-90	475
2	pH		7.7800	NA		0.0000	S.U.	08-24-90	741
3	pH		7.7600	NA		0.0000	S.U.	08-26-90	1298
4	pH		7.8100	NA		0.0000	S.U.	08-27-90	1530
5	pH		7.7500	NA		0.0000	S.U.	08-28-90	1795
1	TEMPERATURE		22.9000	NA		0.0000	C	08-23-90	475
2	TEMPERATURE		24.4000	NA		0.0000	C	08-24-90	741
3	TEMPERATURE		24.3000	NA		0.0000	C	08-26-90	1298
4	TEMPERATURE		23.0000	NA		0.0000	C	08-27-90	1530
5	TEMPERATURE		23.6000	NA		0.0000	C	08-28-90	1795
1	Sp.GRAVITY		1.0084	NA		0.0000	@ 22.9 C	08-23-90	475
5	Sp.GRAVITY		1.0080	NA		0.0000	@ 23.2 C	08-28-90	1795
1	Sp.CONDUCTANCE		12200.0000	NA		0.0000	umhos/cm@25C	08-23-90	475
5	Sp.CONDUCTANCE		12200.0000	NA		0.0000	umhos/cm@25C	08-28-90	1795
1	ALKALINITY		46.0000			46.7000	mg/l	08-23-90	475
2	ALKALINITY		46.7000			47.2000	mg/l	08-24-90	741
3	ALKALINITY		47.6000			46.2000	mg/l	08-26-90	1298
4	ALKALINITY		46.5000			46.5000	mg/l	08-27-90	1530
5	ALKALINITY		46.0000			45.7000	mg/l	08-28-90	1795
1	CHLORIDE		3436.0000			3415.0000	mg/l	08-23-90	475
2	CHLORIDE		3401.0000			3372.0000	mg/l	08-24-90	741
3	CHLORIDE		3458.0000			3436.0000	mg/l	08-26-90	1298
4	CHLORIDE		3458.0000			3465.0000	mg/l	08-27-90	1530
5	CHLORIDE		3465.0000			3450.0000	mg/l	08-28-90	1795
1	DIVALENT CATIONS		74.3000			75.1000	mg/l	08-23-90	475
2	DIVALENT CATIONS		73.8000			73.9000	mg/l	08-24-90	741
3	DIVALENT CATIONS		74.1000			73.5000	mg/l	08-26-90	1298
4	DIVALENT CATIONS		73.6000			73.3000	mg/l	08-27-90	1530
5	DIVALENT CATIONS		73.5000			73.9000	mg/l	08-28-90	1795
1	TOTAL IRON		0.0700			0.0600	mg/l	08-23-90	475
2	TOTAL IRON	<	0.0200	<		0.0200	mg/l	08-24-90	741
3	TOTAL IRON	<	0.0200	<		0.0200	mg/l	08-26-90	1298
4	TOTAL IRON	<	0.0200	<		0.0200	mg/l	08-27-90	1530
5	TOTAL IRON	<	0.0200	<		0.0200	mg/l	08-28-90	1795
1	FERROUS IRON		0.0500			0.0400	mg/l	08-23-90	475
2	FERROUS IRON	<	0.0200	<		0.0200	mg/l	08-24-90	741
3	FERROUS IRON	<	0.0200	<		0.0200	mg/l	08-26-90	1298
4	FERROUS IRON	<	0.0200	<		0.0200	mg/l	08-27-90	1530
5	FERROUS IRON	<	0.0200	<		0.0200	mg/l	08-28-90	1795

SERIAL SAMPLE FIELD ANALYSIS
H-02c, CULEBRA
ROUND 2

NO	PARAMETER	V	VALUE	S D	VALUE_DUP	UNITS	DATE	FLOW
1	Eh		229.0000	NA	0.0000	mV	07-19-90	2939
2	Eh		235.0000	NA	0.0000	mV	07-20-90	3253
3	Eh		213.0000	NA	0.0000	mV	07-22-90	3871
4	Eh		274.0000	NA	0.0000	mV	07-23-90	3957
5	Eh		245.0000	NA	0.0000	mV	07-24-90	4294
1	pH		7.7100	NA	0.0000	S.U.	07-19-90	2939
2	pH		7.7800	NA	0.0000	S.U.	07-20-90	3253
3	pH		7.7800	NA	0.0000	S.U.	07-22-90	3871
4	pH		7.8800	NA	0.0000	S.U.	07-23-90	3957
5	pH		7.7200	NA	0.0000	S.U.	07-24-90	4294
1	TEMPERATURE		22.0000	NA	0.0000	C	07-19-90	2939
2	TEMPERATURE		21.0000	NA	0.0000	C	07-20-90	3253
3	TEMPERATURE		22.0000	NA	0.0000	C	07-22-90	3871
4	TEMPERATURE		21.6000	NA	0.0000	C	07-23-90	3957
5	TEMPERATURE		22.2000	NA	0.0000	C	07-24-90	4294
1	Sp.GRAVITY		1.0100	NA	0.0000	@ 22.6 C	07-19-90	2939
2	Sp.GRAVITY		1.0100	NA	0.0000	@ 20.0 C	07-20-90	3253
5	Sp.GRAVITY		1.0100	NA	0.0000	@ 22.3 C	07-24-90	4294
1	Sp.CONDUCTANCE		12600.0000	NA	0.0000	umhos/cm@25C	07-19-90	2939
5	Sp.CONDUCTANCE		12510.0000	NA	0.0000	umhos/cm@25C	07-24-90	4294
1	ALKALINITY		60.0000		59.1000	mg/l	07-19-90	2939
2	ALKALINITY		59.6000		58.5000	mg/l	07-20-90	3253
3	ALKALINITY		60.4000		59.5000	mg/l	07-22-90	3871
4	ALKALINITY		60.7000		60.2000	mg/l	07-23-90	3957
5	ALKALINITY		61.4000		60.4000	mg/l	07-24-90	4294
1	CHLORIDE		3061.0000		3013.0000	mg/l	07-19-90	2939
2	CHLORIDE		2999.0000		2964.0000	mg/l	07-20-90	3253
3	CHLORIDE		2978.0000		3006.0000	mg/l	07-22-90	3871
4	CHLORIDE		2992.0000		2957.0000	mg/l	07-23-90	3957
5	CHLORIDE		2992.0000		3006.0000	mg/l	07-24-90	4294
1	DIVALENT CATIONS		48.5000		48.3000	mg/l	07-19-90	2939
2	DIVALENT CATIONS		48.8000		48.4000	mg/l	07-20-90	3253
3	DIVALENT CATIONS		48.6000		48.6000	mg/l	07-22-90	3871
4	DIVALENT CATIONS		48.0000		48.3000	mg/l	07-23-90	3957
5	DIVALENT CATIONS		48.7000		48.6000	mg/l	07-24-90	4294
1	TOTAL IRON		1.4800		1.4400	mg/l	07-19-90	2939
2	TOTAL IRON		1.2600		1.3100	mg/l	07-20-90	3253
3	TOTAL IRON		1.4900		1.5100	mg/l	07-22-90	3871
4	TOTAL IRON		2.0400		2.0800	mg/l	07-23-90	3957
5	TOTAL IRON		1.1800		1.2000	mg/l	07-24-90	4294
1	FERROUS IRON		1.1300		1.1000	mg/l	07-19-90	2939
2	FERROUS IRON		1.0200		1.0800	mg/l	07-20-90	3253
3	FERROUS IRON		1.3400		1.3600	mg/l	07-22-90	3871
4	FERROUS IRON		1.7000		1.7300	mg/l	07-23-90	3957
5	FERROUS IRON		1.0800		1.0600	mg/l	07-24-90	4294

SERIAL SAMPLE FIELD ANALYSIS
H-04b, CULEBRA
ROUND 5

NO	PARAMETER	V	VALUE	S D	VALUE_DUP	UNITS	DATE	FLOW
1	Eh		95.0000	NA	0.0000	mV	09-09-90	522
2	Eh		113.0000	NA	0.0000	mV	09-10-90	764
3	Eh		112.0000	NA	0.0000	mV	09-11-90	1018
4	Eh		114.0000	NA	0.0000	mV	09-12-90	1286
1	pH		7.8100	NA	0.0000	S.U.	09-09-90	522
2	pH		7.7400	NA	0.0000	S.U.	09-10-90	764
3	pH		7.7700	NA	0.0000	S.U.	09-11-90	1018
4	pH		7.7600	NA	0.0000	S.U.	09-12-90	1286
1	TEMPERATURE		22.2000	NA	0.0000	C	09-09-90	522
2	TEMPERATURE		21.8000	NA	0.0000	C	09-10-90	764
3	TEMPERATURE		21.5000	NA	0.0000	C	09-11-90	1018
4	TEMPERATURE		22.1000	NA	0.0000	C	09-12-90	1286
1	Sp.GRAVITY		1.0168	NA	0.0000	@ 22.3 C	09-09-90	522
4	Sp.GRAVITY		1.0164	NA	0.0000	@ 21.5 C	09-12-90	1286
1	Sp.CONDUCTANCE		24400.0000	NA	0.0000	umhos/cm@25C	09-09-90	522
4	Sp.CONDUCTANCE		26400.0000	NA	0.0000	umhos/cm@25C	09-12-90	1286
1	ALKALINITY		66.8000		68.7000	mg/l	09-09-90	522
2	ALKALINITY		68.5000		68.5000	mg/l	09-10-90	764
3	ALKALINITY		68.7000		67.8000	mg/l	09-11-90	1018
4	ALKALINITY		69.5000		68.7000	mg/l	09-12-90	1286
1	CHLORIDE		7683.0000		7630.0000	mg/l	09-09-90	522
2	CHLORIDE		7541.0000		7488.0000	mg/l	09-10-90	764
3	CHLORIDE		7541.0000		7594.0000	mg/l	09-11-90	1018
4	CHLORIDE		7577.0000		7577.0000	mg/l	09-12-90	1286
1	DIVALENT CATIONS		70.6000		70.9000	mg/l	09-09-90	522
2	DIVALENT CATIONS		72.0000		71.4000	mg/l	09-10-90	764
3	DIVALENT CATIONS		72.0000		71.8000	mg/l	09-11-90	1018
4	DIVALENT CATIONS		71.0000		71.7000	mg/l	09-12-90	1286
1	TOTAL IRON		1.2400		1.2700	mg/l	09-09-90	522
2	TOTAL IRON		1.0700		1.0500	mg/l	09-10-90	764
3	TOTAL IRON		1.0200		1.0300	mg/l	09-11-90	1018
4	TOTAL IRON		0.9900		1.0300	mg/l	09-12-90	1286
1	FERROUS IRON		1.2100		1.2000	mg/l	09-09-90	522
2	FERROUS IRON		0.9800		1.0100	mg/l	09-10-90	764
3	FERROUS IRON		0.9400		0.9700	mg/l	09-11-90	1018
4	FERROUS IRON		0.8900		0.8900	mg/l	09-12-90	1286

SERIAL SAMPLING FIELD ANALYSIS
H-03b3, CULEBRA
ROUND 5

NO	PARAMETER	V	VALUE	S D	VALUE_DUP	UNITS	DATE	FLOW
1	Eh		206.0000	NA	0.0000	mV	08-12-90	3403
2	Eh		190.0000	NA	0.0000	mV	08-13-90	4063
3	Eh		212.0000	NA	0.0000	mV	08-14-90	4718
4	Eh		175.0000	NA	0.0000	mV	08-15-90	5466
1	pH		7.5100	NA	0.0000	S.U.	08-12-90	3403
2	pH		7.4100	NA	0.0000	S.U.	08-13-90	4063
3	pH		7.4400	NA	0.0000	S.U.	08-14-90	4718
4	pH		7.4500	NA	0.0000	S.U.	08-15-90	5466
1	TEMPERATURE		22.1000	NA	0.0000	C	08-12-90	3403
2	TEMPERATURE		22.1000	NA	0.0000	C	08-13-90	4063
3	TEMPERATURE		22.2000	NA	0.0000	C	08-14-90	4718
4	TEMPERATURE		22.2000	NA	0.0000	C	08-15-90	5466
1	Sp.GRAVITY		1.0420	NA	0.0000	@ 22.6 C	08-12-90	3403
4	Sp.GRAVITY		1.0400	NA	0.0000	@ 22.3 C	08-15-90	5466
1	Sp.CONDUCTANCE		69300.0000	NA	0.0000	umhos/cm@25C	08-12-90	3403
4	Sp.CONDUCTANCE		69300.0000	NA	0.0000	umhos/cm@25C	08-15-90	5466
1	ALKALINITY		50.7000		50.2000	mg/l	08-12-90	3403
2	ALKALINITY		51.0000		50.2000	mg/l	08-13-90	4063
3	ALKALINITY		50.5000		50.5000	mg/l	08-14-90	4718
4	ALKALINITY		50.7000		50.2000	mg/l	08-15-90	5466
1	CHLORIDE		27799.0000		27694.0000	mg/l	08-12-90	3403
2	CHLORIDE		27625.0000		27729.0000	mg/l	08-13-90	4063
3	CHLORIDE		27833.0000		27729.0000	mg/l	08-14-90	4718
4	CHLORIDE		27729.0000		27660.0000	mg/l	08-15-90	5466
1	DIVALENT CATIONS		137.6000		137.6000	mg/l	08-12-90	3403
2	DIVALENT CATIONS		136.6000		136.8000	mg/l	08-13-90	4063
3	DIVALENT CATIONS		136.2000		137.2000	mg/l	08-14-90	4718
4	DIVALENT CATIONS		137.8000		138.0000	mg/l	08-15-90	5466
1	TOTAL IRON		0.2200		0.2100	mg/l	08-12-90	3403
2	TOTAL IRON		0.2100		0.1900	mg/l	08-13-90	4063
3	TOTAL IRON		0.2000		0.2100	mg/l	08-14-90	4718
4	TOTAL IRON		0.2500		0.2200	mg/l	08-15-90	5466
1	FERROUS IRON		0.1900		0.1900	mg/l	08-12-90	3403
2	FERROUS IRON		0.1600		0.1300	mg/l	08-13-90	4063
3	FERROUS IRON		0.1900		0.1800	mg/l	08-14-90	4718
4	FERROUS IRON		0.1800		0.1900	mg/l	08-15-90	5466

SERIAL SAMPLE FIELD ANALYSIS
H-11b3, CULEBRA
ROUND 5

NO	PARAMETER	V	VALUE	S D	VALUE_DUP	UNITS	DATE	FLOW
1	Eh		118.0000	NA	0.0000	mV	10-14-90	161
2	Eh		144.0000	NA	0.0000	mV	10-15-90	248
3	Eh		102.0000	NA	0.0000	mV	10-16-90	422
4	Eh		119.0000	NA	0.0000	mV	10-17-90	502
1	pH		7.3700	NA	0.0000	S.U.	10-14-90	161
2	pH		7.3800	NA	0.0000	S.U.	10-15-90	248
3	pH		7.3600	NA	0.0000	S.U.	10-16-90	422
4	pH		7.3800	NA	0.0000	S.U.	10-17-90	502
1	TEMPERATURE		22.0000	NA	0.0000	C	10-14-90	161
2	TEMPERATURE		22.0000	NA	0.0000	C	10-15-90	248
3	TEMPERATURE		21.8000	NA	0.0000	C	10-16-90	422
4	TEMPERATURE		21.8000	NA	0.0000	C	10-17-90	502
1	Sp.GRAVITY		1.0804	NA	0.0000	@24.1	10-14-90	161
4	Sp.GRAVITY		1.0804	NA	0.0000	@20.4	10-17-90	585
1	Sp.CONDUCTANCE		133400.0000	NA	0.0000	umhos/cm@25C	10-14-90	161
4	Sp.CONDUCTANCE		133800.0000	NA	0.0000	umhos/cm@25C	10-17-90	585
1	ALKALINITY		56.3000		55.3000	mg/l	10-14-90	161
2	ALKALINITY		55.5000		54.5000	mg/l	10-15-90	248
3	ALKALINITY		55.3000		55.3000	mg/l	10-16-90	422
4	ALKALINITY		54.5000		53.8000	mg/l	10-17-90	502
1	CHLORIDE		66696.0000		65984.0000	mg/l	10-14-90	161
2	CHLORIDE		65451.0000		64917.0000	mg/l	10-15-90	248
3	CHLORIDE		65806.0000		65273.0000	mg/l	10-16-90	422
4	CHLORIDE		65451.0000		65451.0000	mg/l	10-17-90	502
1	DIVALENT CATIONS		187.2000		186.4000	meq/l	10-14-90	161
2	DIVALENT CATIONS		186.8000		185.6000	meq/l	10-15-90	248
3	DIVALENT CATIONS		186.4000		185.2000	meq/l	10-16-90	422
4	DIVALENT CATIONS		184.8000		185.6000	meq/l	10-17-90	502
1	TOTAL IRON		0.4700		0.4800	mg/l	10-14-90	161
2	TOTAL IRON		0.4300		0.4500	mg/l	10-15-90	248
3	TOTAL IRON		0.4600		0.4600	mg/l	10-16-90	422
4	TOTAL IRON		0.4700		0.4600	mg/l	10-17-90	502
1	FERROUS IRON		0.3600		0.3700	mg/l	10-14-90	161
2	FERROUS IRON		0.3400		0.3600	mg/l	10-15-90	248
3	FERROUS IRON		0.3500		0.3300	mg/l	10-16-90	422
4	FERROUS IRON		0.3600		0.3900	mg/l	10-17-90	502

SERIAL SAMPLE FIELD ANALYSIS
H-04c, MAGENTA
ROUND 5

NO	PARAMETER	V	VALUE	S D	VALUE_DUP	UNITS	DATE	FLOW
1	Eh		-86.0000	NA	0.0000	mV	09-27-90	161
2	Eh		-82.0000	NA	0.0000	mV	09-28-90	248
3	Eh		-58.0000	NA	0.0000	mV	09-30-90	422
4	Eh		-81.0000	NA	0.0000	mV	10-01-90	502
5	Eh		-61.0000	NA	0.0000	mV	10-02-90	585
1	pH		7.9800	NA	0.0000	S.U.	09-27-90	161
2	pH		8.0000	NA	0.0000	S.U.	09-28-90	248
3	pH		8.0300	NA	0.0000	S.U.	09-30-90	422
4	pH		8.0000	NA	0.0000	S.U.	10-01-90	502
5	pH		8.0100	NA	0.0000	S.U.	10-02-90	585
1	TEMPERATURE		23.9000	NA	0.0000	C	09-27-90	161
2	TEMPERATURE		21.7000	NA	0.0000	C	09-28-90	248
3	TEMPERATURE		21.0000	NA	0.0000	C	09-30-90	422
4	TEMPERATURE		21.6000	NA	0.0000	C	10-01-90	502
5	TEMPERATURE		20.6000	NA	0.0000	C	10-02-90	585
1	Sp.GRAVITY		1.0200	NA	0.0000	@24.1	09-27-90	161
5	Sp.GRAVITY		1.0202	NA	0.0000	@20.4	10-02-90	585
1	Sp.CONDUCTANCE		30900.0000	NA	0.0000	umhos/cm@25C	09-27-90	161
5	Sp.CONDUCTANCE		30900.0000	NA	0.0000	umhos/cm@25C	10-02-90	585
1	ALKALINITY		79.7000		81.5000	mg/l	09-27-90	161
2	ALKALINITY		79.5000		79.5000	mg/l	09-28-90	248
3	ALKALINITY		82.2000		82.1000	mg/l	09-30-90	422
4	ALKALINITY		80.7000		81.0000	mg/l	10-01-90	502
5	ALKALINITY		81.2000		80.5000	mg/l	10-02-90	585
1	CHLORIDE		8395.0000		8466.0000	mg/l	09-27-90	161
2	CHLORIDE		8501.0000		8430.0000	mg/l	09-28-90	248
3	CHLORIDE		8519.0000		8484.0000	mg/l	09-30-90	422
4	CHLORIDE		8501.0000		8501.0000	mg/l	10-01-90	502
5	CHLORIDE		8519.0000		8466.0000	mg/l	10-02-90	585
1	DIVALENT CATIONS		70.6000		70.1000	meq/l	09-27-90	161
2	DIVALENT CATIONS		69.5000		69.0000	meq/l	09-28-90	248
3	DIVALENT CATIONS		70.3000		70.3000	meq/l	09-30-90	422
4	DIVALENT CATIONS		69.8000		70.4000	meq/l	10-01-90	502
5	DIVALENT CATIONS		70.1000		70.1000	meq/l	10-02-90	585
1	TOTAL IRON		0.1400		0.1500	mg/l	09-27-90	161
2	TOTAL IRON		0.1600		0.1700	mg/l	09-28-90	248
3	TOTAL IRON		0.1900		0.1600	mg/l	09-30-90	422
4	TOTAL IRON		0.1600		0.1700	mg/l	10-01-90	502
5	TOTAL IRON		0.1800		0.1500	mg/l	10-02-90	585
1	FERROUS IRON		0.1200		0.1300	mg/l	09-27-90	161
2	FERROUS IRON		0.0900		0.1200	mg/l	09-28-90	248
3	FERROUS IRON		0.0500		0.0700	mg/l	09-30-90	422
4	FERROUS IRON		0.0900		0.0800	mg/l	10-01-90	502
5	FERROUS IRON		0.0900		0.1000	mg/l	10-02-90	585

FIELD ANALYSIS
FOR
PRIVATE WELLS SAMPLED IN 1990

FIELD ANALYSIS
ENGLE WELL, CULEBRA
ROUND 3

NO	PARAMETER	V	VALUE	S	D	VALUE_DUP	UNITS	DATE	FLOW
1	pH		7.4600		NA	0.0000	S.U.	01-31-90	N/A
1	Sp.GRAVITY		1.0033		NA	0.0000	@ 20.2 C	01-31-90	N/A
1	Sp.CONDUCTANCE		2990.0000		NA	0.0000	umhos/cm@25C	01-31-90	N/A
1	ALKALINITY		79.6000			78.4000	mg/l	01-31-90	N/A
1	CHLORIDE		230.0000			233.0000	mg/l	01-31-90	N/A
1	DIVALENT CATIONS		42.6000			42.8000	meq/l	01-31-90	N/A

FIELD ANALYSIS
BARN WELL, DEWEY LAKE
ROUND 4

NO	PARAMETER	V	VALUE	S	D	VALUE_DUP	UNITS	DATE	FLOW
1	pH		7.5800		NA	0.0000	S.U.	06-21-90	N/A
1	Sp.GRAVITY		1.0008		NA	0.0000	@ 25.2 C	06-21-90	N/A
1	Sp.CONDUCTANCE		1070.0000		NA	0.0000	umhos/cm@25C	06-21-90	N/A
1	ALKALINITY		282.6000			285.5000	mg/l	06-21-90	N/A
1	CHLORIDE		55.0000			57.0000	mg/l	06-21-90	N/A
1	DIVALENT CATIONS		5.0000			5.0000	meq/l	06-21-90	N/A

FIELD ANALYSIS
RANCH WELL, DEWEY LAKE
ROUND 5

NO	PARAMETER	V	VALUE	S	D	VALUE_DUP	UNITS	DATE	FLOW
1	pH		7.2400		NA	0.0000	S.U.	06-20-90	N/A
1	Sp.GRAVITY		1.0014		NA	0.0000	@ 23.7 C	06-20-90	N/A
1	Sp.CONDUCTANCE		3020.0000		NA	0.0000	umhos/cm@25C	06-20-90	N/A
1	ALKALINITY		246.8000			248.5000	mg/l	06-20-90	N/A
1	CHLORIDE		354.0000			361.0000	mg/l	06-20-90	N/A
1	DIVALENT CATIONS		38.5000			38.5000	meq/l	06-20-90	N/A

FIELD ANALYSIS
TWIN WELL, DEWEY LAKE
ROUND 4

NO	PARAMETER	V	VALUE	S	D	VALUE_DUP	UNITS	DATE	FLOW
1	pH		7.7000		NA	0.0000	S.U.	06-01-90	N/A
1	Sp.GRAVITY		1.0028		NA	0.0000	@ 23.2 C	06-01-90	N/A
1	Sp.CONDUCTANCE		614.0000		NA	0.0000	umhos/cm@25C	06-01-90	N/A
1	ALKALINITY		220.0000			217.8000	mg/l	06-01-90	N/A
1	CHLORIDE		57.0000			55.0000	mg/l	06-01-90	N/A
1	DIVALENT CATIONS		5.4000			5.5000	meq/l	06-01-90	N/A

SERIAL SAMPLE FIELD ANALYSIS
H-07b1, CULEBRA
ROUND 5

NO	PARAMETER	V	VALUE	S D	VALUE_DUP	UNITS	DATE	FLOW
1	Eh		356.0000	NA	0.0000	mV	11-02-90	2008
2	Eh		337.0000	NA	0.0000	mV	11-04-90	4397
3	Eh		334.0000	NA	0.0000	mV	11-05-90	5489
4	Eh		311.0000	NA	0.0000	mV	11-06-90	6619
5	Eh		353.0000	NA	0.0000	mV	11-07-90	7750
6	Eh		335.0000	NA	0.0000	mV	11-08-90	8878
1	pH		7.3500	NA	0.0000	S.U.	11-02-90	2008
2	pH		7.3800	NA	0.0000	S.U.	11-04-90	4397
3	pH		7.3500	NA	0.0000	S.U.	11-05-90	5489
4	pH		7.3600	NA	0.0000	S.U.	11-06-90	6619
5	pH		7.3200	NA	0.0000	S.U.	11-07-90	7750
6	pH		7.3400	NA	0.0000	S.U.	11-08-90	8878
1	TEMPERATURE		21.9000	NA	0.0000	C	11-02-90	2008
2	TEMPERATURE		21.2000	NA	0.0000	C	11-04-90	4397
3	TEMPERATURE		21.6000	NA	0.0000	C	11-05-90	5489
4	TEMPERATURE		21.4000	NA	0.0000	C	11-06-90	6619
5	TEMPERATURE		20.6000	NA	0.0000	C	11-07-90	7750
6	TEMPERATURE		20.8000	NA	0.0000	C	11-08-90	8878
1	Sp.GRAVITY		1.0042	NA	0.0000	@22.0	11-02-90	2008
6	Sp.GRAVITY		1.0026	NA	0.0000	@20.8	11-08-90	8878
1	Sp.CONDUCTANCE		3520.0000	NA	0.0000	umhos/cm@25C	11-02-90	2008
6	Sp.CONDUCTANCE		3620.0000	NA	0.0000	umhos/cm@25C	11-08-90	8878
1	ALKALINITY		112.2000		113.0000	mg/l	11-02-90	2008
2	ALKALINITY		111.1000		110.9000	mg/l	11-04-90	4397
3	ALKALINITY		113.5000		113.4000	mg/l	11-05-90	5489
4	ALKALINITY		113.7000		112.8000	mg/l	11-06-90	6619
5	ALKALINITY		113.3000		113.3000	mg/l	11-07-90	7750
6	ALKALINITY		112.5000		113.0000	mg/l	11-08-90	8878
1	CHLORIDE		277.0000		279.0000	mg/l	11-02-90	2008
2	CHLORIDE		277.0000		272.0000	mg/l	11-04-90	4397
3	CHLORIDE		276.0000		275.0000	mg/l	11-05-90	5489
4	CHLORIDE		276.0000		276.0000	mg/l	11-06-90	6619
5	CHLORIDE		277.0000		277.0000	mg/l	11-07-90	7750
6	CHLORIDE		275.0000		277.0000	mg/l	11-08-90	8878
1	DIVALENT CATIONS		49.8000		47.6000	meq/l	11-02-90	2008
2	DIVALENT CATIONS		48.0000		47.9000	meq/l	11-04-90	4397
3	DIVALENT CATIONS		46.1000		46.8000	meq/l	11-05-90	5489
4	DIVALENT CATIONS		47.9000		47.3000	meq/l	11-06-90	6619
5	DIVALENT CATIONS		47.8000		47.9000	meq/l	11-07-90	7750
6	DIVALENT CATIONS		47.8000		47.4000	meq/l	11-08-90	8878
1	TOTAL IRON		0.2500		0.2800	mg/l	11-02-90	2008
2	TOTAL IRON		0.5900		0.6000	mg/l	11-04-90	4397
3	TOTAL IRON		0.1800		0.1800	mg/l	11-05-90	5489
4	TOTAL IRON		0.2000		0.1900	mg/l	11-06-90	6619
5	TOTAL IRON		0.1800		0.1800	mg/l	11-07-90	7750
6	TOTAL IRON		0.1900		0.2200	mg/l	11-08-90	8878
1	FERROUS IRON		0.2200		0.2200	mg/l	11-02-90	2008
2	FERROUS IRON		0.5500		0.5600	mg/l	11-04-90	4397
3	FERROUS IRON		0.1500		0.1500	mg/l	11-05-90	5489
4	FERROUS IRON		0.1200		0.1300	mg/l	11-06-90	6619
5	FERROUS IRON		0.1400		0.1500	mg/l	11-07-90	7750
6	FERROUS IRON		0.1700		0.1700	mg/l	11-08-90	8878

APPENDIX VIII
LAST DAY SERIAL SAMPLING GRAPHS
FOR
PREVIOUS SAMPLING ROUNDS

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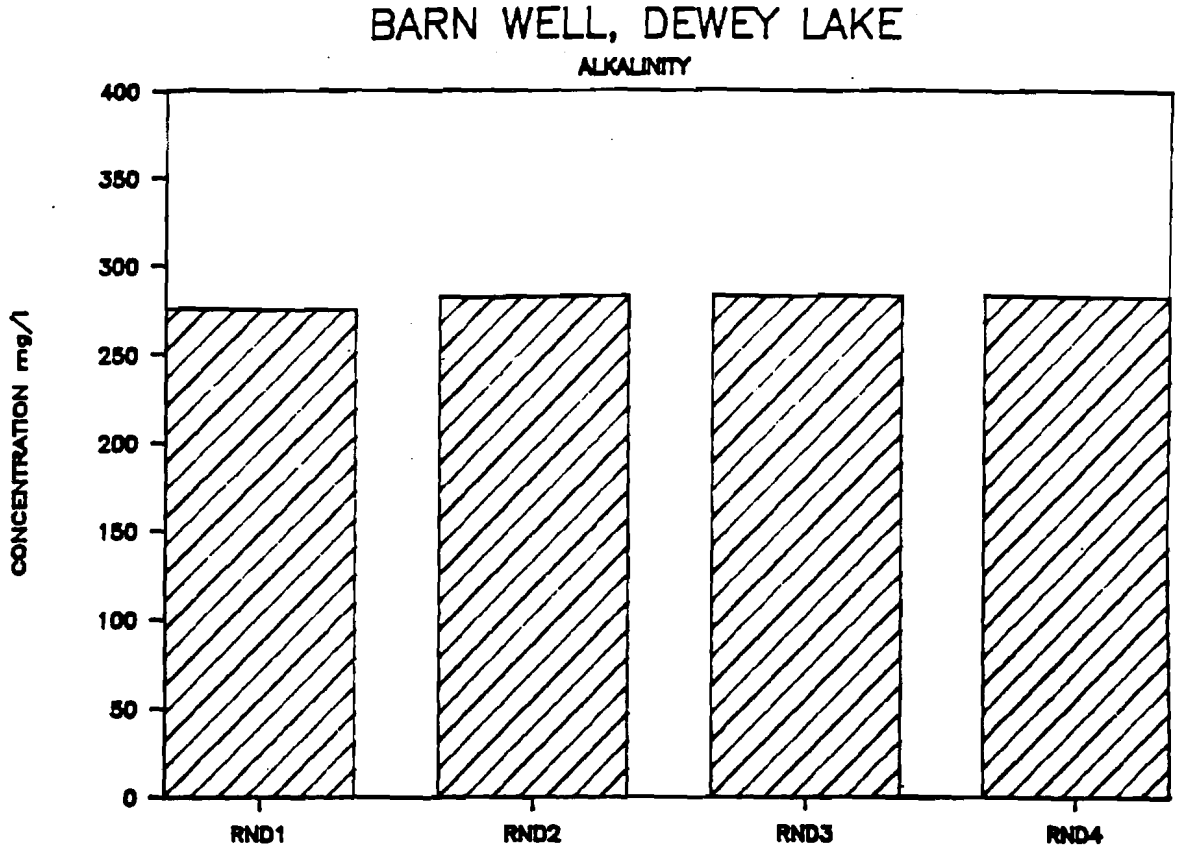
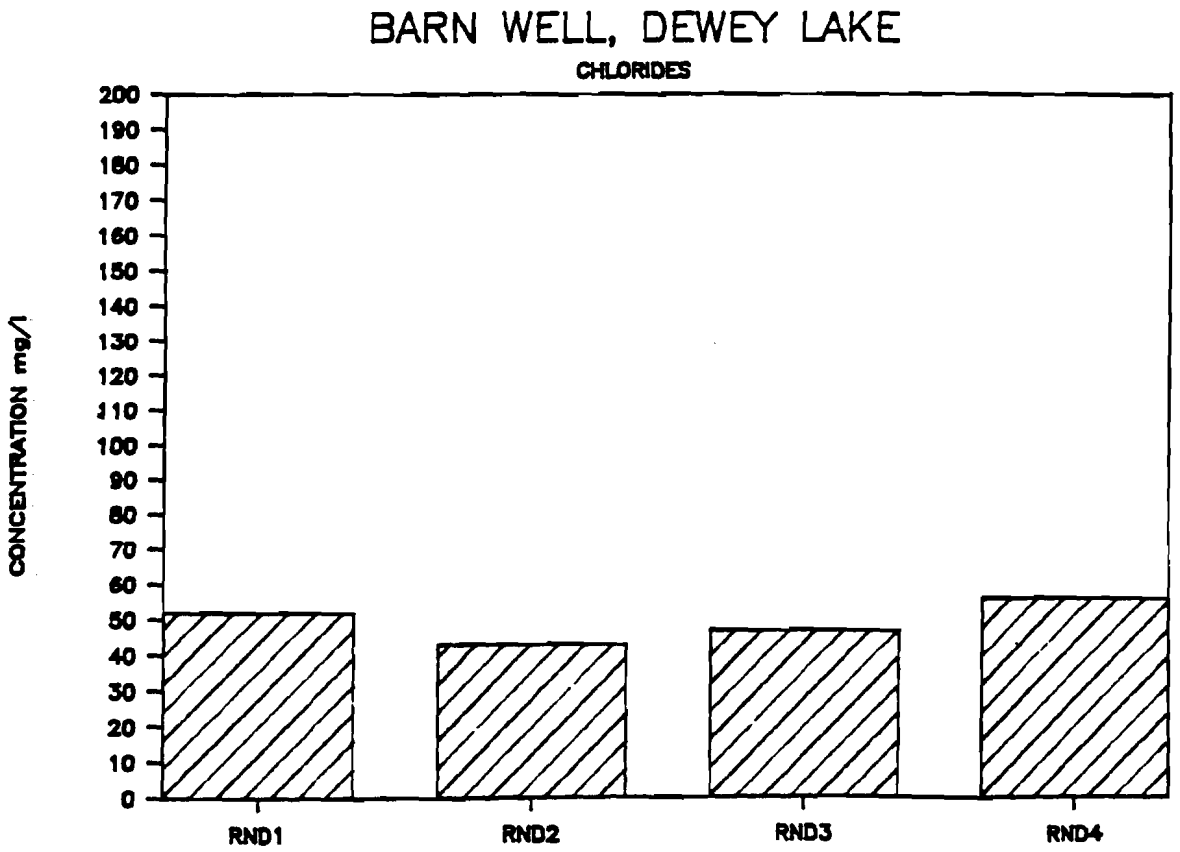
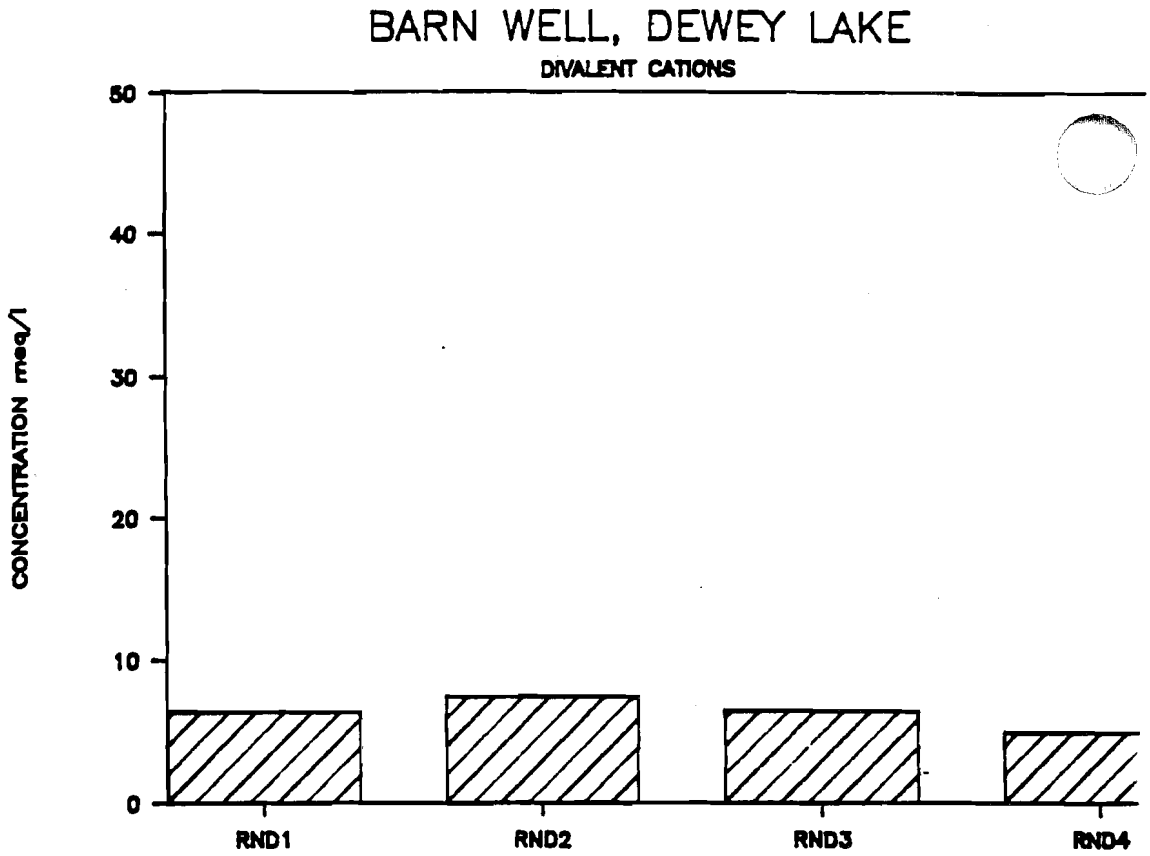
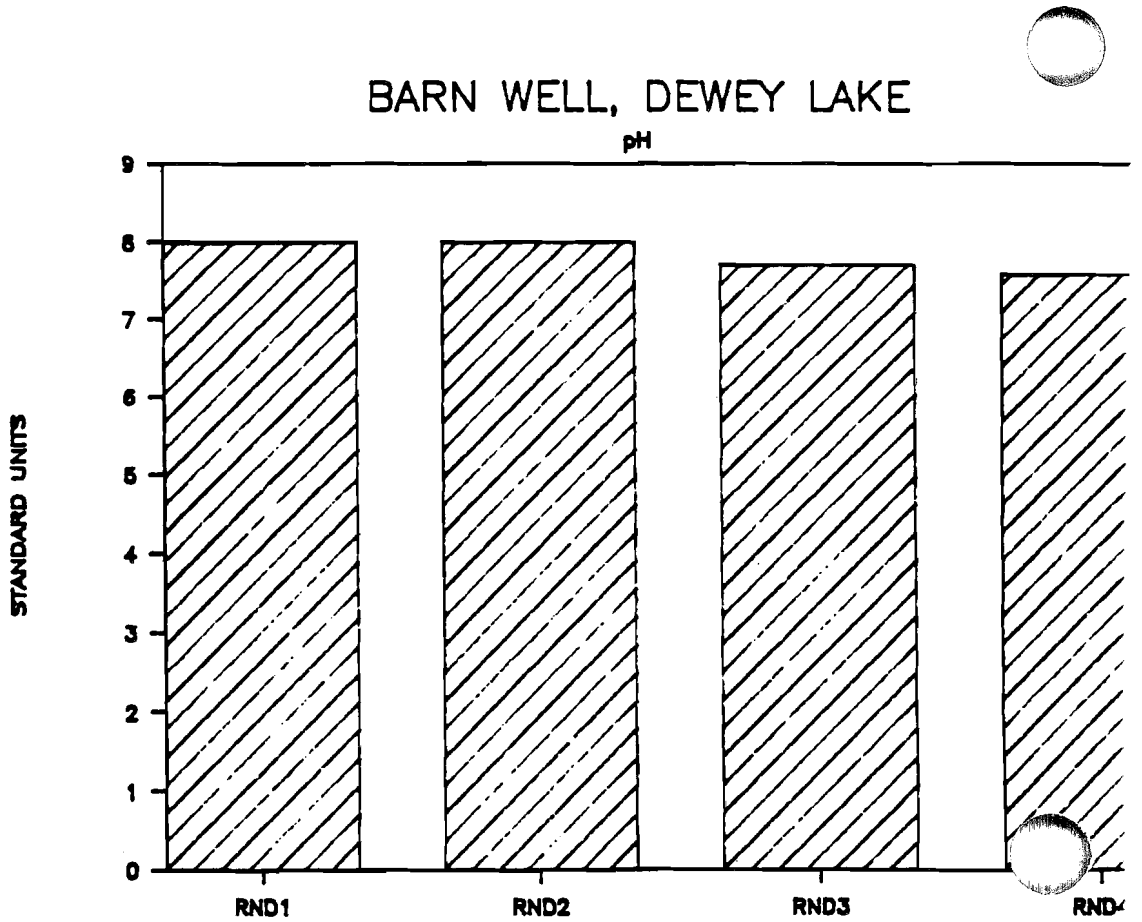
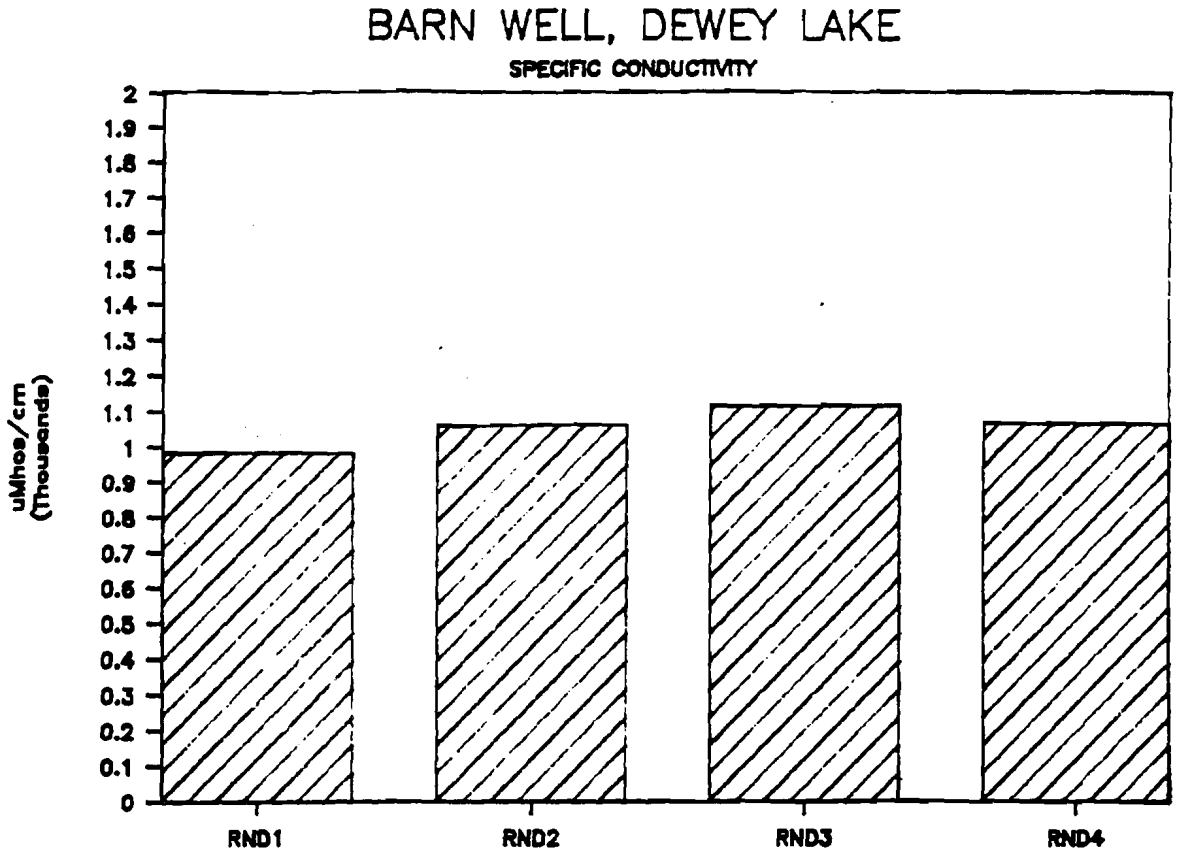
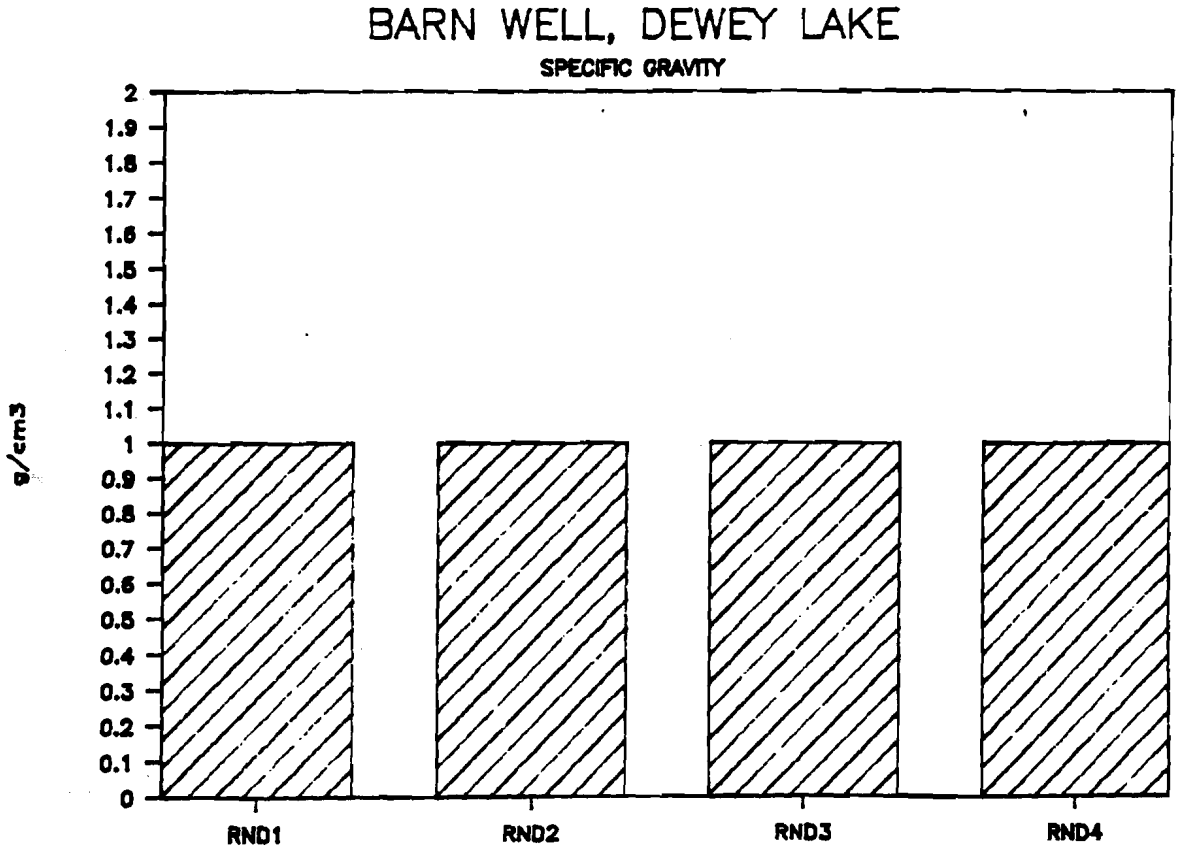

BARN WELL, DEWEY LAKE
ALKALINITY
CONCENTRATION mg/l
400
350
300
250
200
150
100
50
0
RND1
RND2
RND3
RND4

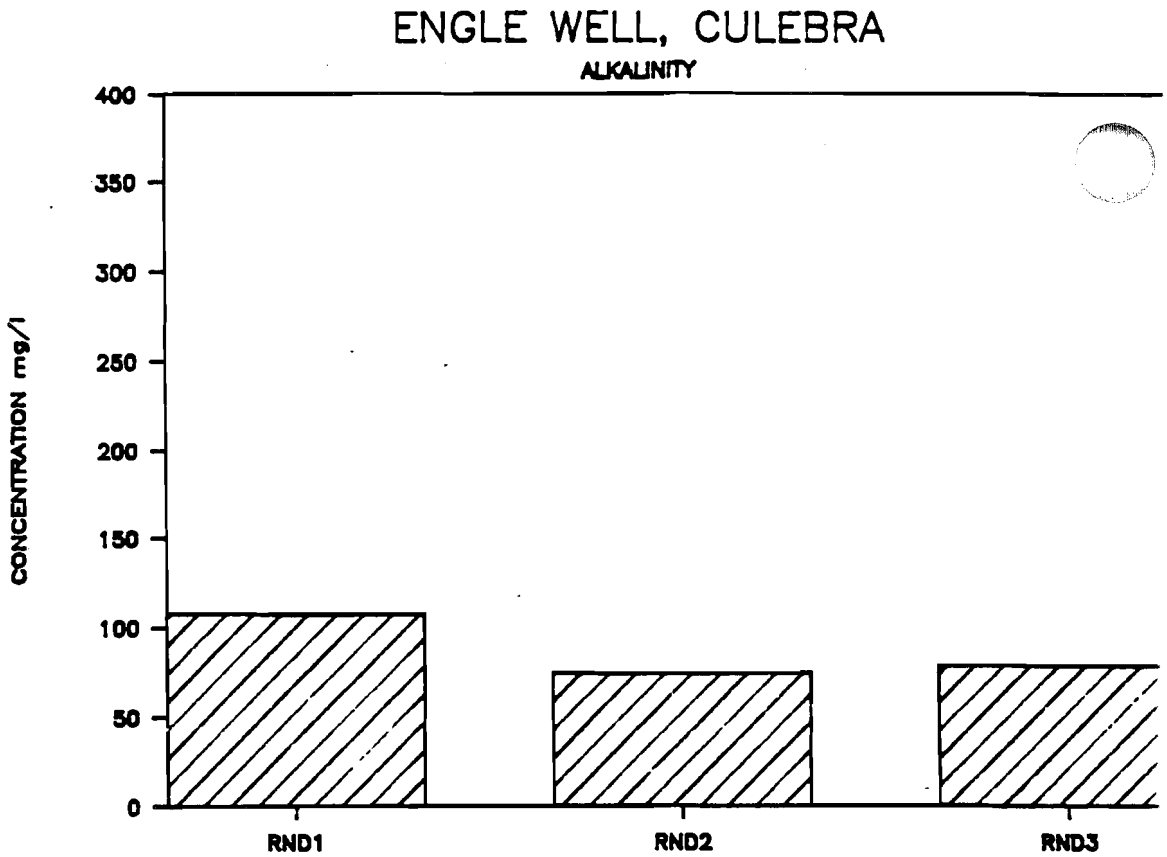

BARN WELL, DEWEY LAKE
CHLORIDES
CONCENTRATION mg/l
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4

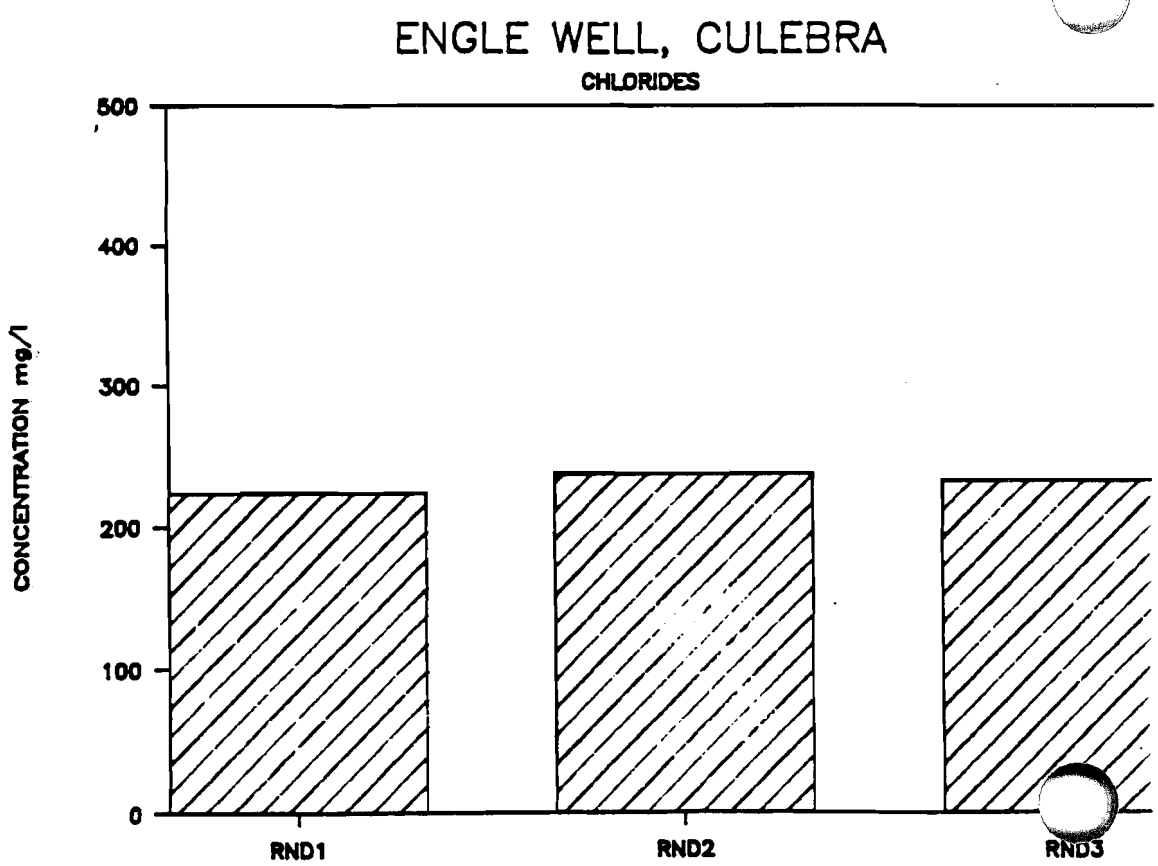

BARN WELL, DEWEY LAKE
DIVALENT CATIONS
CONCENTRATION meq/l
50
40
30
20
10
0
RND1
RND2
RND3
RND4

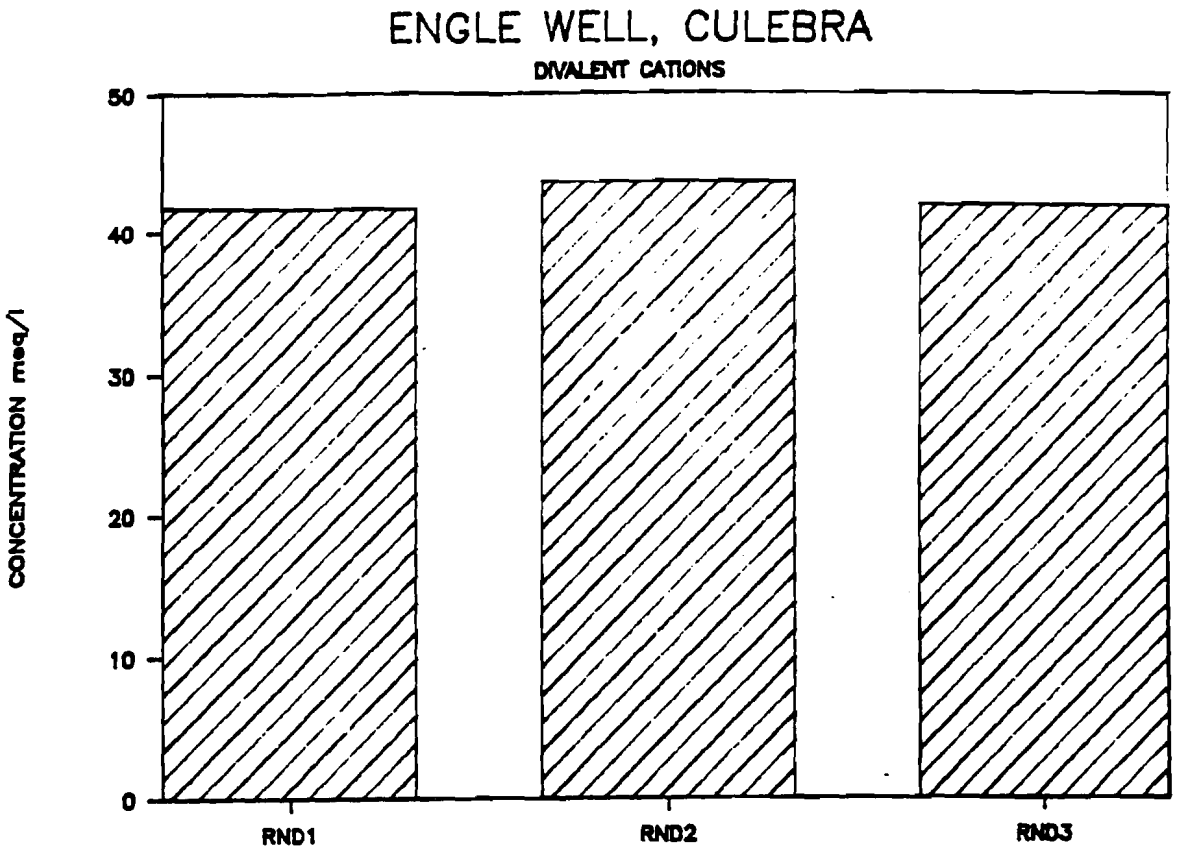

BARN WELL, DEWEY LAKE
pH
STANDARD UNITS
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3

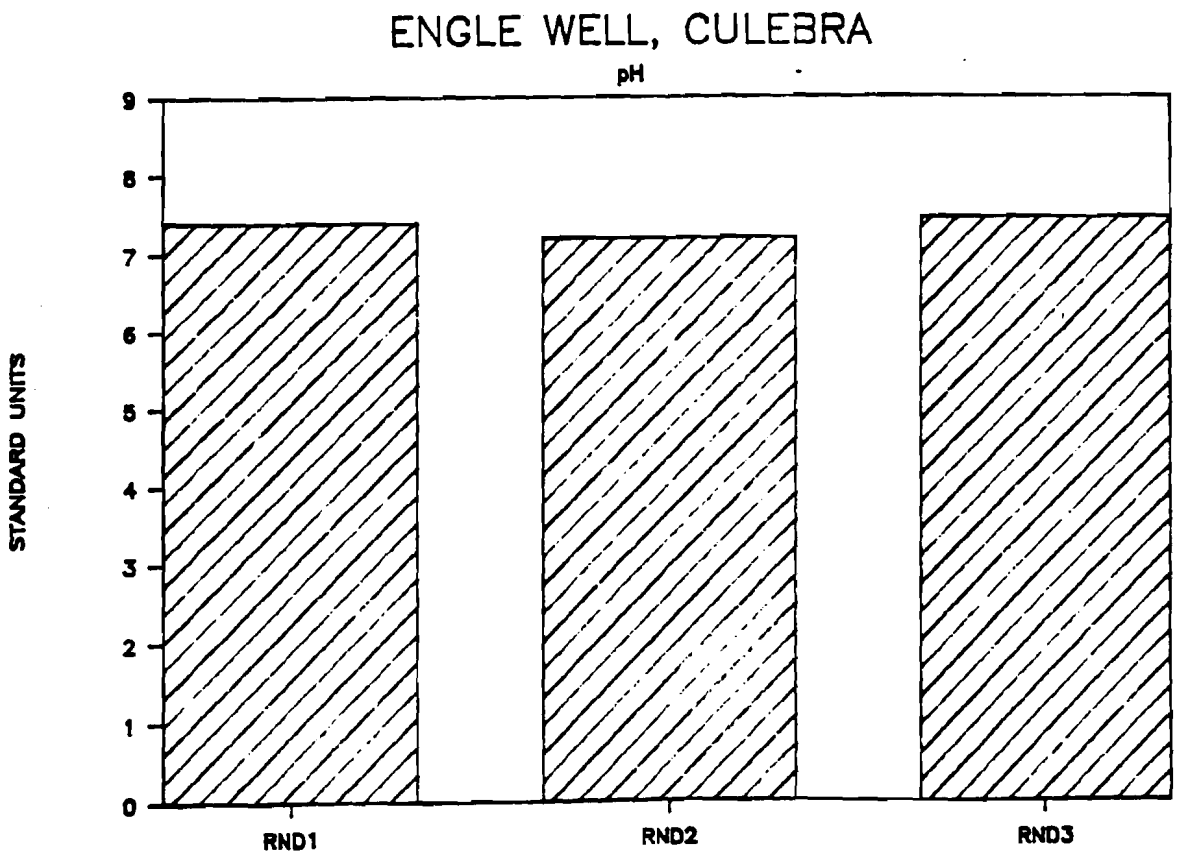

BARN WELL, DEWEY LAKE
SPECIFIC CONDUCTIVITY
uMhos/cm (Thousands)
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4

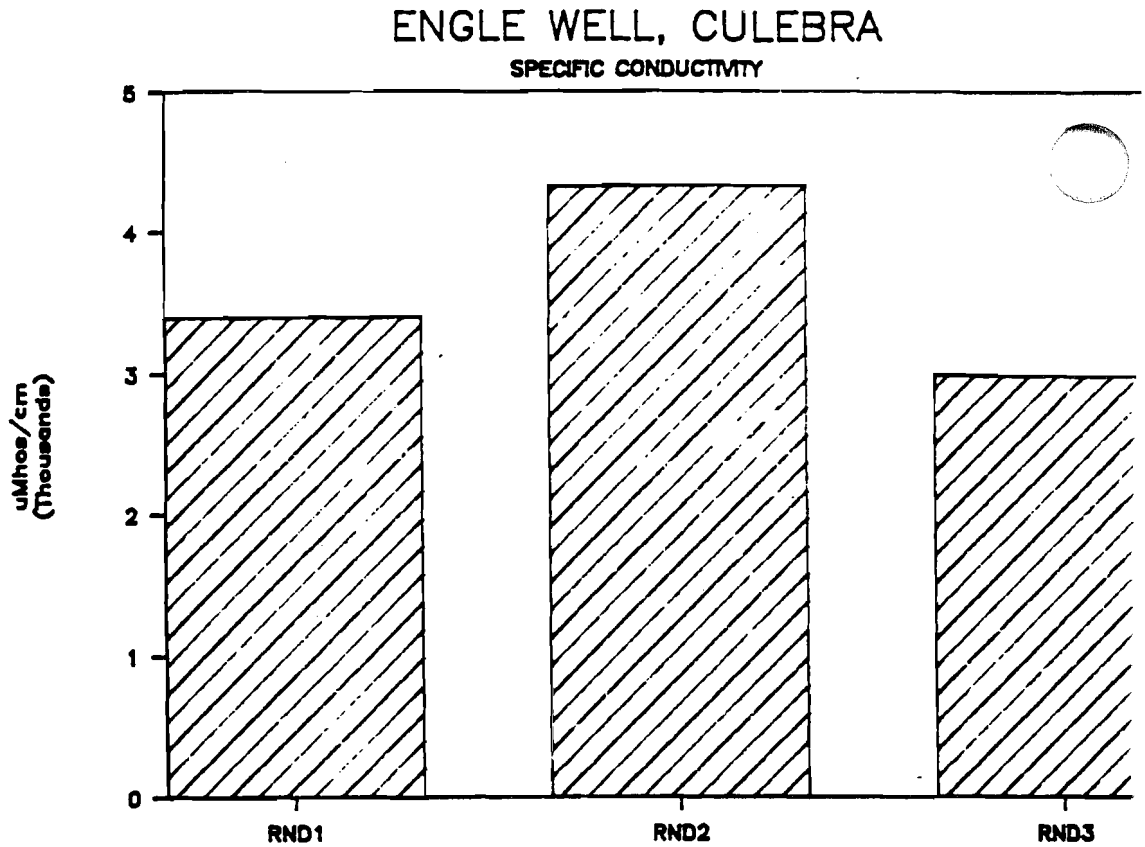

BARN WELL, DEWEY LAKE
SPECIFIC GRAVITY
g/cm3
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4

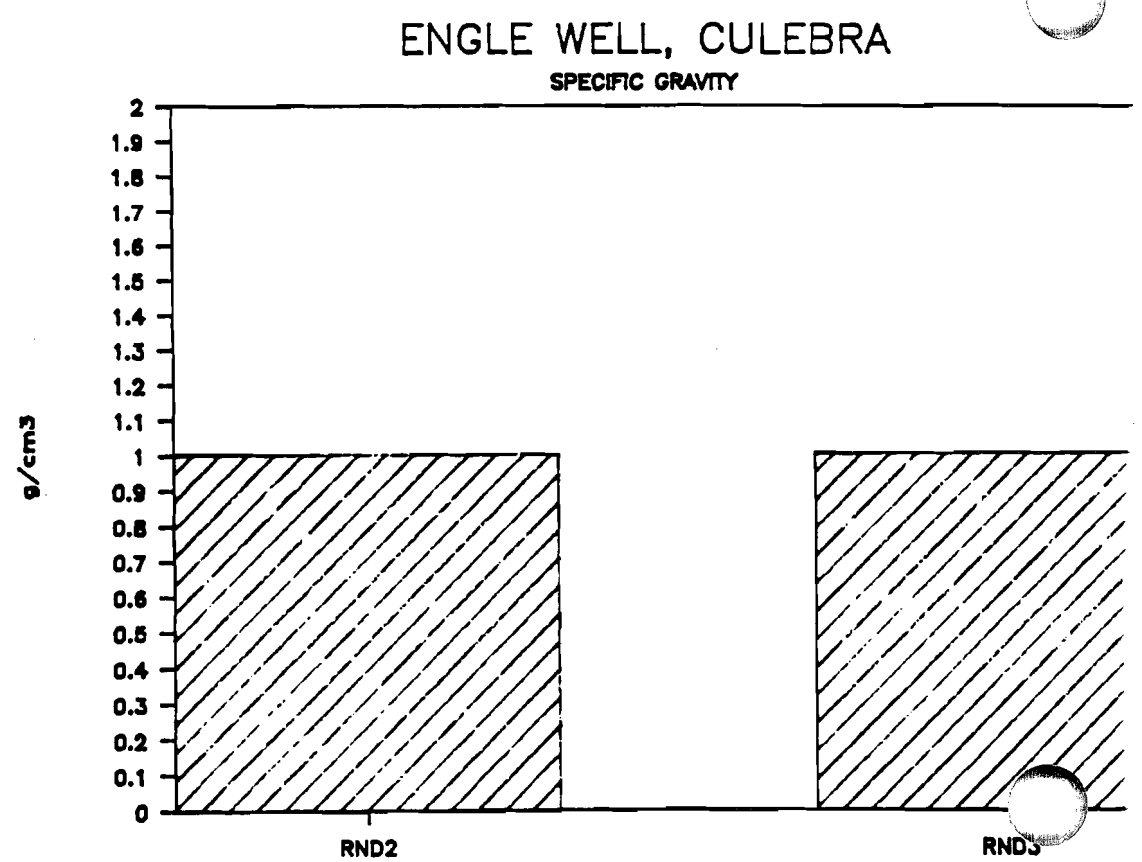

ENGLE WELL, CULEBRA
ALKALINITY
CONCENTRATION mg/l
400
350
300
250
200
150
100
50
0
RND1
RND2
RND3

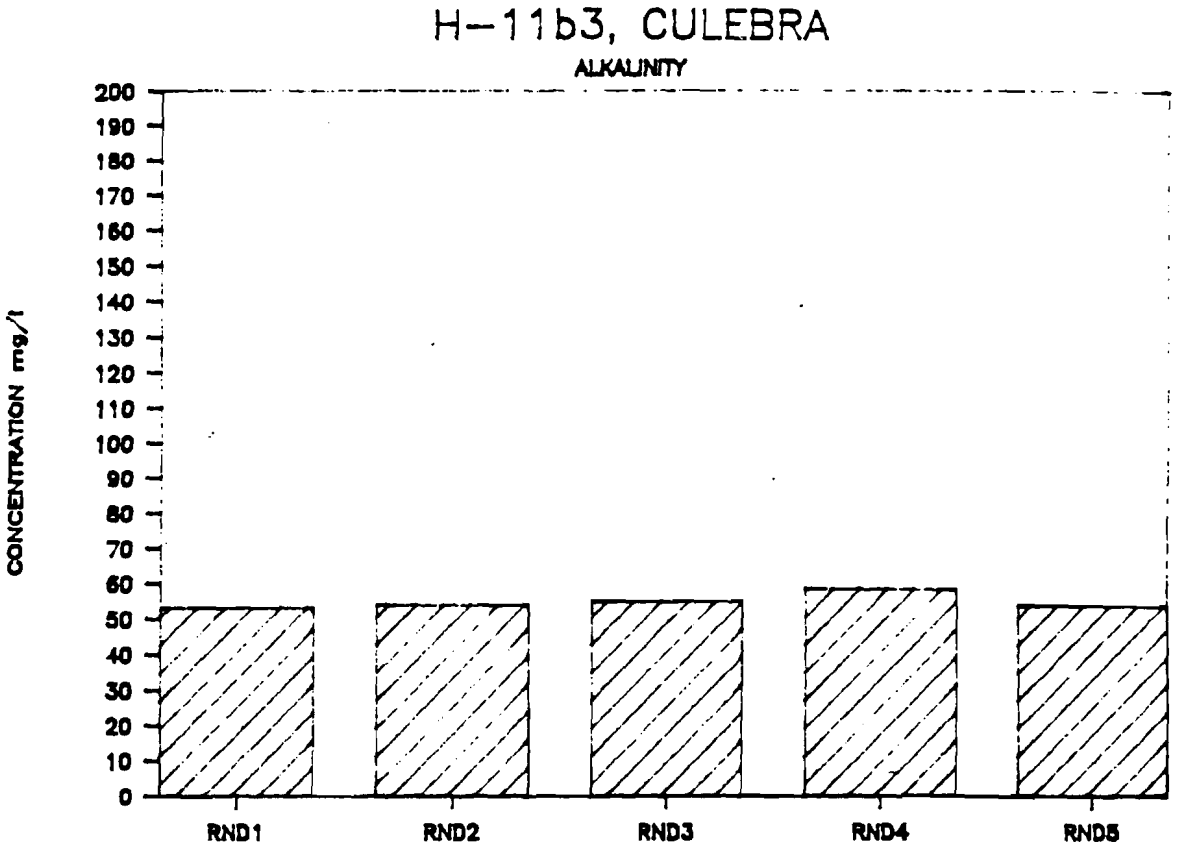

ENGLE WELL, CULEBRA
CHLORIDES
CONCENTRATION mg/l
500
400
300
200
100
0
RND1
RND2
RND3

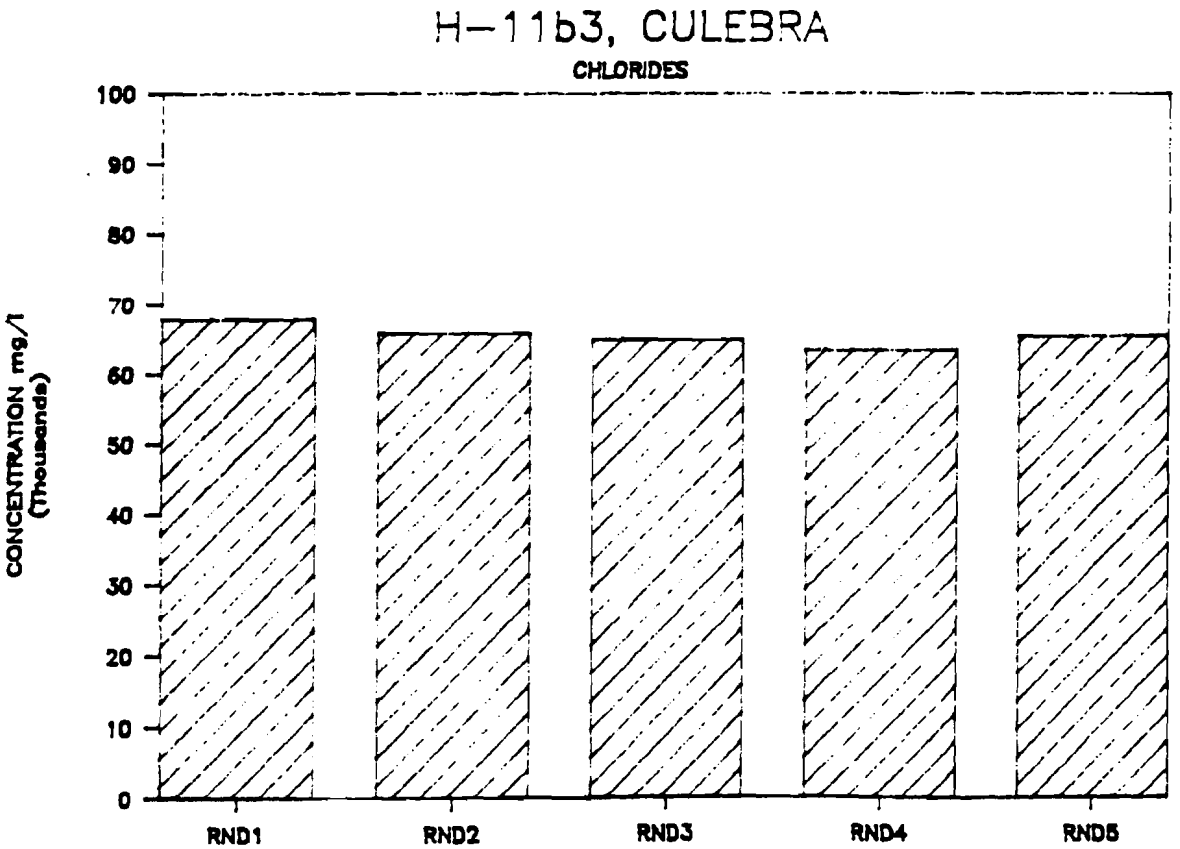

ENGLE WELL, CULEBRA
DIVALENT CATIONS
CONCENTRATION meq/l
50
40
30
20
10
0
RND1
RND2
RND3

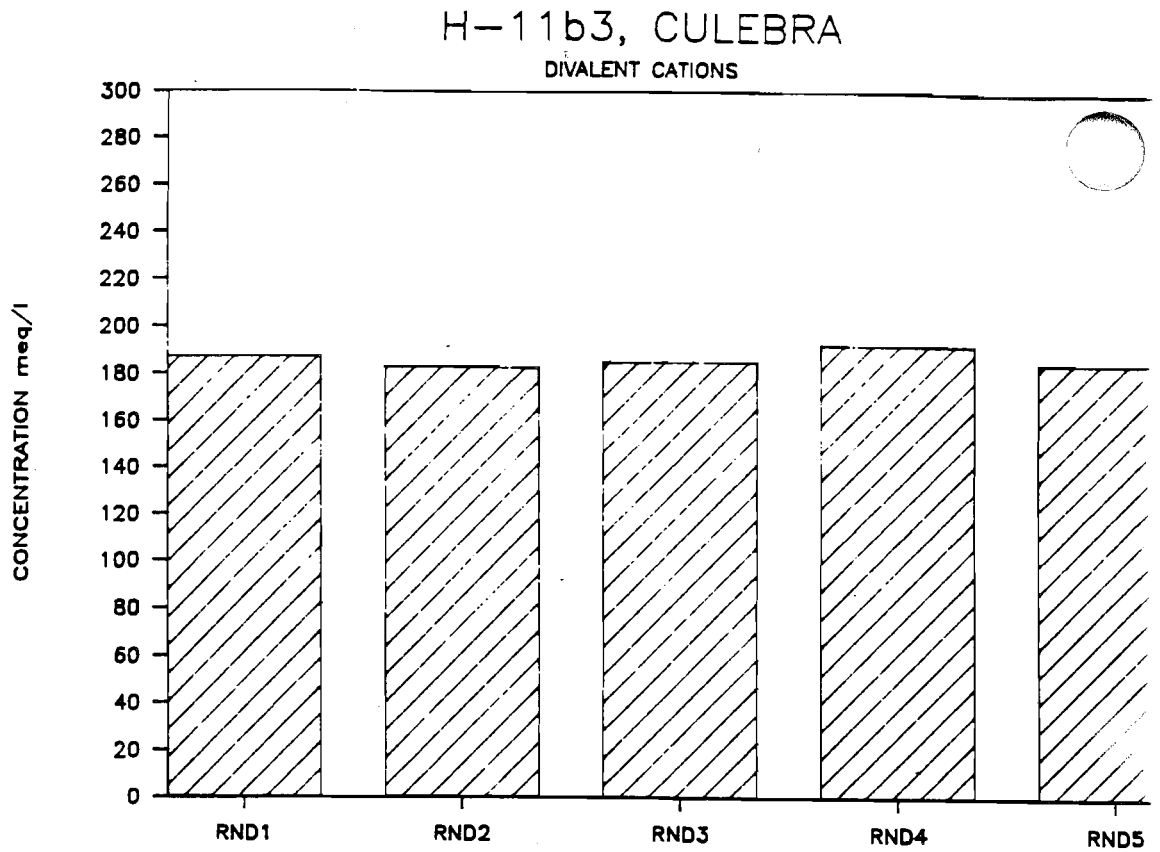

ENGLE WELL, CULEBRA
pH
STANDARD UNITS
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3

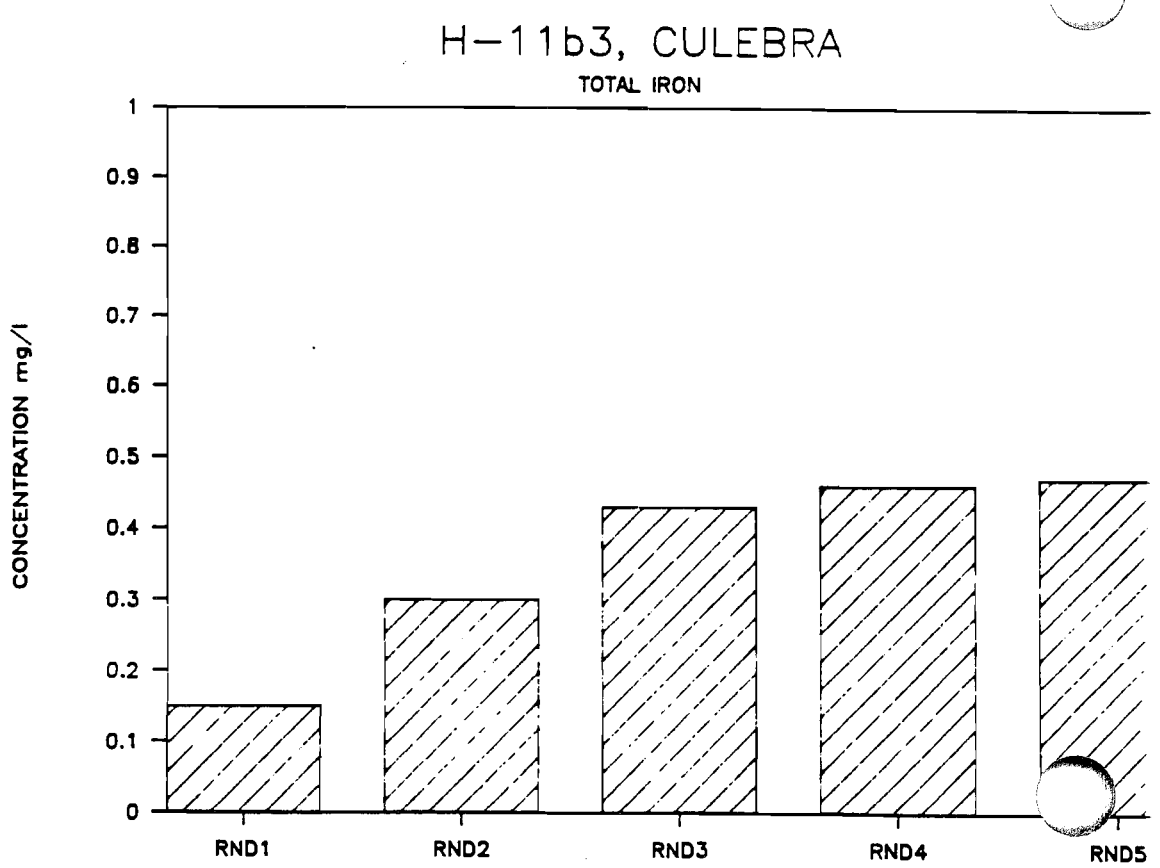

ENGLE WELL, CULEBRA
SPECIFIC CONDUCTIVITY
uMhos/cm (Thousands)
0
1
2
3
4
5
RND1
RND2
RND3

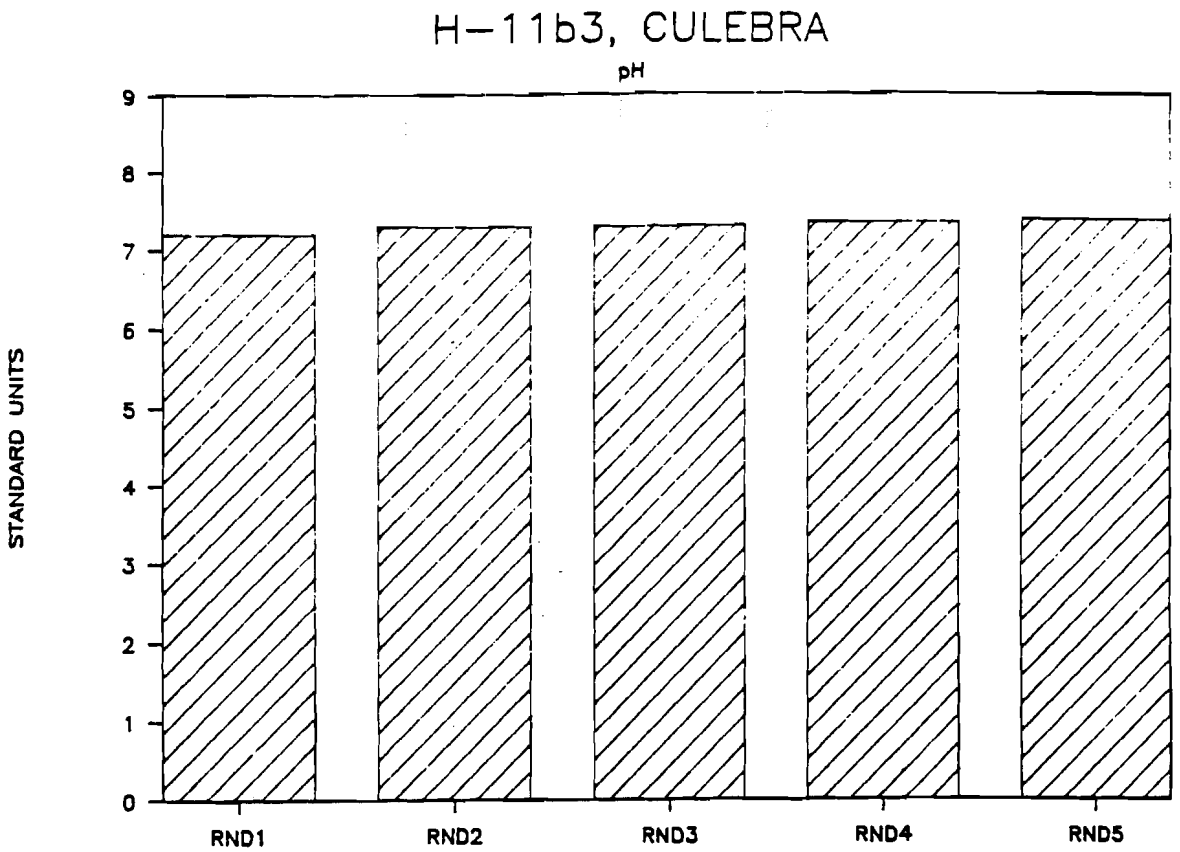

ENGLE WELL, CULEBRA
SPECIFIC GRAVITY
g/cm3
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2
RND2
RND3

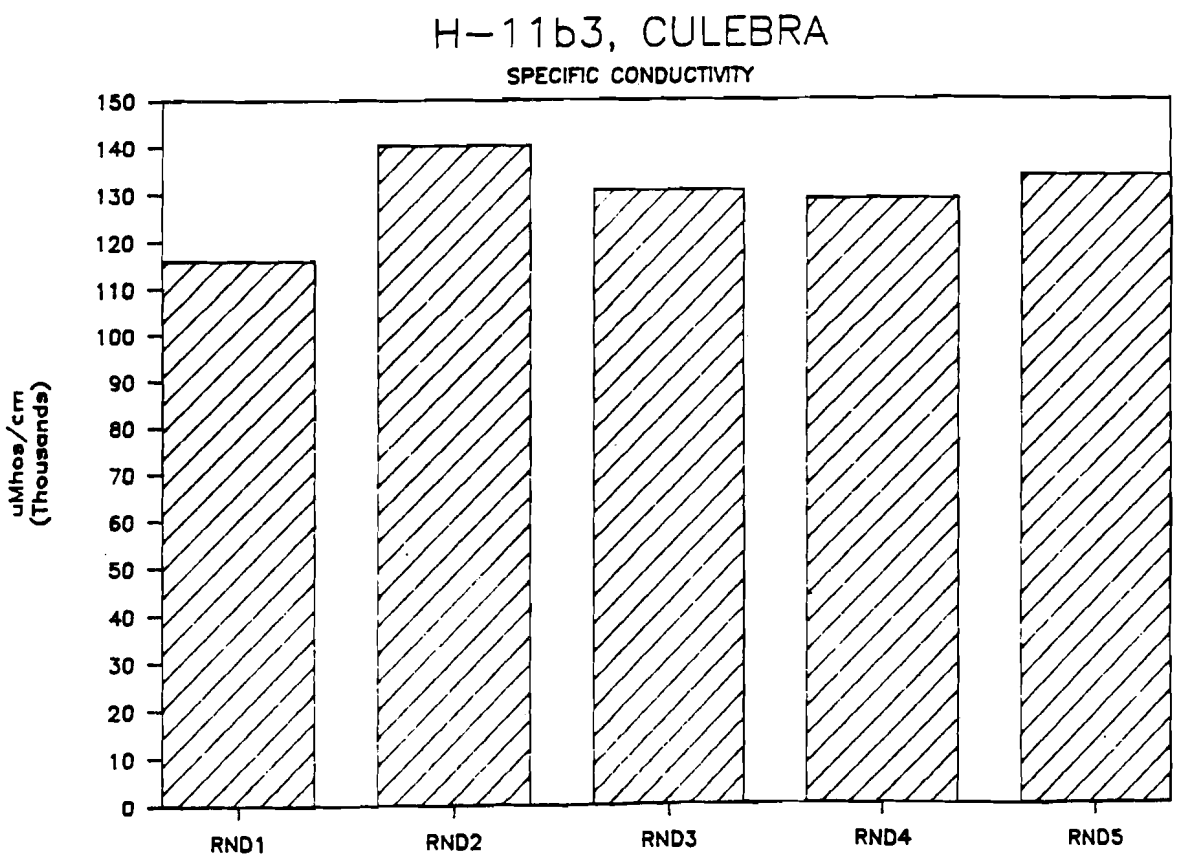

H-11b3, CULEBRA
ALKALINITY
CONCENTRATION mg/l
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5

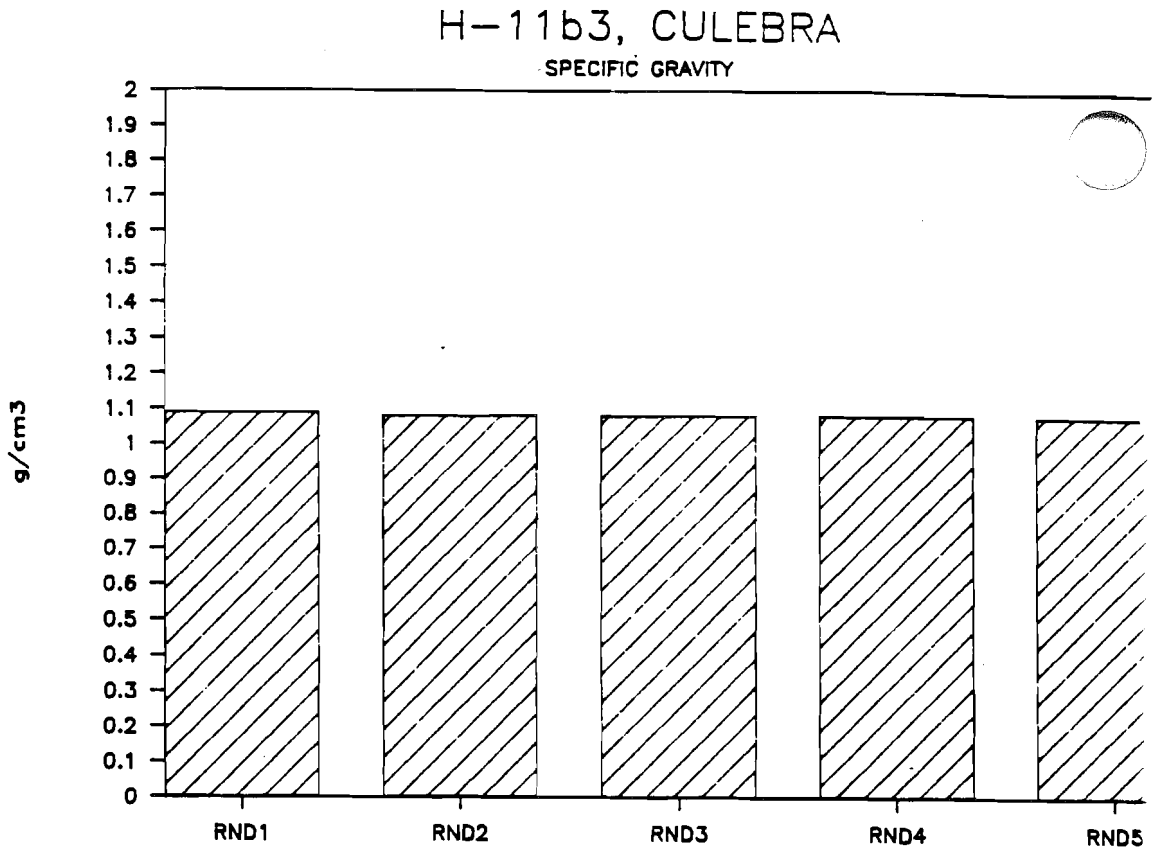

H-11b3, CULEBRA
CHLORIDES
CONCENTRATION mg/l
(Thousands)
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5

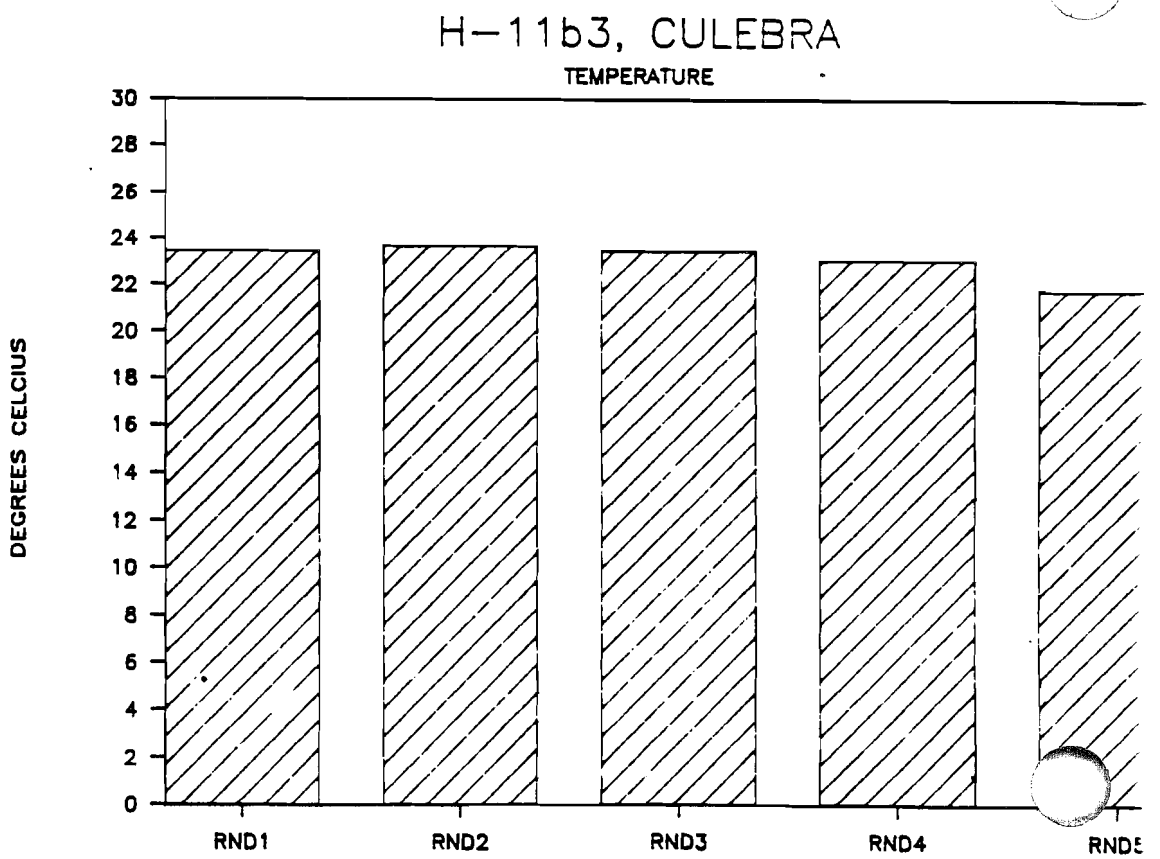

H-11b3, CULEBRA
DIVALENT CATIONS
CONCENTRATION meq/l
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
RND1
RND2
RND3
RND4
RND5

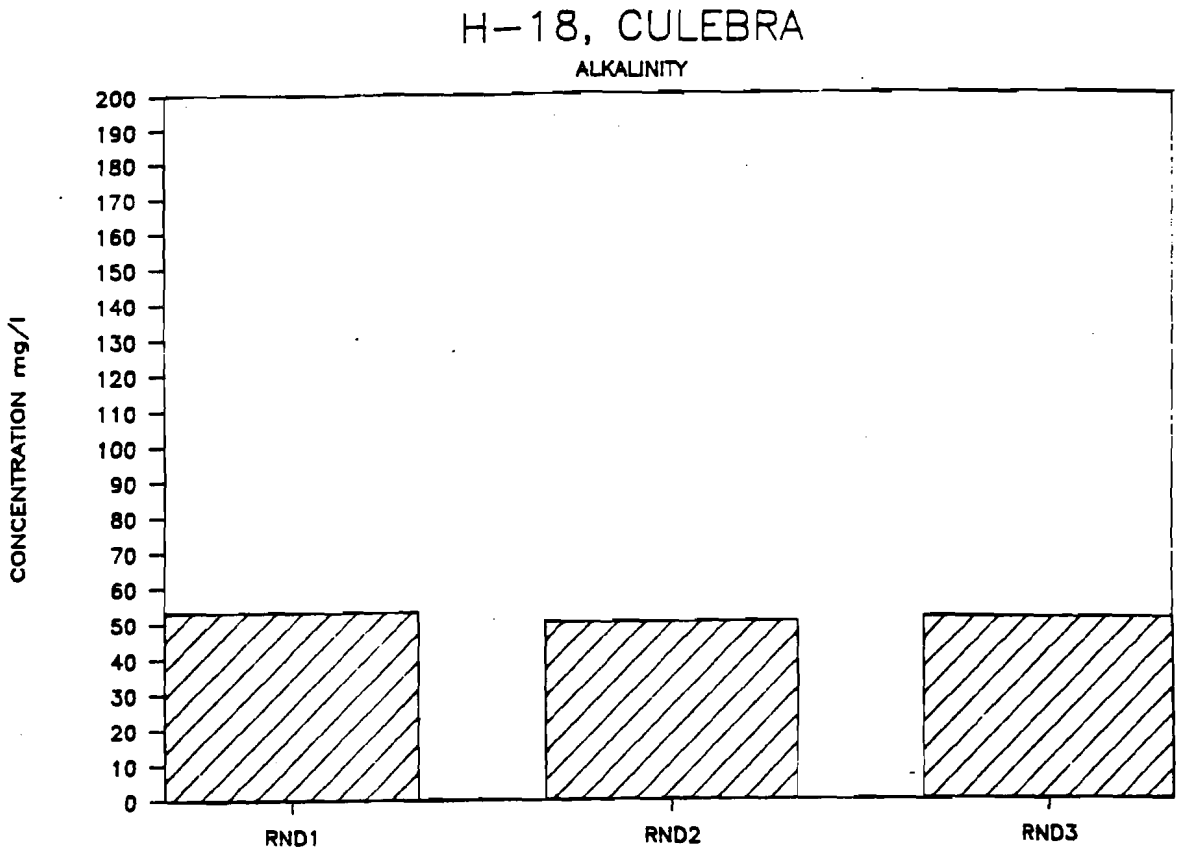

H-11b3, CULEBRA
TOTAL IRON
CONCENTRATION mg/l
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5

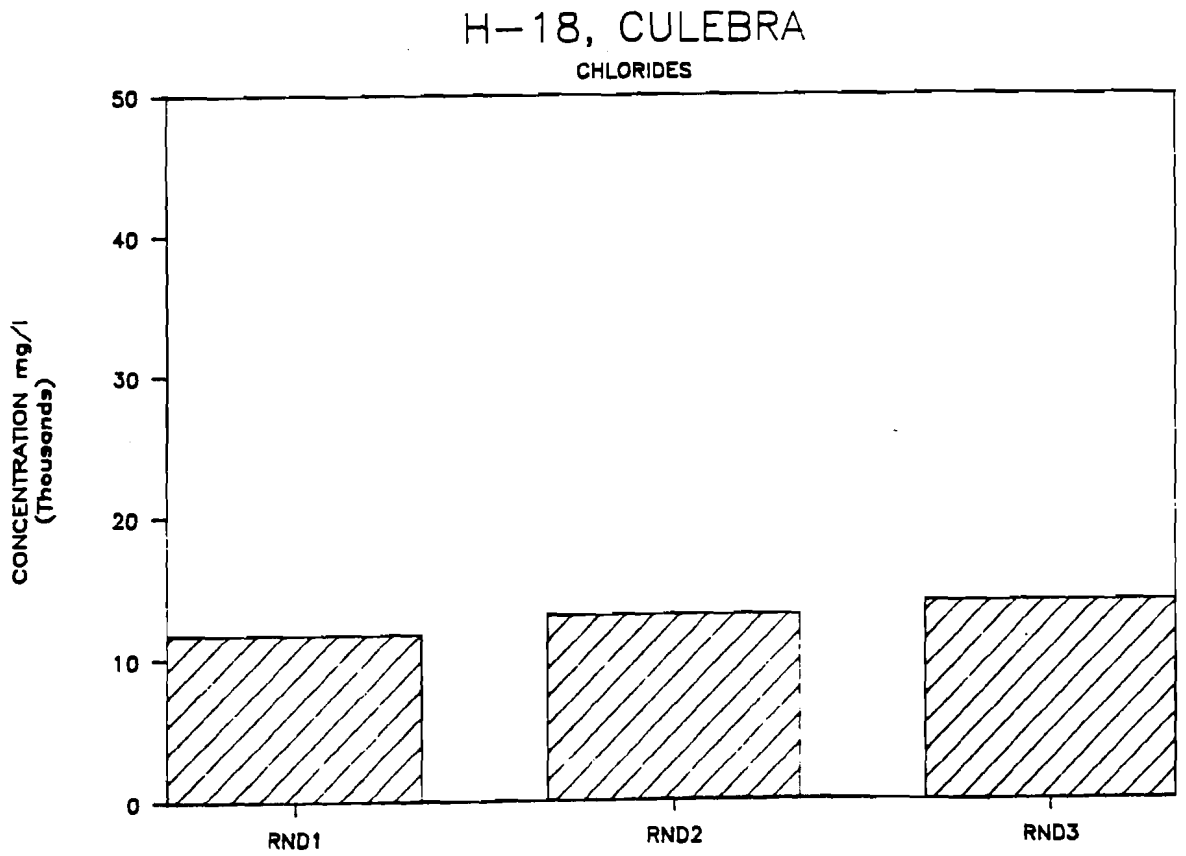

H-11b3, CULEBRA
pH
STANDARD UNITS
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5

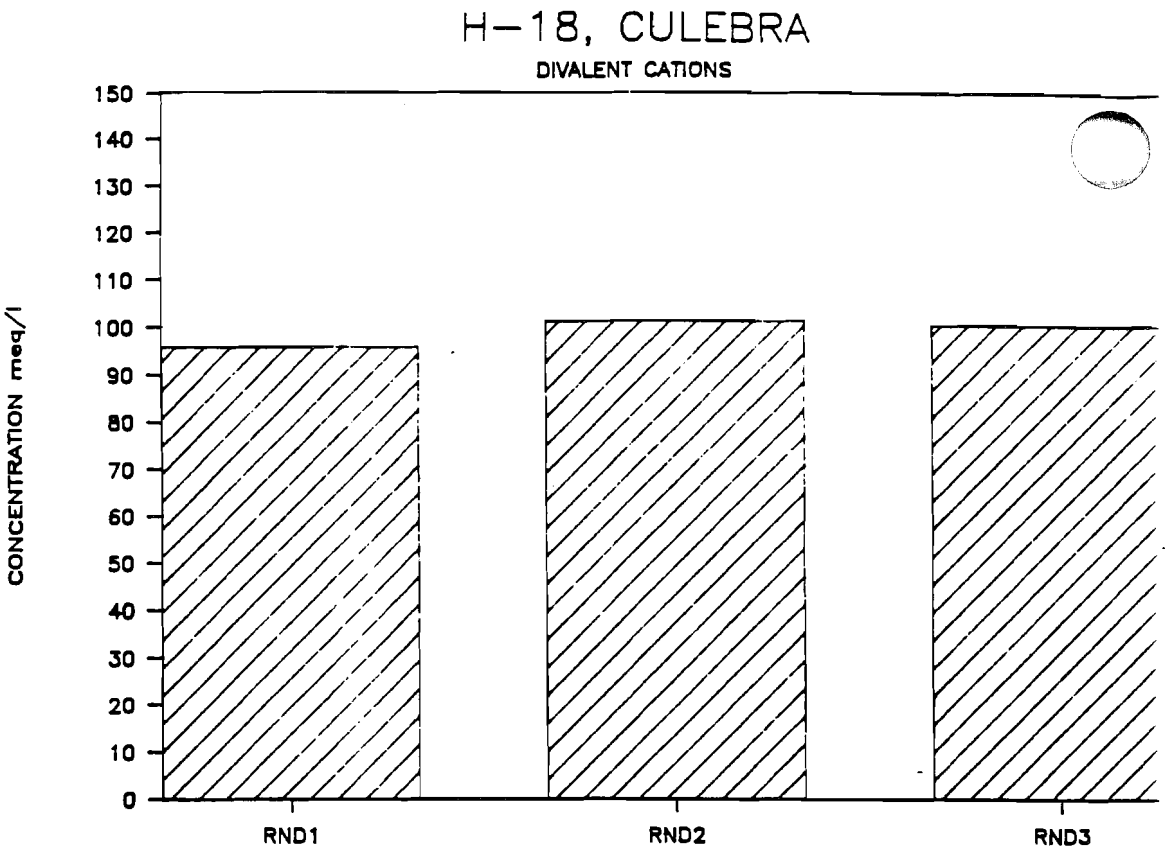

H-11b3, CULEBRA
SPECIFIC CONDUCTIVITY
uMhos/cm
(Thousands)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5

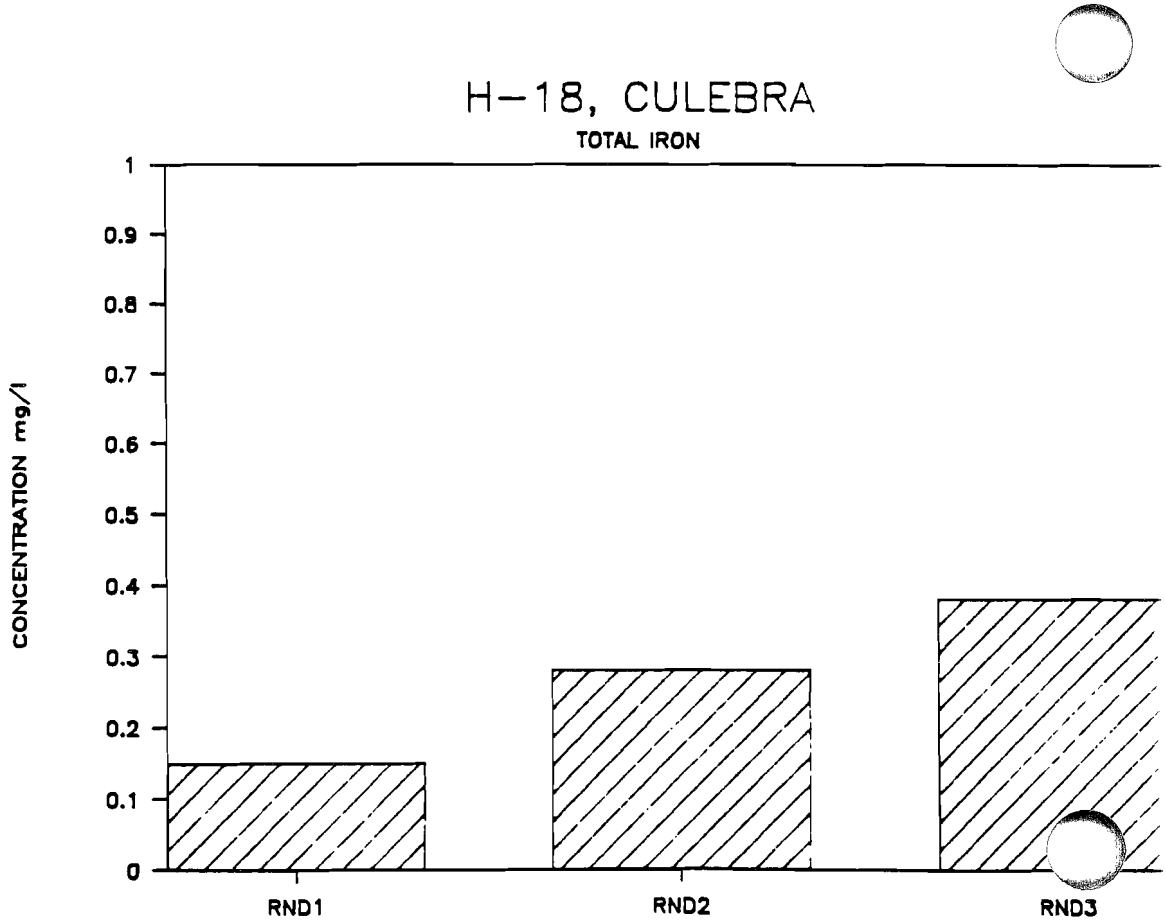

H-11b3, CULEBRA
SPECIFIC GRAVITY
g/cm3
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5

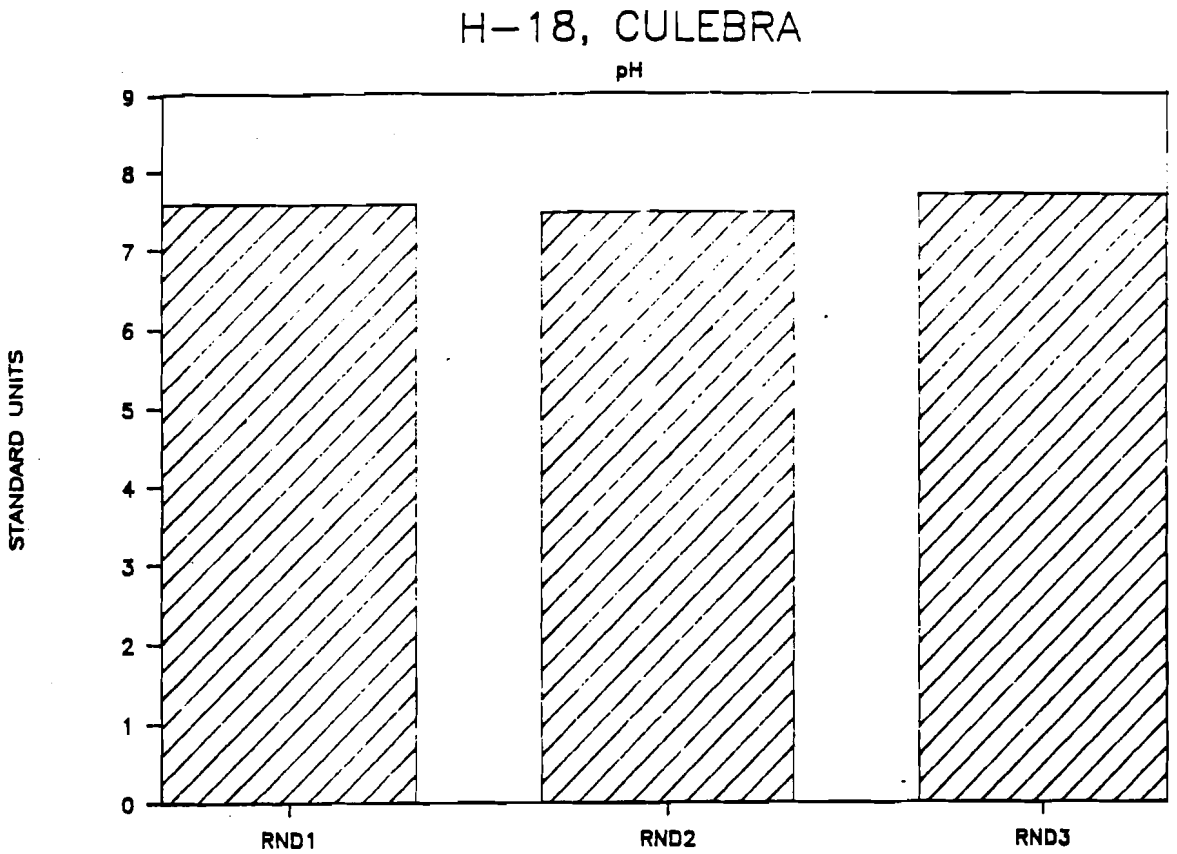

H-11b3, CULEBRA
TEMPERATURE
DEGREES CELCIUS
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
RND1
RND2
RND3
RND4

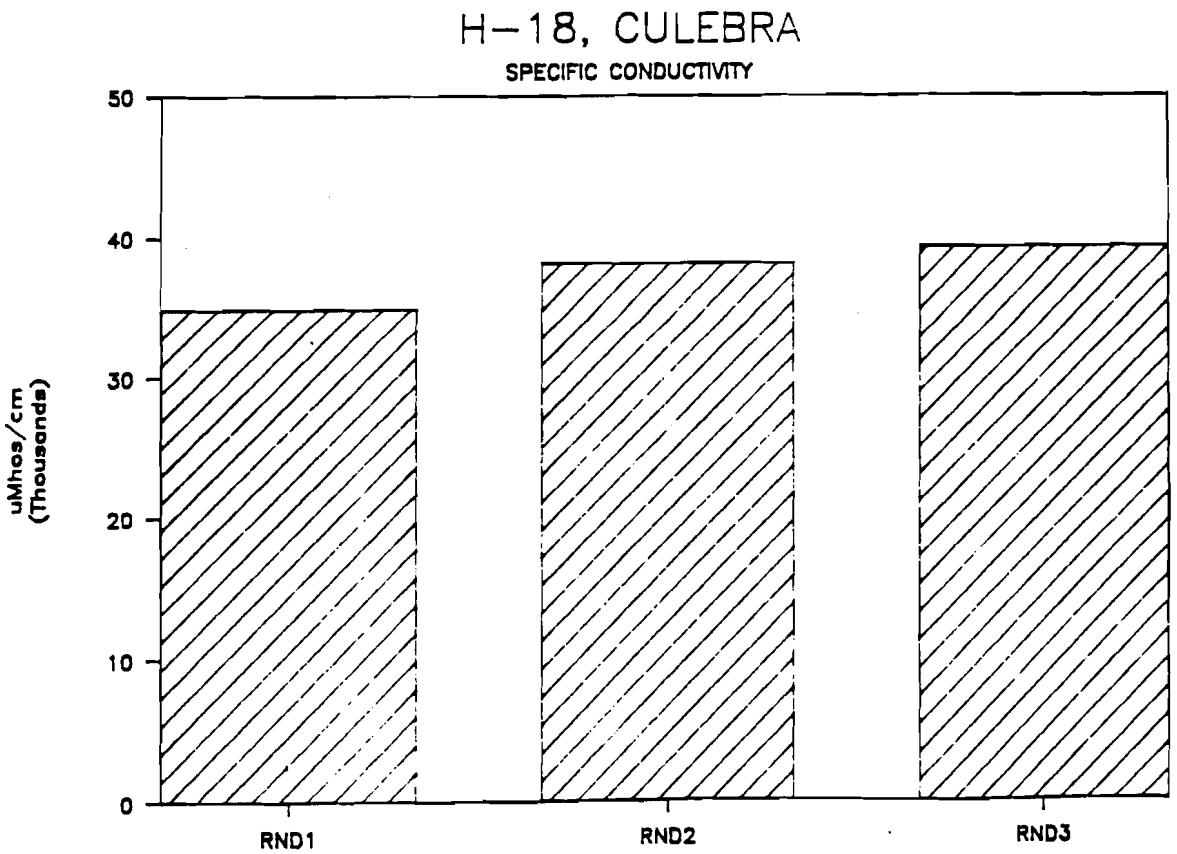

H-18, CULEBRA
ALKALINITY
CONCENTRATION mg/l
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3

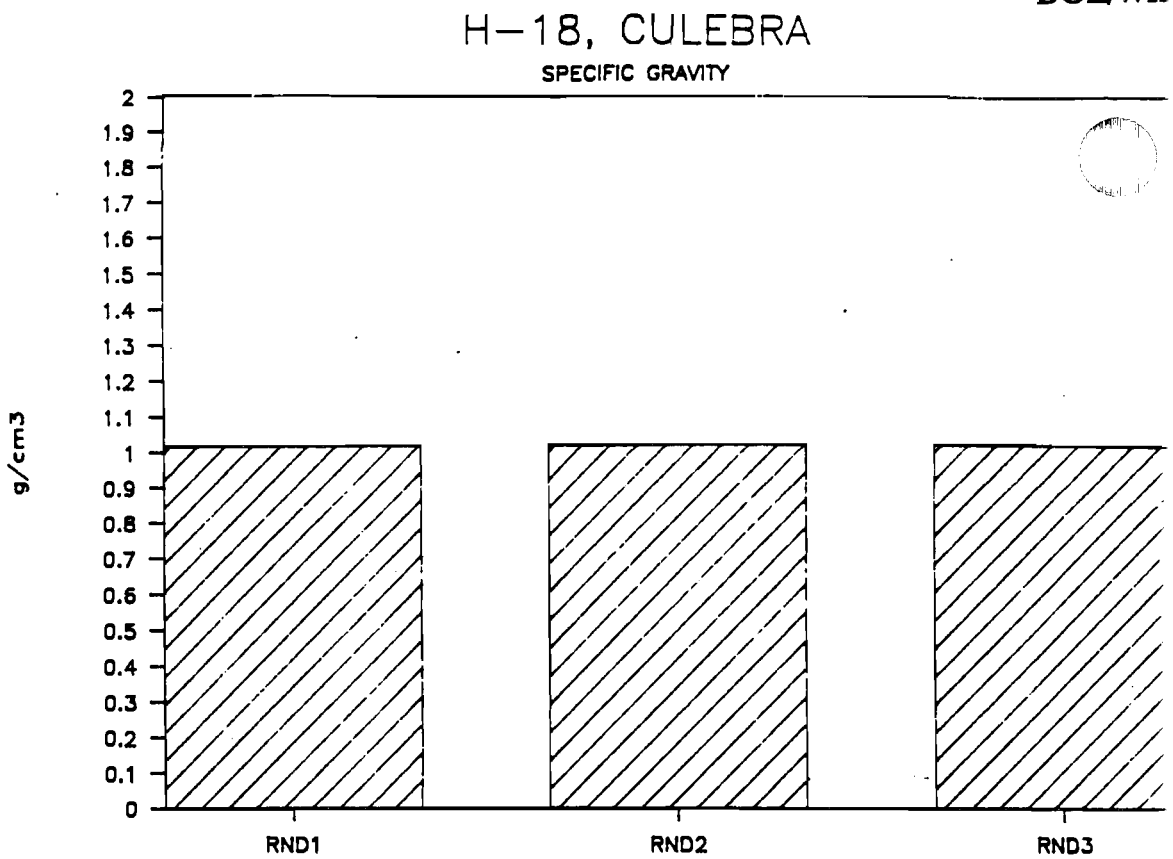

H-18, CULEBRA
CHLORIDES
CONCENTRATION mg/l
(Thousands)
50
40
30
20
10
0
RND1
RND2
RND3

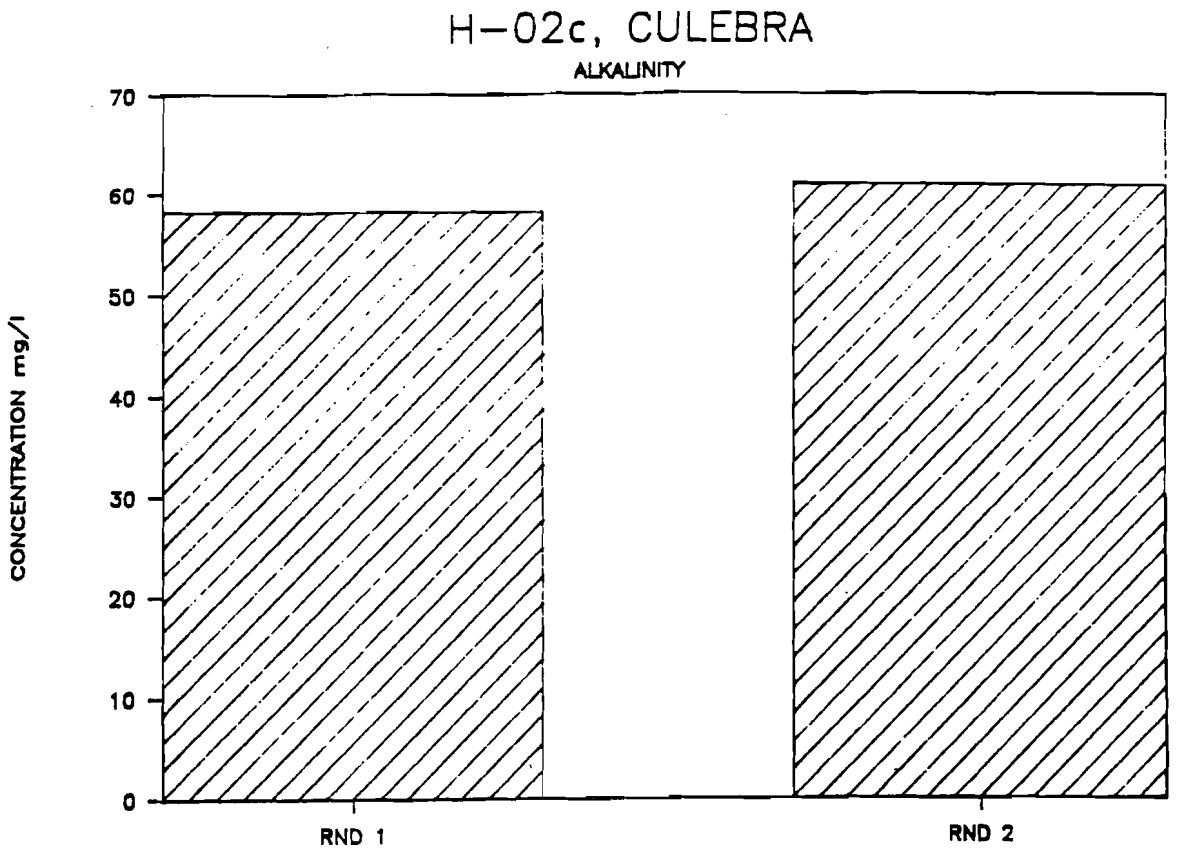

H-18, CULEBRA
DIVALENT CATIONS
CONCENTRATION meq/l
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3

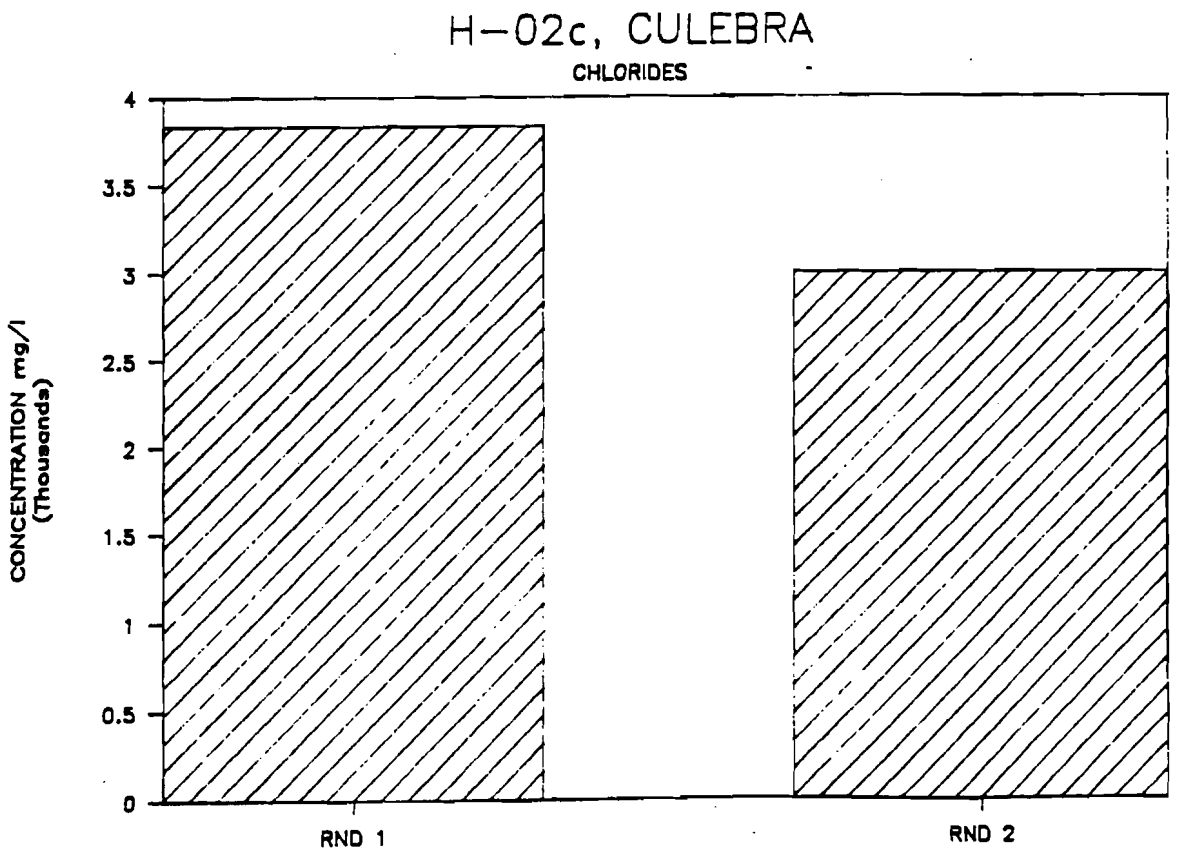

H-18, CULEBRA
TOTAL IRON
CONCENTRATION mg/l
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3

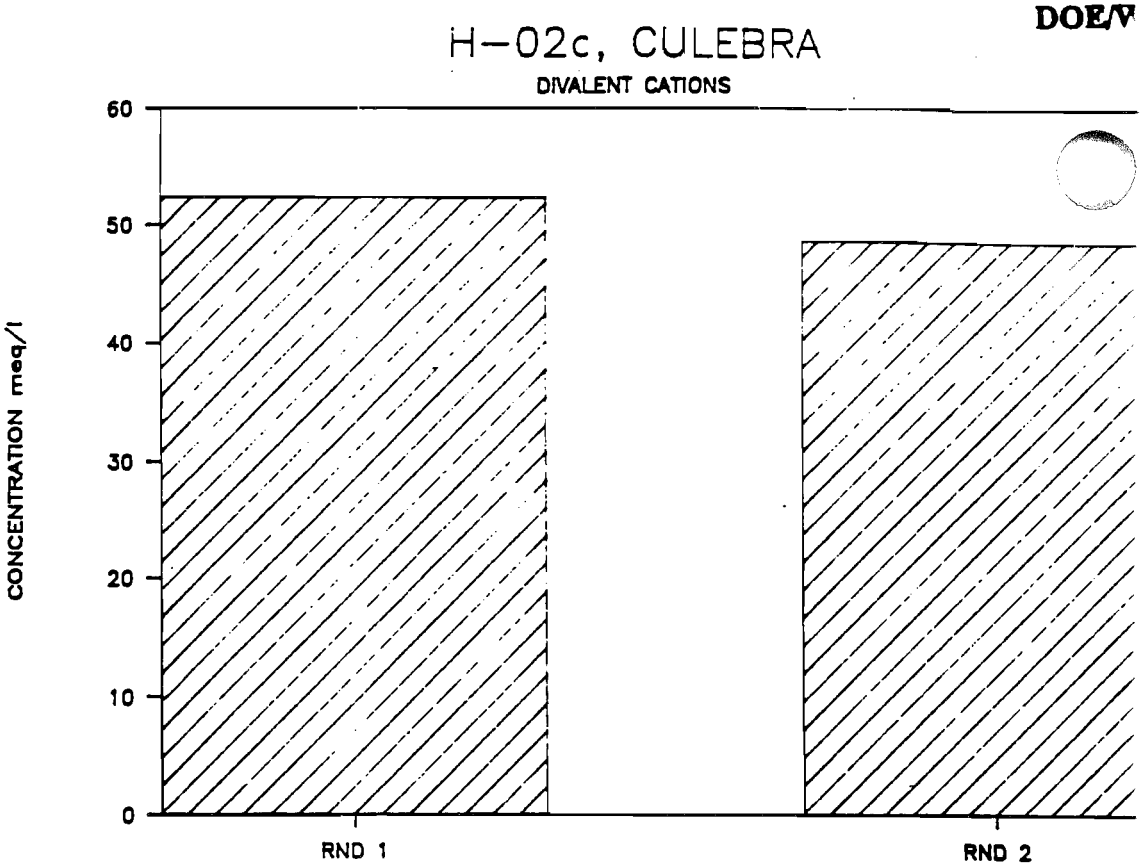

H-18, CULEBRA
pH
STANDARD UNITS
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3

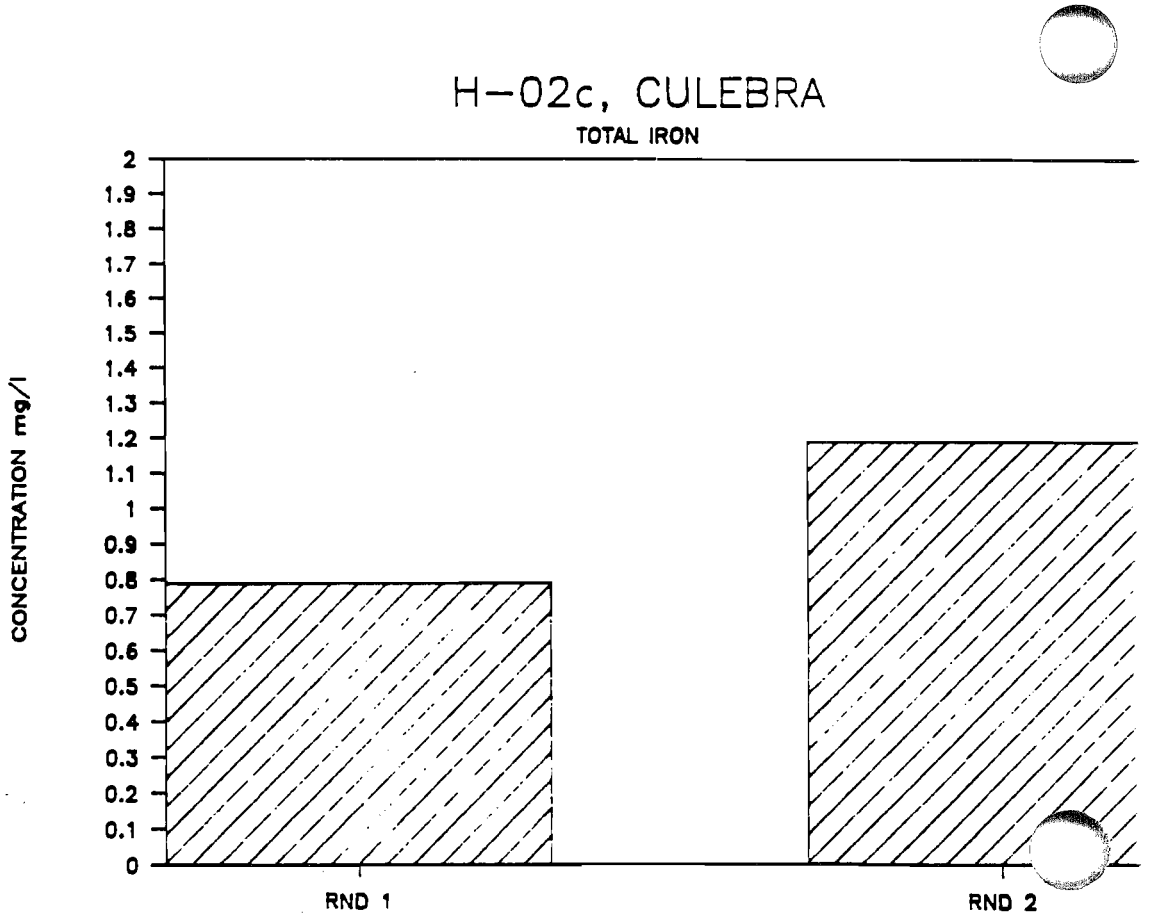

H-18, CULEBRA
SPECIFIC CONDUCTIVITY
uMhos/cm
(Thousands)
50
40
30
20
10
0
RND1
RND2
RND3

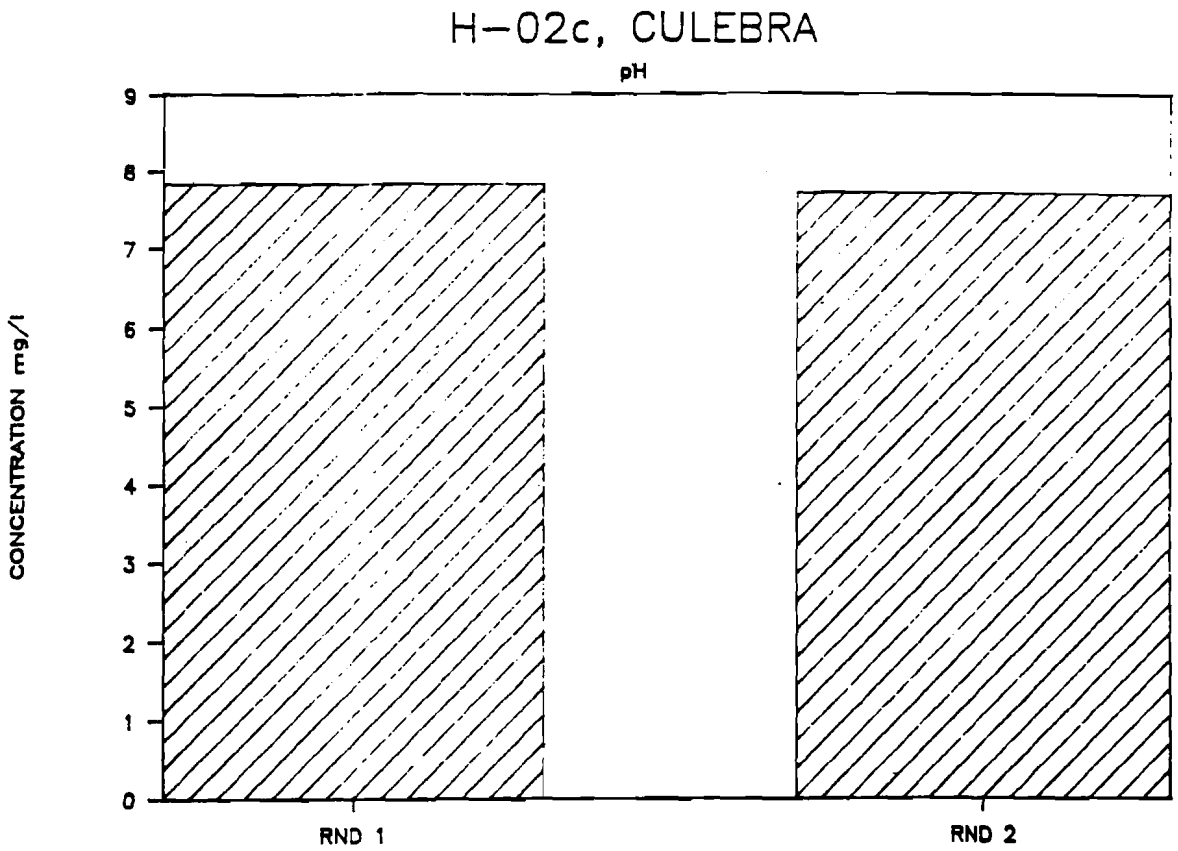

H-18, CULEBRA
SPECIFIC GRAVITY
g/cm3
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3

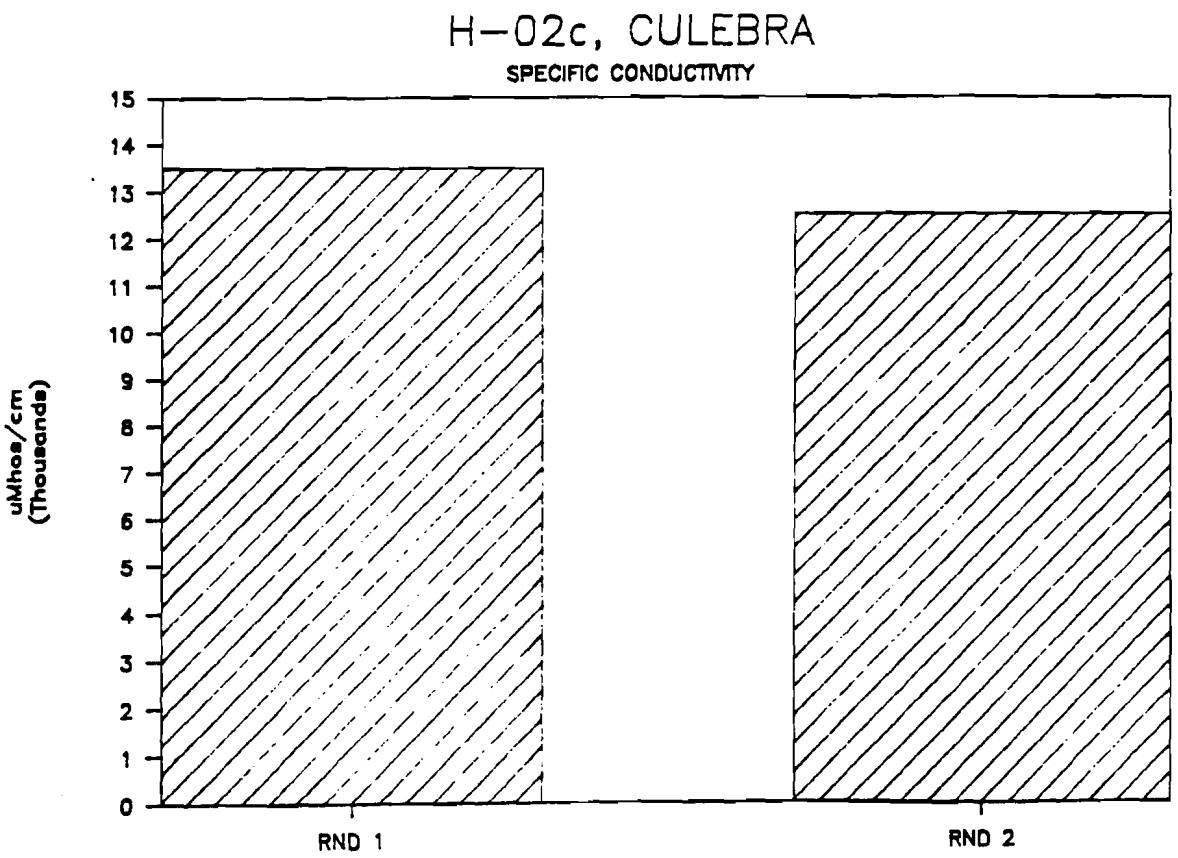

H-02c, CULEBRA
ALKALINITY
CONCENTRATION mg/l
70
60
50
40
30
20
10
0
RND 1
RND 2

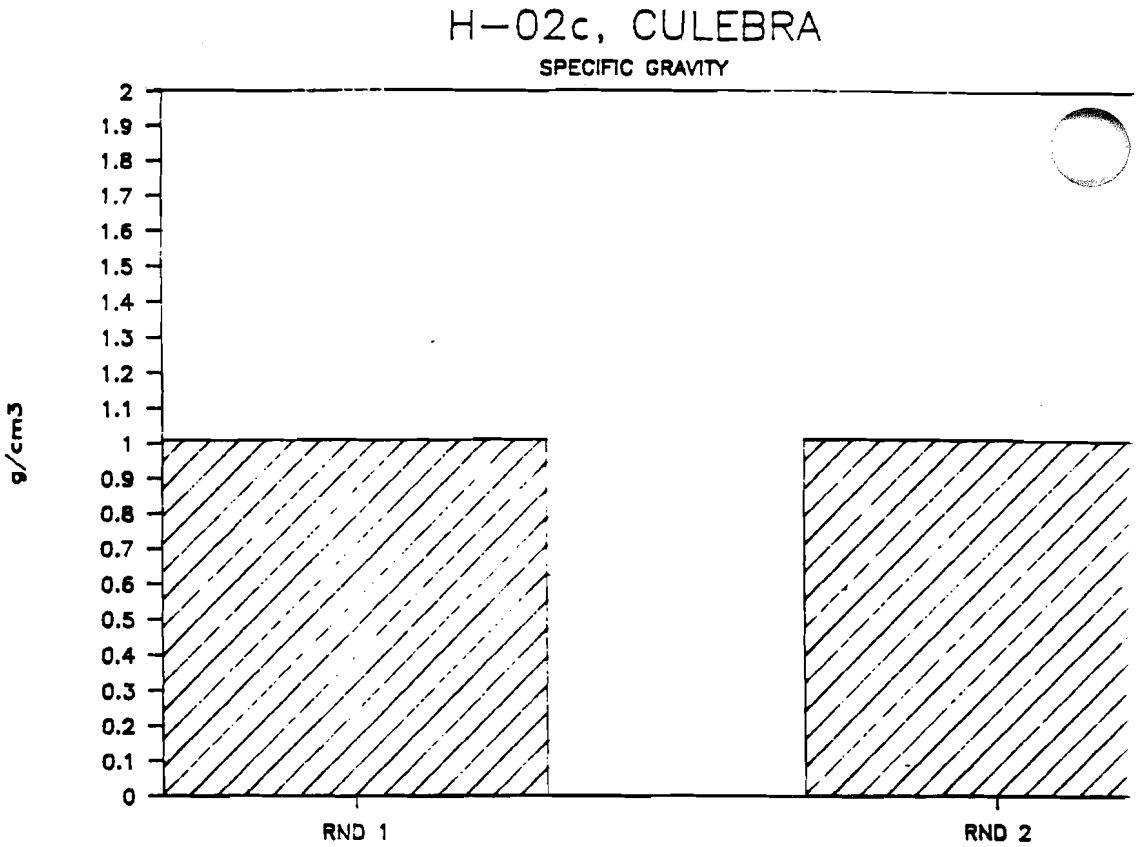

H-02c, CULEBRA
CHLORIDES
CONCENTRATION mg/l
(Thousands)
4
3.5
3
2.5
2
1.5
1
0.5
0
RND 1
RND 2

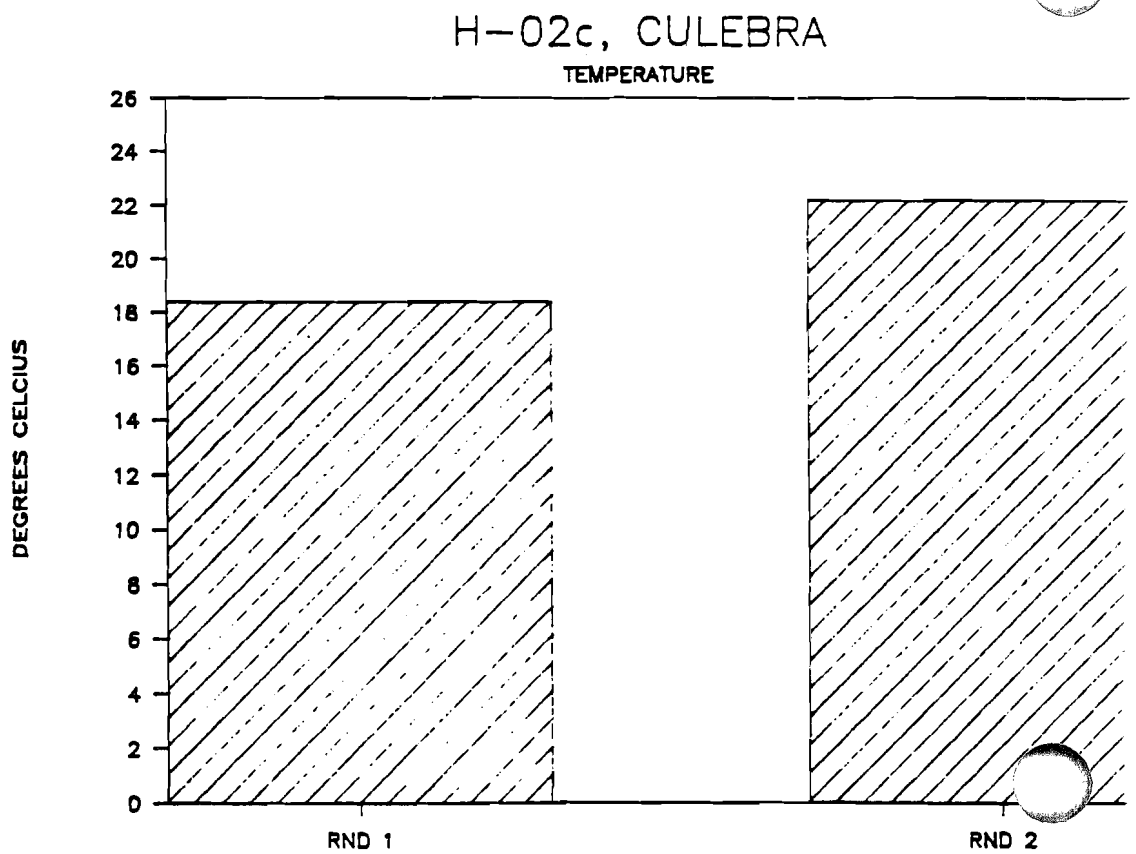

H-02c, CULEBRA
DIVALENT CATIONS
CONCENTRATION meq/l
60
50
40
30
20
10
0
RND 1
RND 2

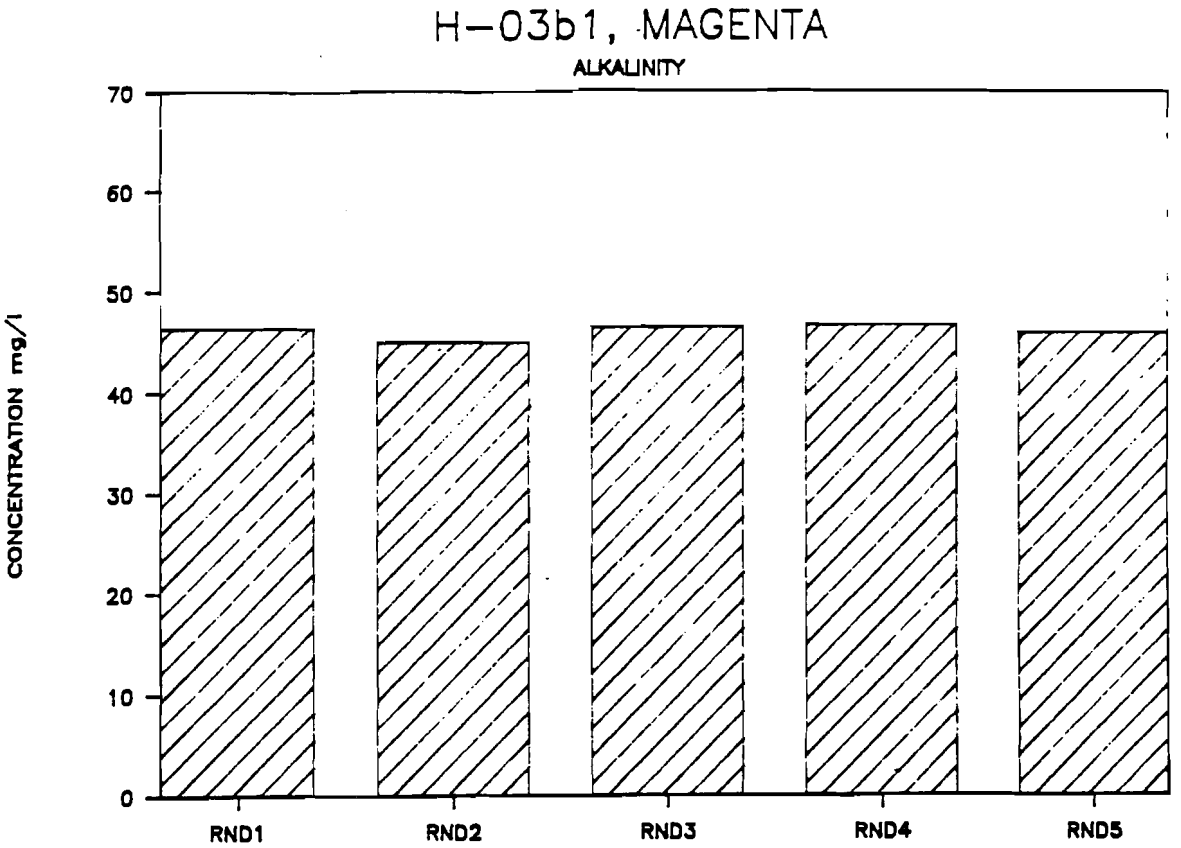

H-02c, CULEBRA
TOTAL IRON
CONCENTRATION mg/l
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND 1
RND 2

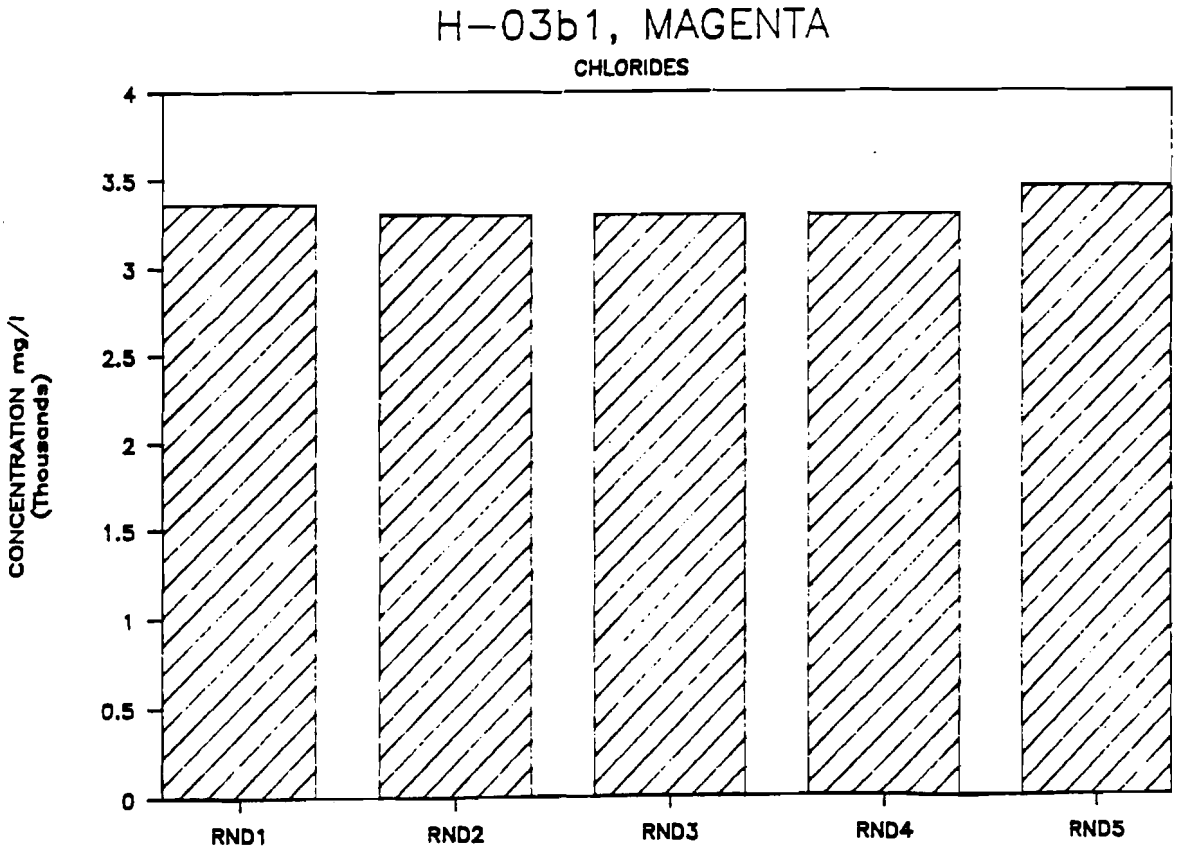

H-02c, CULEBRA
pH
CONCENTRATION mg/l
0
1
2
3
4
5
6
7
8
9
RND 1
RND 2

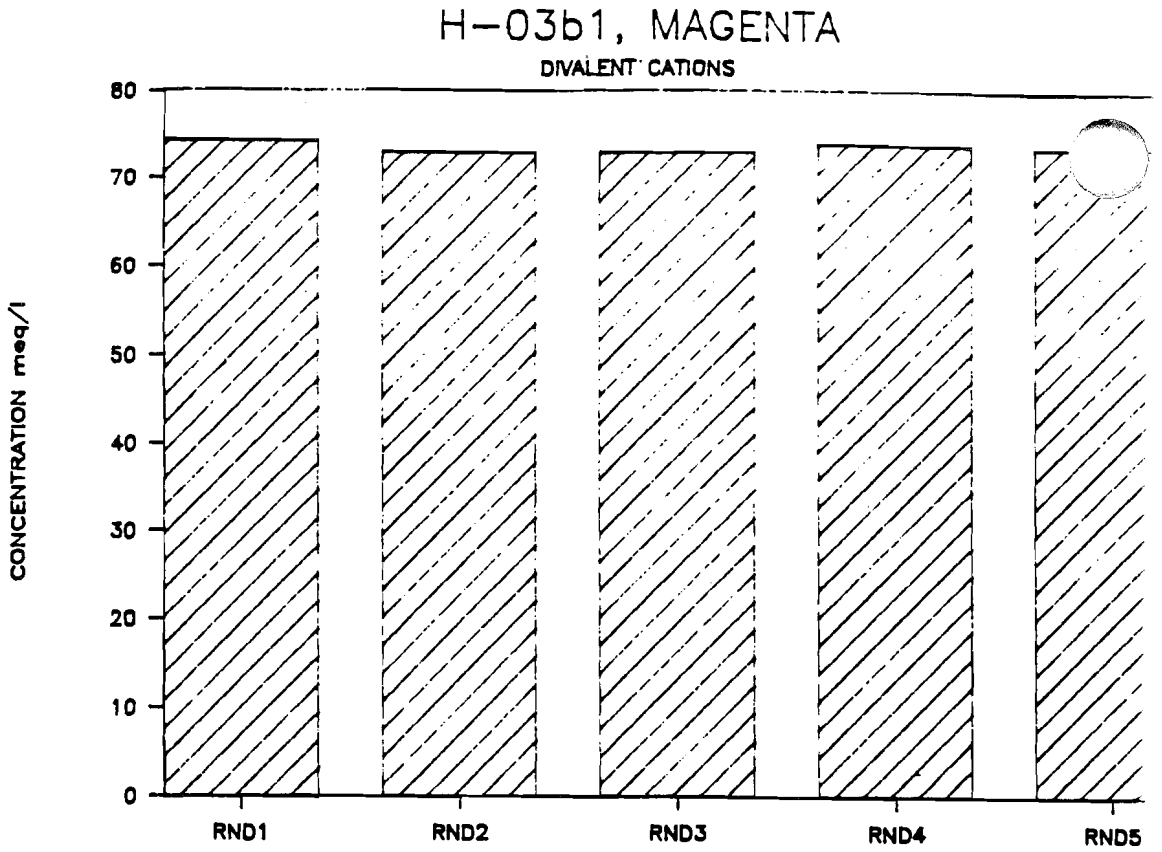

H-02c, CULEBRA
SPECIFIC CONDUCTIVITY
uMhos/cm
(Thousands)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
RND 1
RND 2

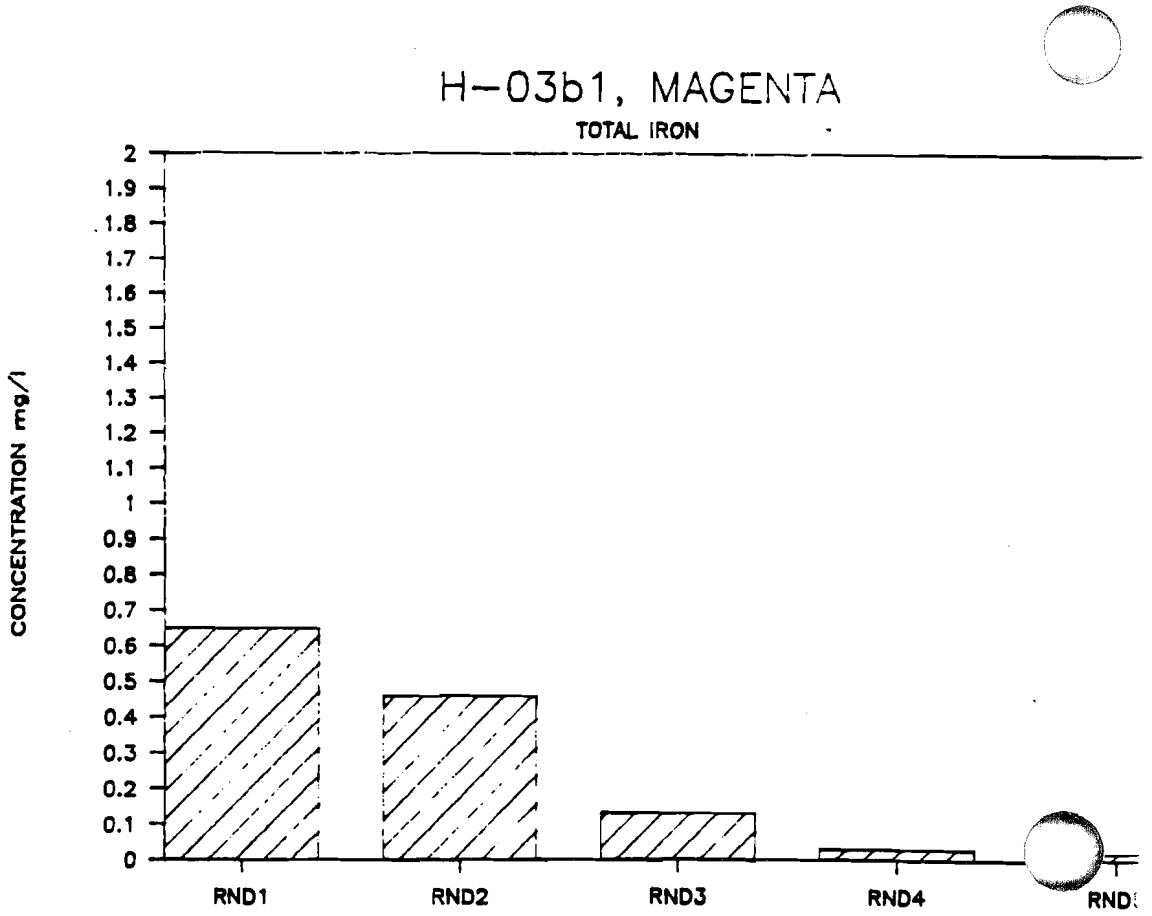

H-02c, CULEBRA
SPECIFIC GRAVITY
g/cm3
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND 1
RND 2

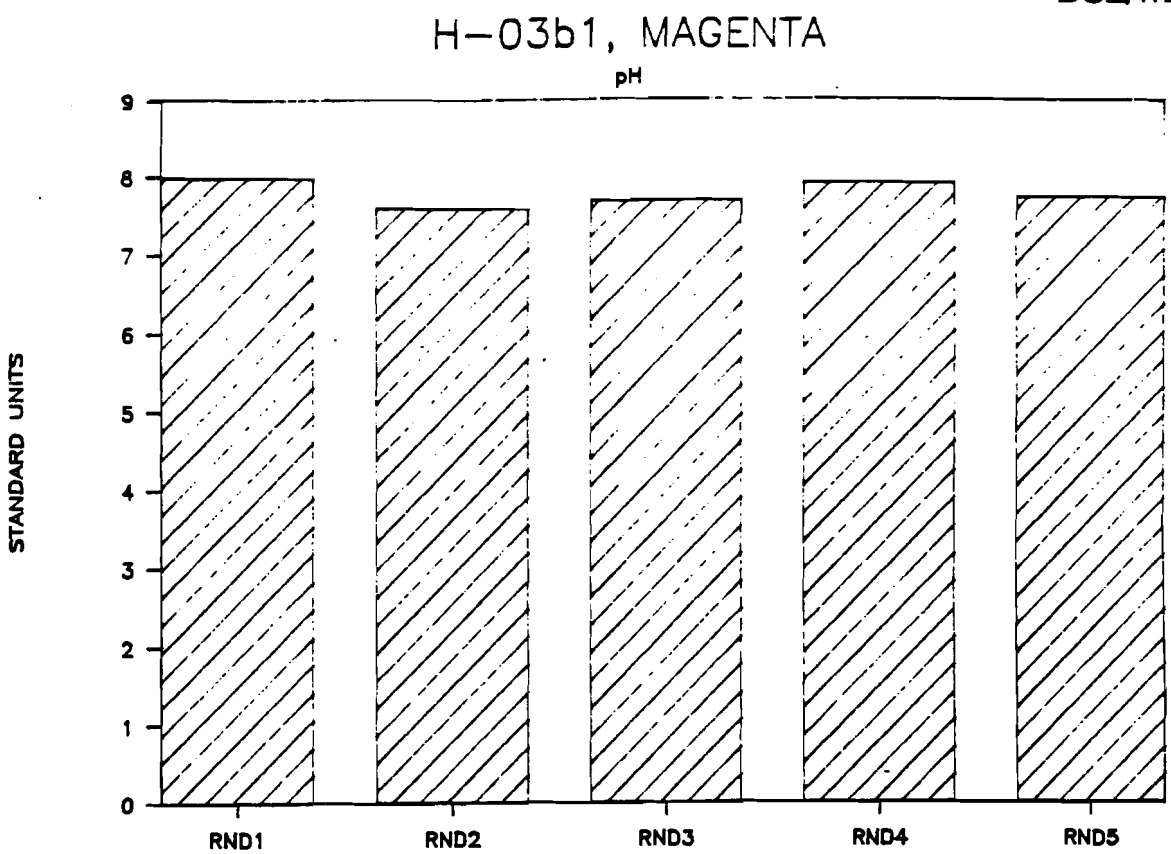

H-02c, CULEBRA
TEMPERATURE
DEGREES CELCIUS
26
24
22
20
18
16
14
12
10
8
6
4
2
0
RND 1
RND 2

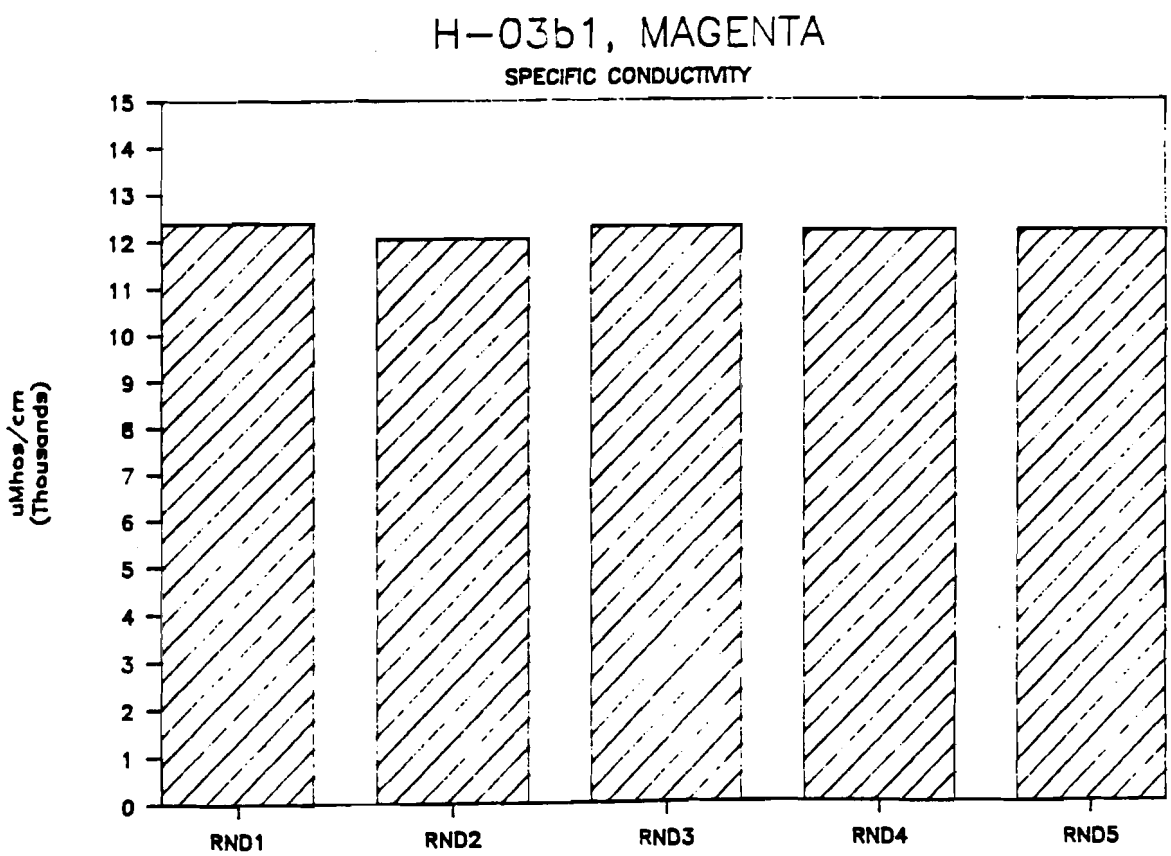

H-03b1, MAGENTA
ALKALINITY
CONCENTRATION mg/l
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5

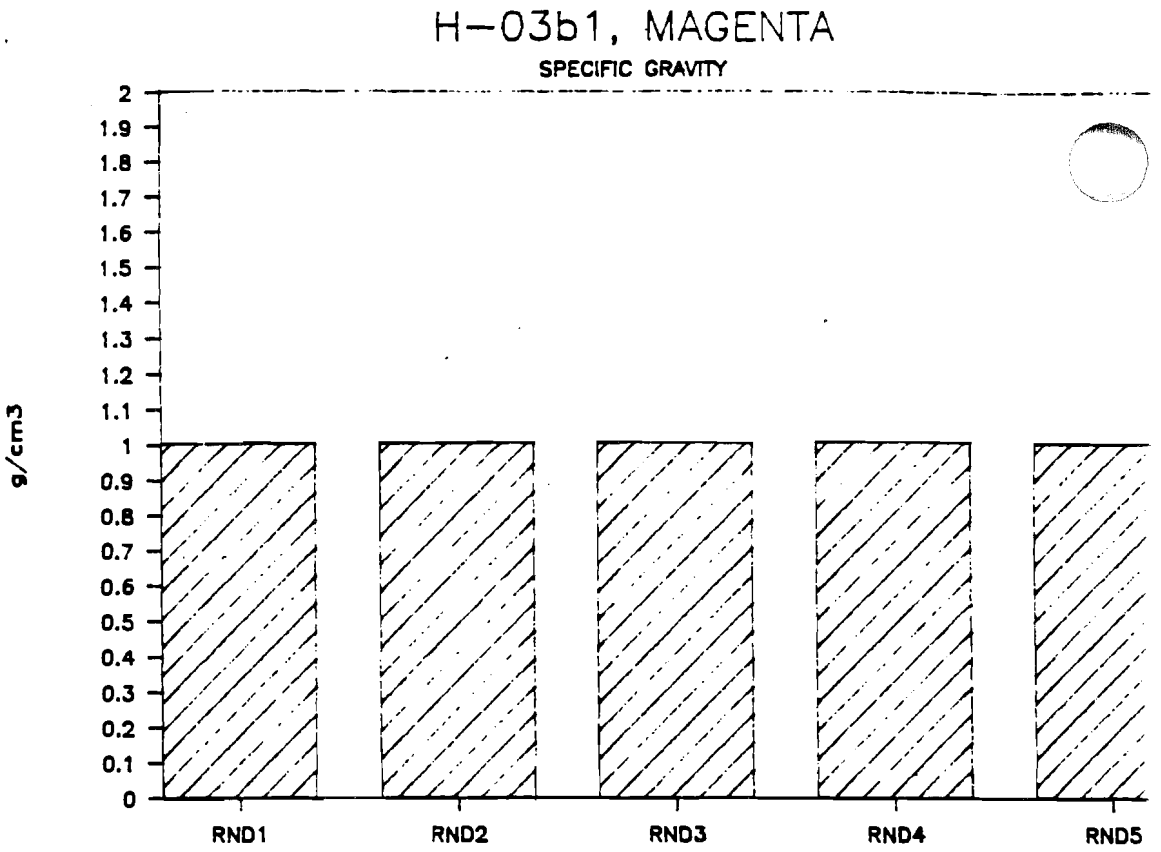

H-03b1, MAGENTA
CHLORIDES
CONCENTRATION mg/l
(Thousands)
4
3.5
3
2.5
2
1.5
1
0.5
0
RND1
RND2
RND3
RND4
RND5

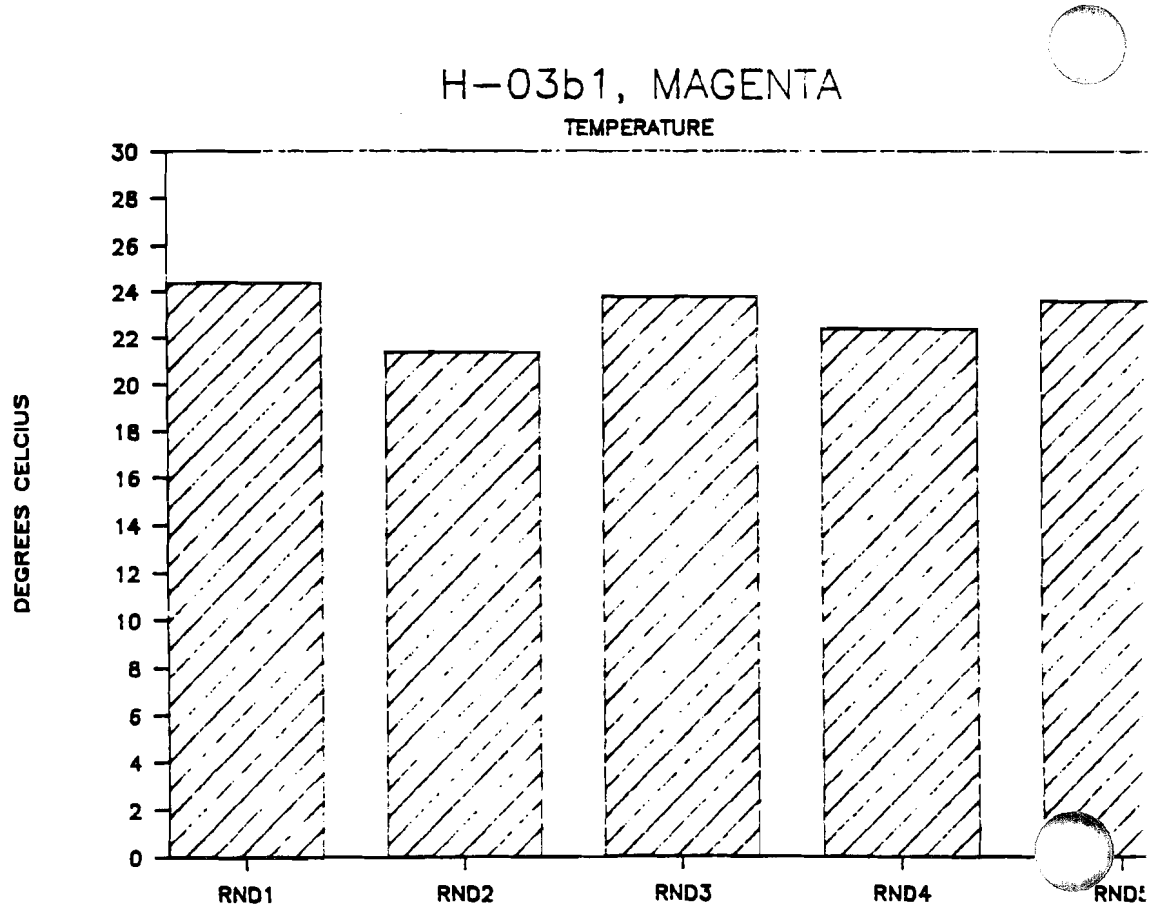

H-03b1, MAGENTA
DIVALENT CATIONS
CONCENTRATION meq/l
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5

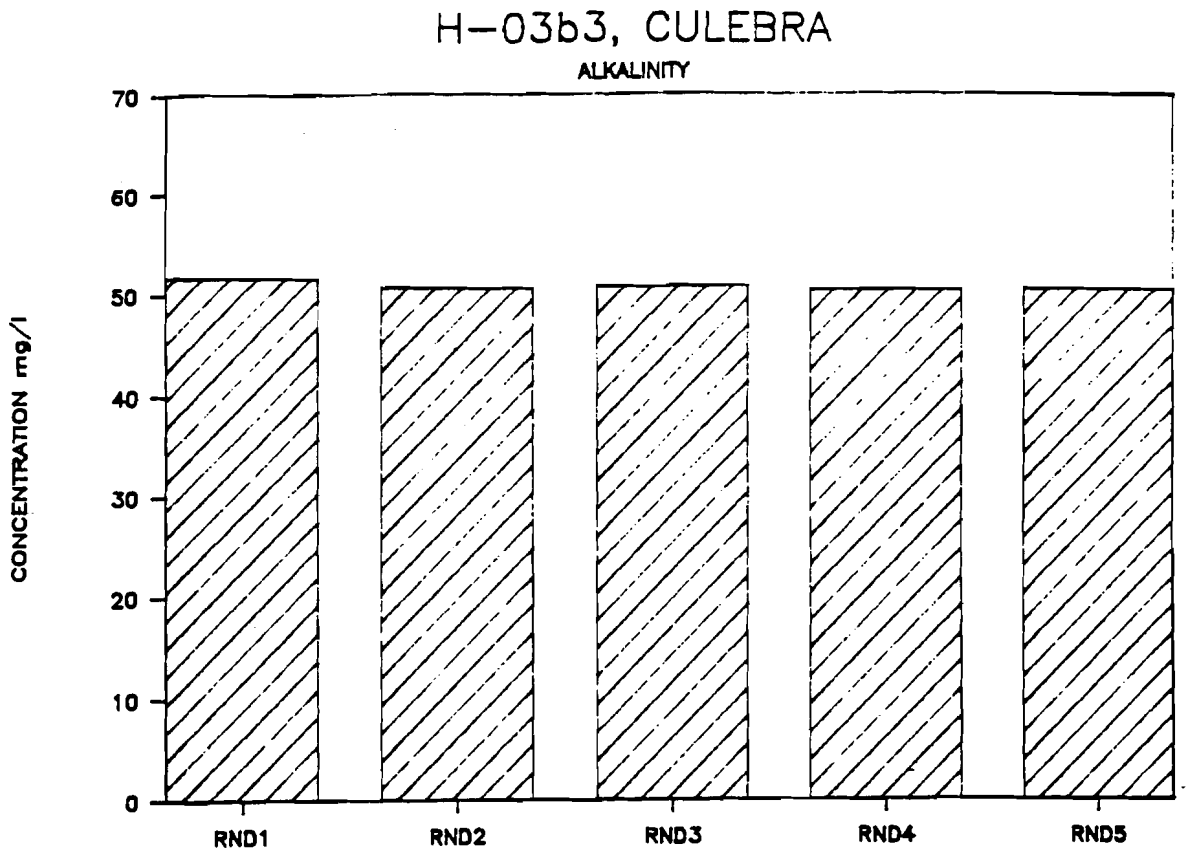

H-03b1, MAGENTA
TOTAL IRON
CONCENTRATION mg/l
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4

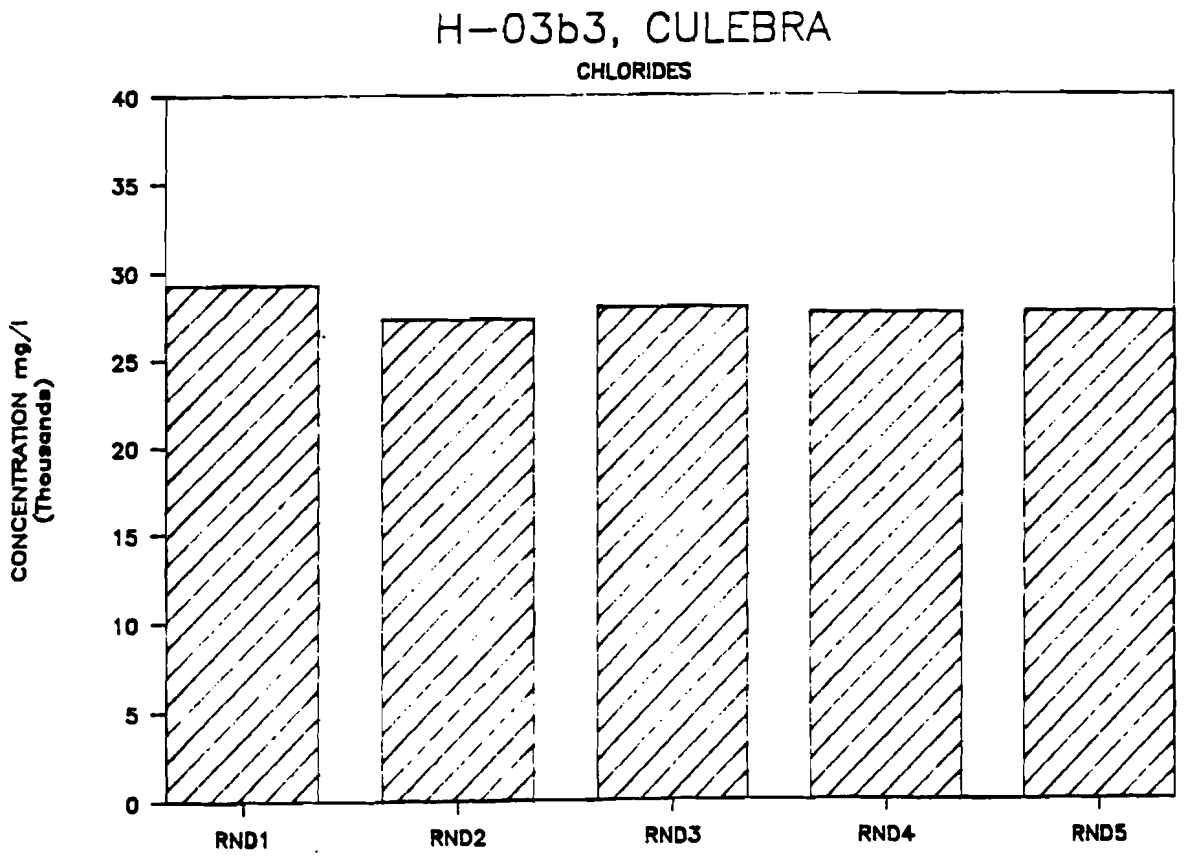

H-03b1, MAGENTA
pH
STANDARD UNITS
0
1
2
3
4
5
6
7
8
9
RND1
RND2
RND3
RND4
RND5

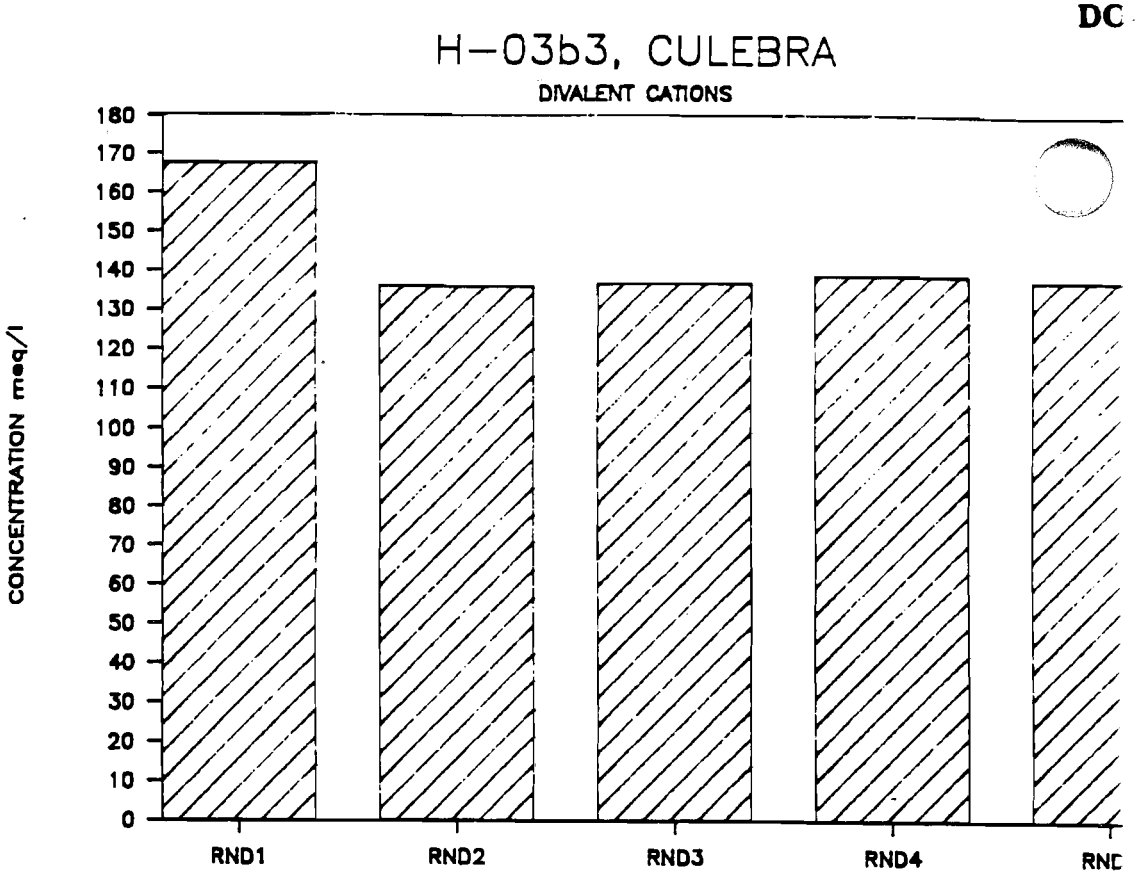

H-03b1, MAGENTA
SPECIFIC CONDUCTIVITY
uMhos/cm
(Thousands)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
RND1
RND2
RND3
RND4
RND5

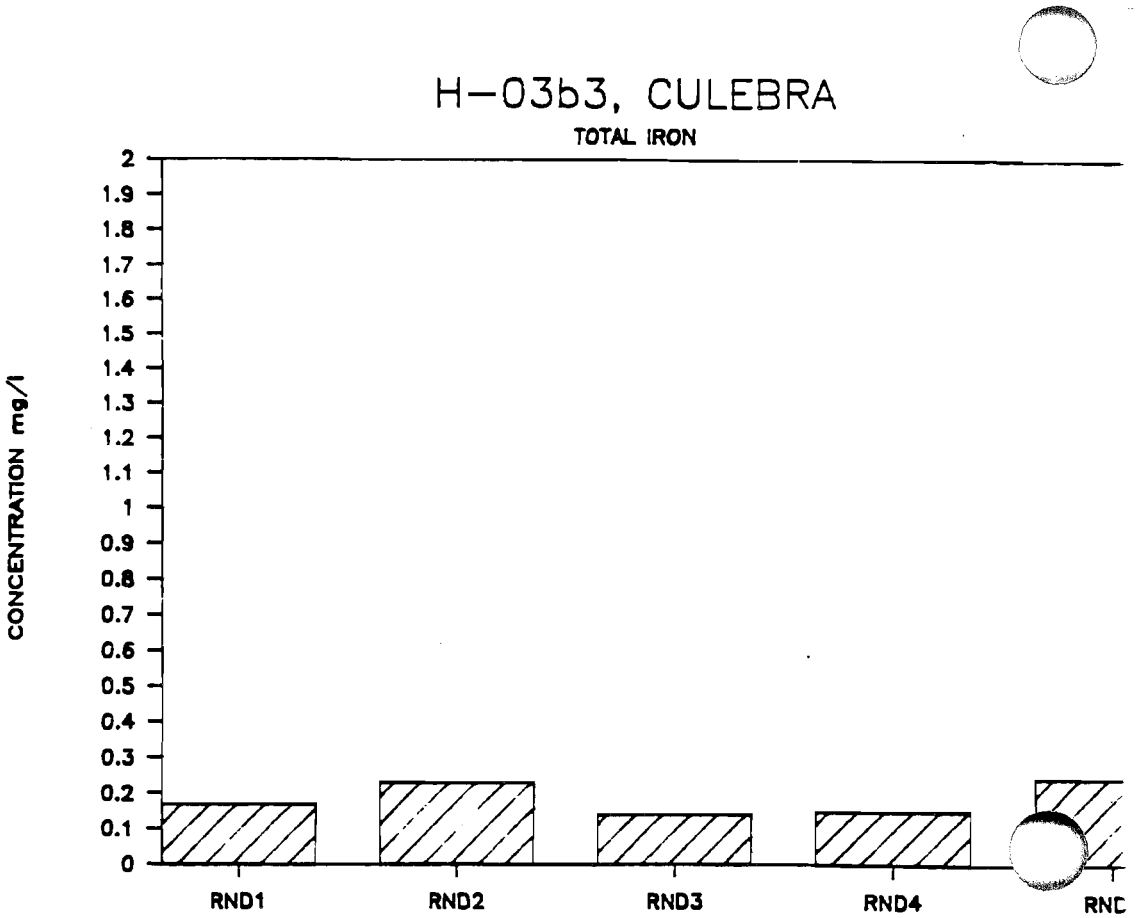

H-03b1, MAGENTA
SPECIFIC GRAVITY
g/cm3
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5

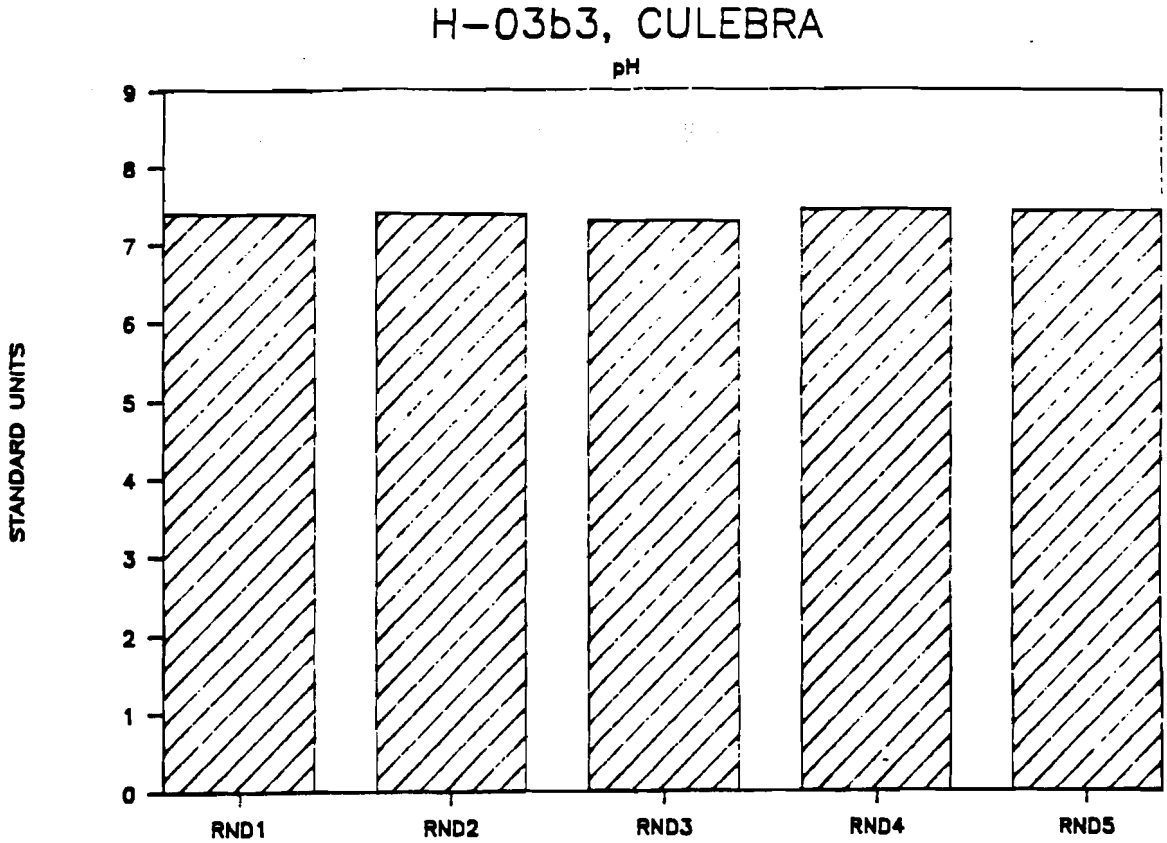

H-03b1, MAGENTA
TEMPERATURE
DEGREES CELCIUS
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
RND1
RND2
RND3
RND4

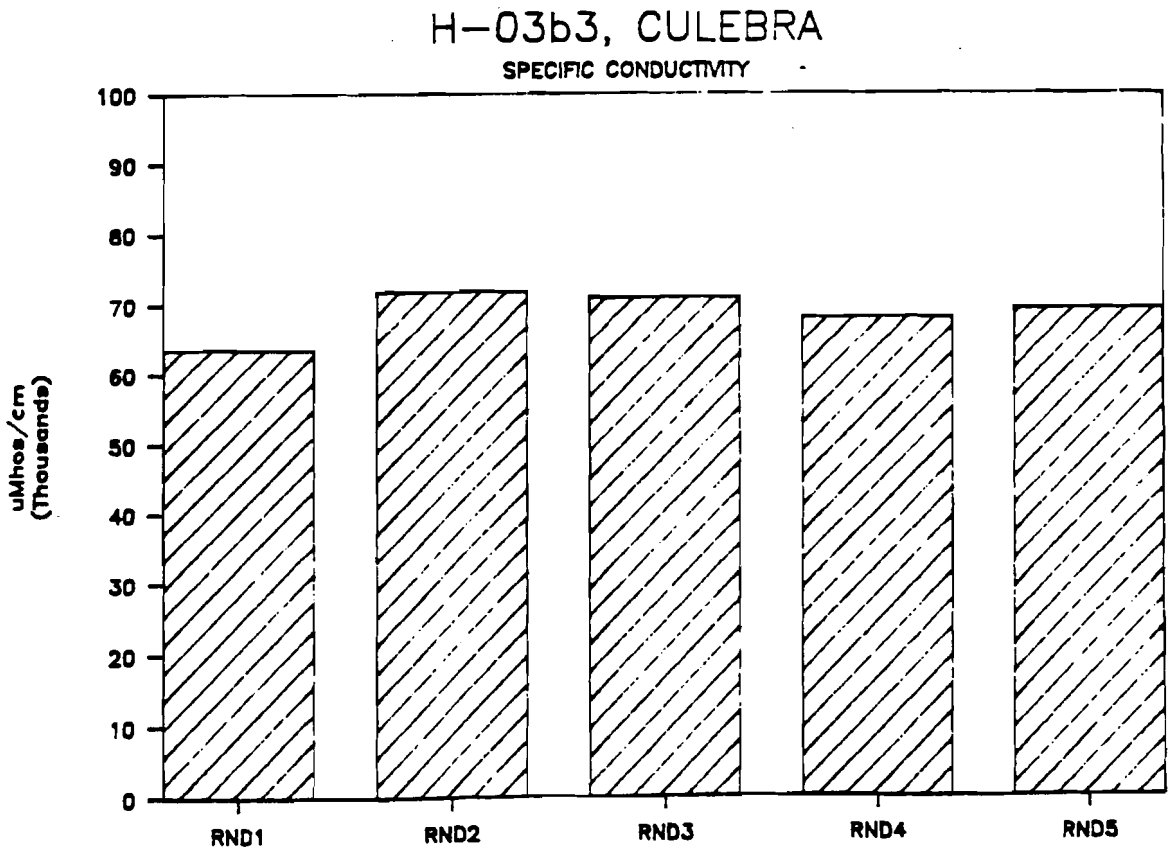

H-03b3, CULEBRA
ALKALINITY
CONCENTRATION mg/l
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5

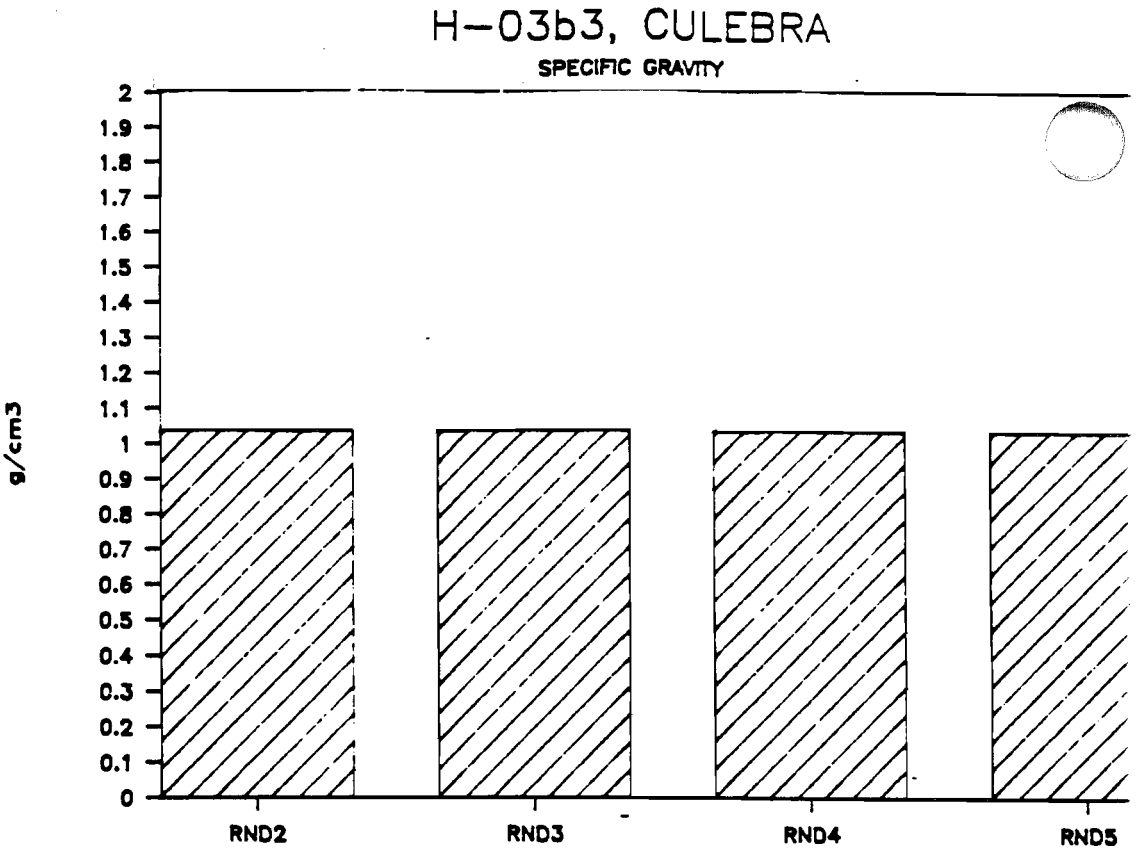

H-03b3, CULEBRA
CHLORIDES
CONCENTRATION mg/l
(Thousands)
40
35
30
25
20
15
10
5
0
RND1
RND2
RND3
RND4
RND5

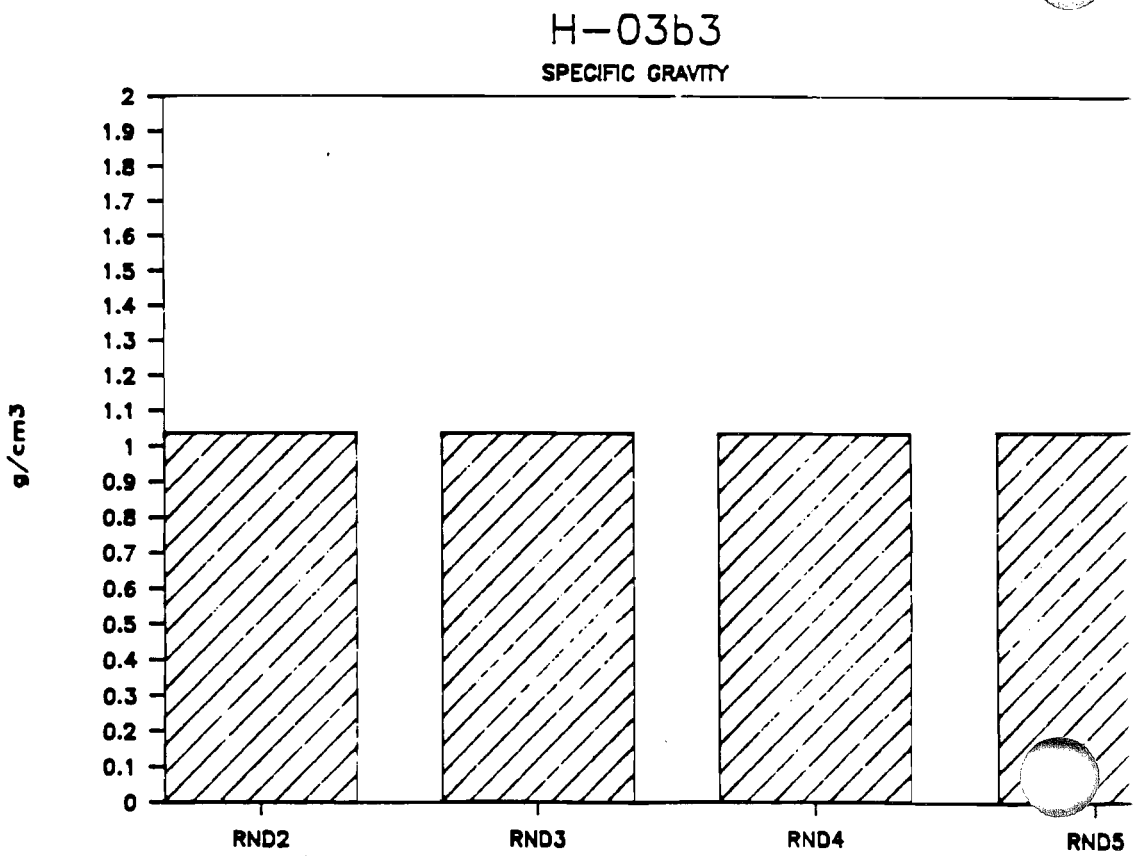

H-03b3, CULEBRA
DIVALENT CATIONS
CONCENTRATION meq/l
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RNC

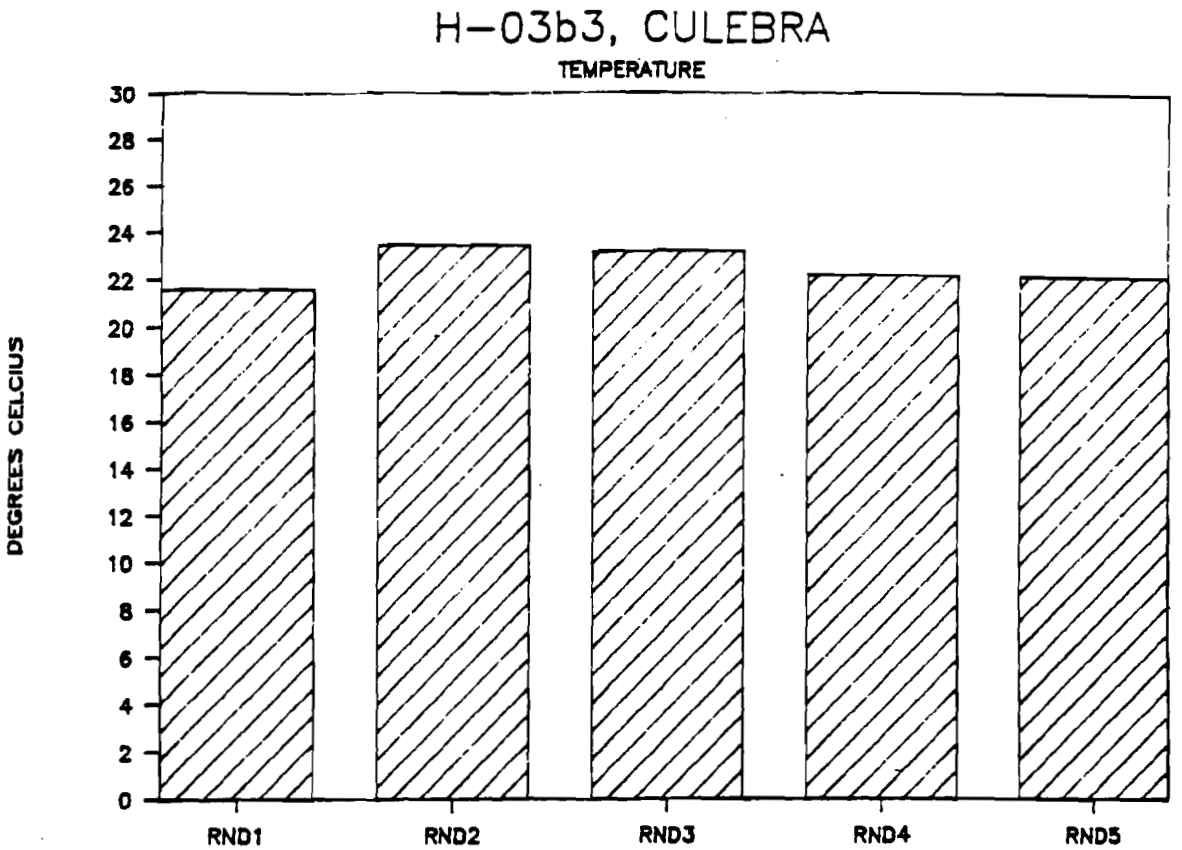

H-03b3, CULEBRA
TOTAL IRON
CONCENTRATION mg/l
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RNC

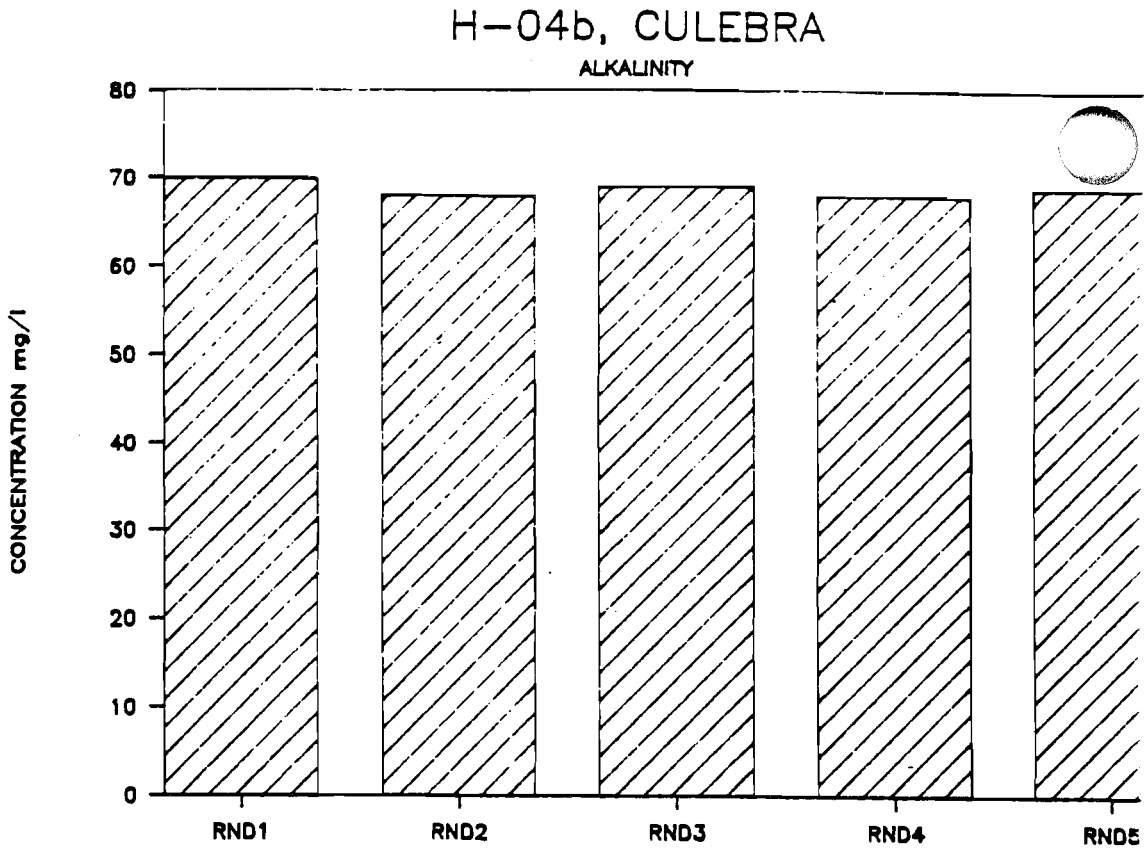

H-03b3, CULEBRA
pH
STANDARD UNITS
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5

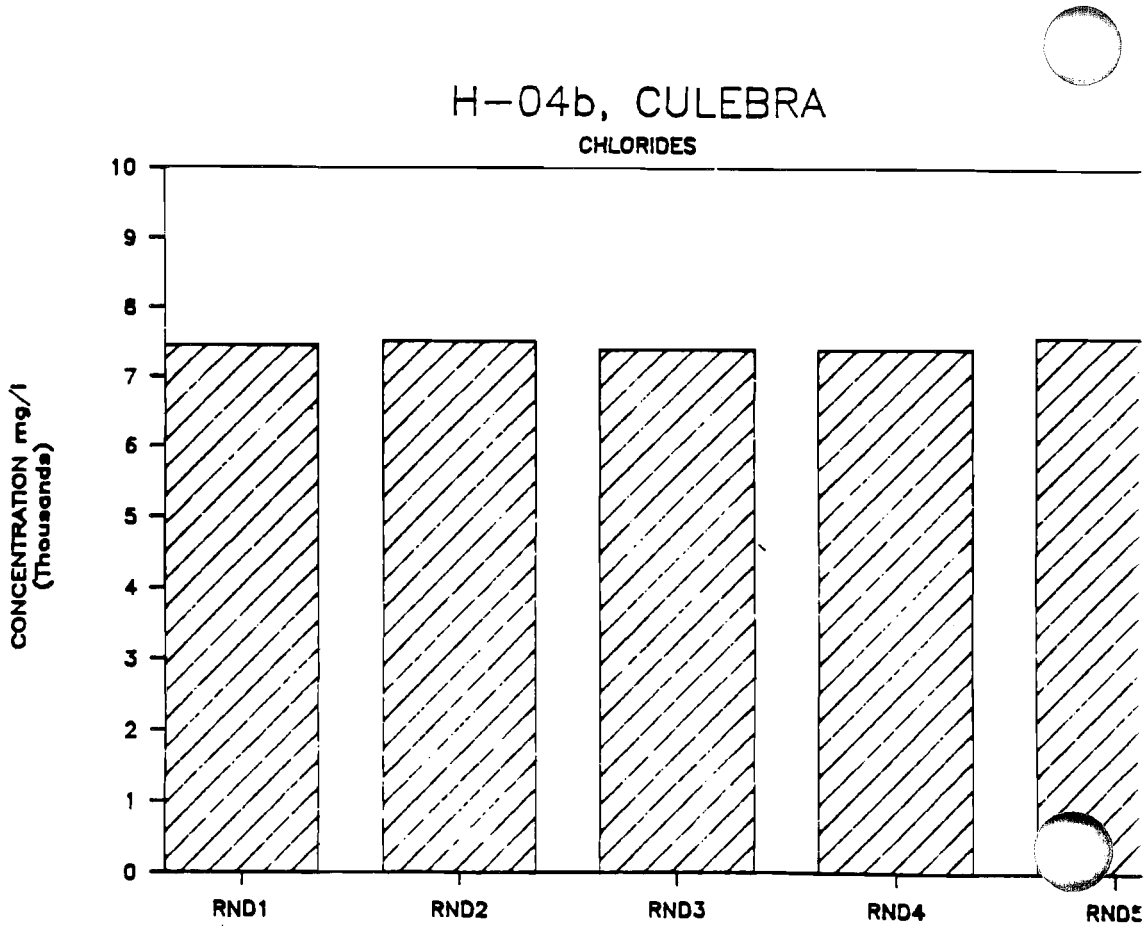

H-03b3, CULEBRA
SPECIFIC CONDUCTIVITY
uMhos/cm
(Thousands)
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5

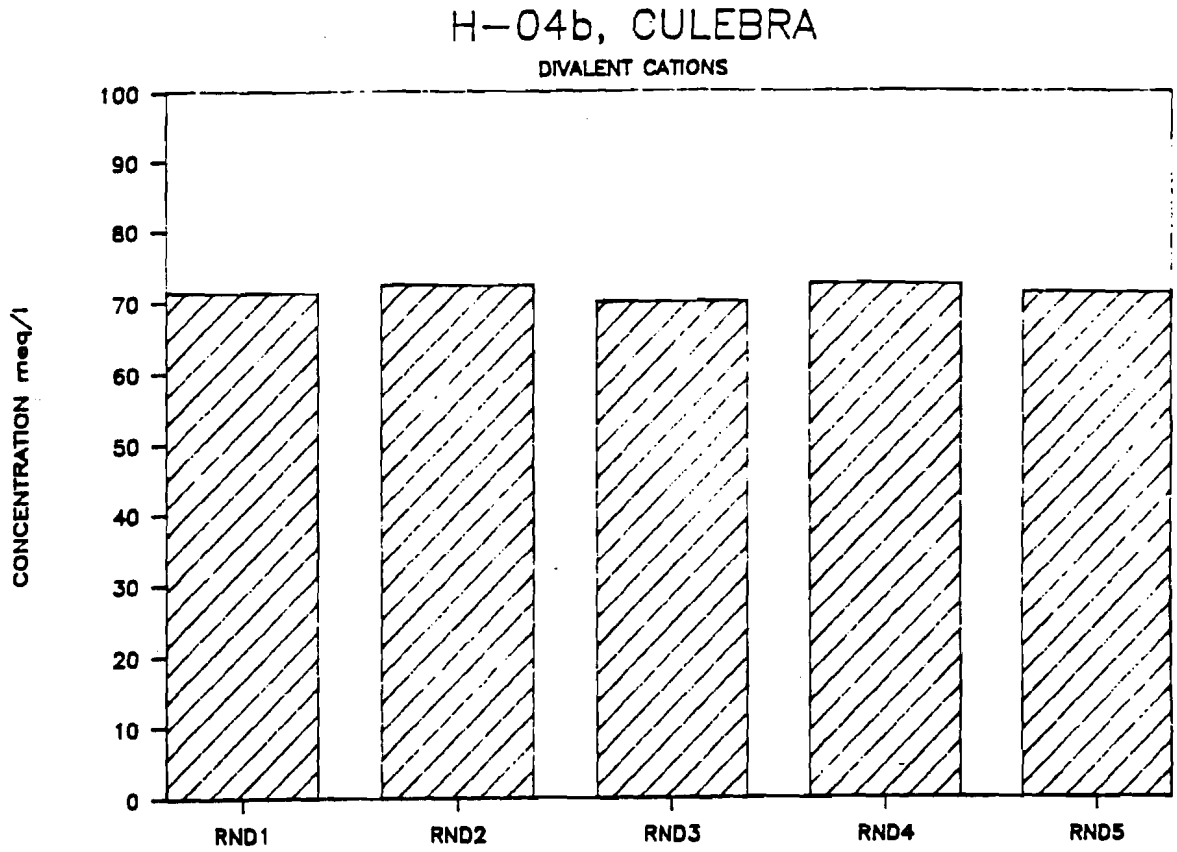

H-03b3, CULEBRA
SPECIFIC GRAVITY
g/cm3
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND2
RND3
RND4
RND5

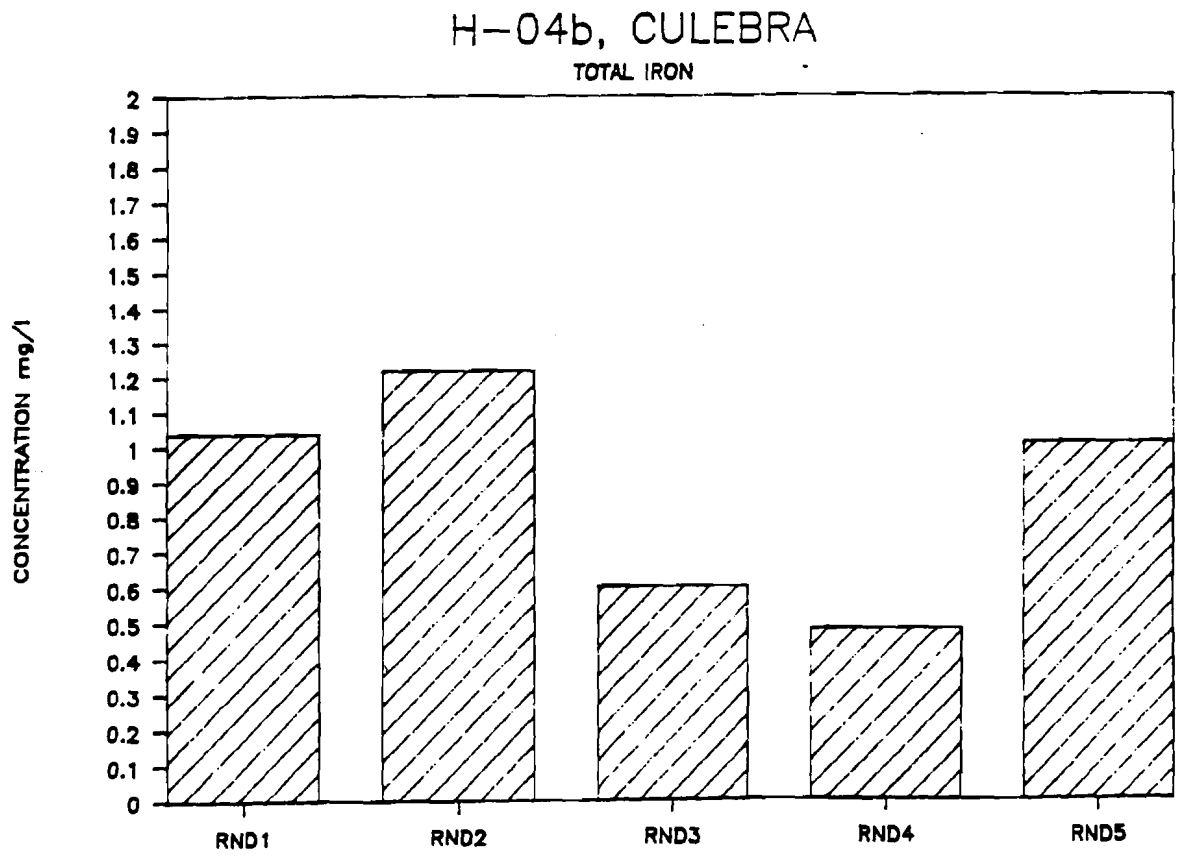

H-03b3
SPECIFIC GRAVITY
g/cm3
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND2
RND3
RND4
RND5

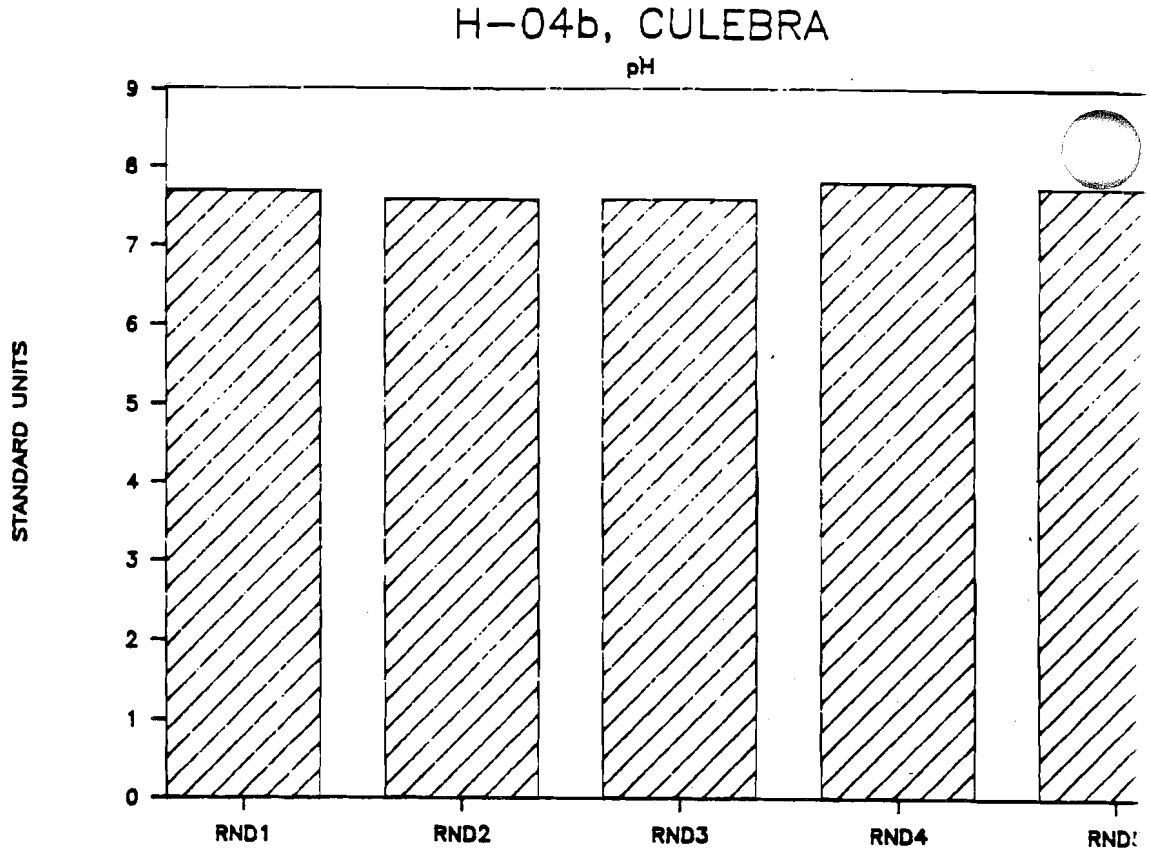

H-03b3, CULEBRA
TEMPERATURE
DEGREES CELCIUS
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
RND1
RND2
RND3
RND4
RND5

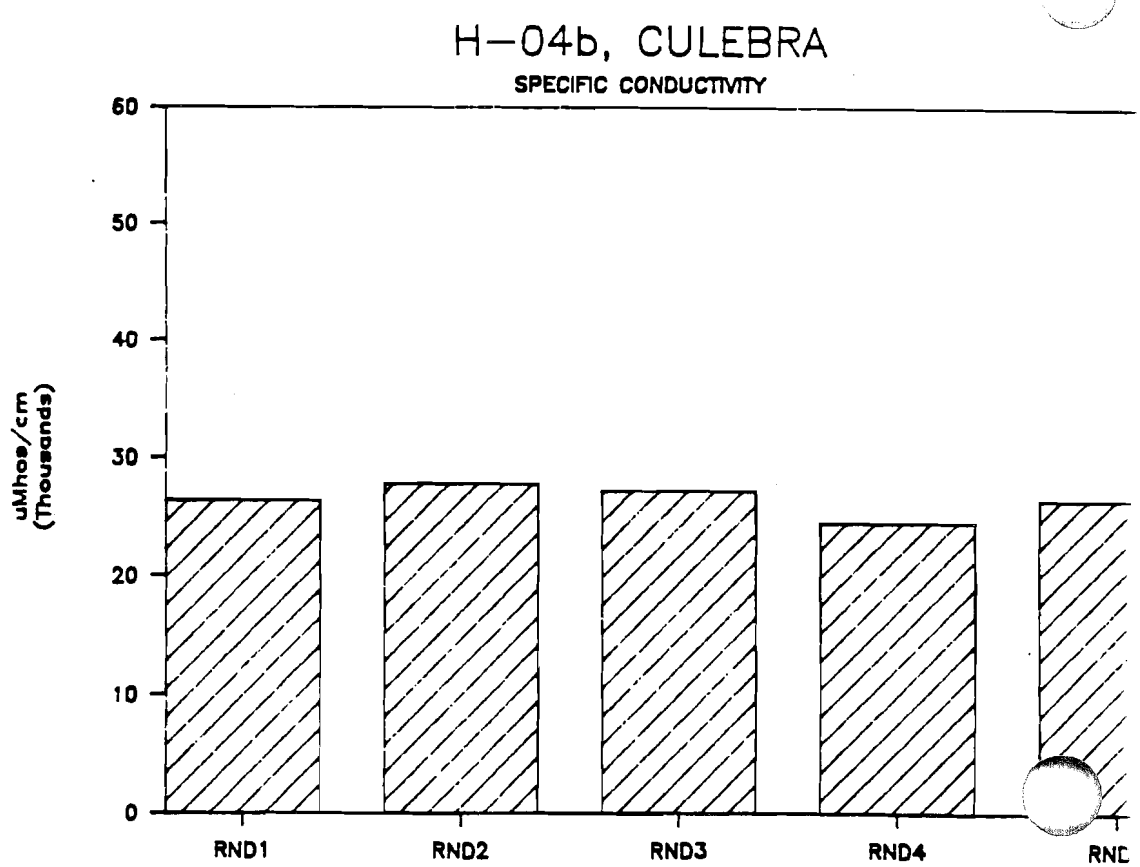

H-04b, CULEBRA
ALKALINITY
CONCENTRATION mg/l
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5

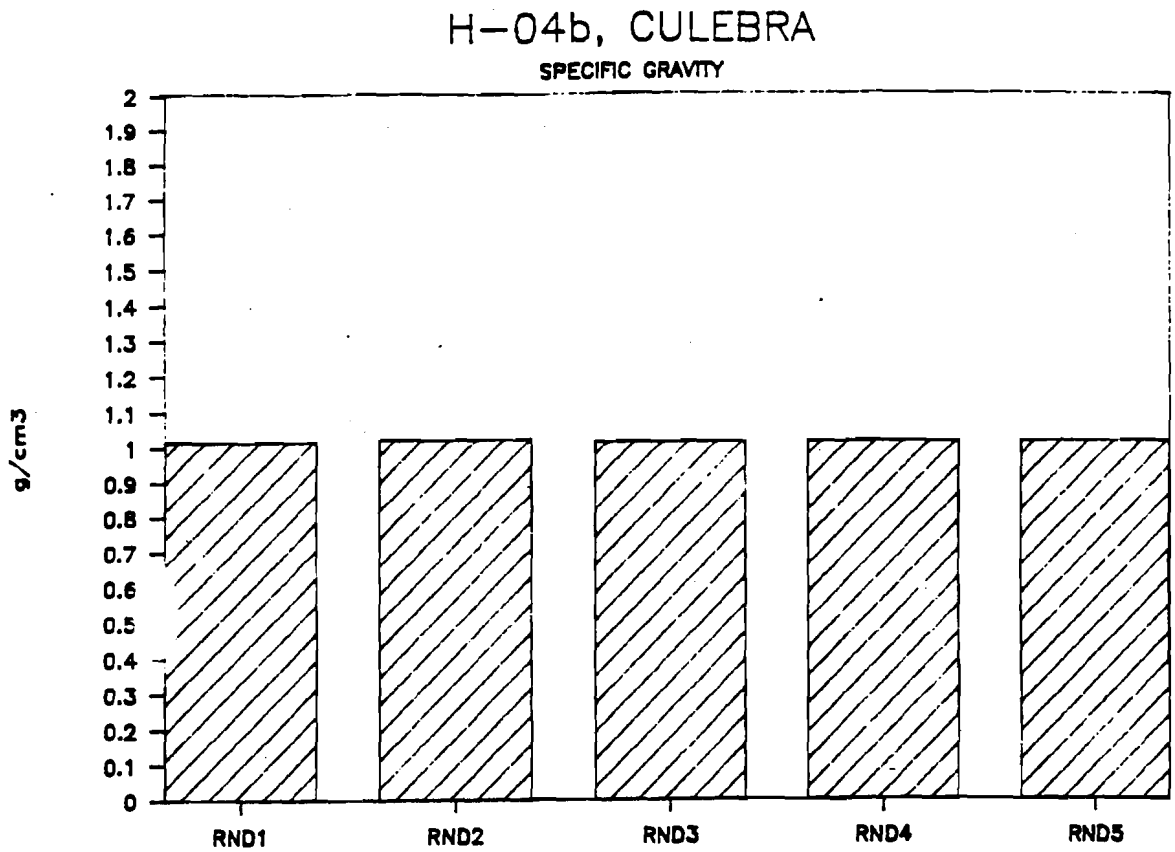

H-04b, CULEBRA
CHLORIDES
CONCENTRATION mg/l
(Thousands)
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5

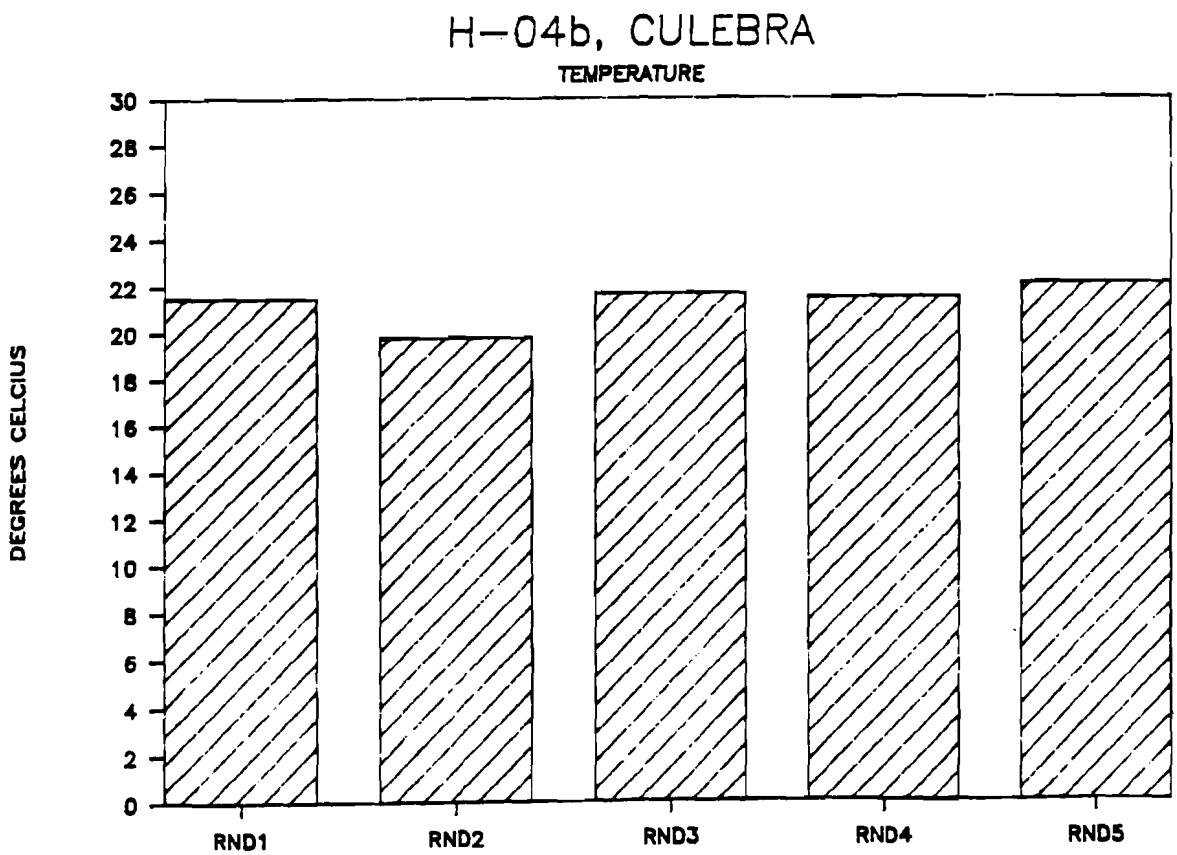

H-04b, CULEBRA
DIVALENT CATIONS
CONCENTRATION meq/l
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5

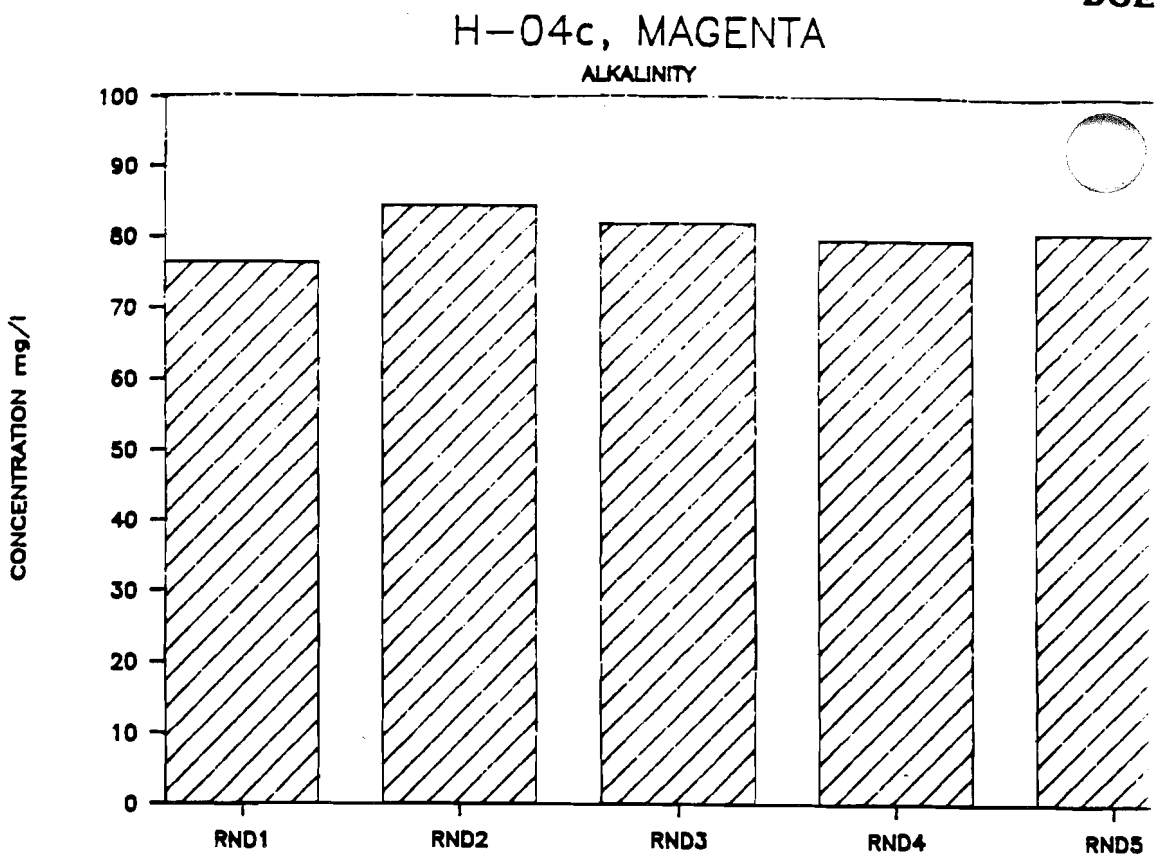

H-04b, CULEBRA
TOTAL IRON
CONCENTRATION mg/l
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5

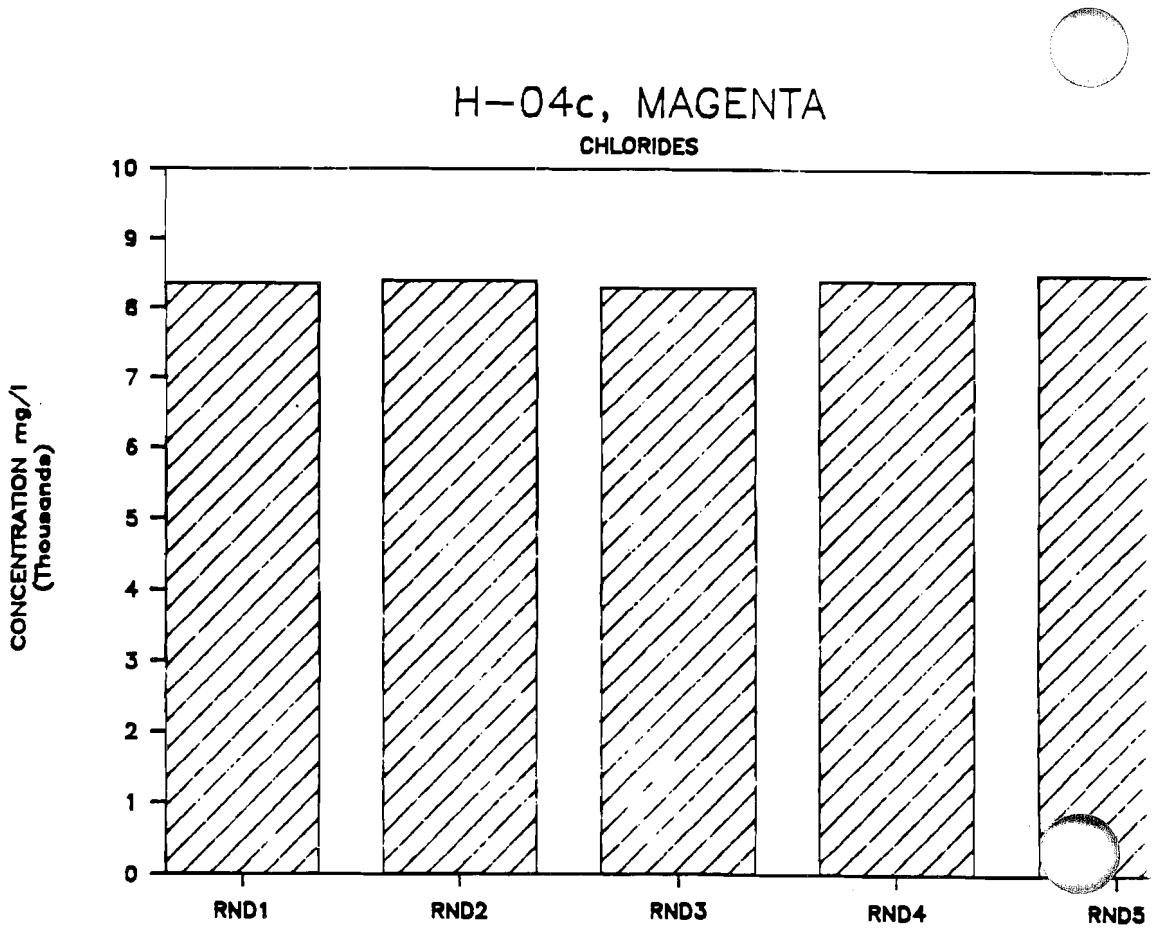

H-04b, CULEBRA
pH
STANDARD UNITS
0
1
2
3
4
5
6
7
8
9
RND1
RND2
RND3
RND4

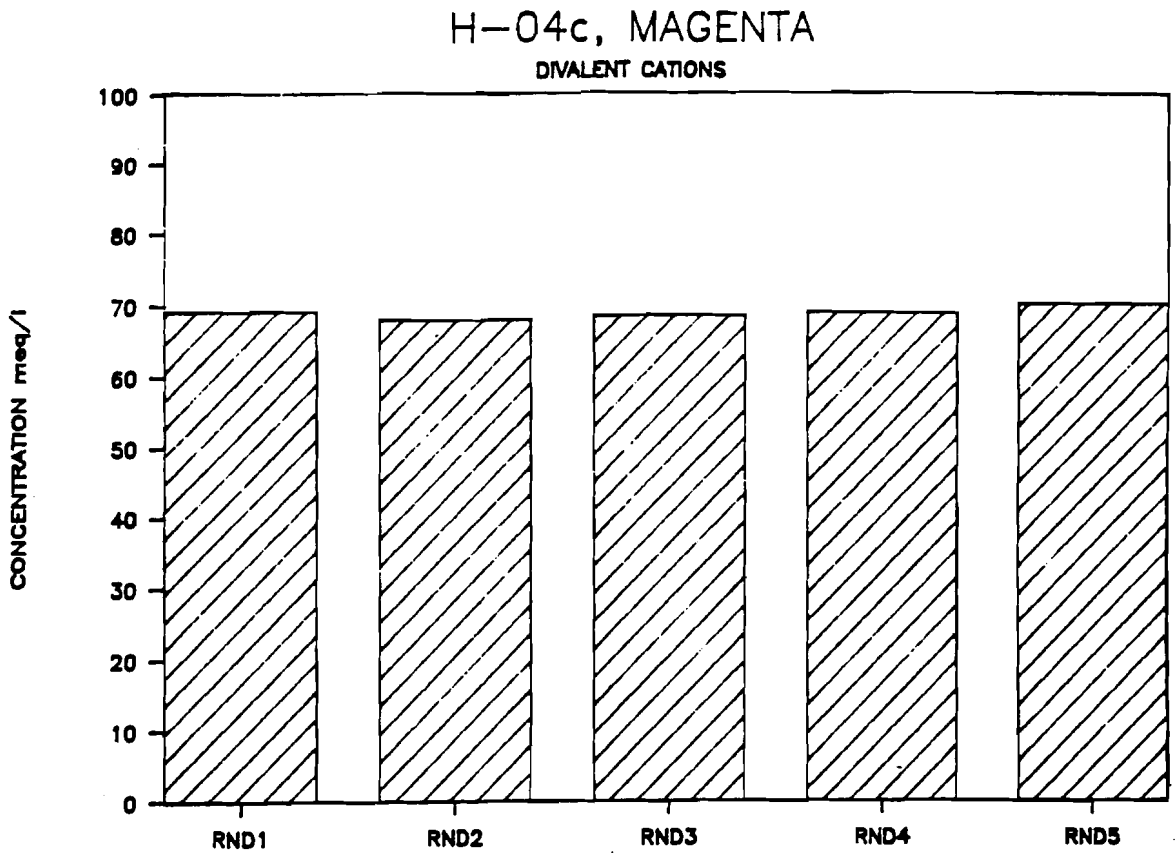

H-04b, CULEBRA
SPECIFIC CONDUCTIVITY
uMhos/cm
(Thousands)
0
10
20
30
40
50
60
RND1
RND2
RND3
RND4

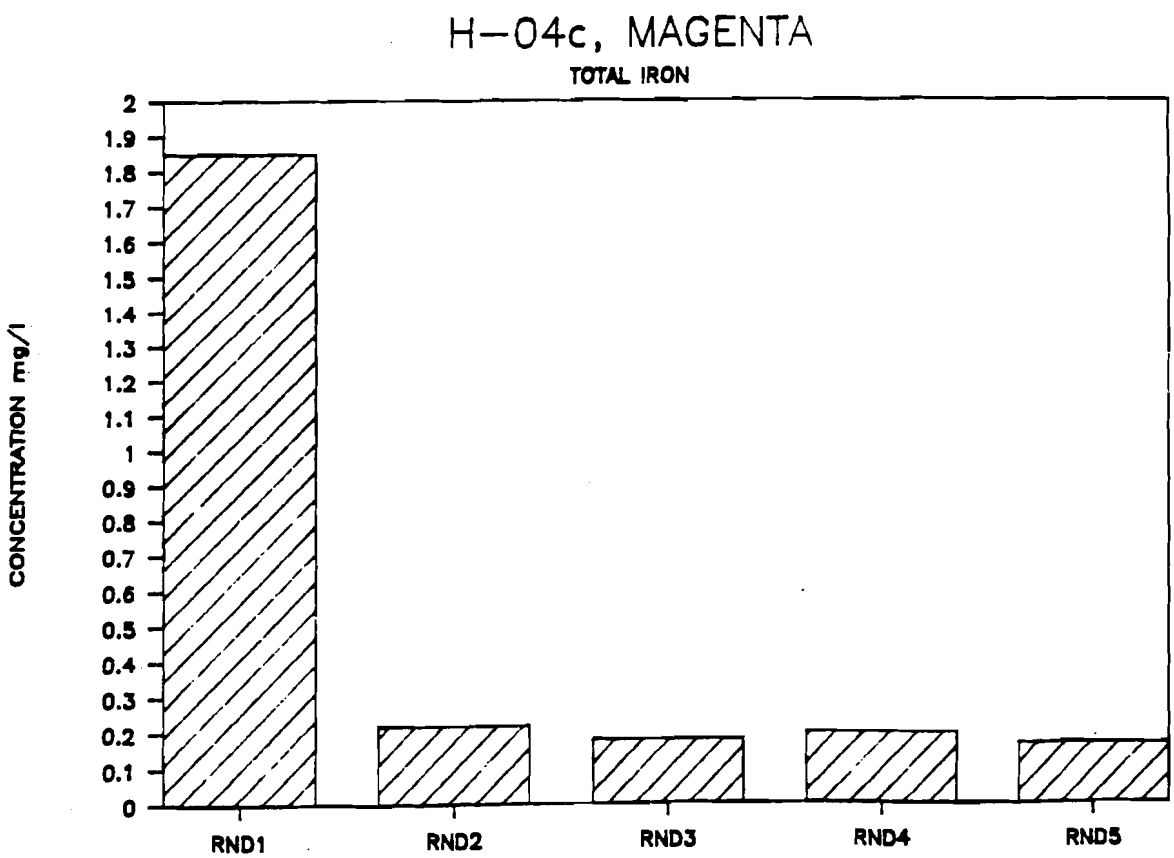

H-04b, CULEBRA
SPECIFIC GRAVITY
g/cm3
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5

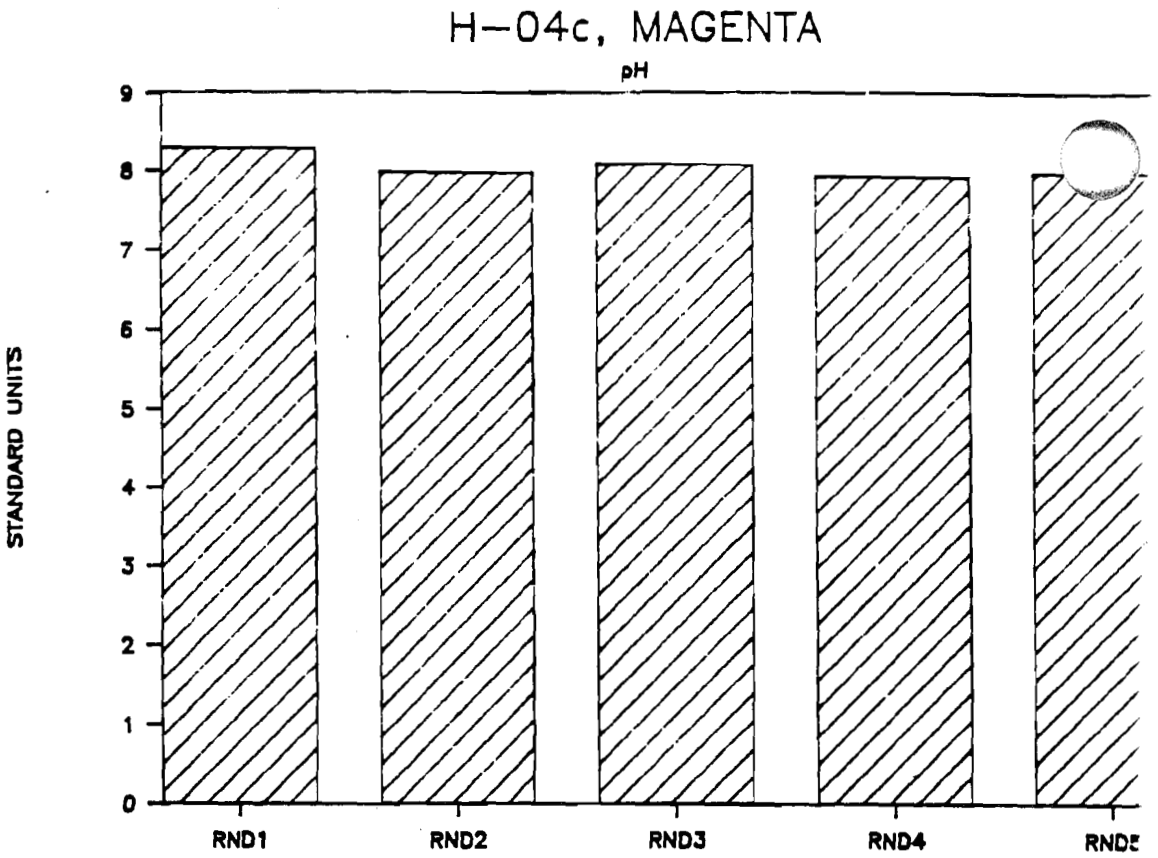

H-04b, CULEBRA
TEMPERATURE
DEGREES CELCIUS
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
RND1
RND2
RND3
RND4
RND5

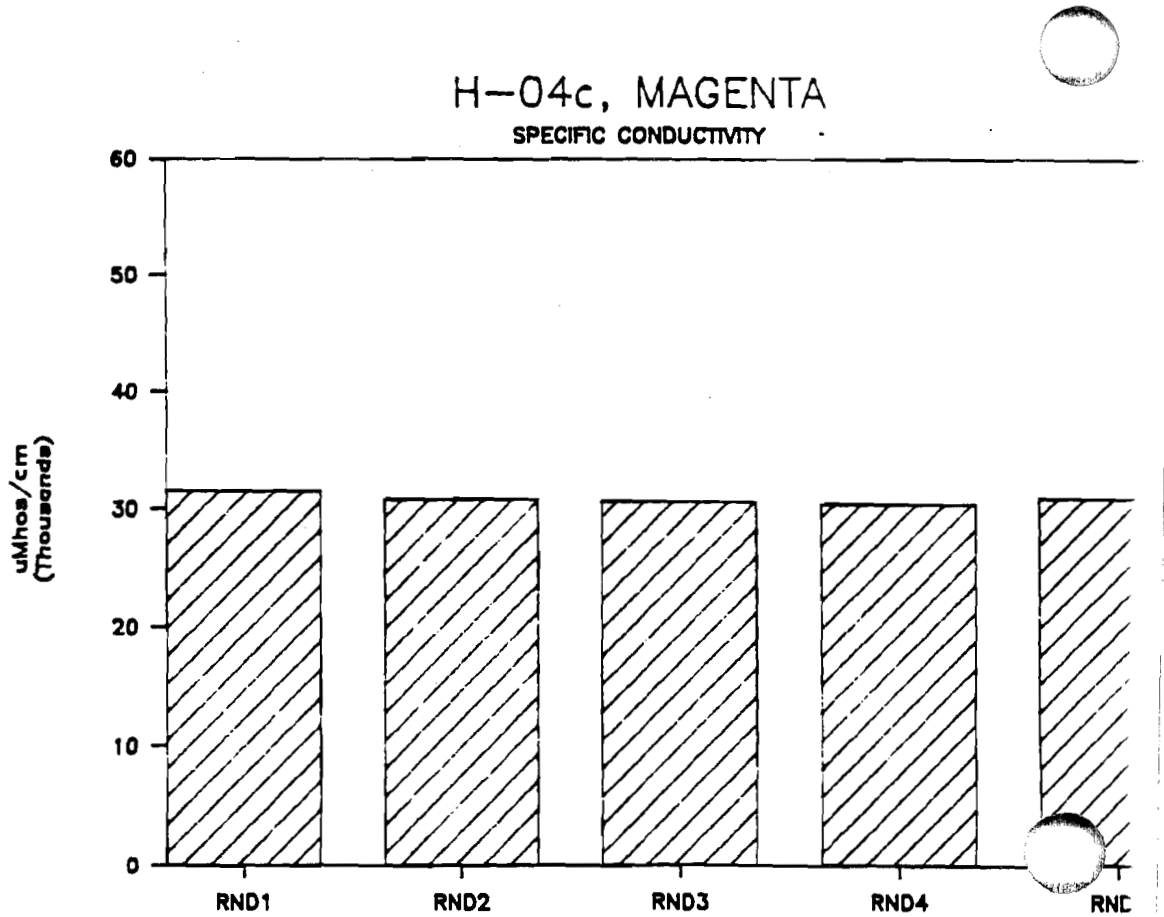

H-04c, MAGENTA
ALKALINITY
CONCENTRATION mg/l
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5

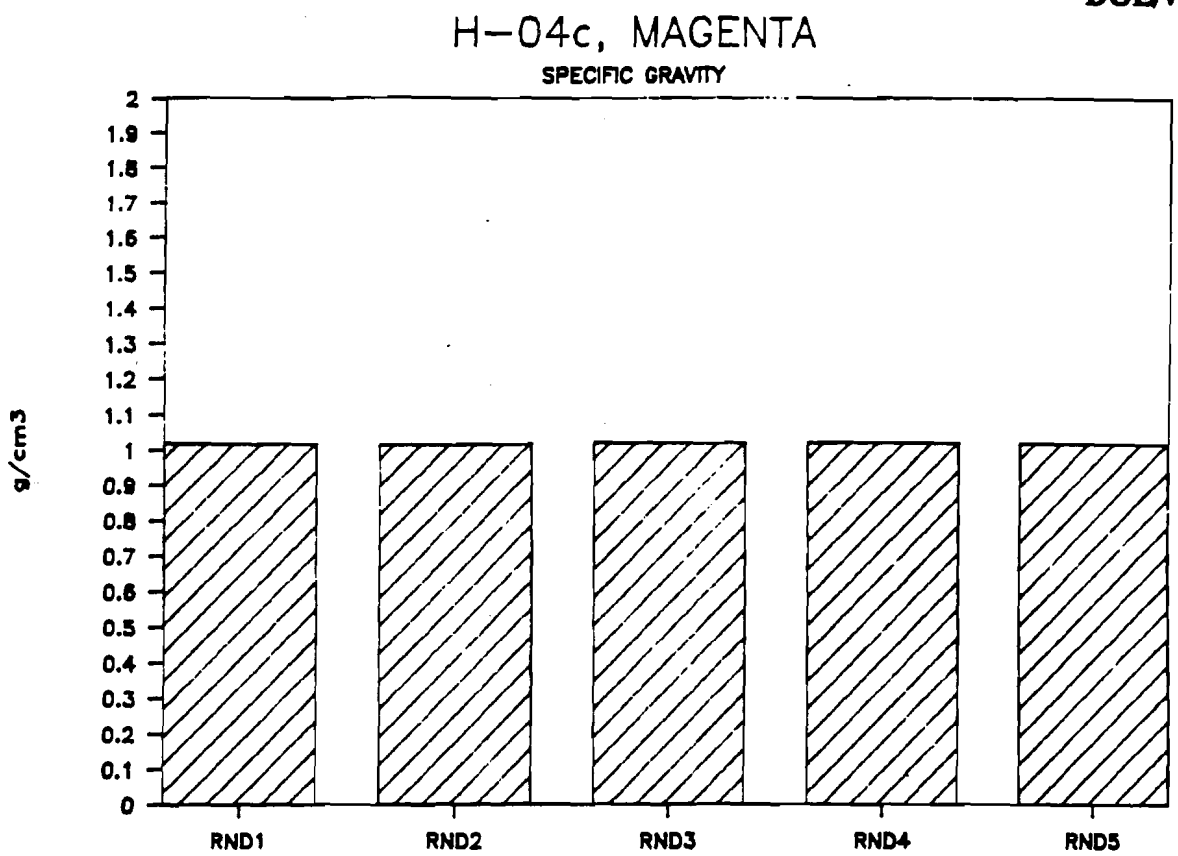

H-04c, MAGENTA
CHLORIDES
CONCENTRATION mg/l
(Thousands)
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5

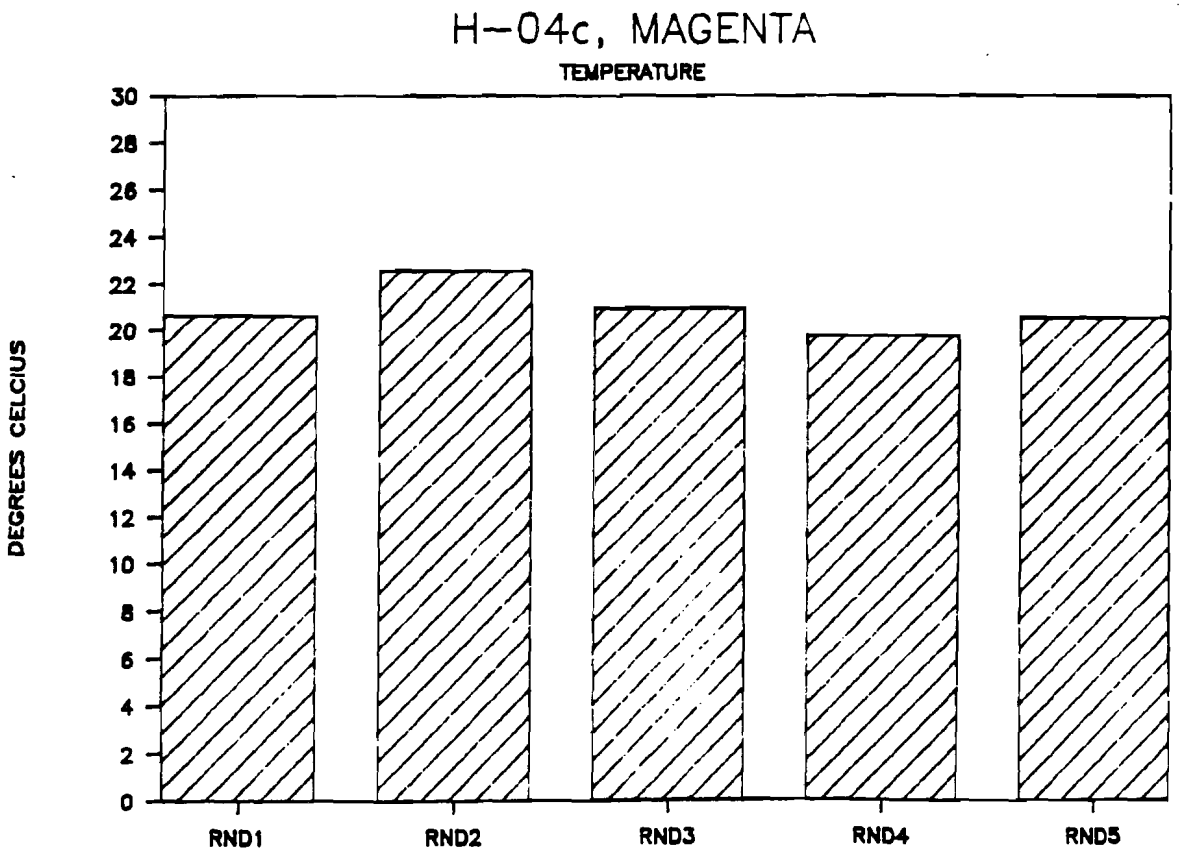

H-04c, MAGENTA
DIVALENT CATIONS
CONCENTRATION meq/l
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5

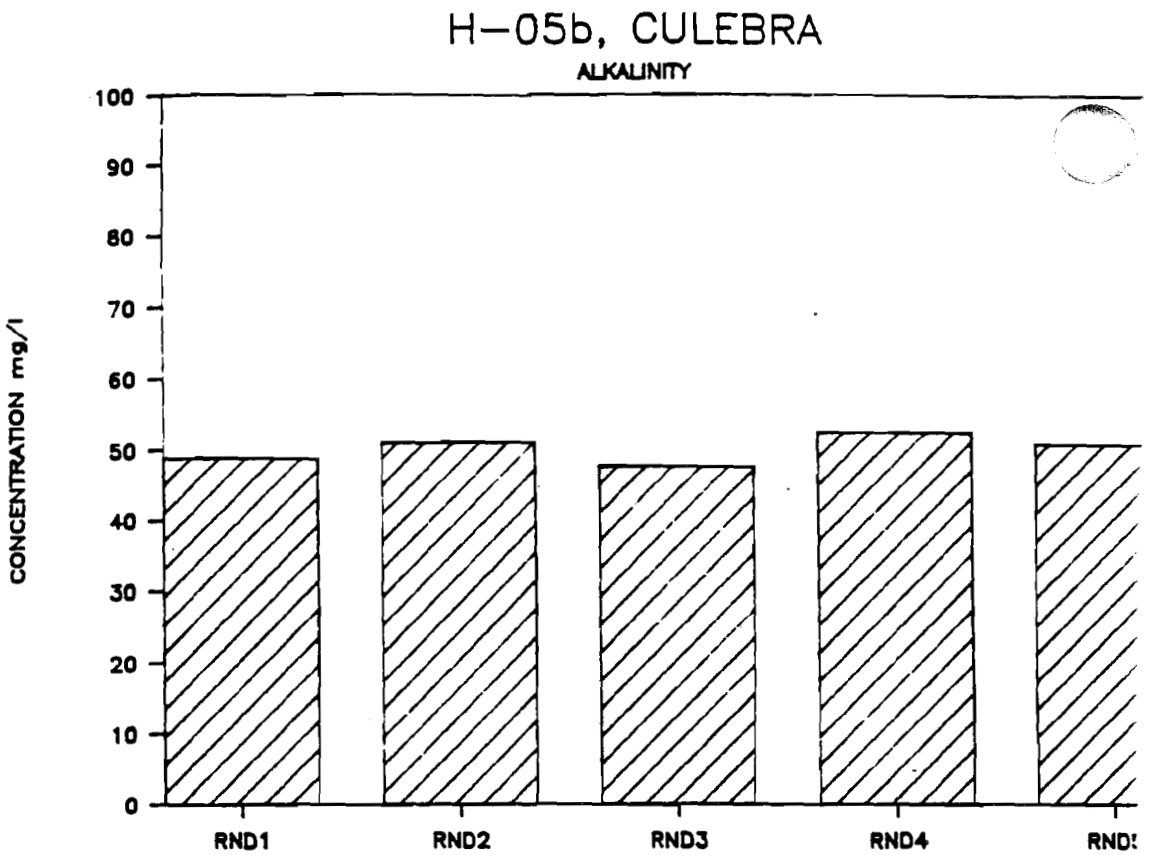

H-04c, MAGENTA
TOTAL IRON
CONCENTRATION mg/l
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5

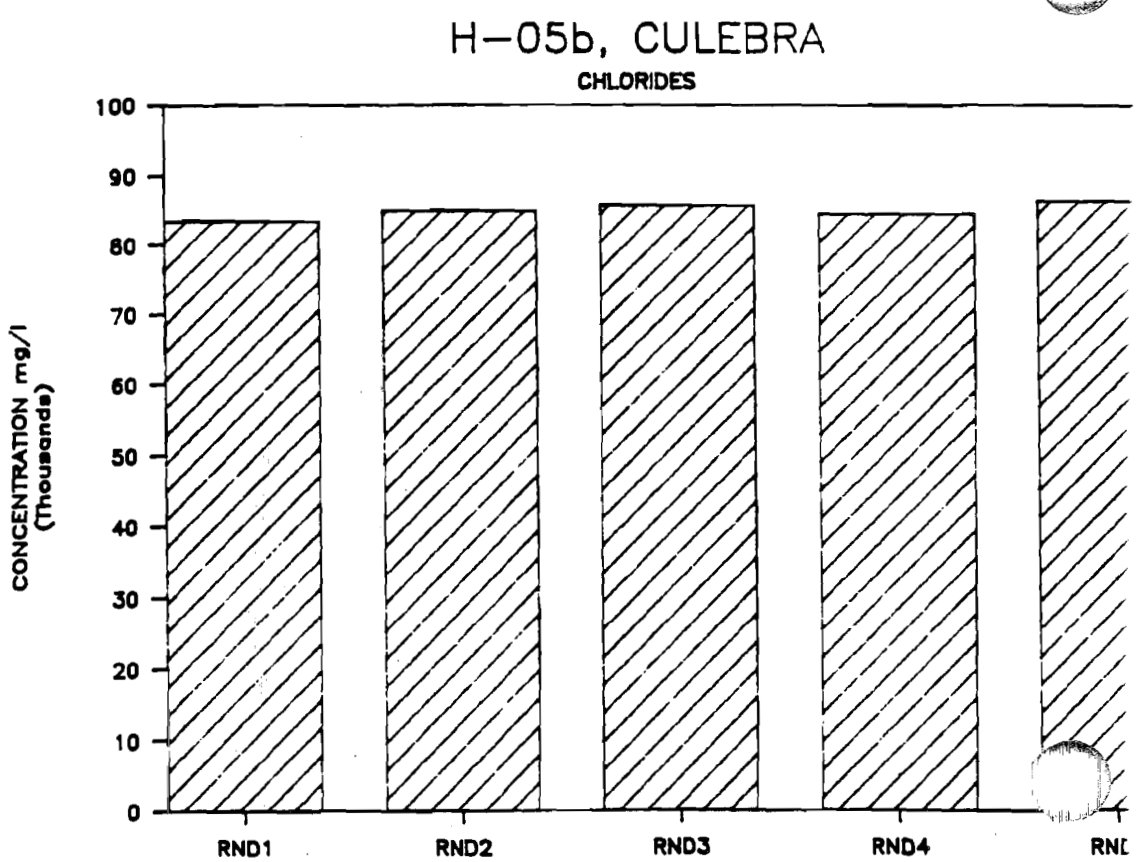

H-04c, MAGENTA
pH
STANDARD UNITS
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5

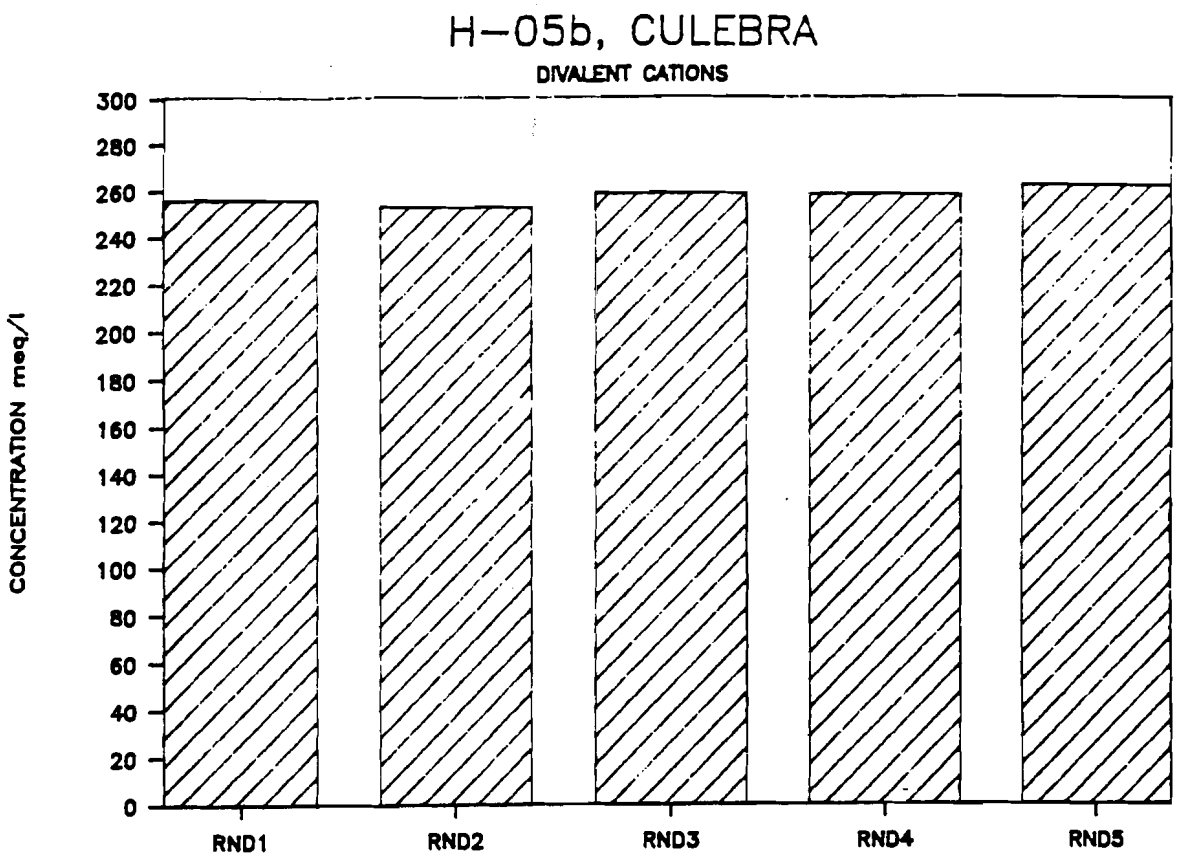

H-04c, MAGENTA
SPECIFIC CONDUCTIVITY
uMhos/cm
(Thousands)
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND

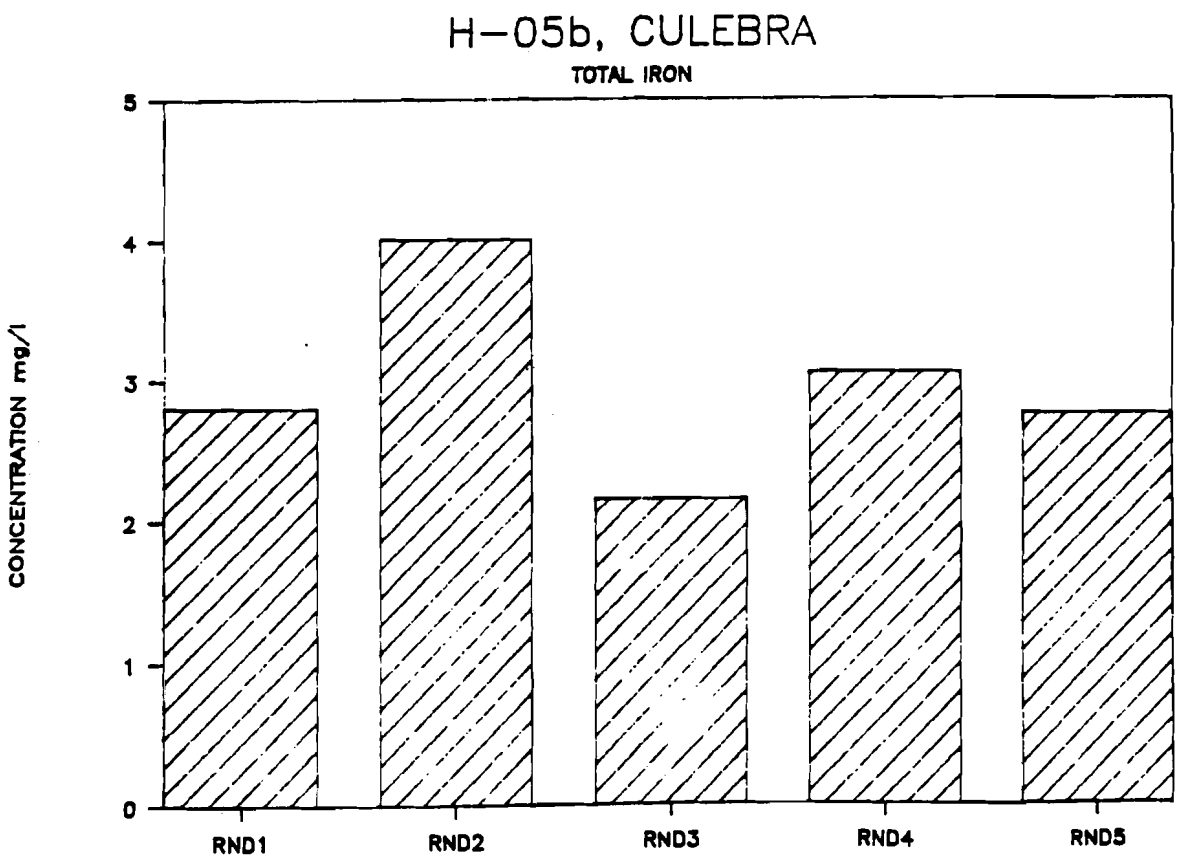

H-04c, MAGENTA
SPECIFIC GRAVITY
g/cm3
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5

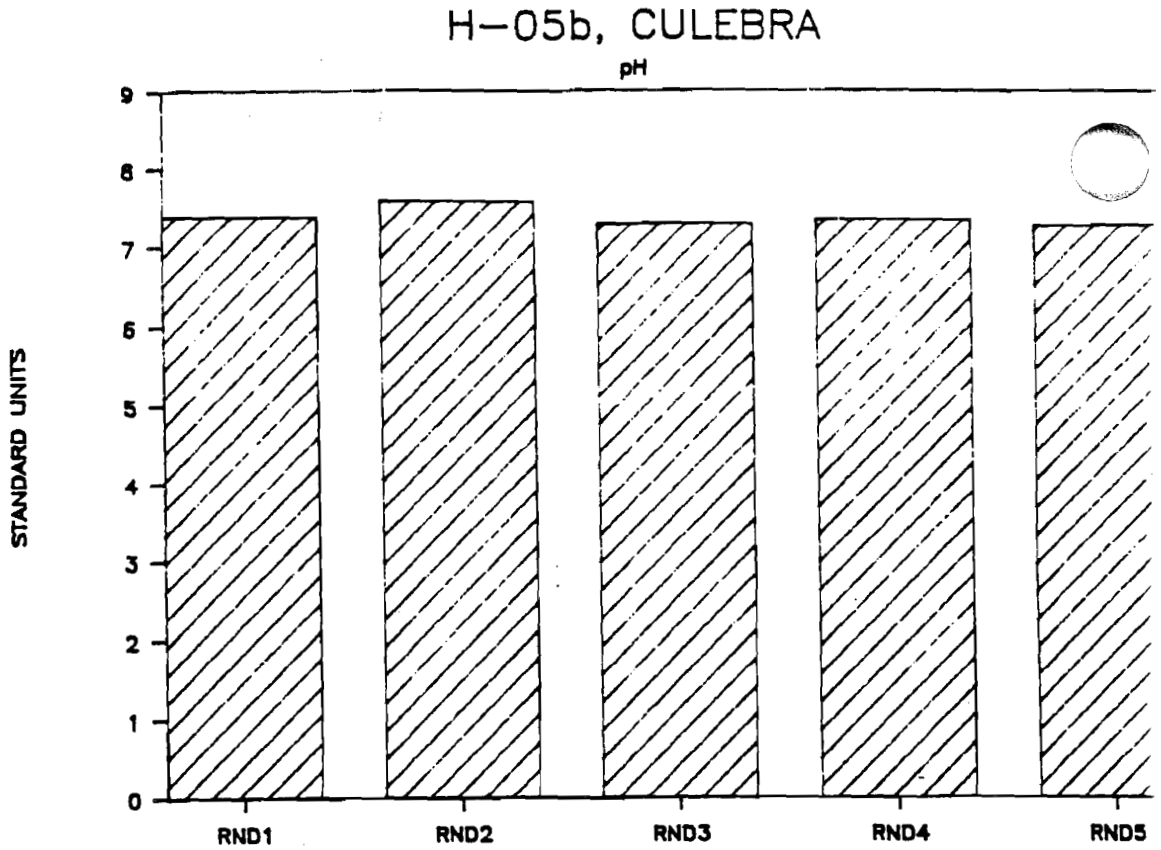

H-04c, MAGENTA
TEMPERATURE
DEGREES CELCIUS
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
RND1
RND2
RND3
RND4
RND5

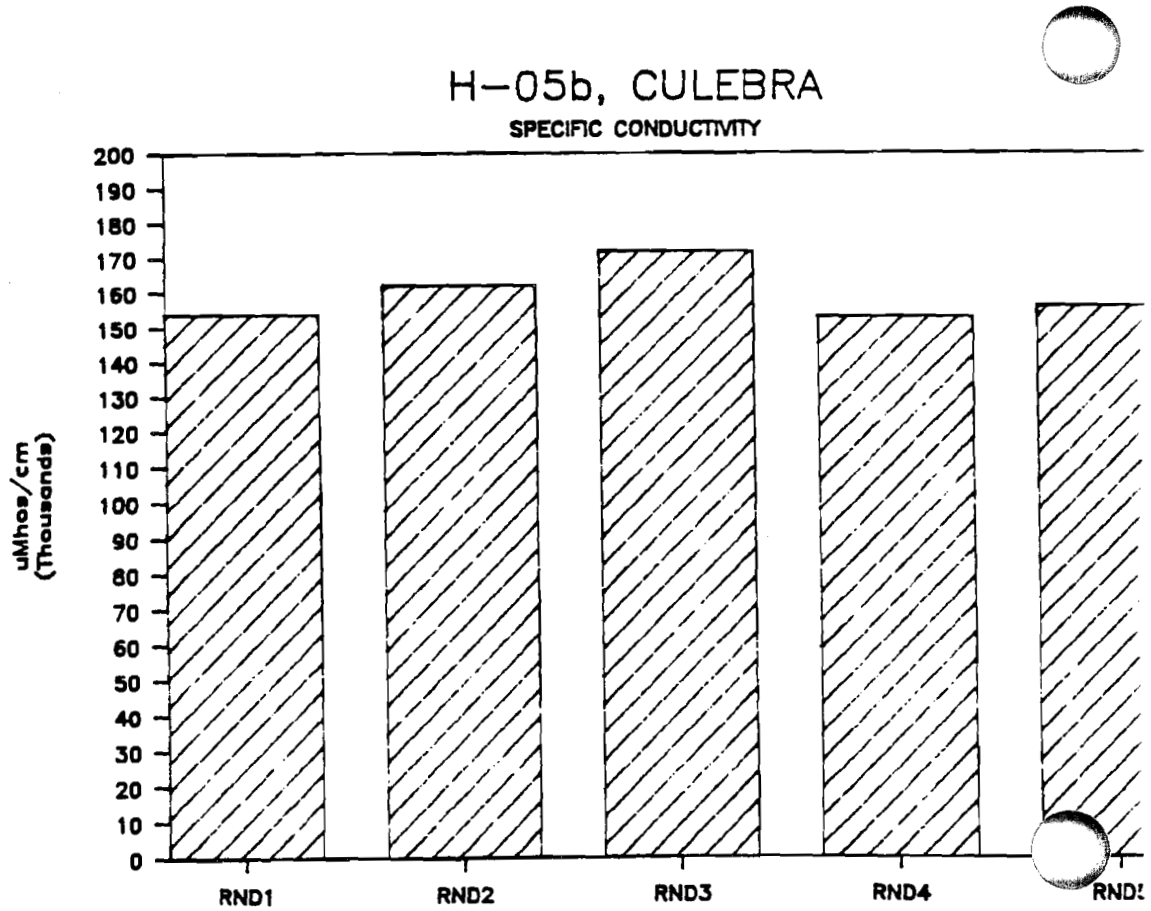

H-05b, CULEBRA
ALKALINITY
CONCENTRATION mg/l
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5

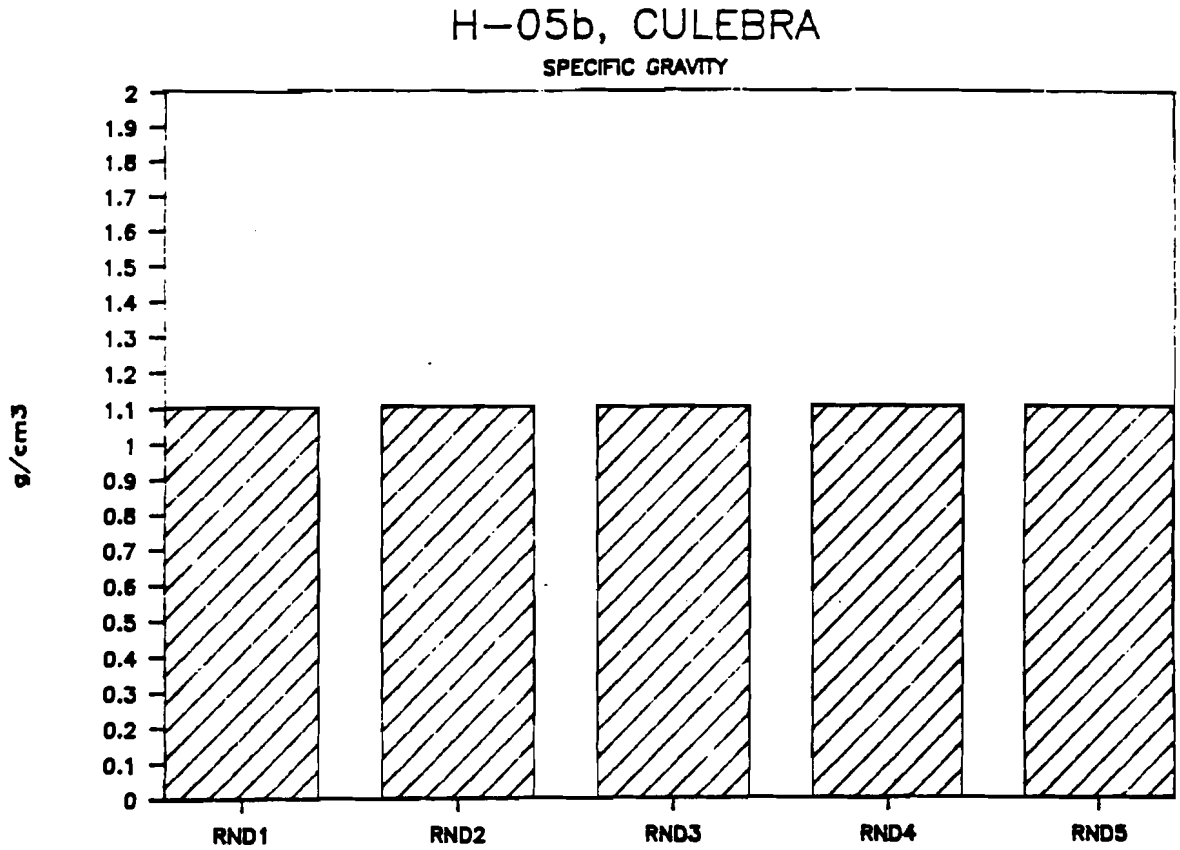

H-05b, CULEBRA
CHLORIDES
CONCENTRATION mg/l
(Thousands)
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4

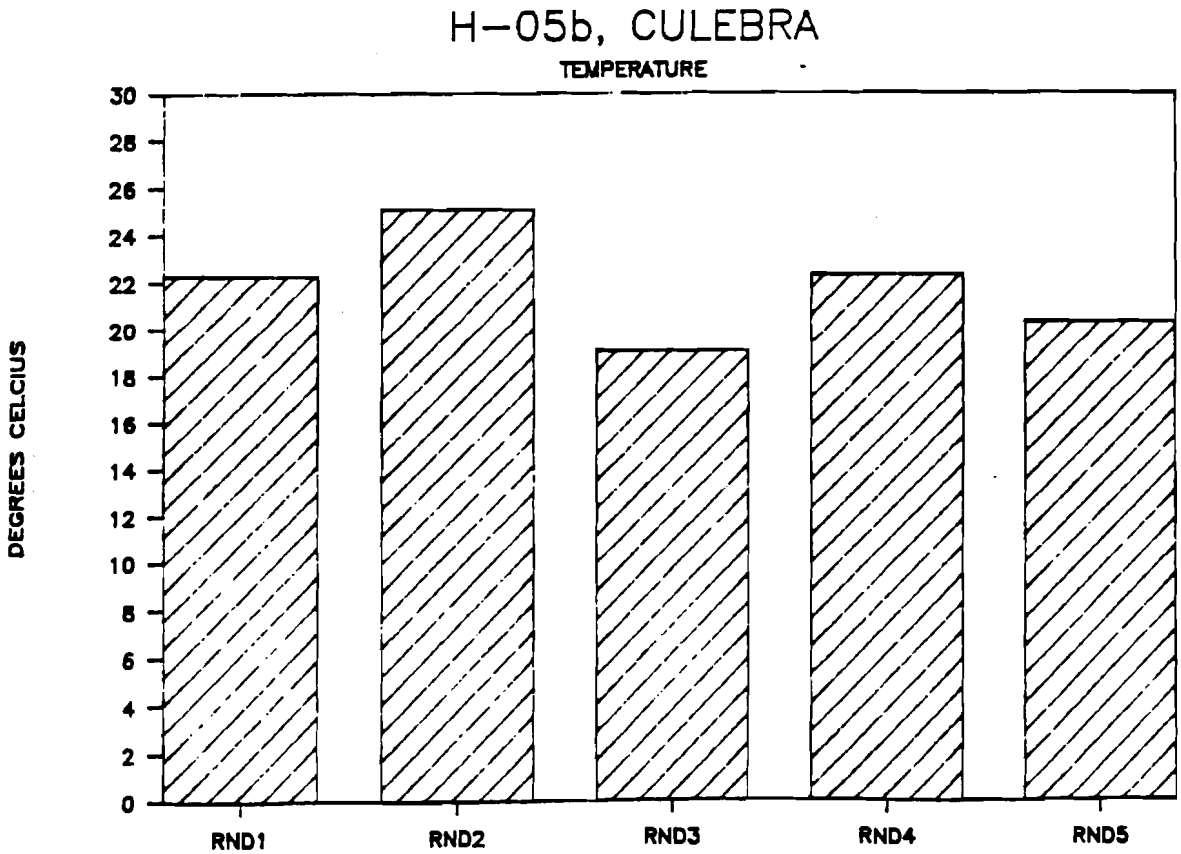

H-05b, CULEBRA
DIVALENT CATIONS
CONCENTRATION meq/l
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
RND1
RND2
RND3
RND4
RND5

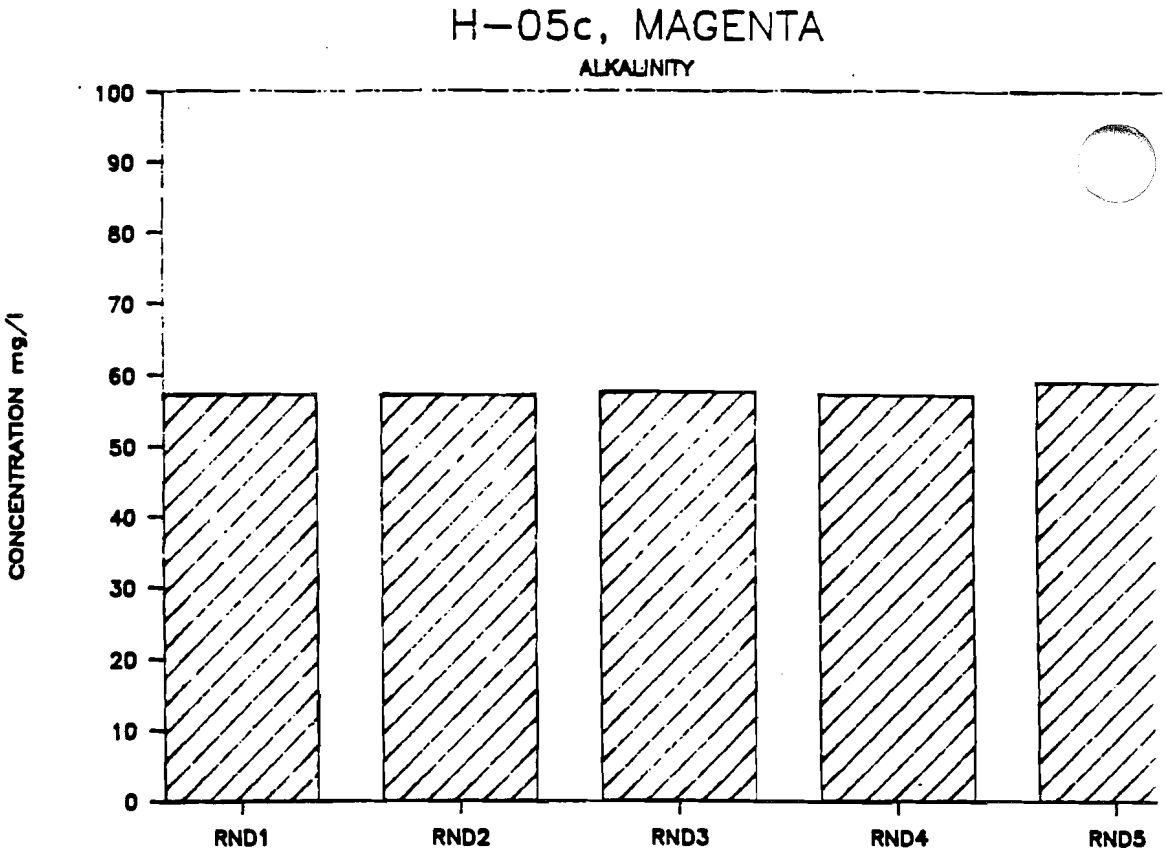

H-05b, CULEBRA
TOTAL IRON
CONCENTRATION mg/l
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5

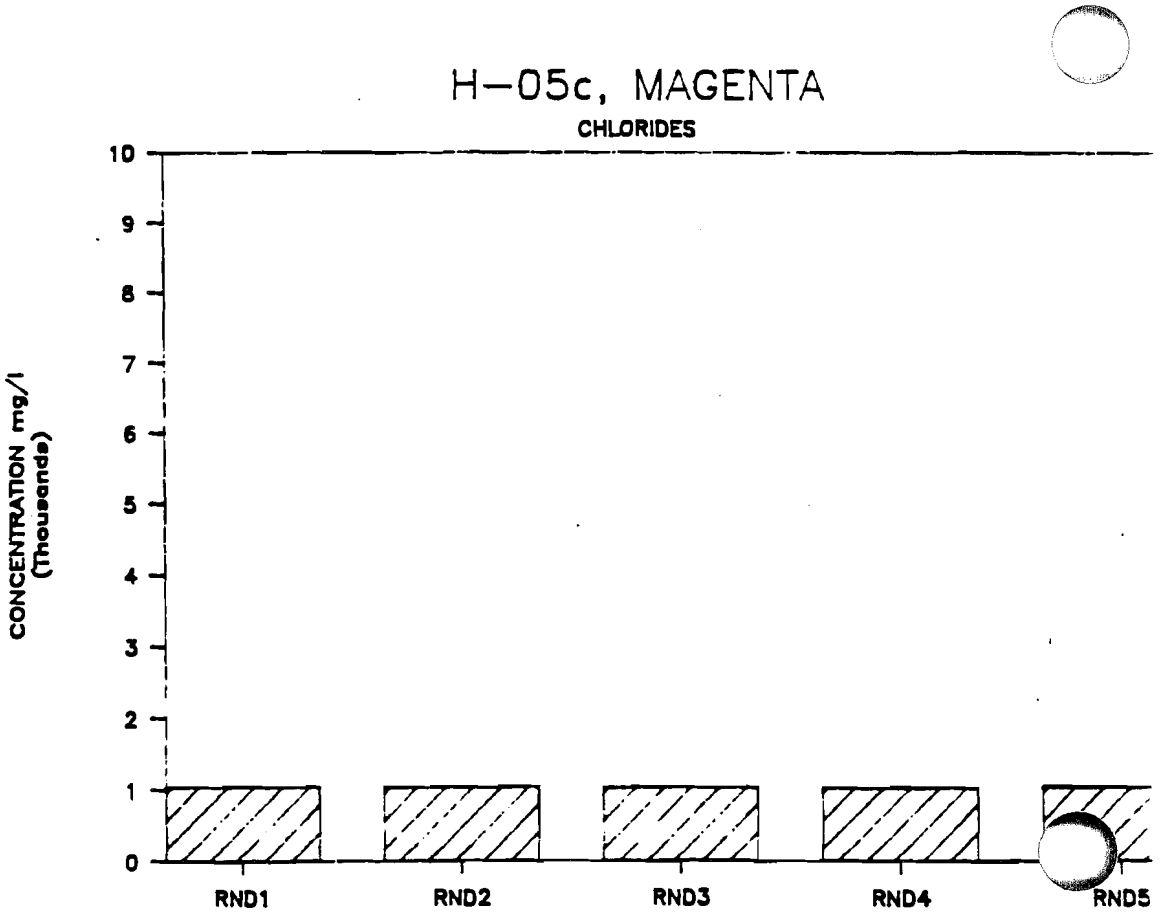

H-05b, CULEBRA
pH
STANDARD UNITS
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5

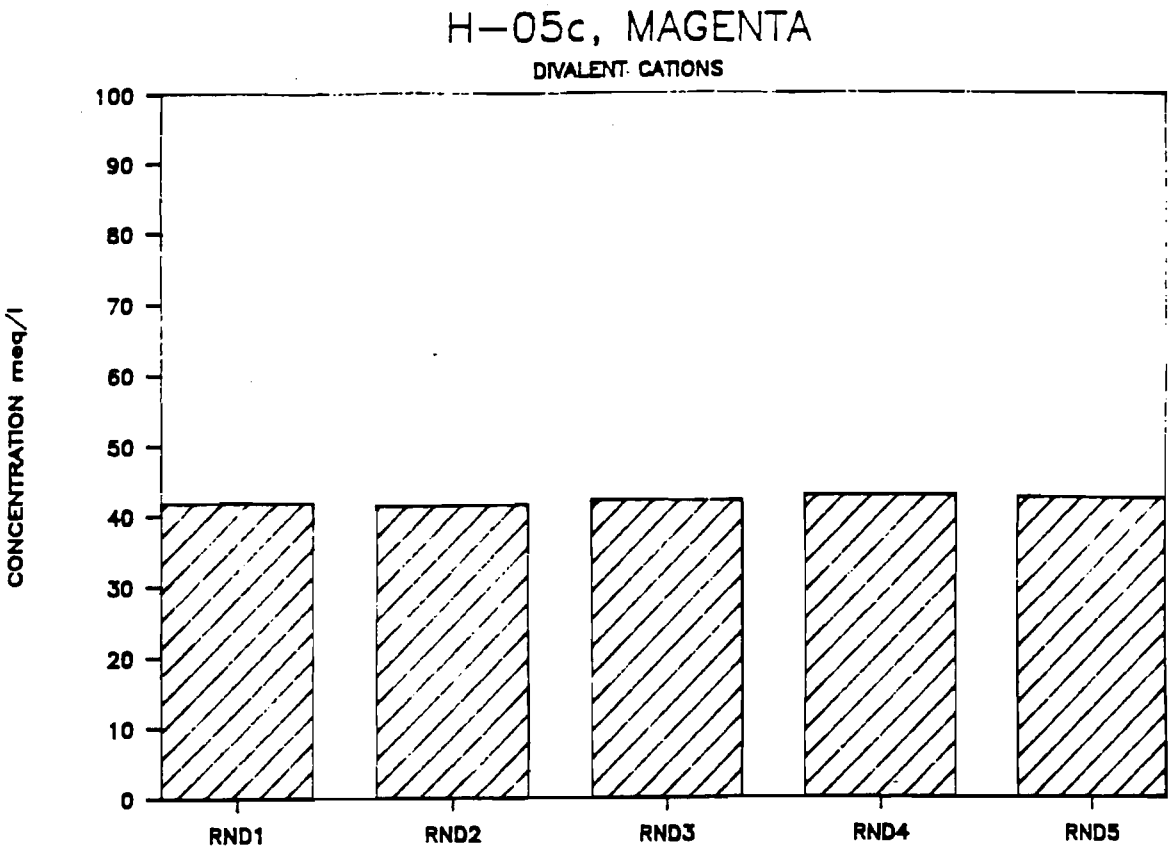

H-05b, CULEBRA
SPECIFIC CONDUCTIVITY
uMhos/cm
(Thousands)
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4

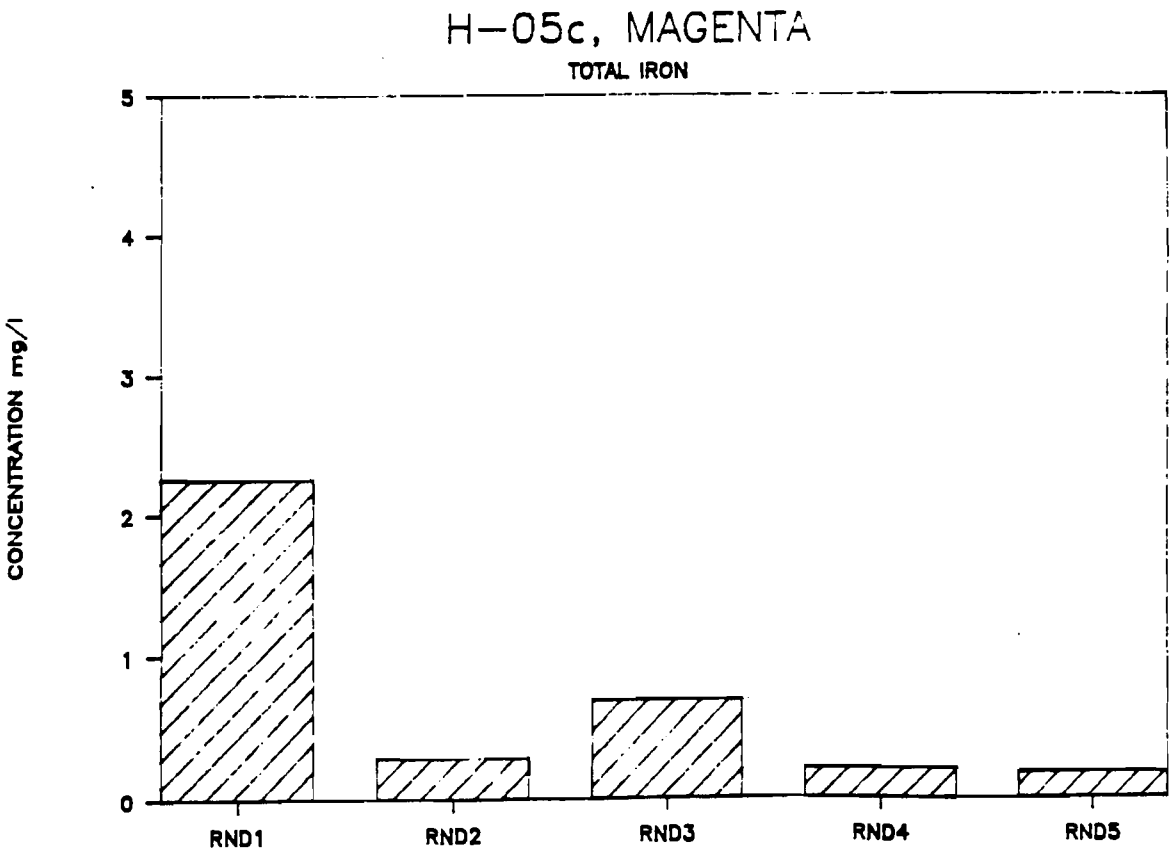

H-05b, CULEBRA
SPECIFIC GRAVITY
g/cm3
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5

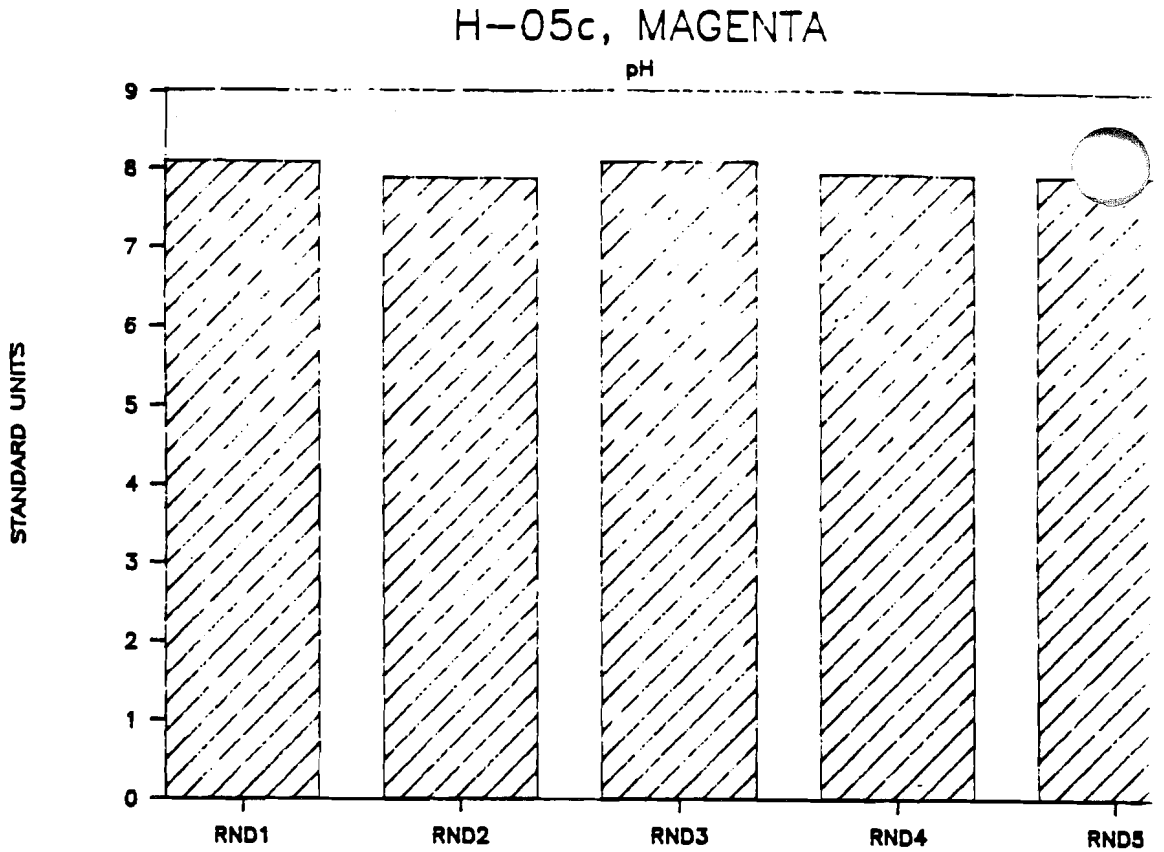

H-05b, CULEBRA
TEMPERATURE
DEGREES CELCIUS
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
RND1
RND2
RND3
RND4
RND5

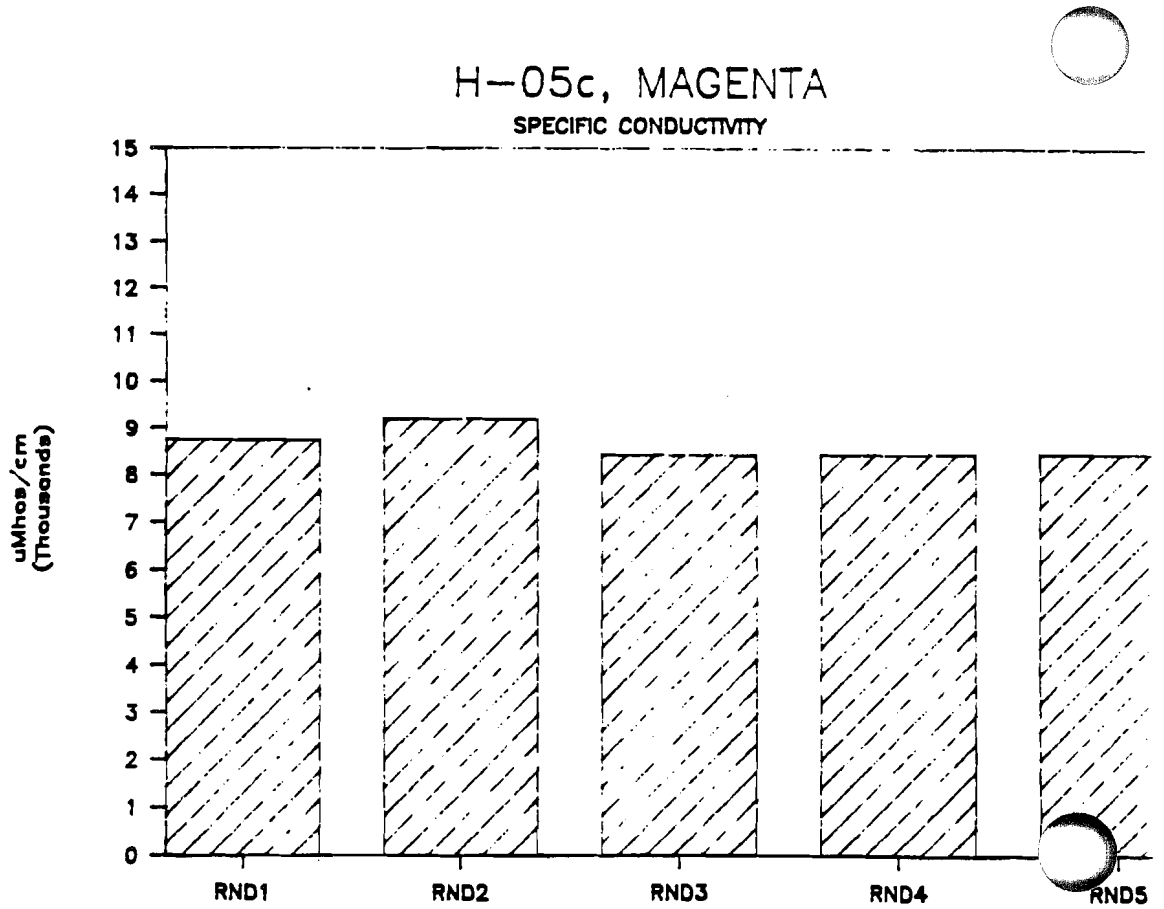

H-05c, MAGENTA
ALKALINITY
CONCENTRATION mg/l
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5

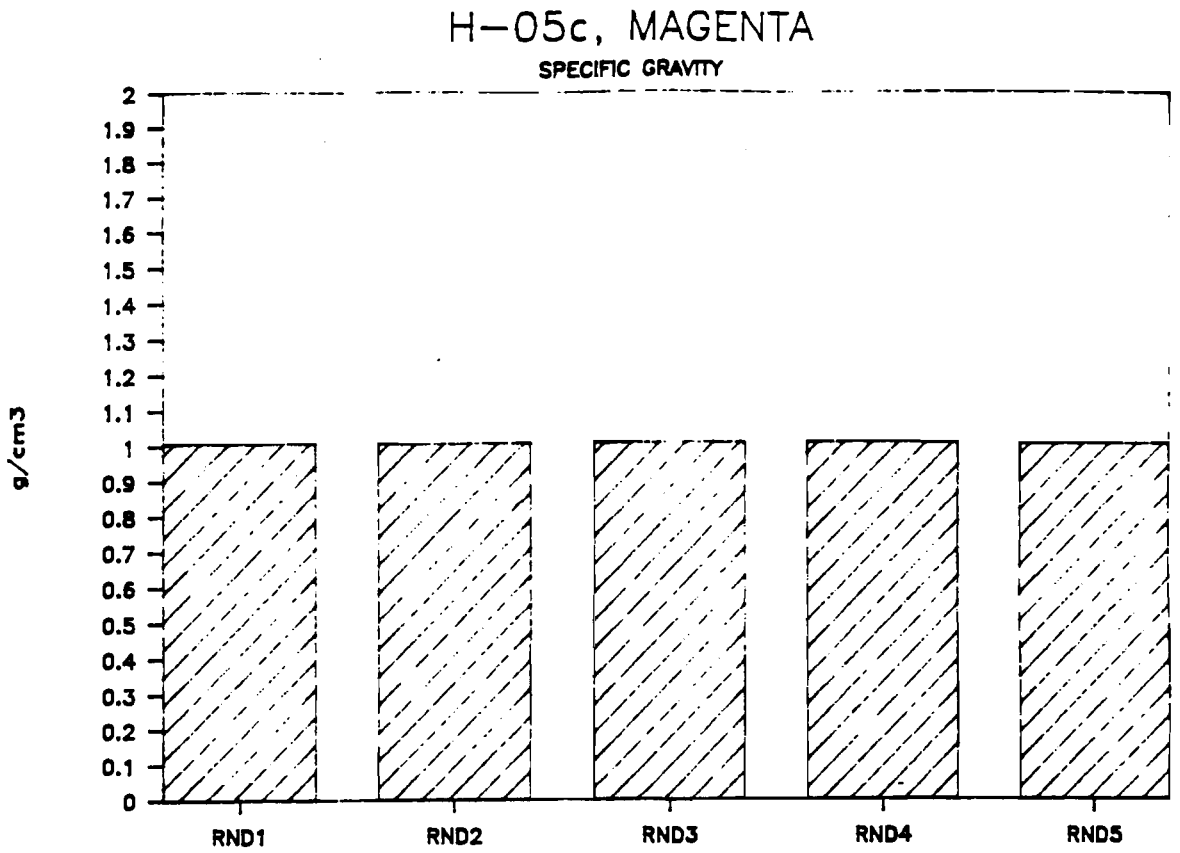

H-05c, MAGENTA
CHLORIDES
CONCENTRATION mg/l
(Thousands)
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5

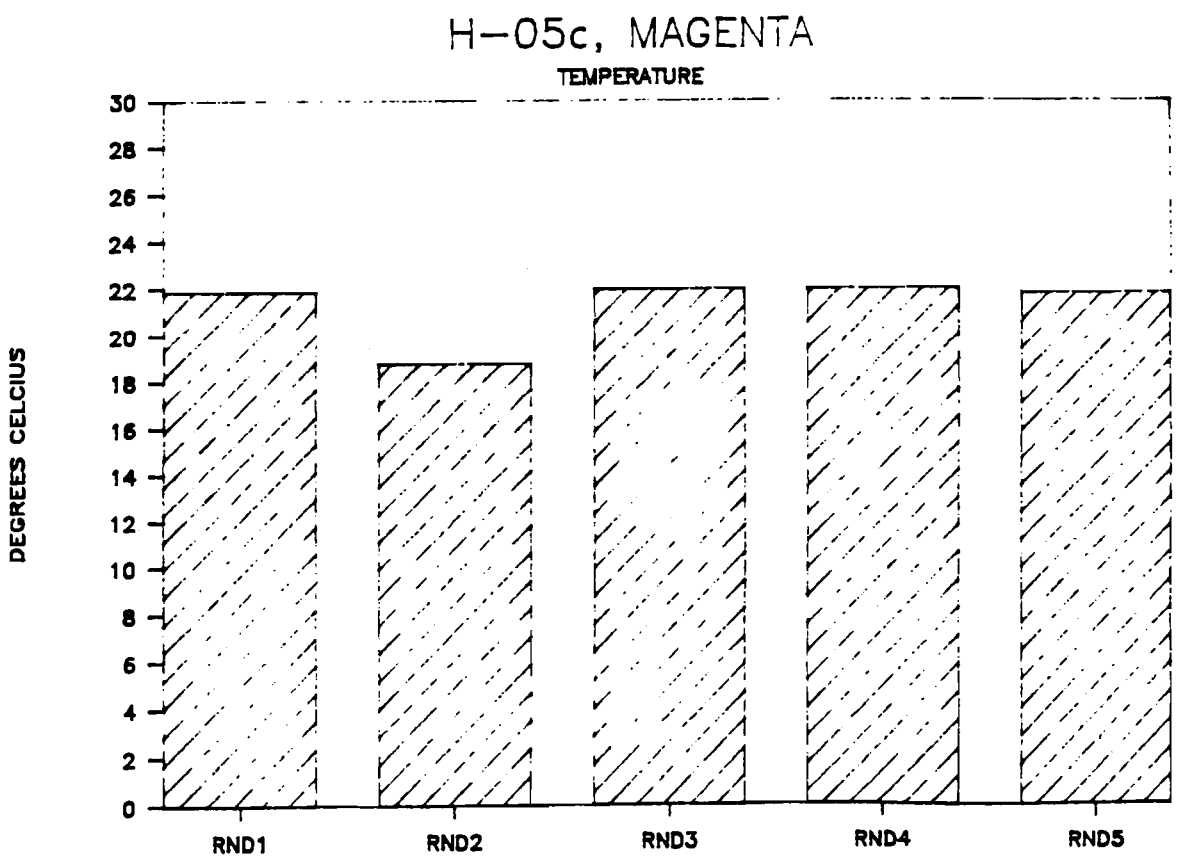

H-05c, MAGENTA
DIVALENT CATIONS
CONCENTRATION meq/l
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5

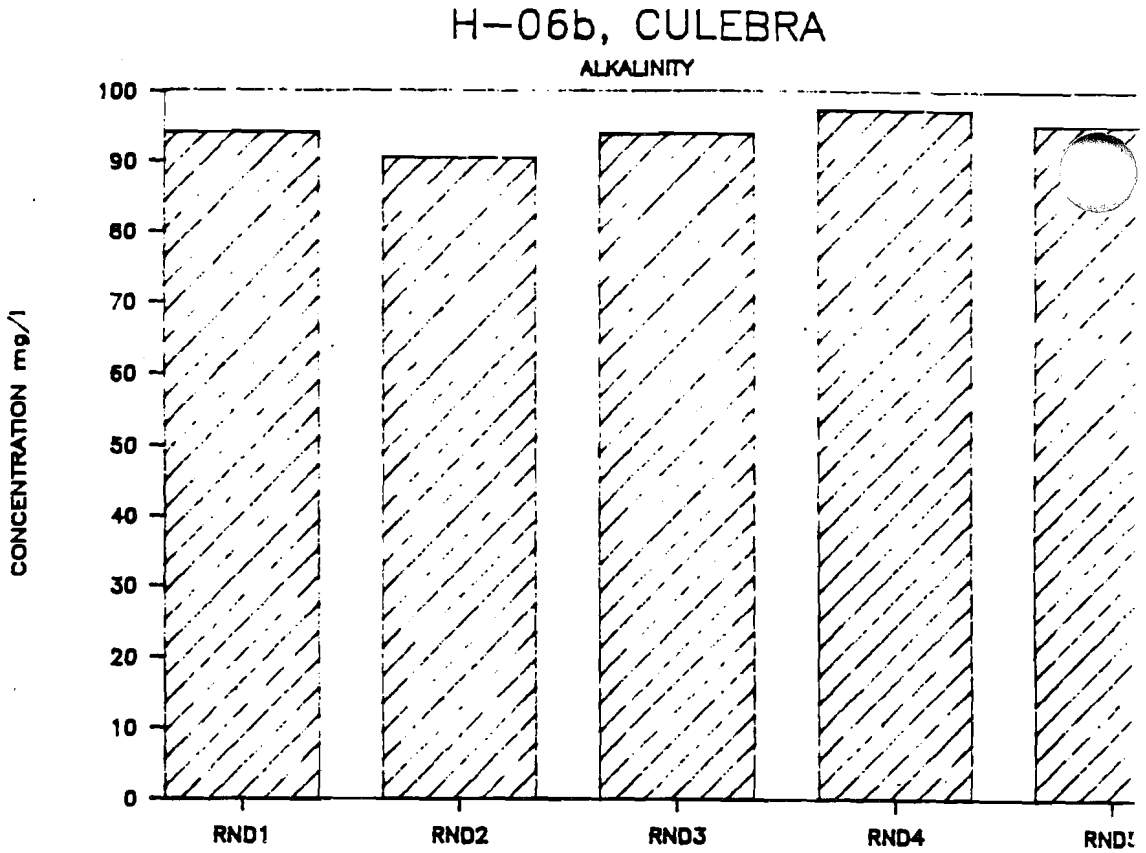

H-05c, MAGENTA
TOTAL IRON
CONCENTRATION mg/l
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5

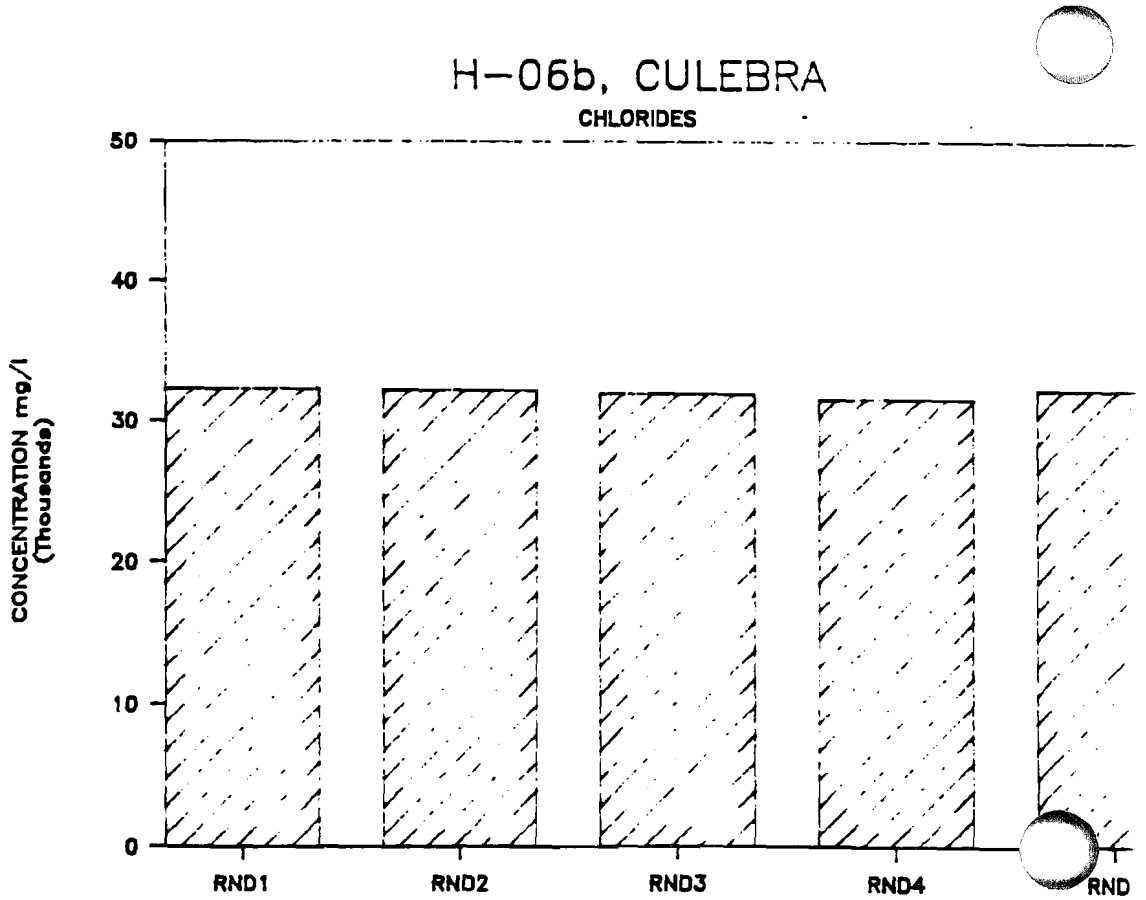

H-05c, MAGENTA
pH
STANDARD UNITS
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5

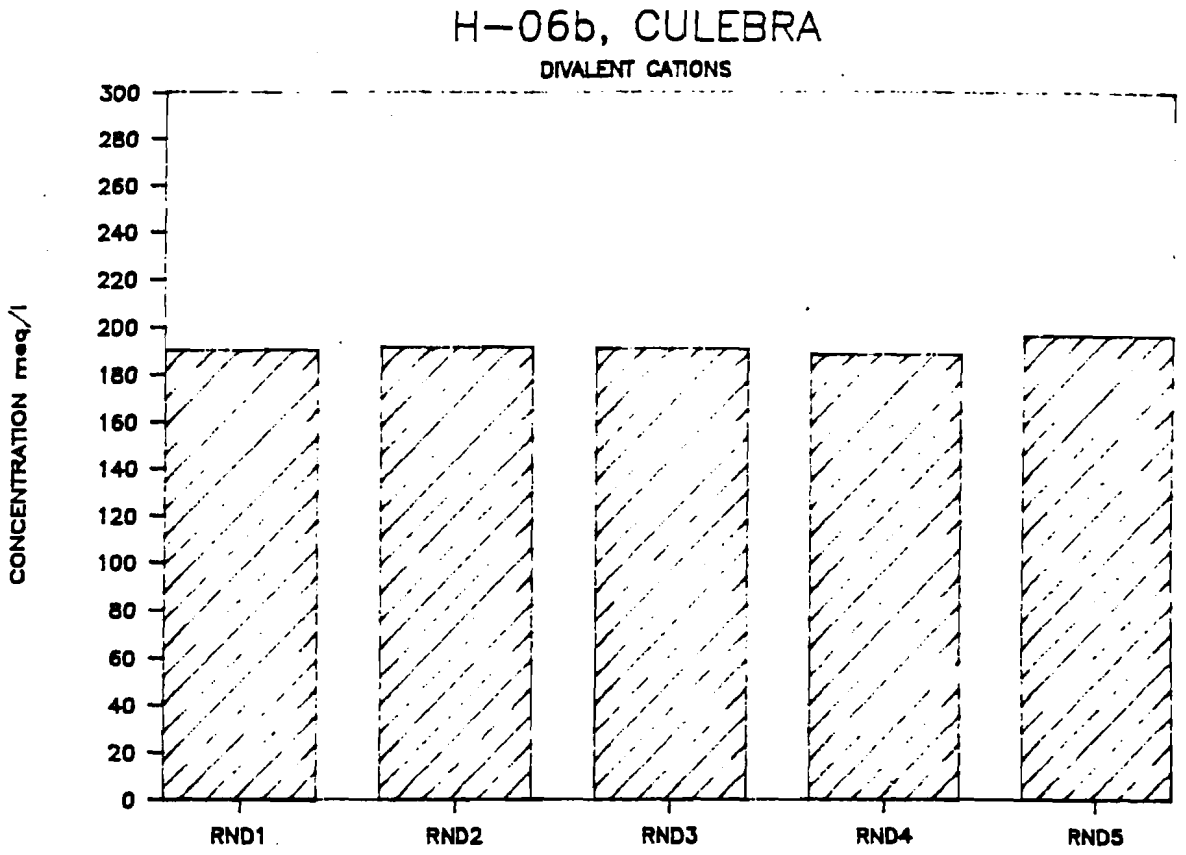

H-05c, MAGENTA
SPECIFIC CONDUCTIVITY
uMhos/cm
(Thousands)
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5

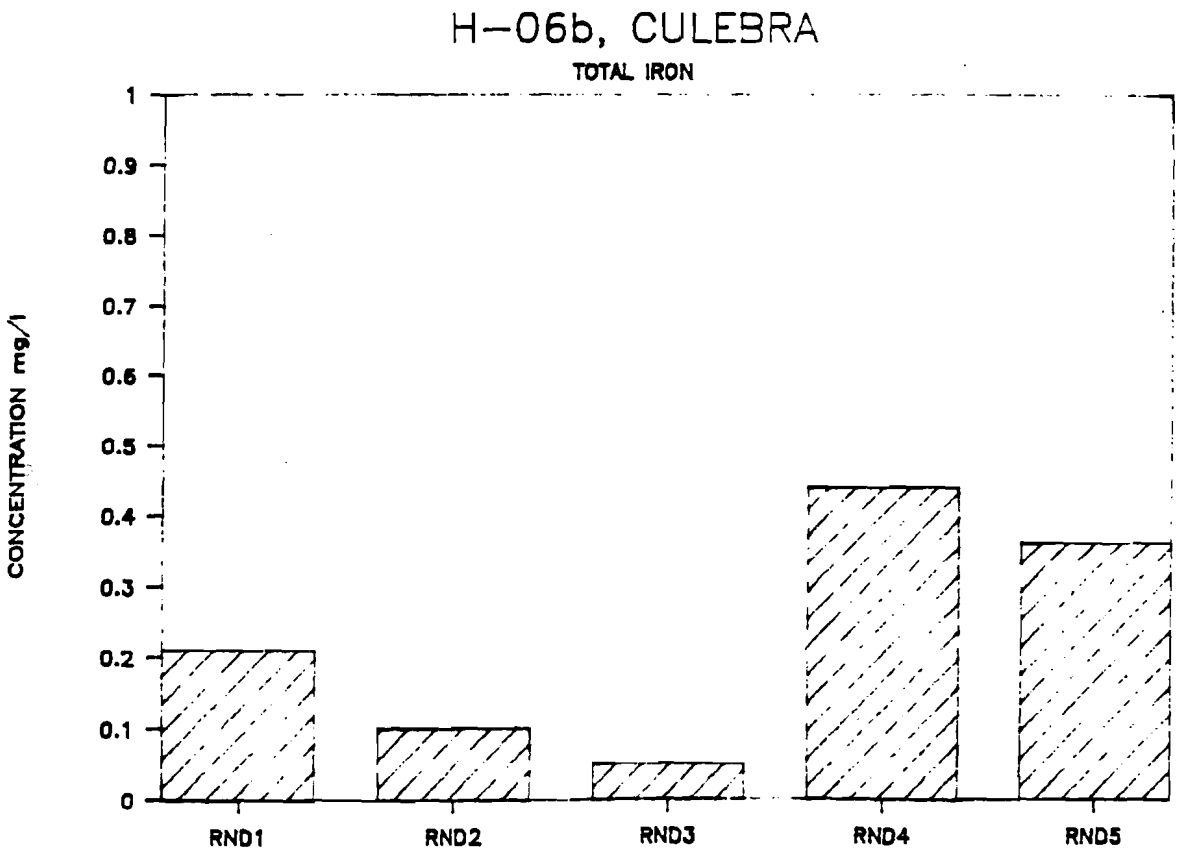

H-05c, MAGENTA
SPECIFIC GRAVITY
g/cm3
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5

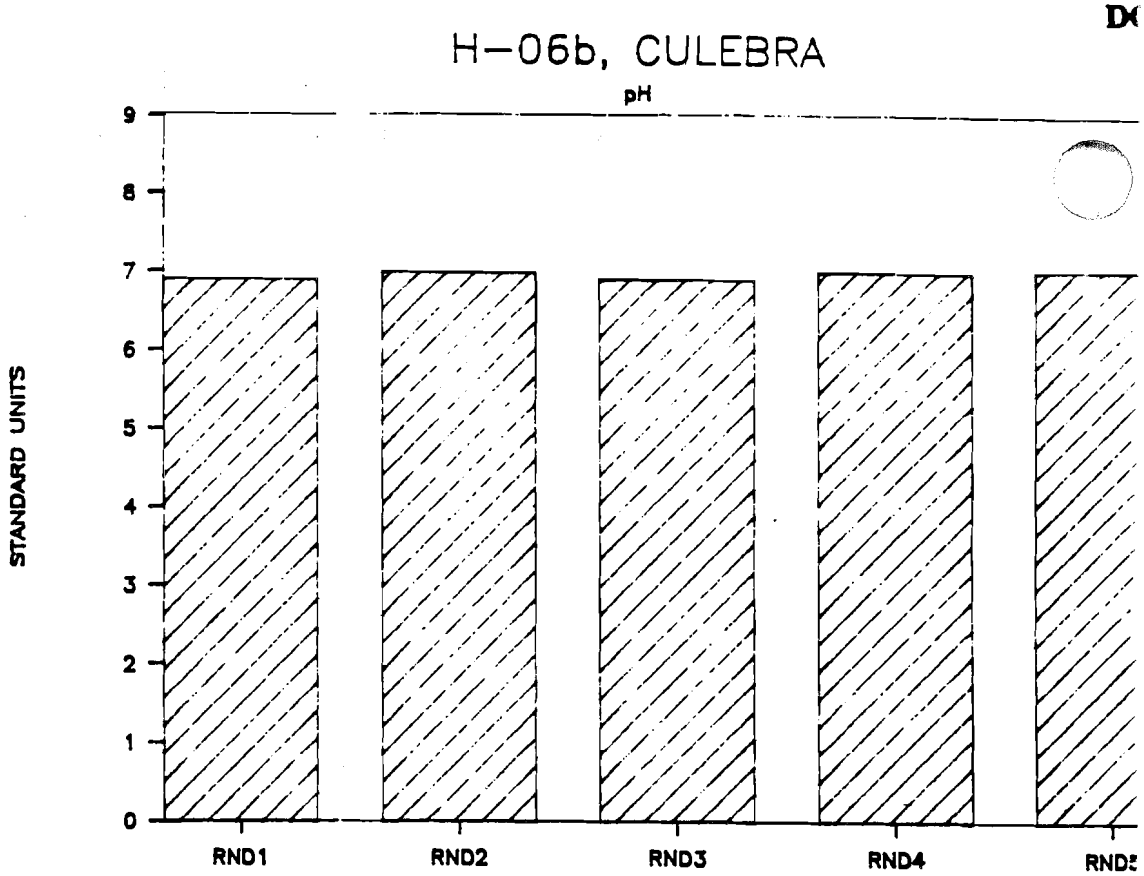

H-05c, MAGENTA
TEMPERATURE
DEGREES CELCIUS
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
RND1
RND2
RND3
RND4
RND5

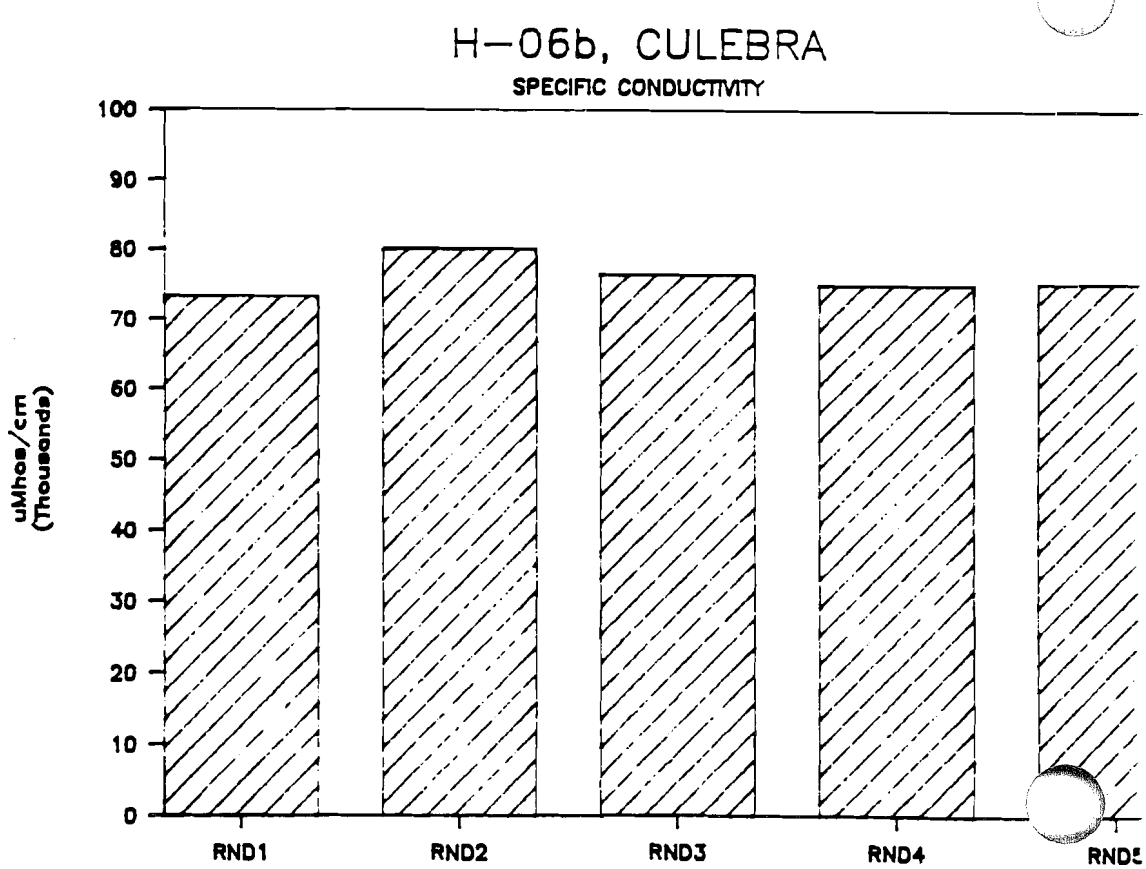

H-06b, CULEBRA
ALKALINITY
CONCENTRATION mg/l
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4

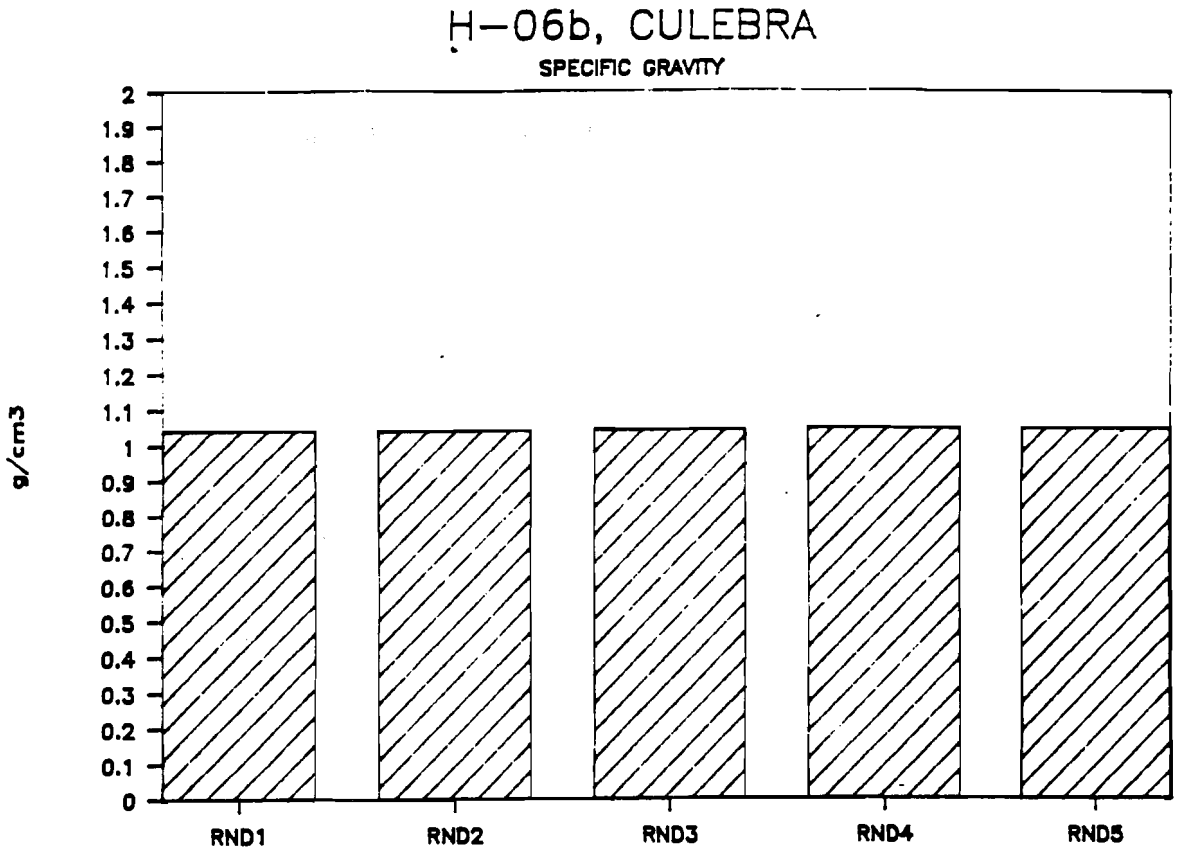

H-06b, CULEBRA
CHLORIDES
CONCENTRATION mg/l
(Thousands)
50
40
30
20
10
0
RND1
RND2
RND3
RND4

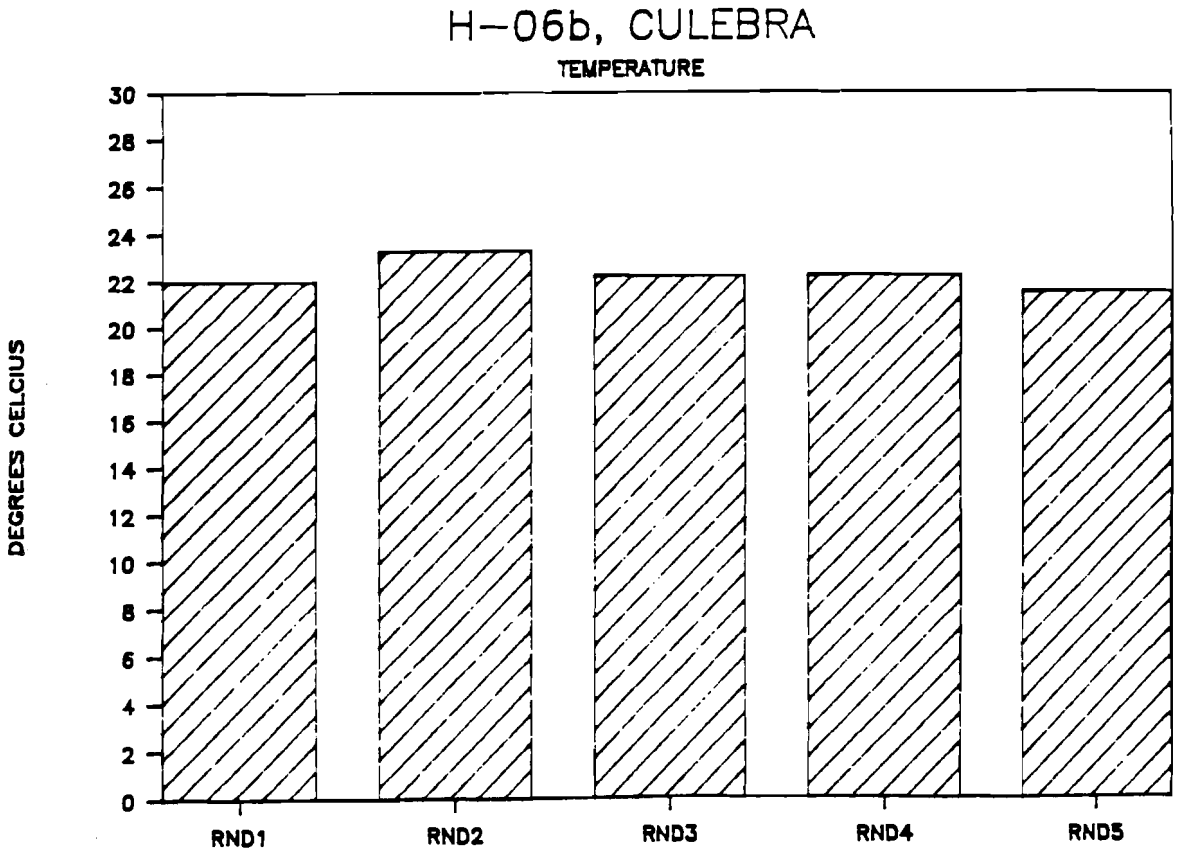

H-06b, CULEBRA
DIVALENT CATIONS
CONCENTRATION meq/l
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
RND1
RND2
RND3
RND4
RND5

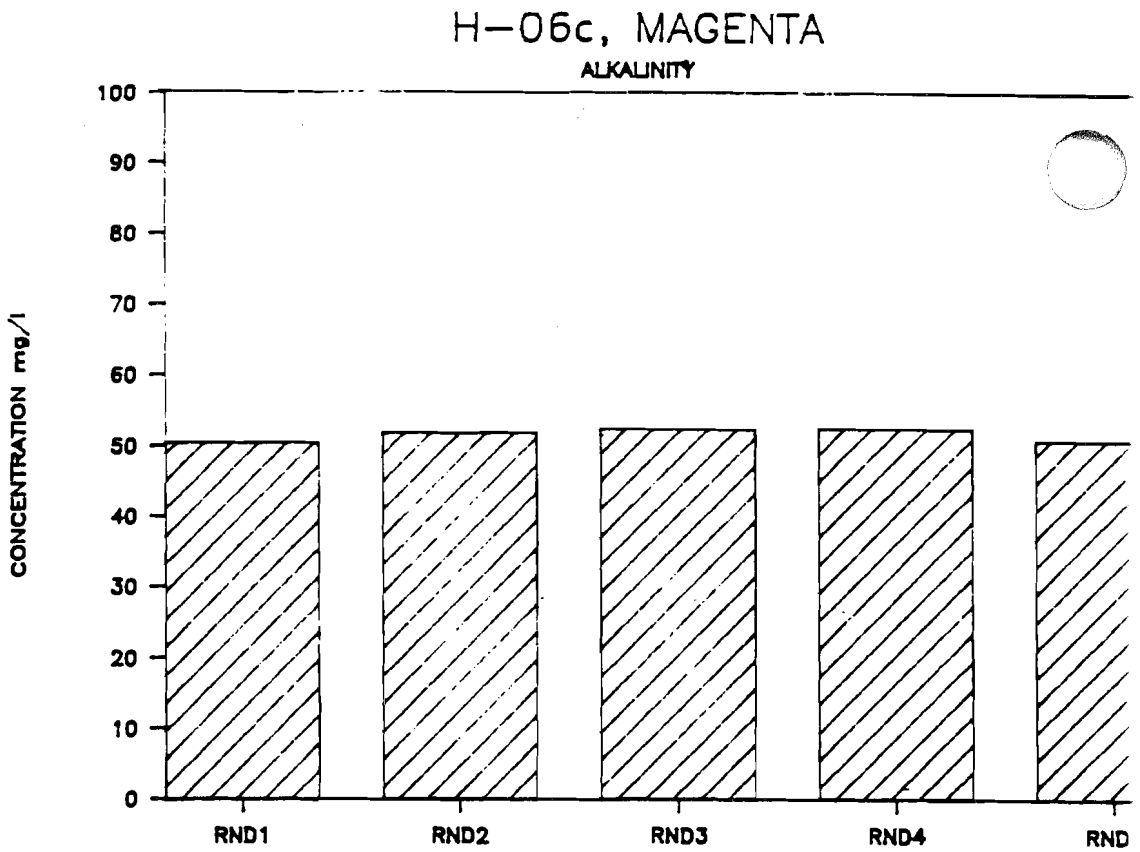

H-06b, CULEBRA
TOTAL IRON
CONCENTRATION mg/l
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5

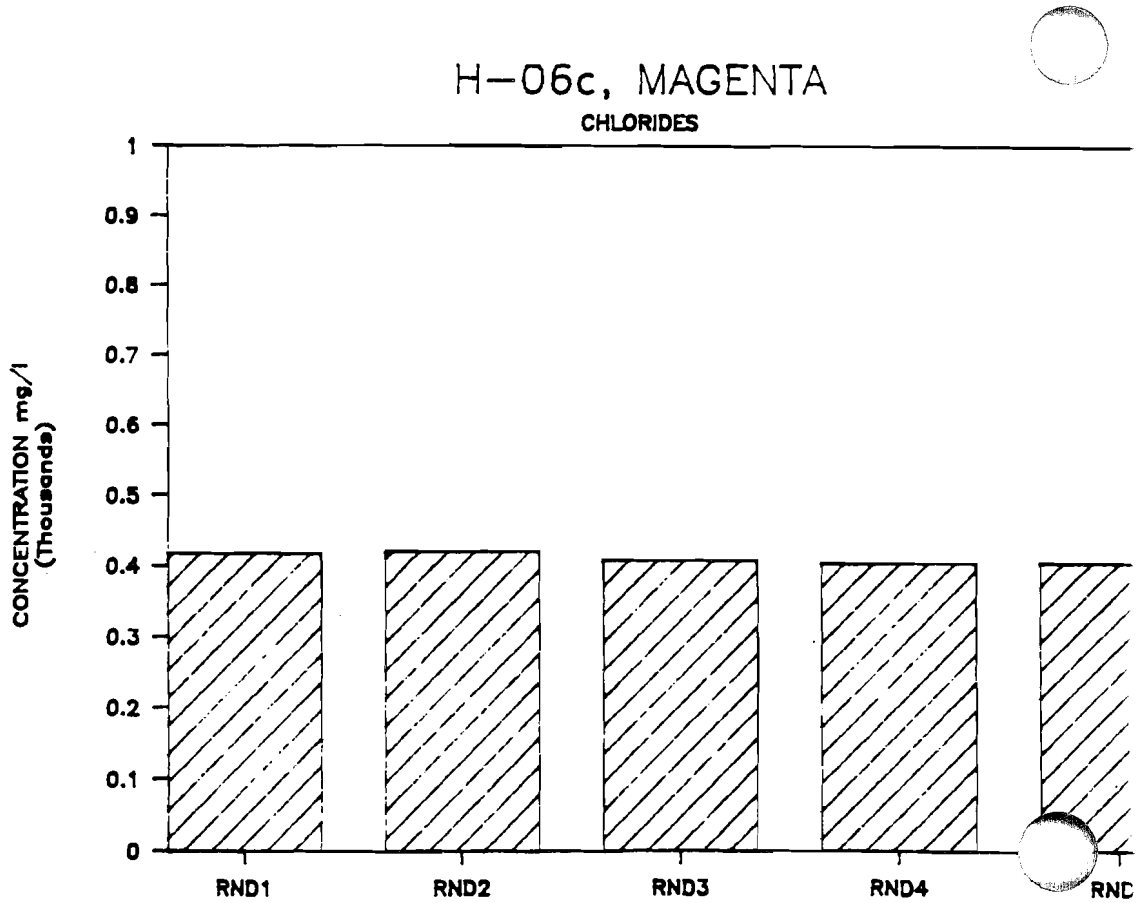

H-06b, CULEBRA
pH
STANDARD UNITS
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4

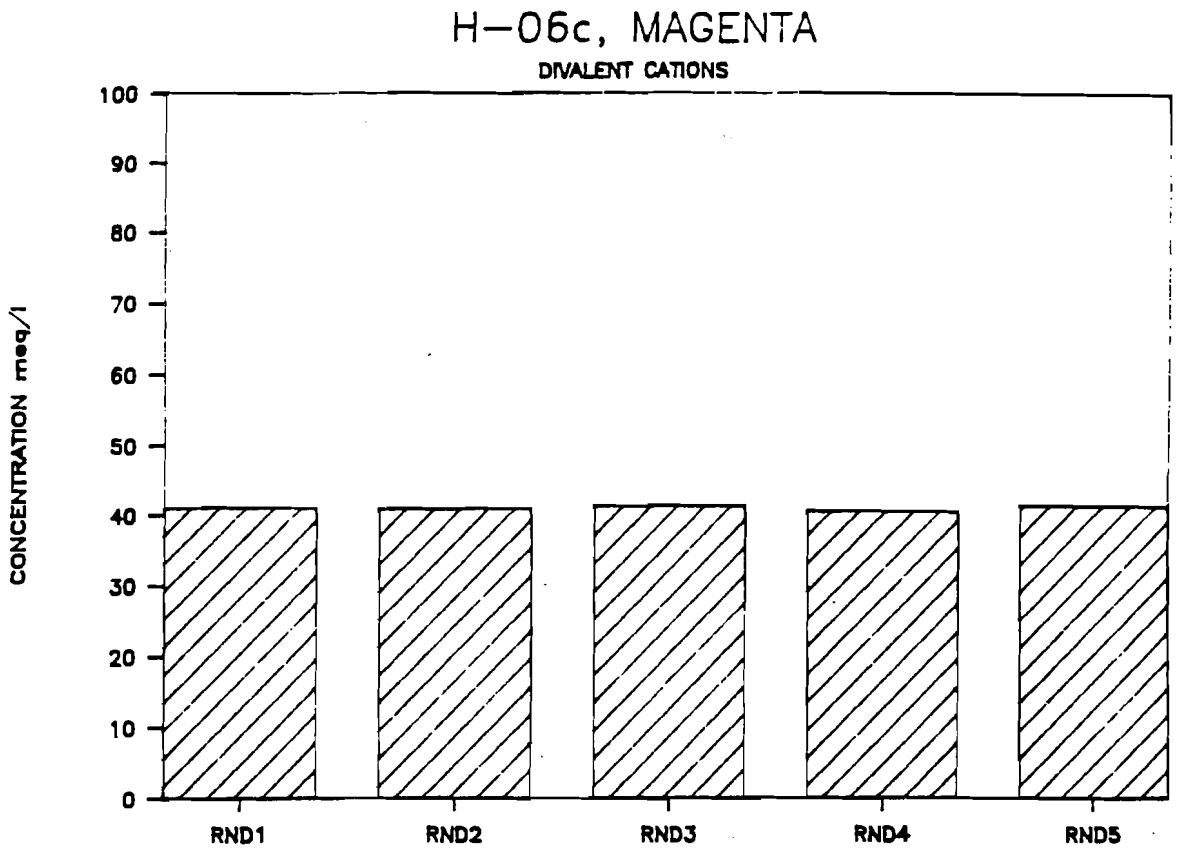

H-06b, CULEBRA
SPECIFIC CONDUCTIVITY
uMhos/cm
(Thousands)
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4

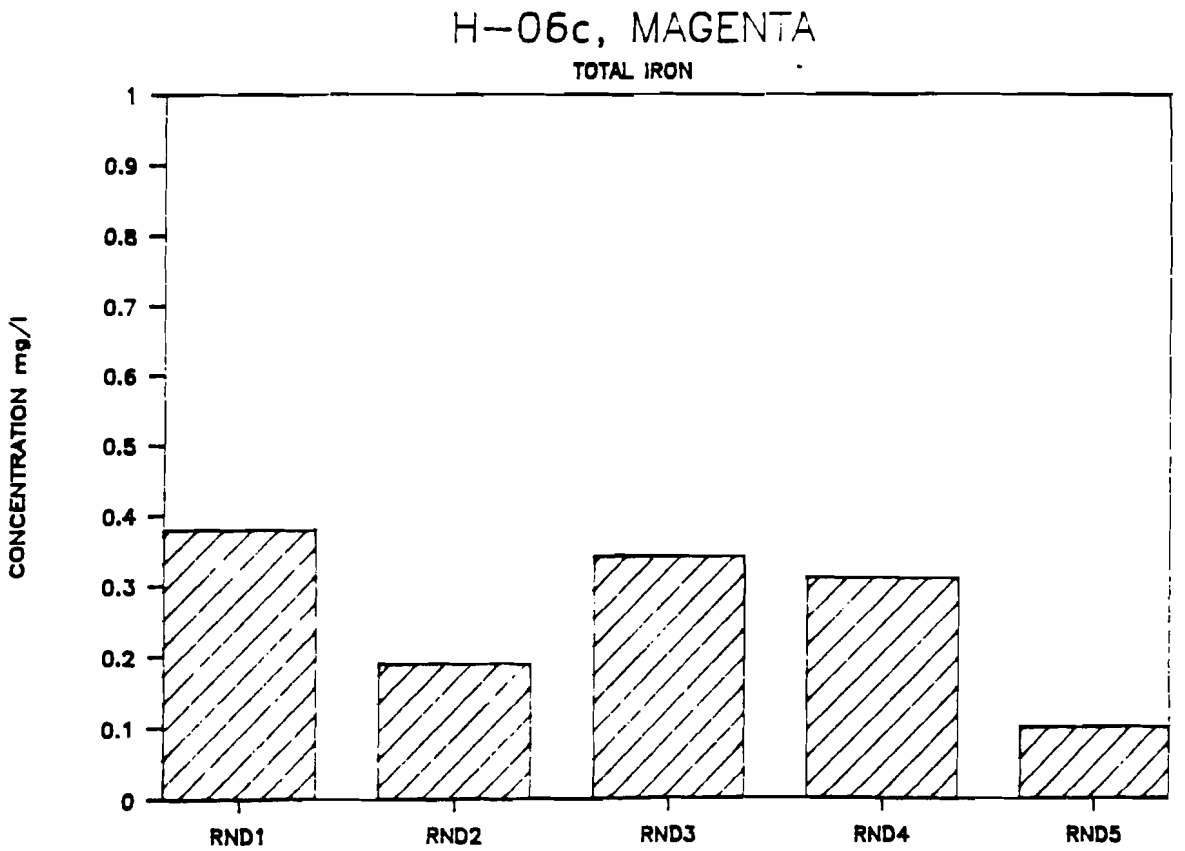

H-06b, CULEBRA
SPECIFIC GRAVITY
g/cm3
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5

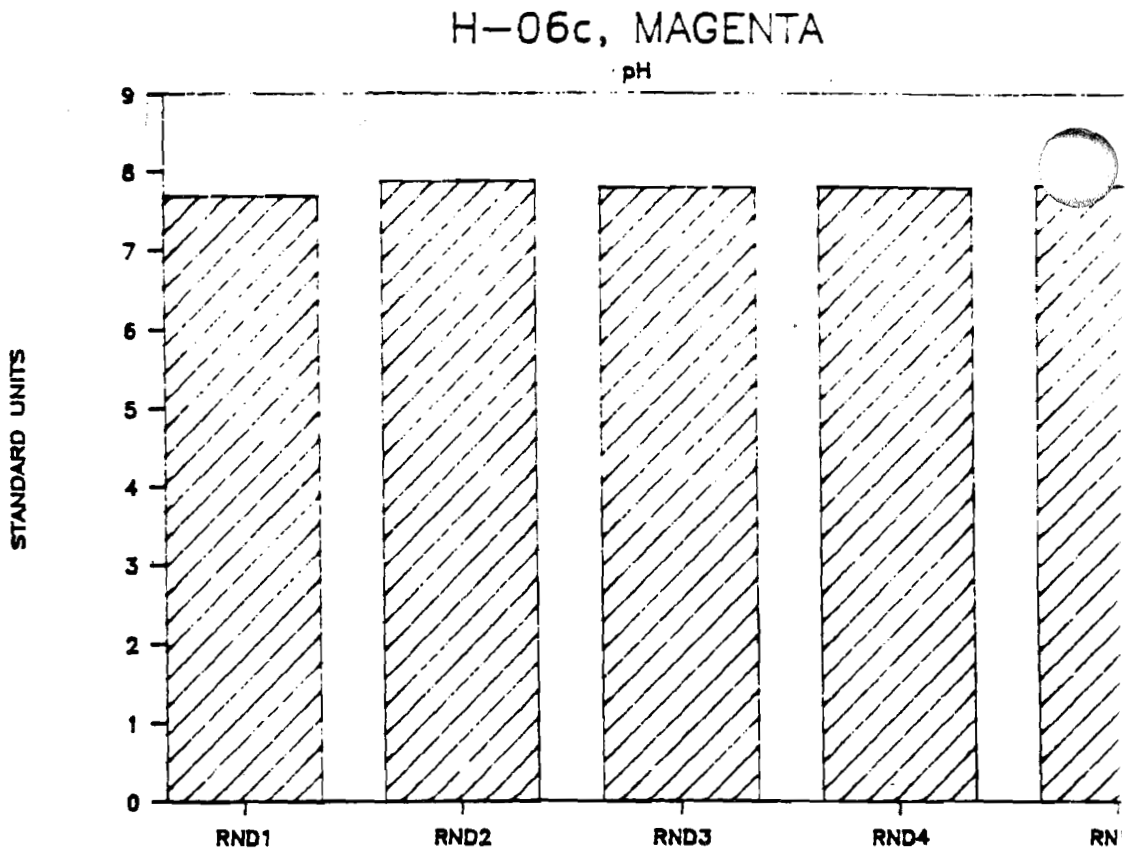

H-06b, CULEBRA
TEMPERATURE
DEGREES CELCIUS
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
RND1
RND2
RND3
RND4
RND5

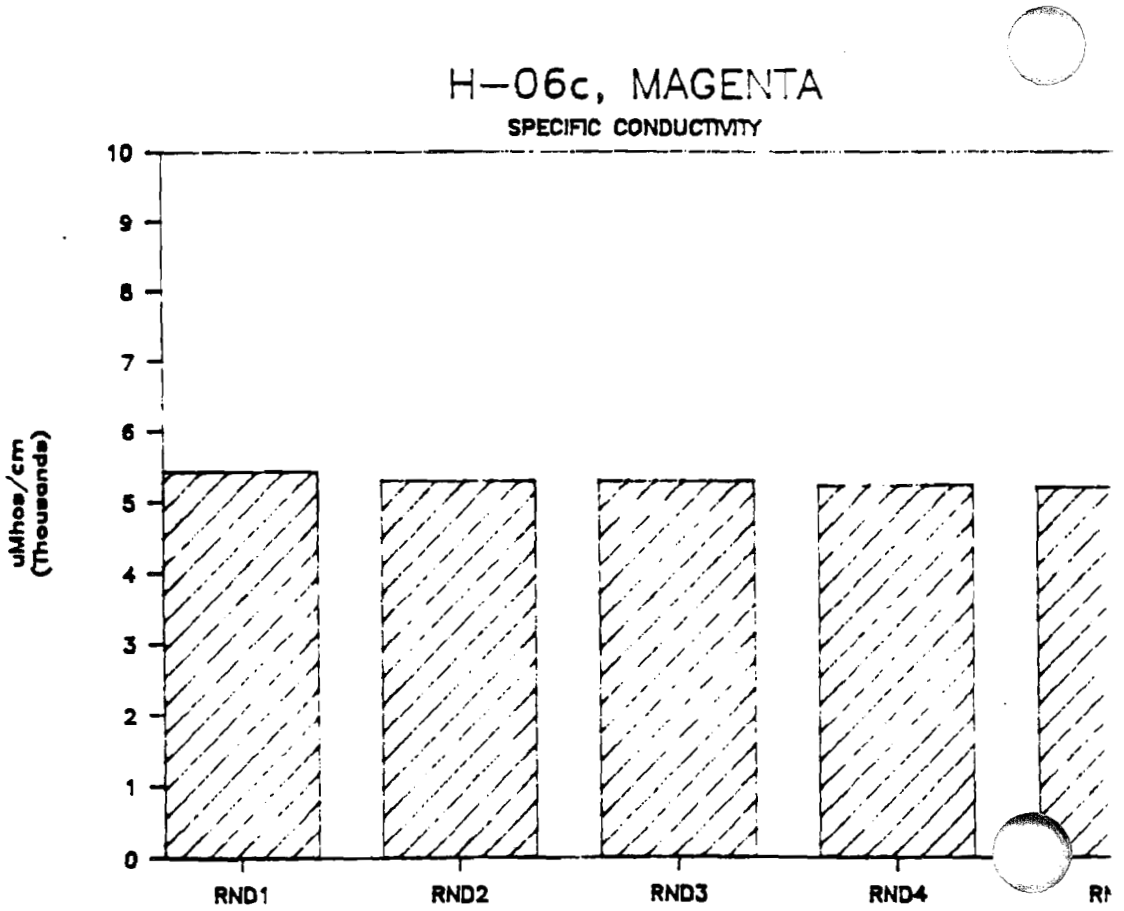

H-06c, MAGENTA
ALKALINITY
CONCENTRATION mg/l
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND

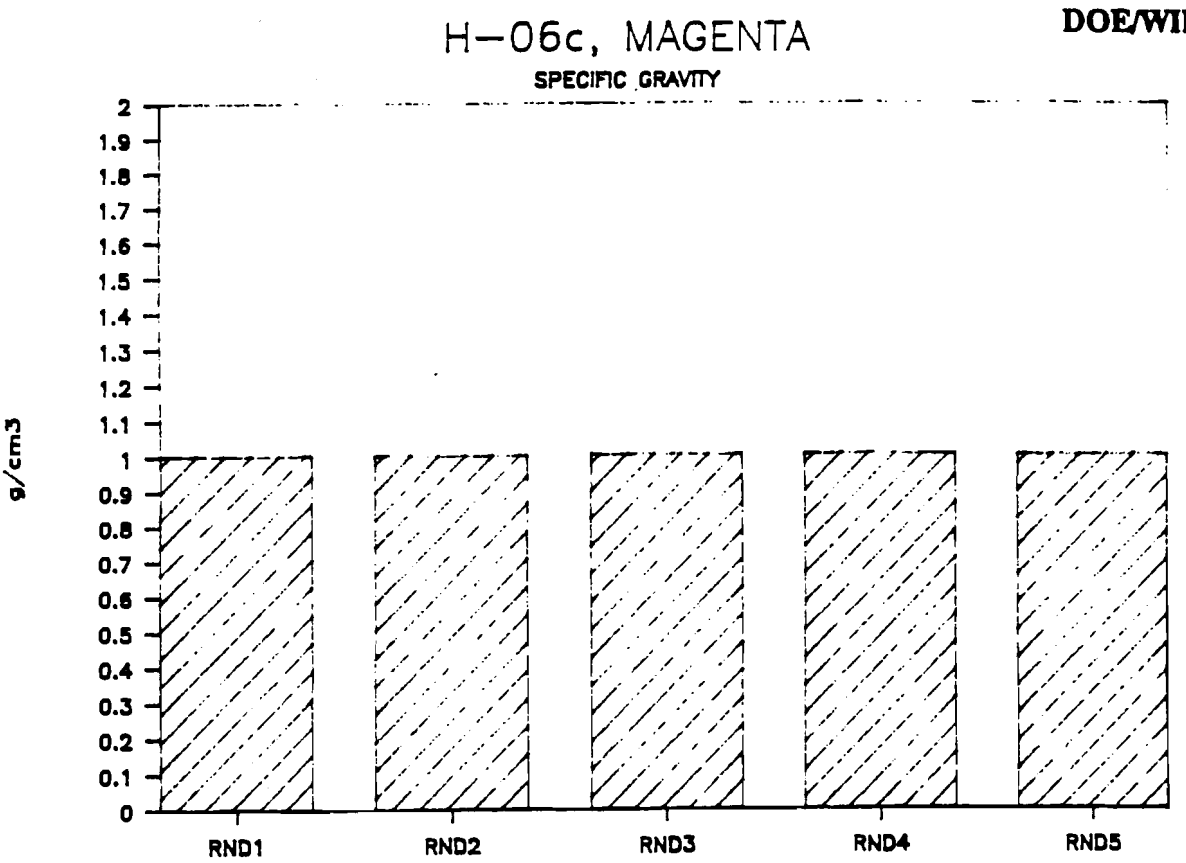

H-06c, MAGENTA
CHLORIDES
CONCENTRATION mg/l
(Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND

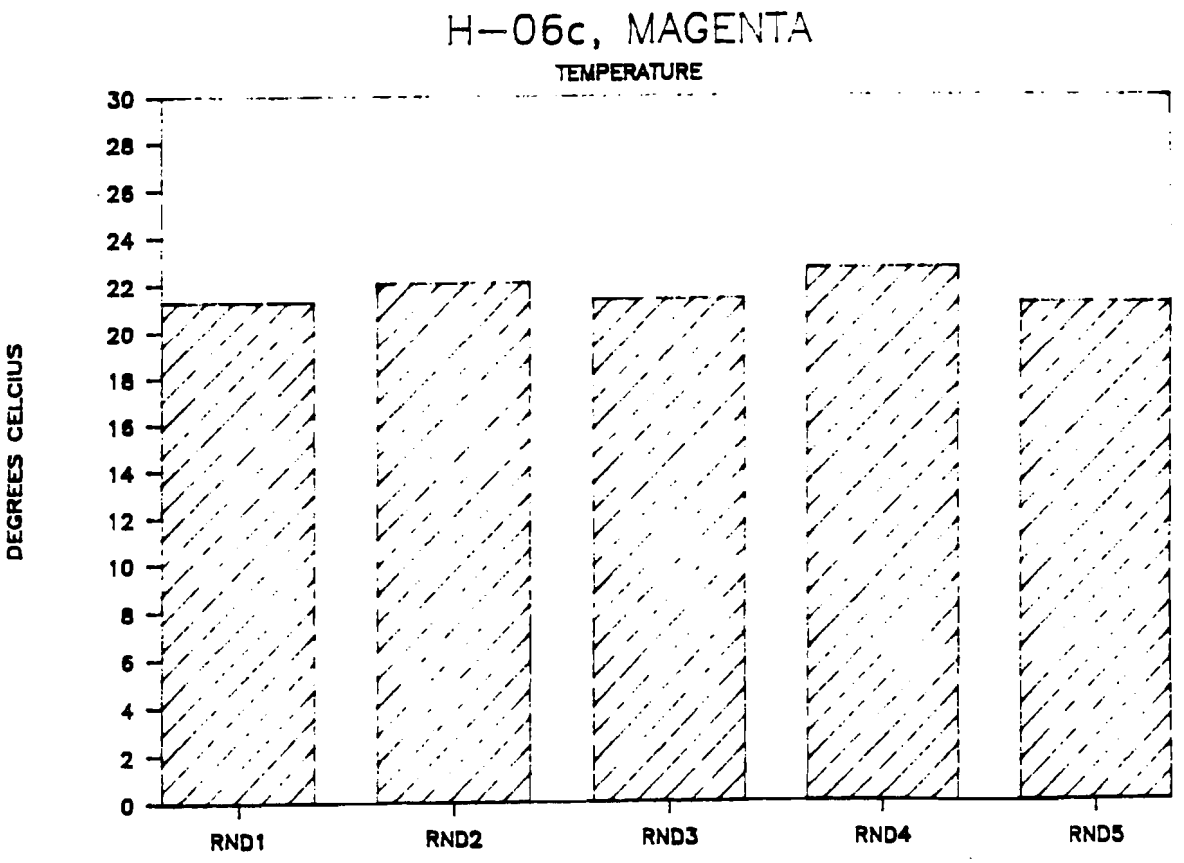

H-06c, MAGENTA
DIVALENT CATIONS
CONCENTRATION meq/l
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5

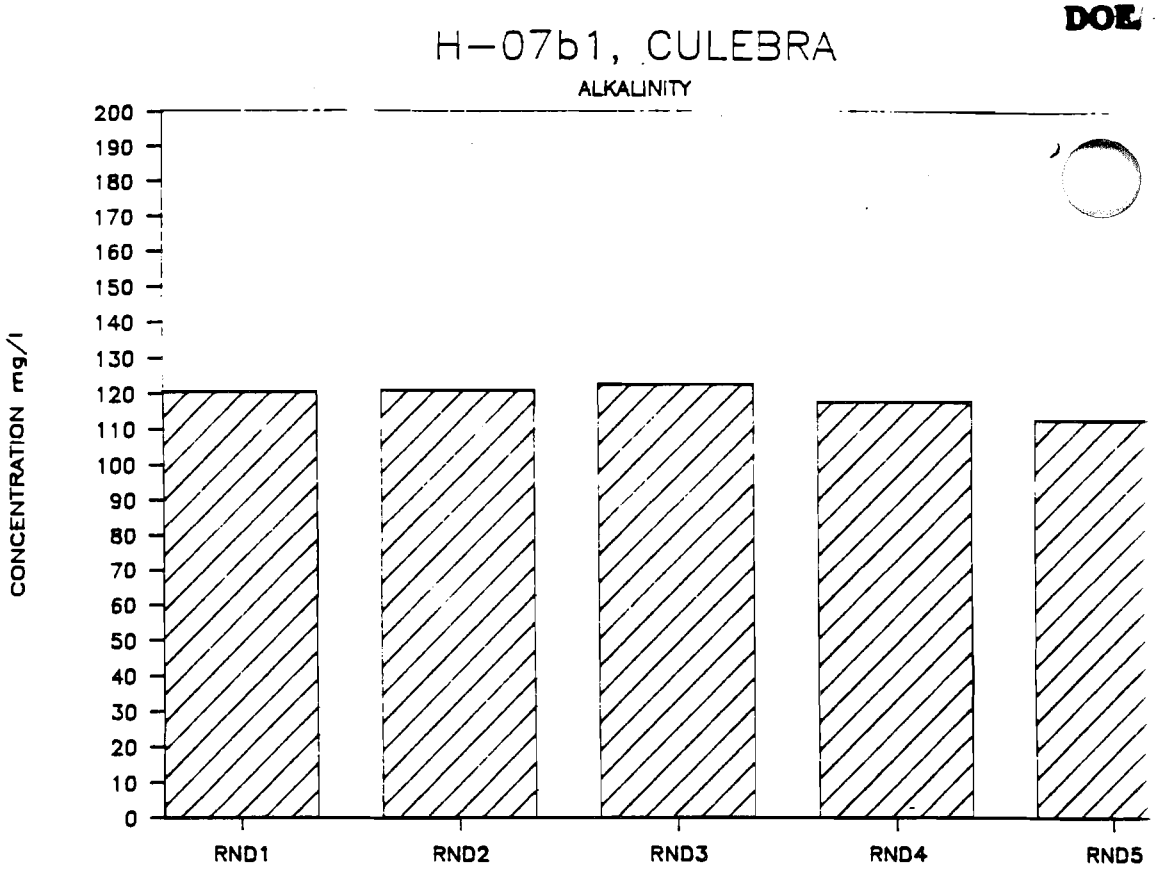

H-06c, MAGENTA
TOTAL IRON
CONCENTRATION mg/l
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5

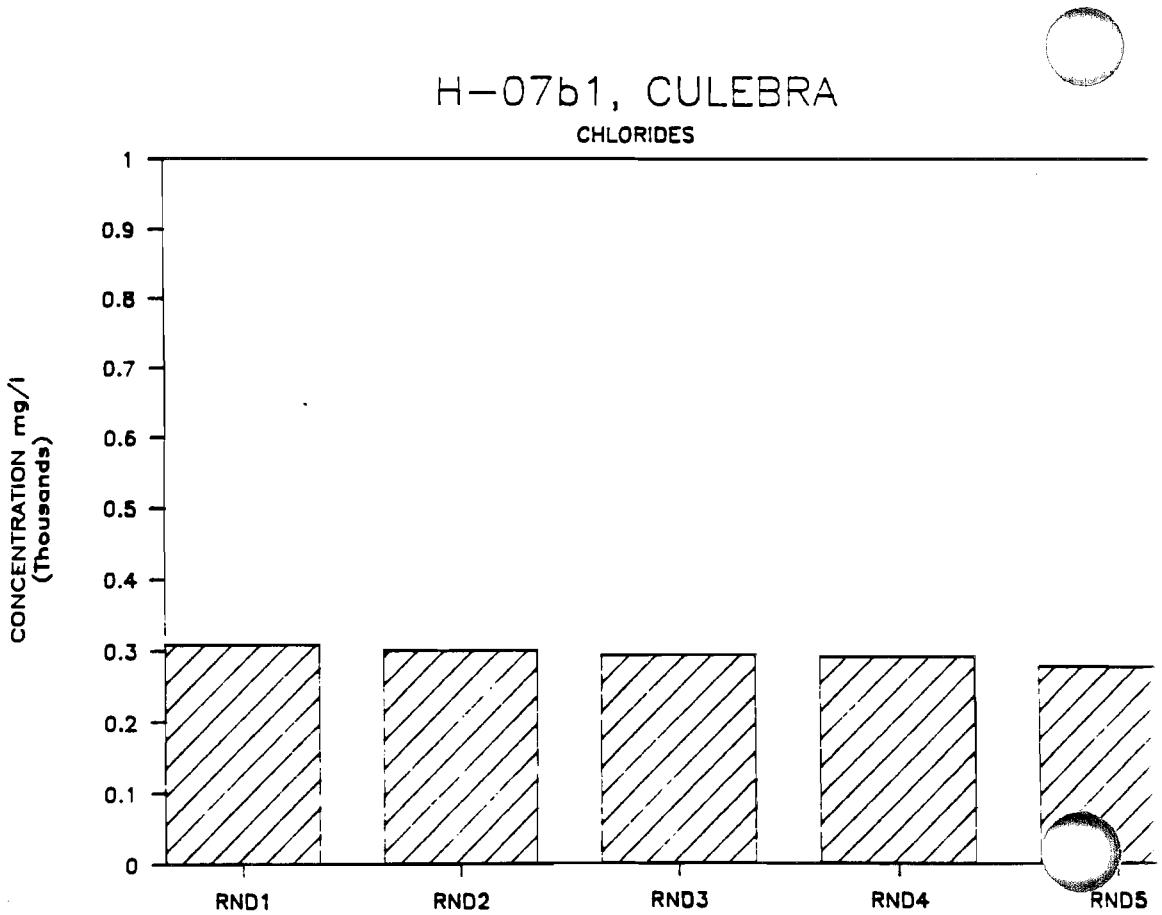

H-06c, MAGENTA
pH
STANDARD UNITS
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RN

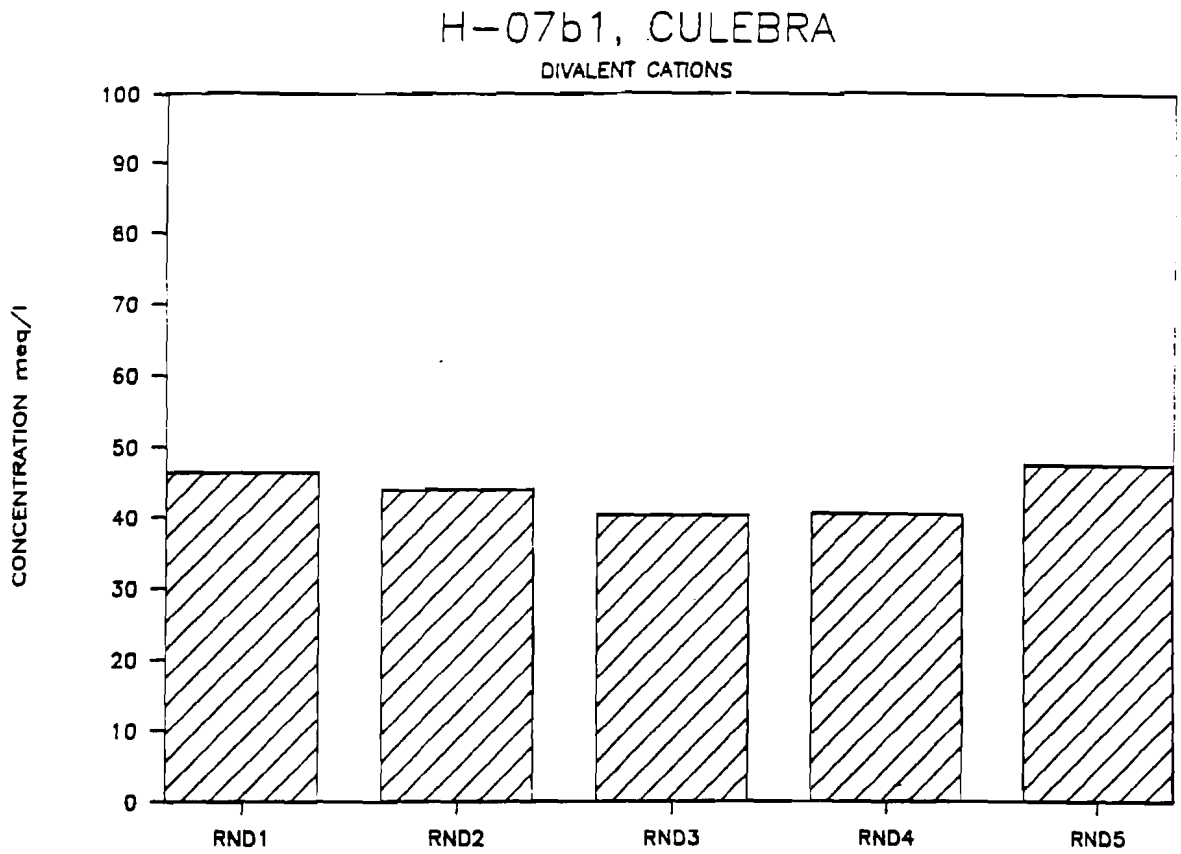

H-06c, MAGENTA
SPECIFIC CONDUCTIVITY
uMhos/cm
(Thousands)
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RN

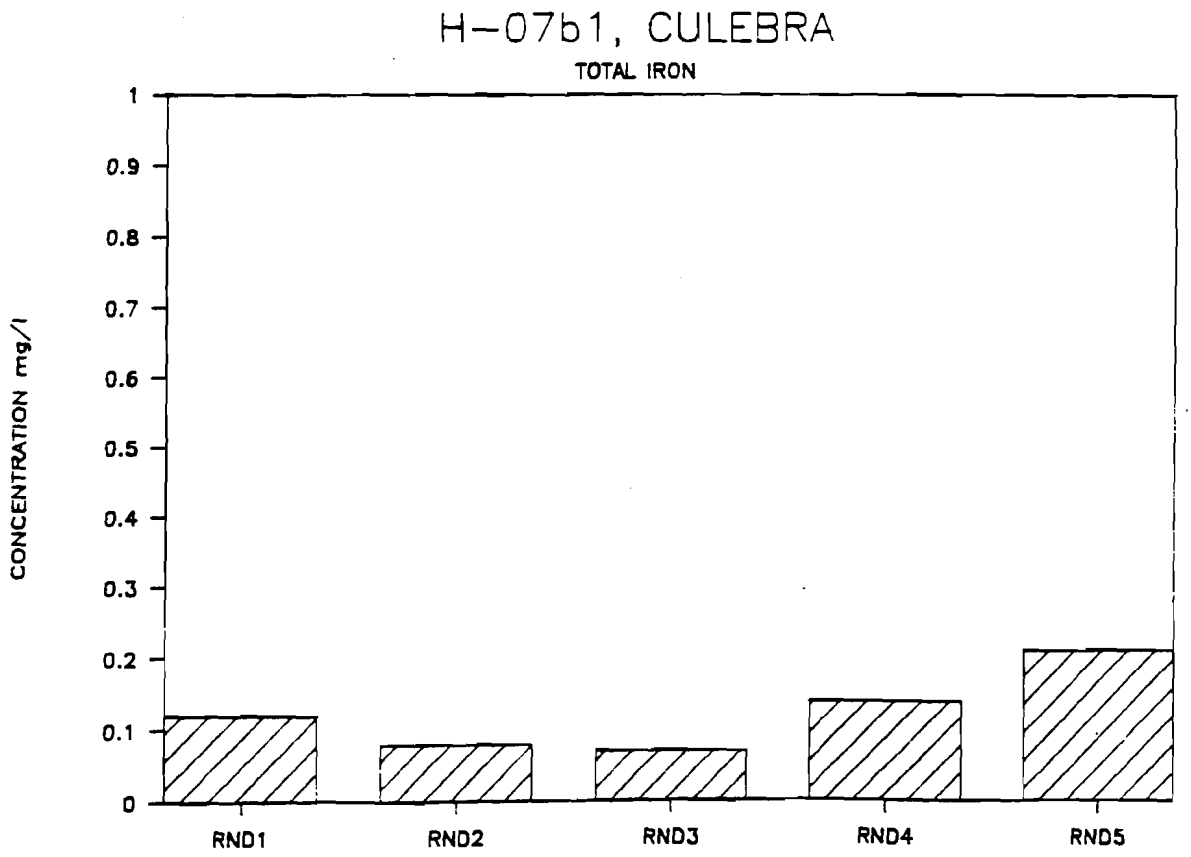

H-06c, MAGENTA
SPECIFIC GRAVITY
g/cm3
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5

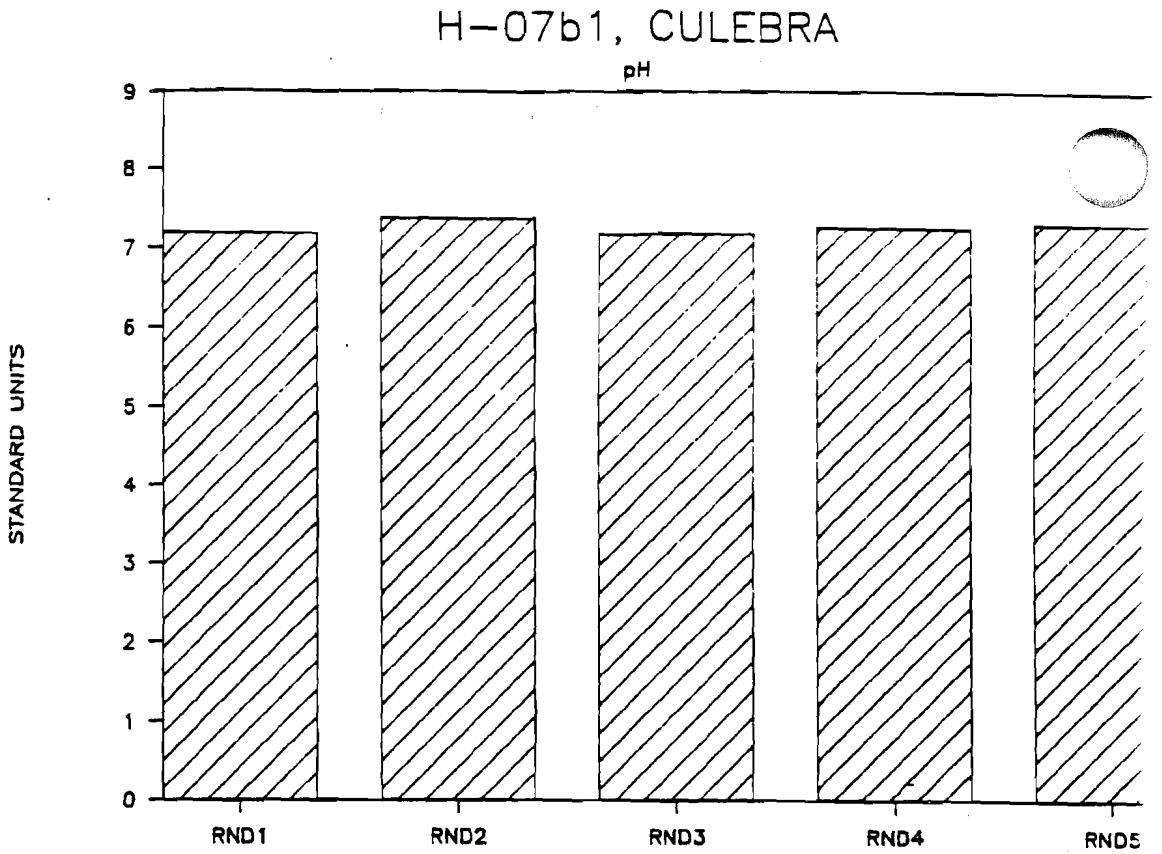

H-06c, MAGENTA
TEMPERATURE
DEGREES CELCIUS
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
RND1
RND2
RND3
RND4
RND5

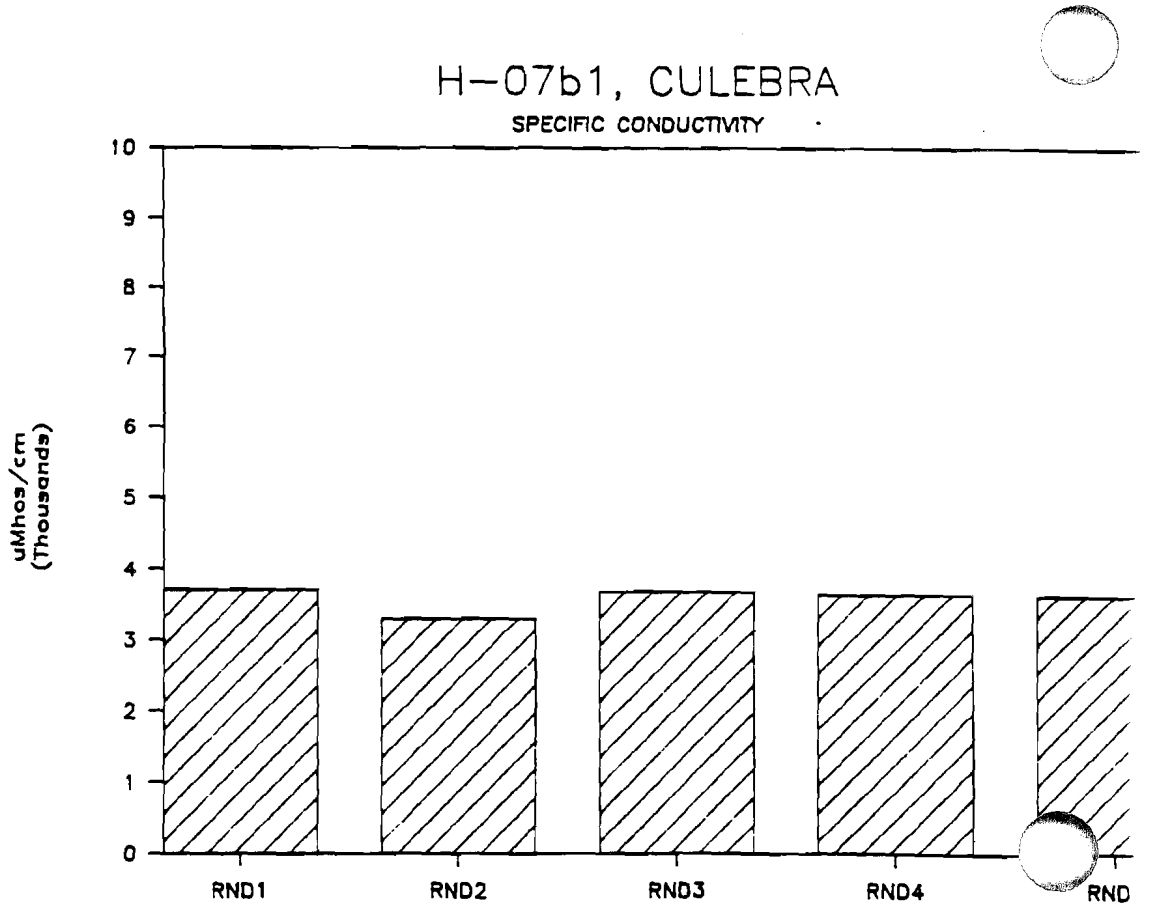

H-07b1, CULEBRA
ALKALINITY
CONCENTRATION mg/l
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5

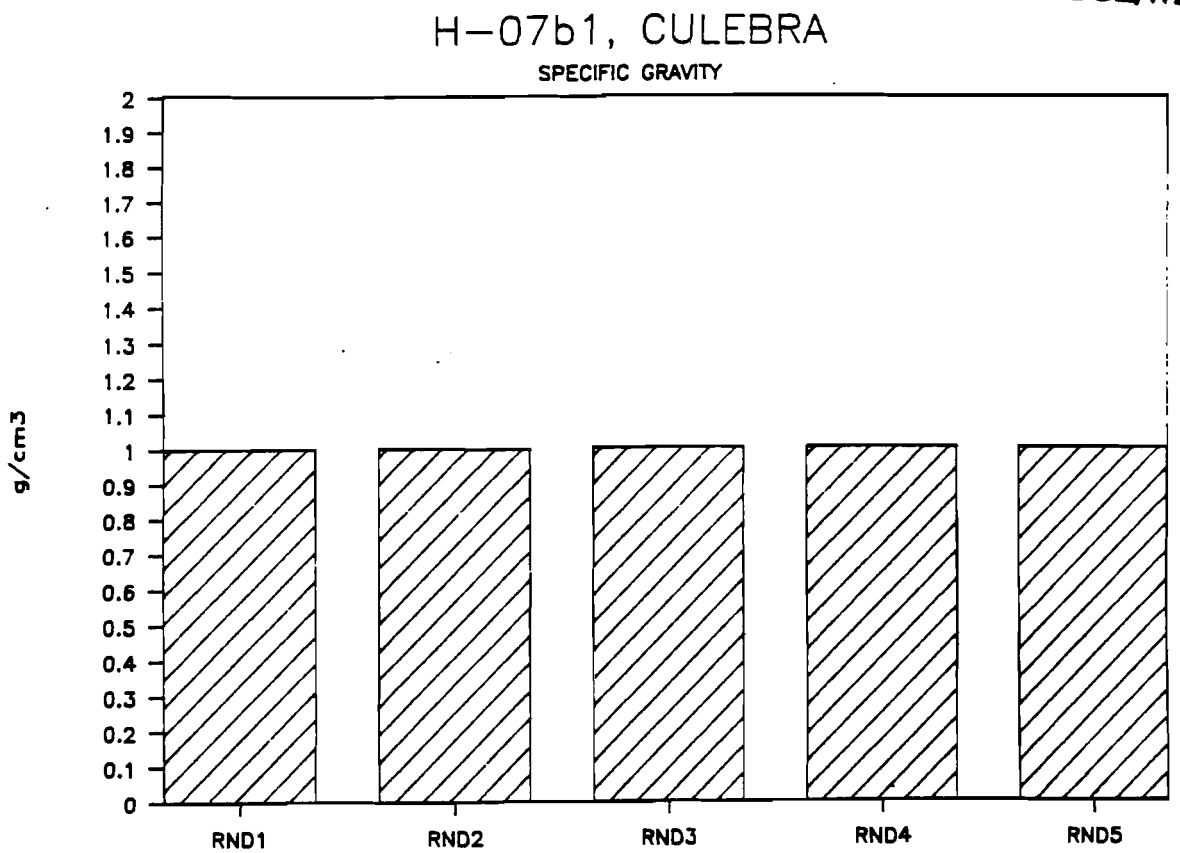

H-07b1, CULEBRA
CHLORIDES
CONCENTRATION mg/l
(Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5

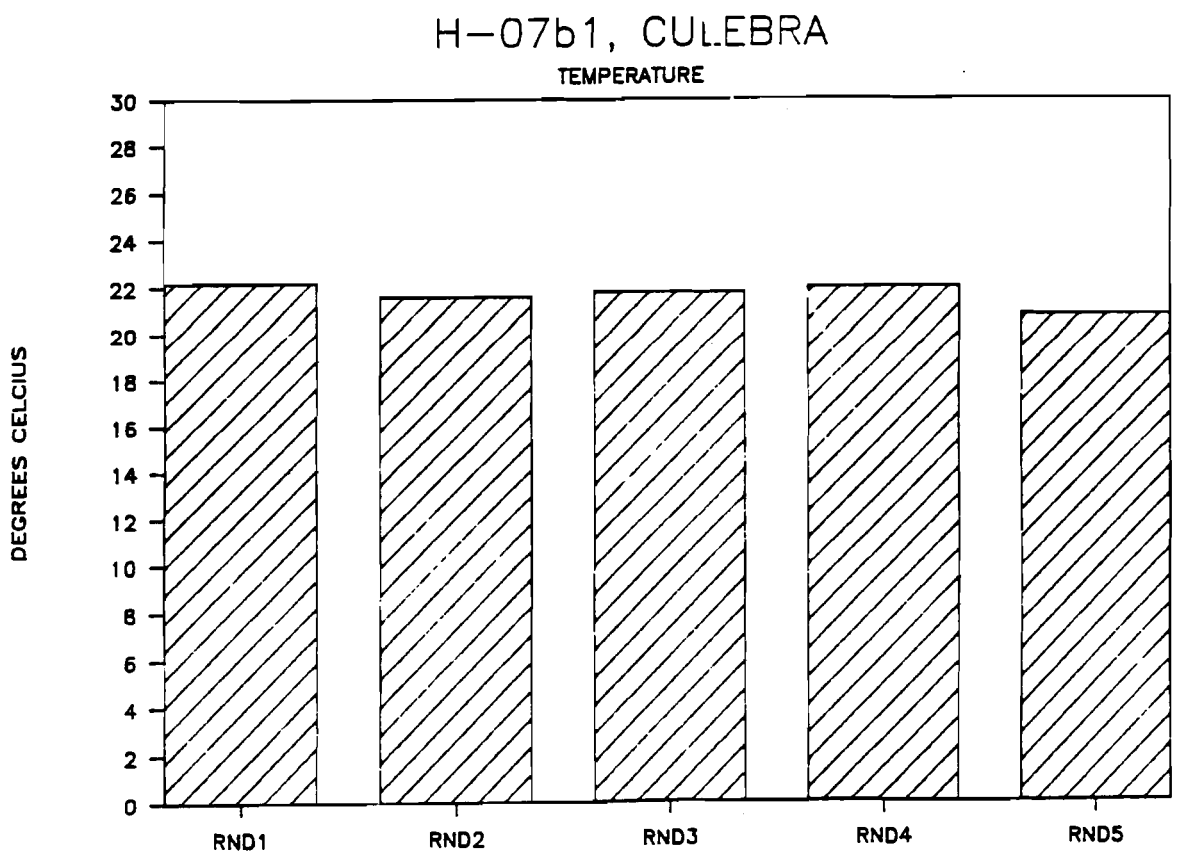

H-07b1, CULEBRA
DIVALENT CATIONS
CONCENTRATION meq/l
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5

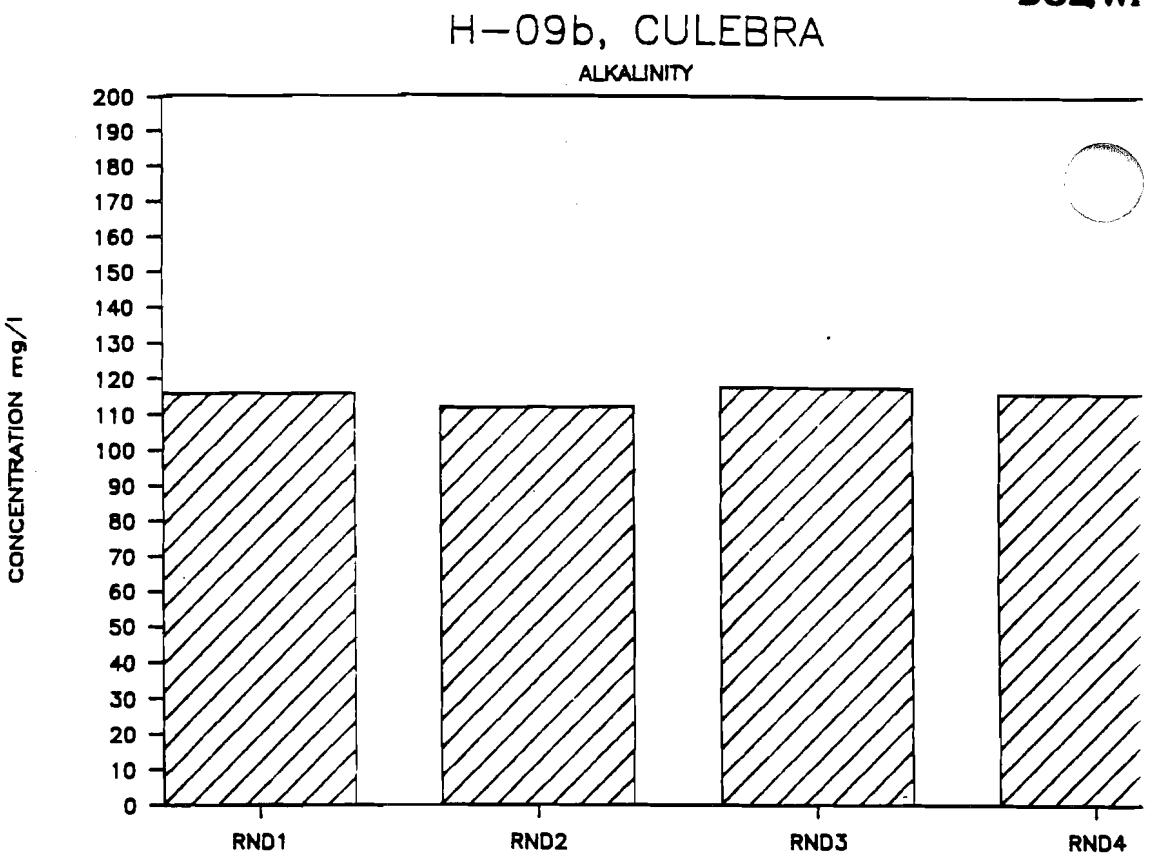

H-07b1, CULEBRA
TOTAL IRON
CONCENTRATION mg/l
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5

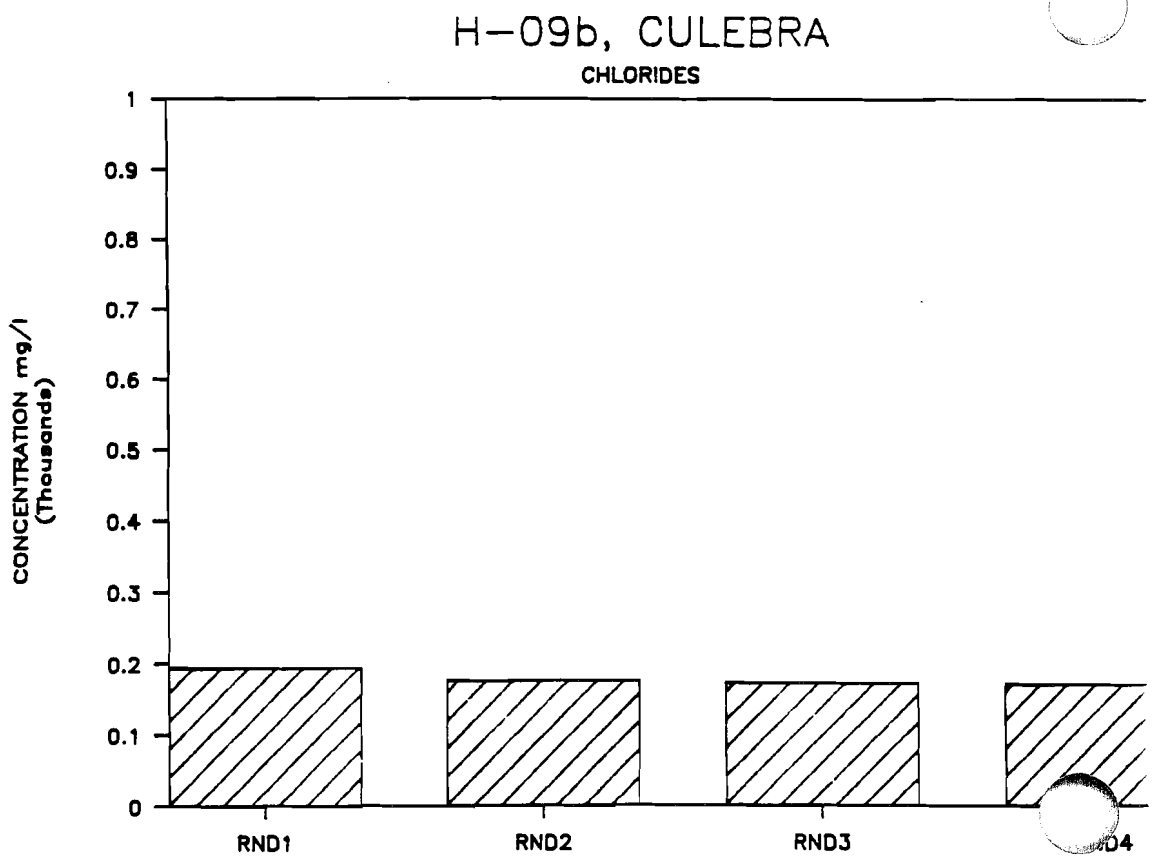

H-07b1, CULEBRA
pH
STANDARD UNITS
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5

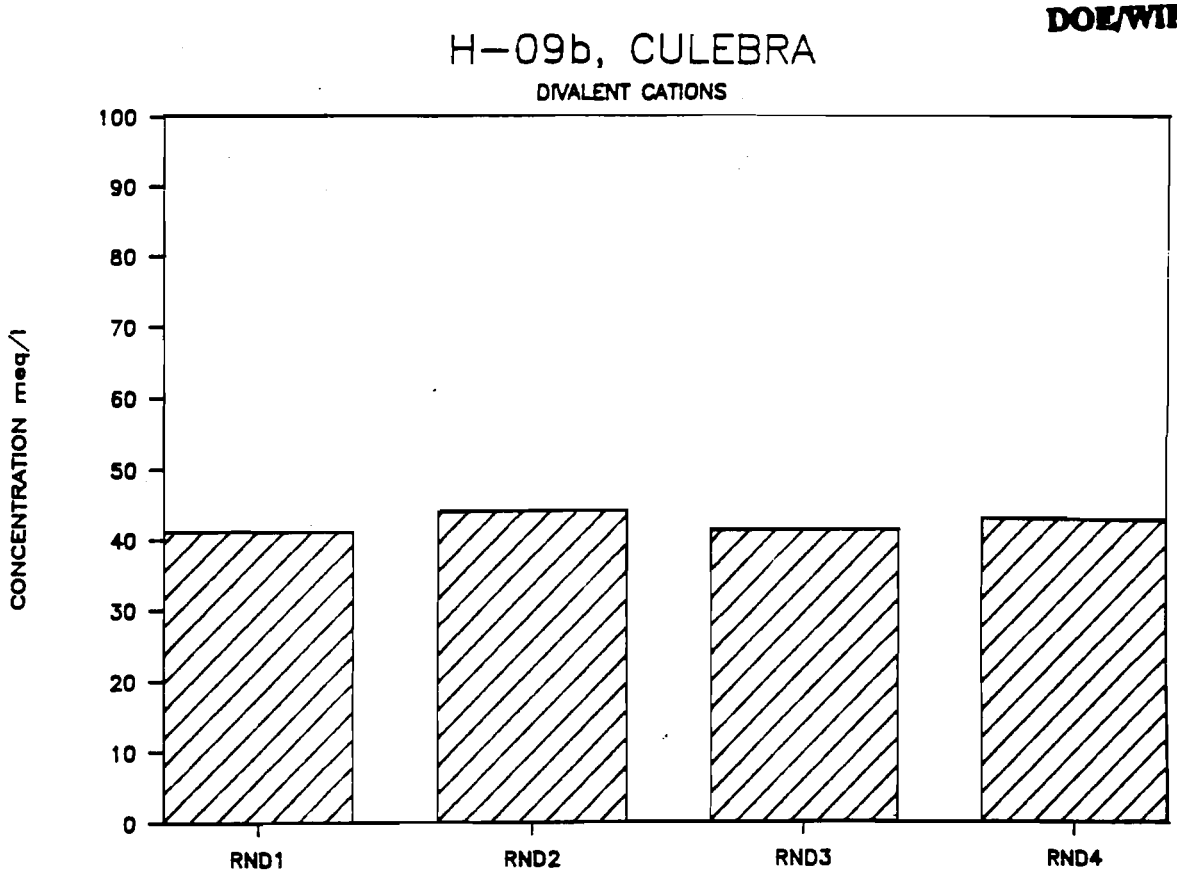

H-07b1, CULEBRA
SPECIFIC CONDUCTIVITY
uMhos/cm
(Thousands)
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND

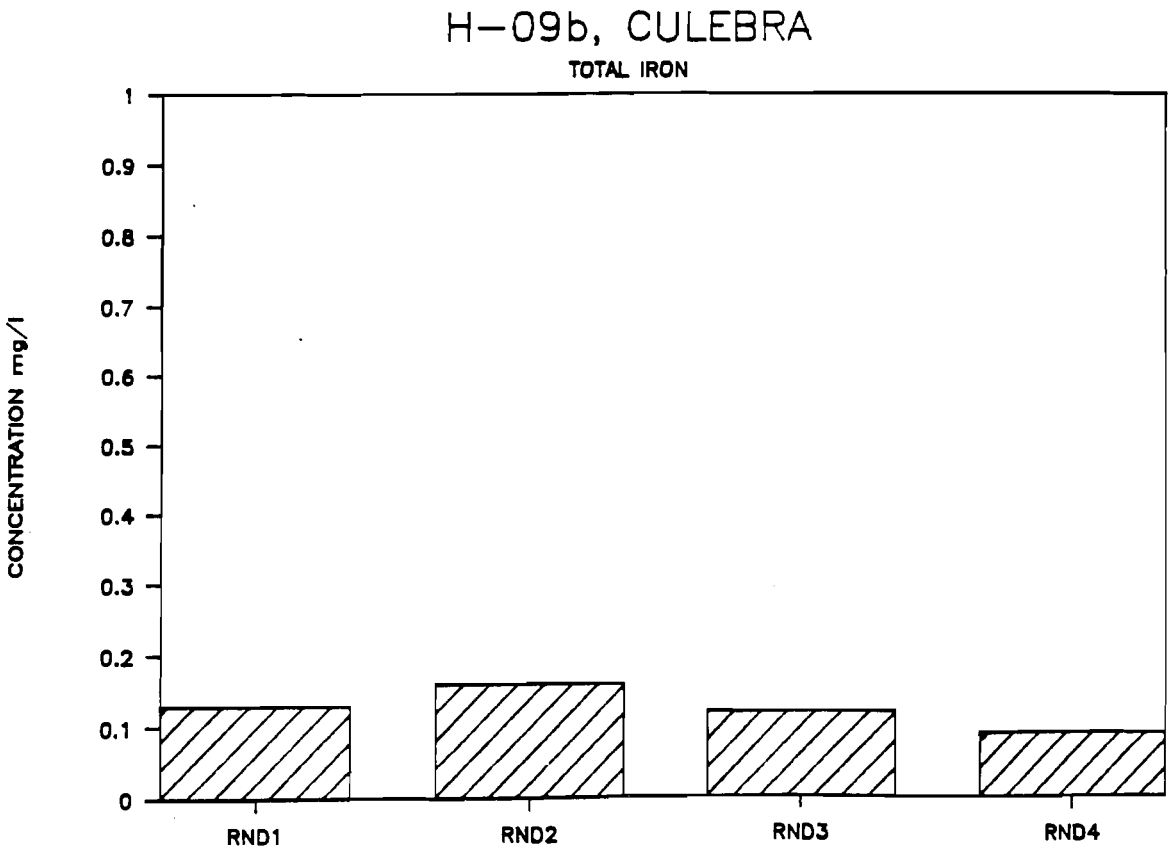

H-07b1, CULEBRA
SPECIFIC GRAVITY
g/cm3
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5

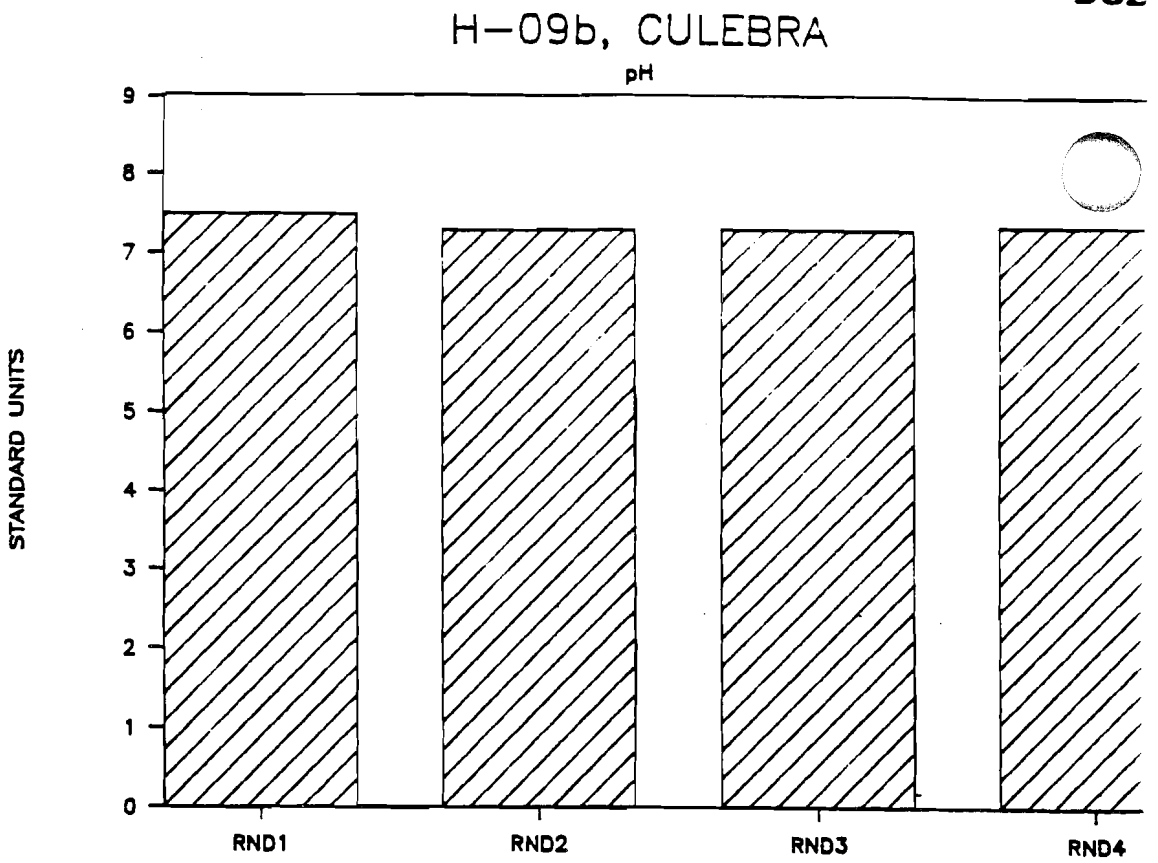

H-07b1, CULEBRA
TEMPERATURE
DEGREES CELCIUS
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
RND1
RND2
RND3
RND4
RND5

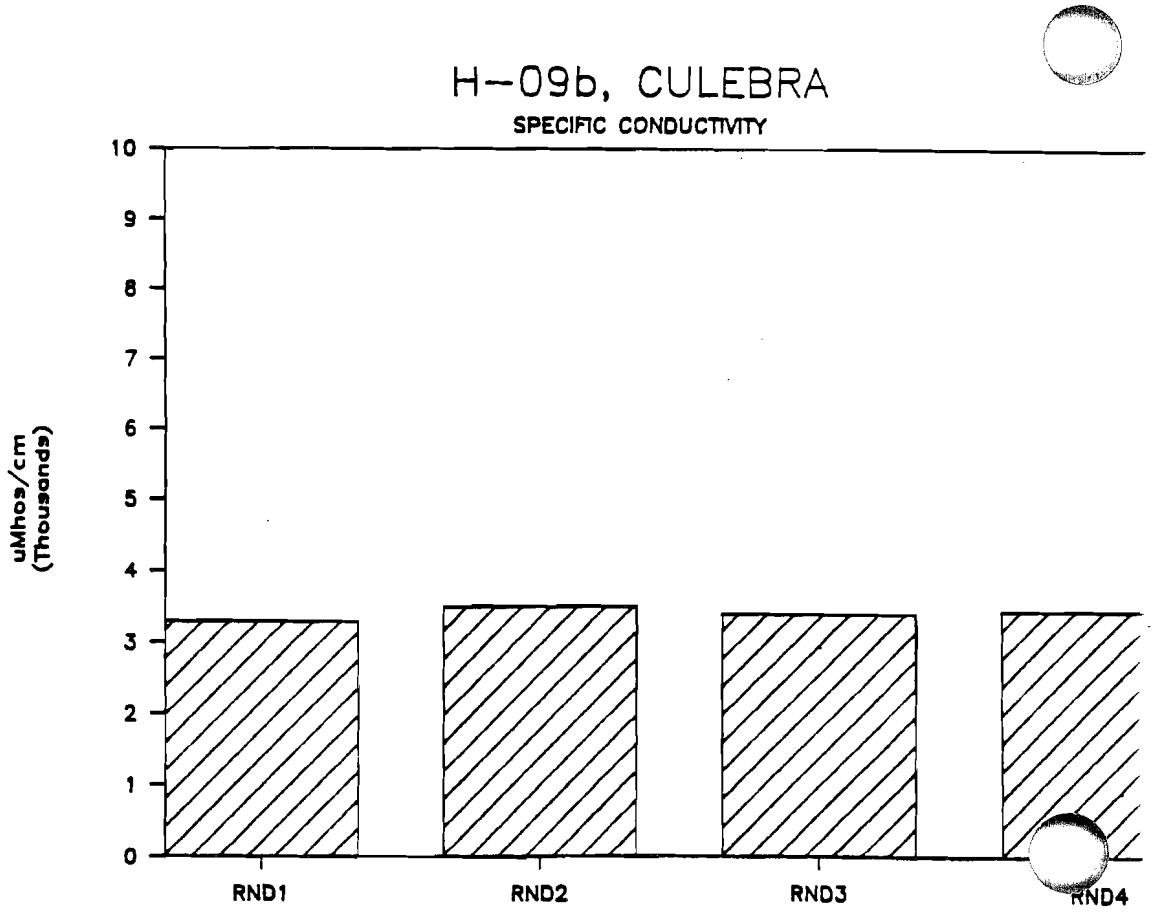

H-09b, CULEBRA
ALKALINITY
CONCENTRATION mg/l
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4

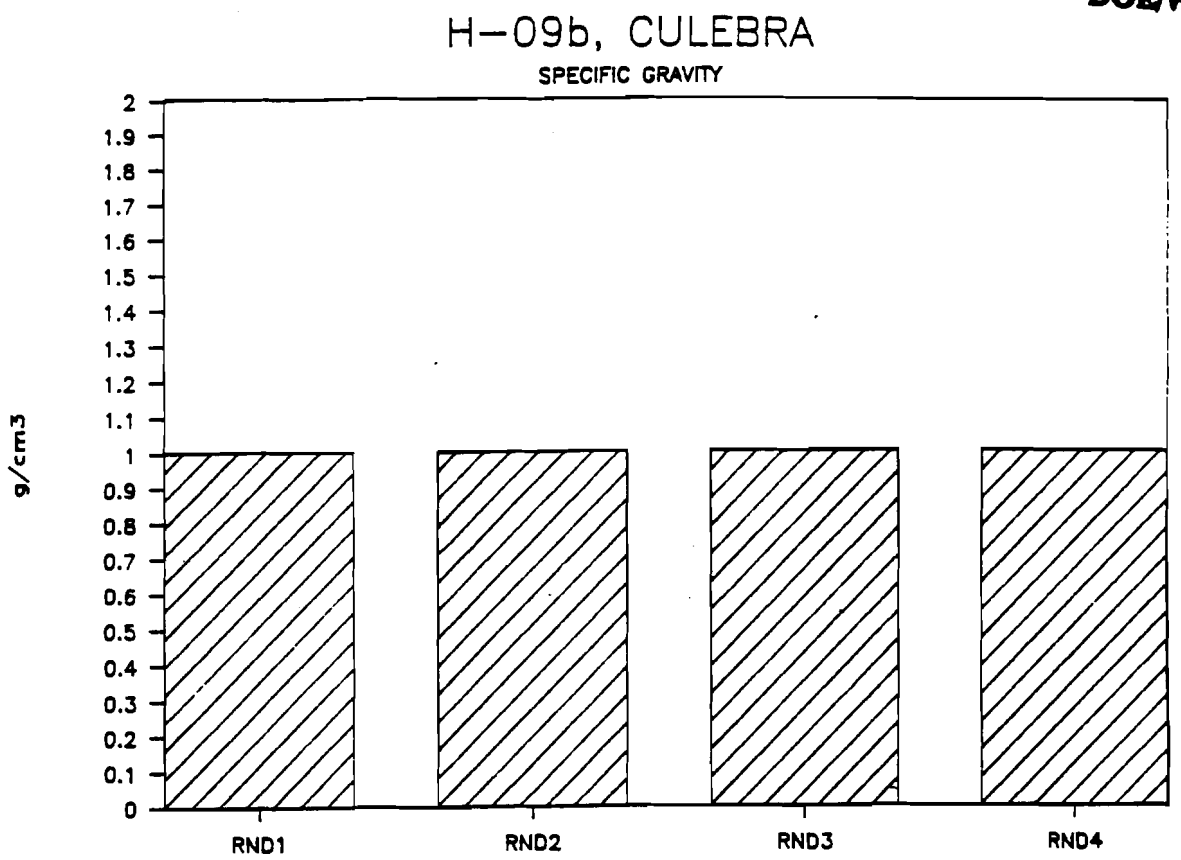

H-09b, CULEBRA
CHLORIDES
CONCENTRATION mg/l
(Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3

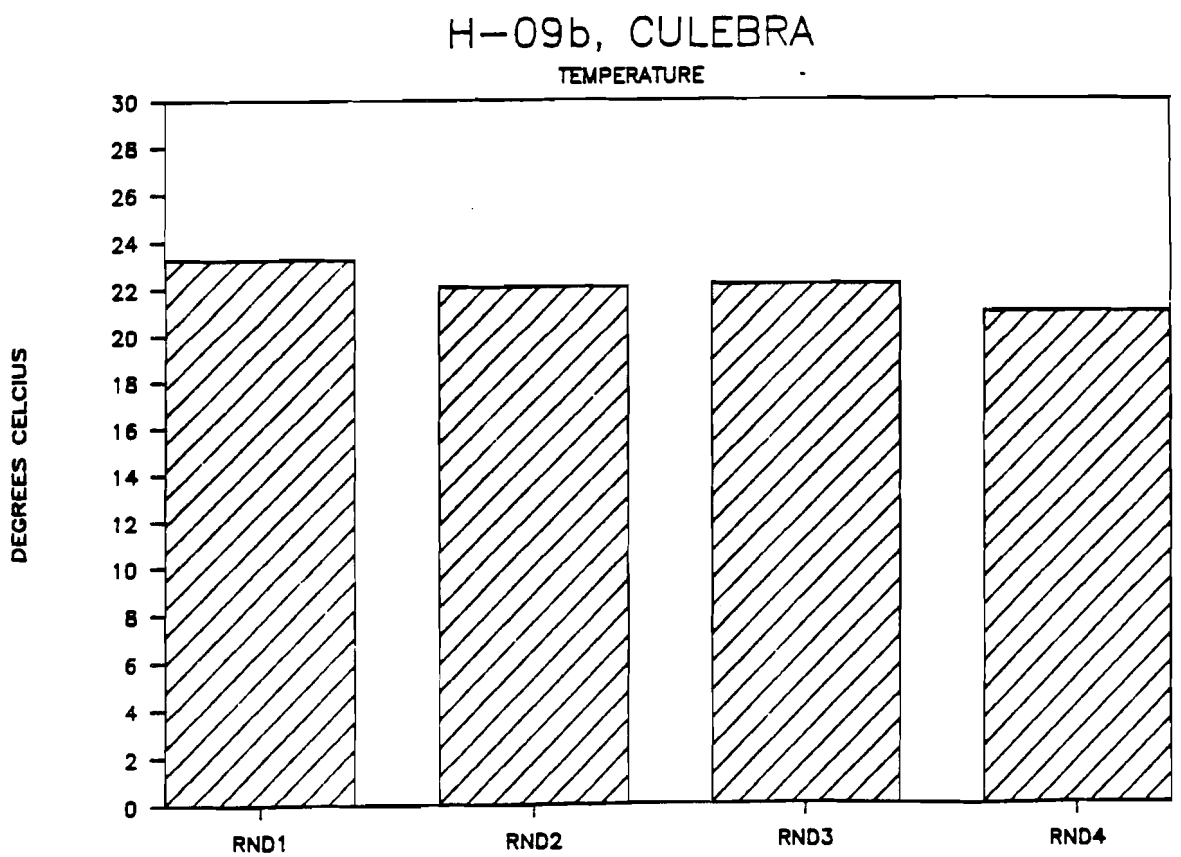

H-09b, CULEBRA
DIVALENT CATIONS
CONCENTRATION meq/l
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4

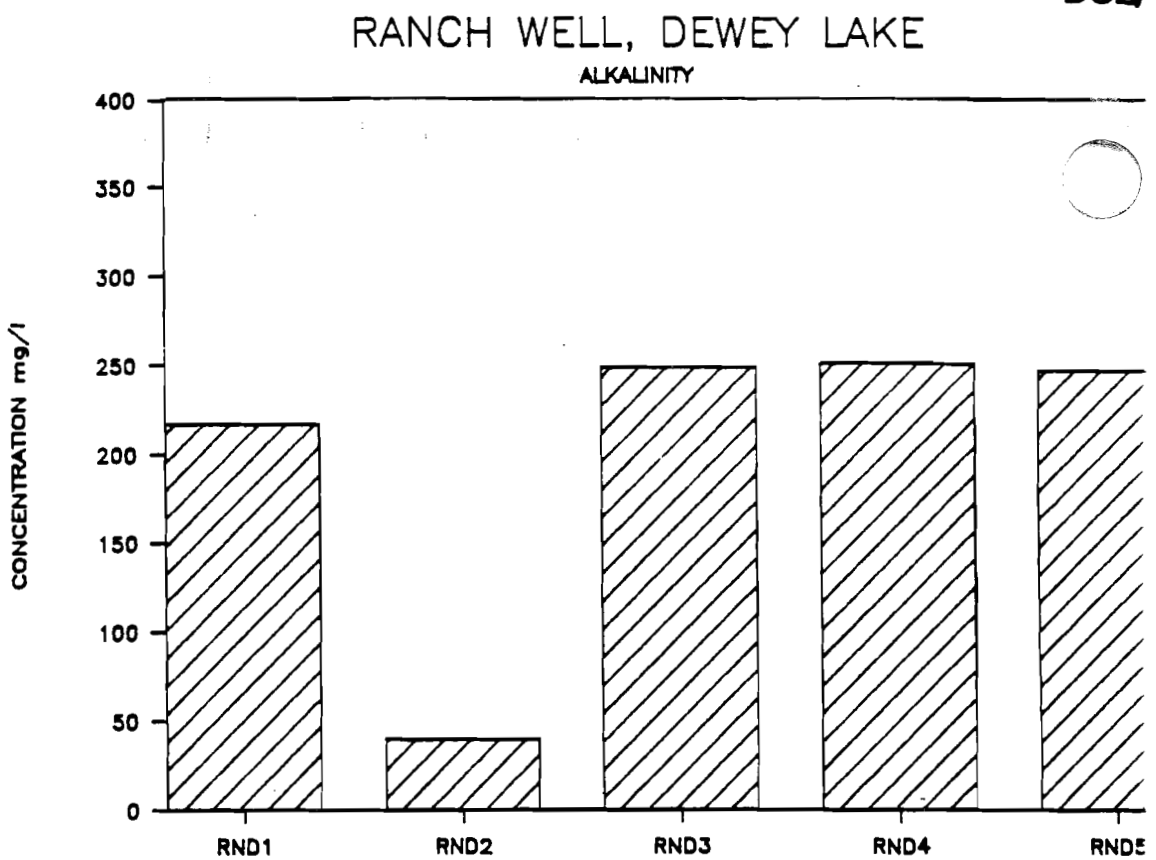

H-09b, CULEBRA
TOTAL IRON
CONCENTRATION mg/l
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4

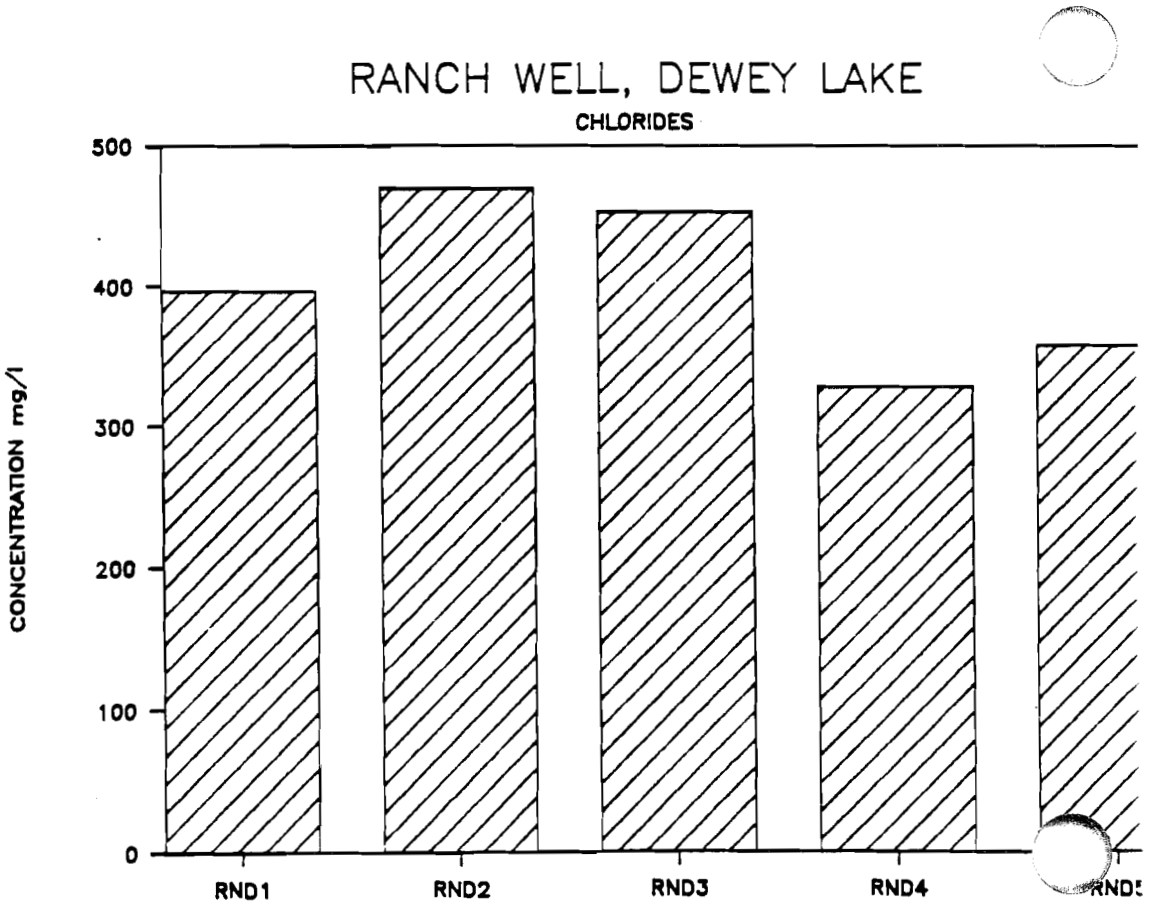

H-09b, CULEBRA
pH
STANDARD UNITS
0
1
2
3
4
5
6
7
8
9
RND1
RND2
RND3
RND4

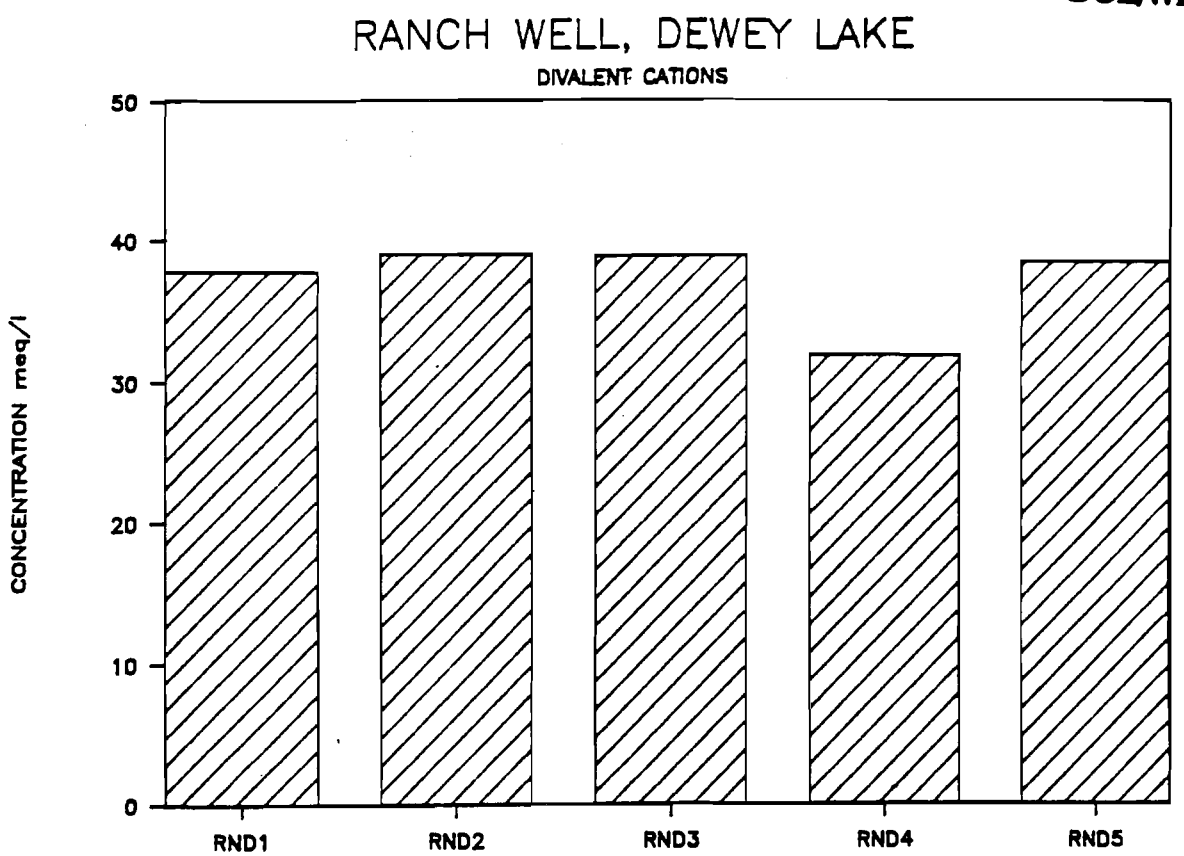

H-09b, CULEBRA
SPECIFIC CONDUCTIVITY
uMhos/cm
(Thousands)
0
1
2
3
4
5
6
7
8
9
10
RND1
RND2
RND3
RND4

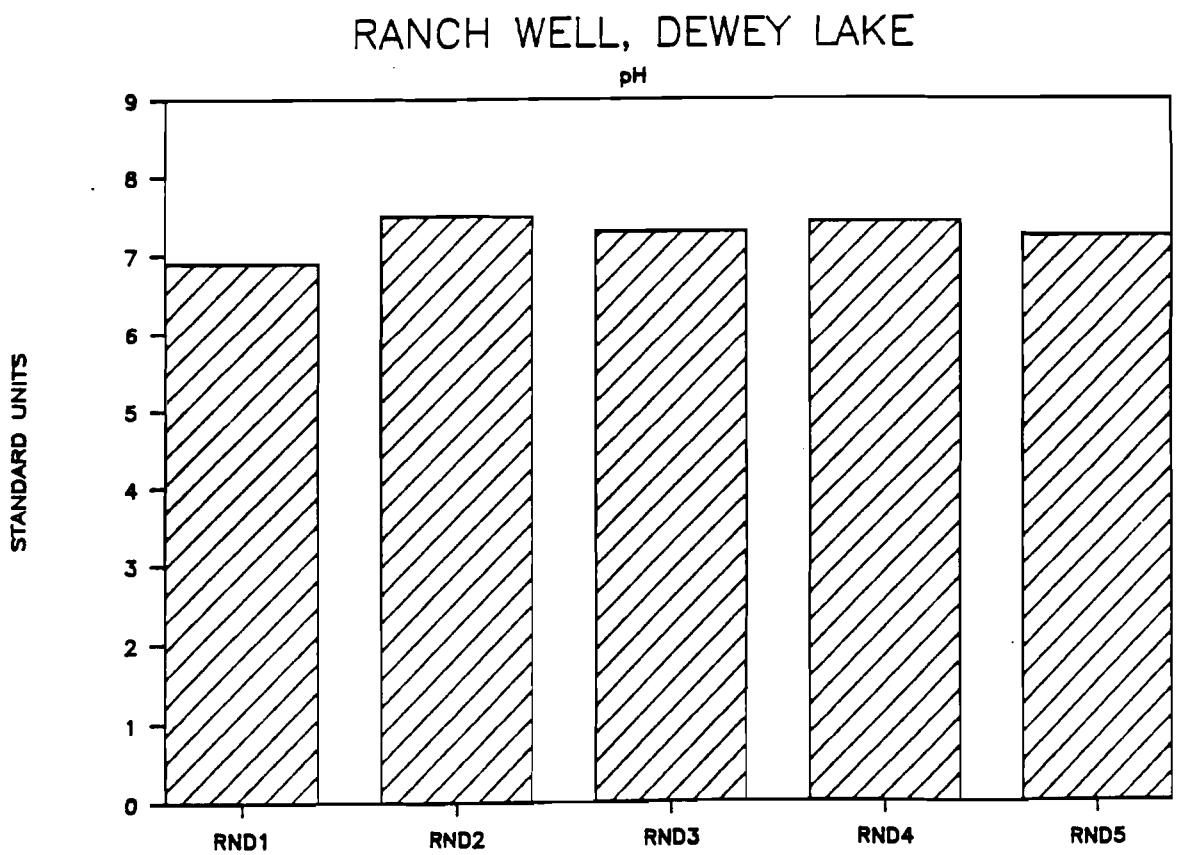

H-09b, CULEBRA
SPECIFIC GRAVITY
g/cm3
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4

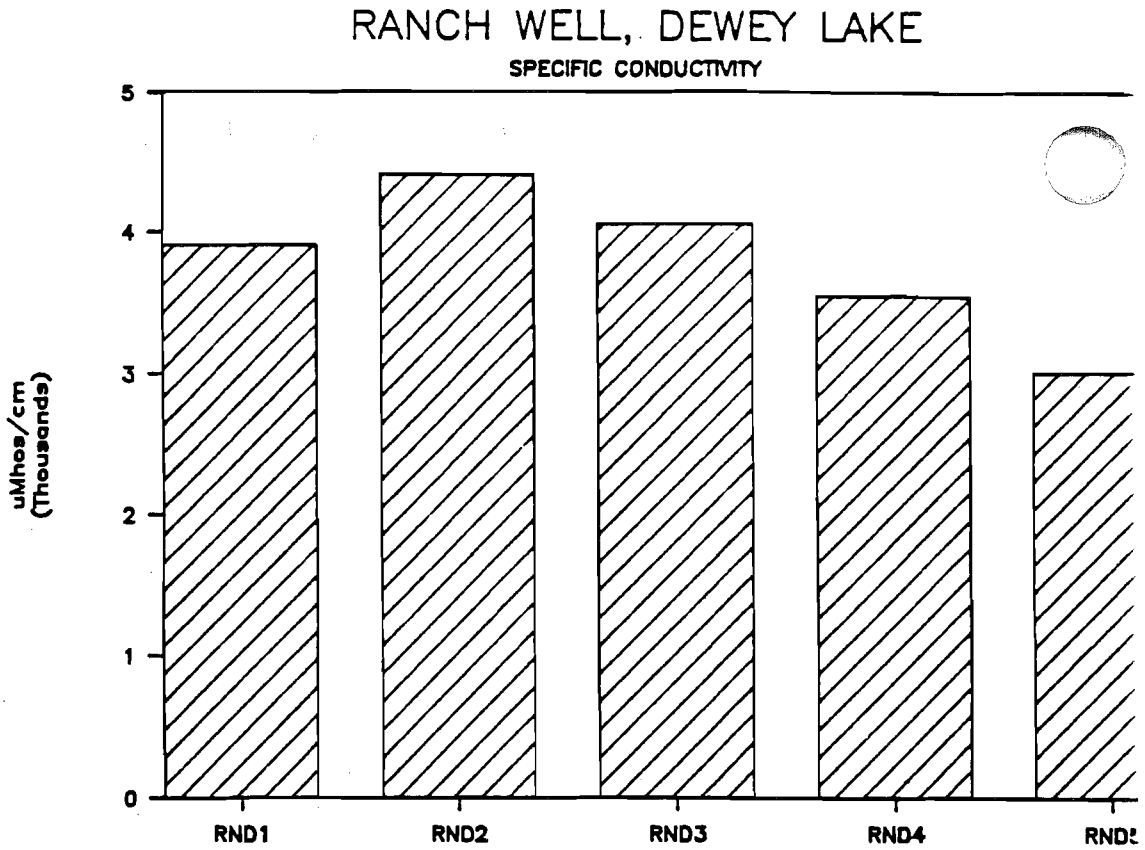

H-09b, CULEBRA
TEMPERATURE
DEGREES CELCIUS
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
RND1
RND2
RND3
RND4

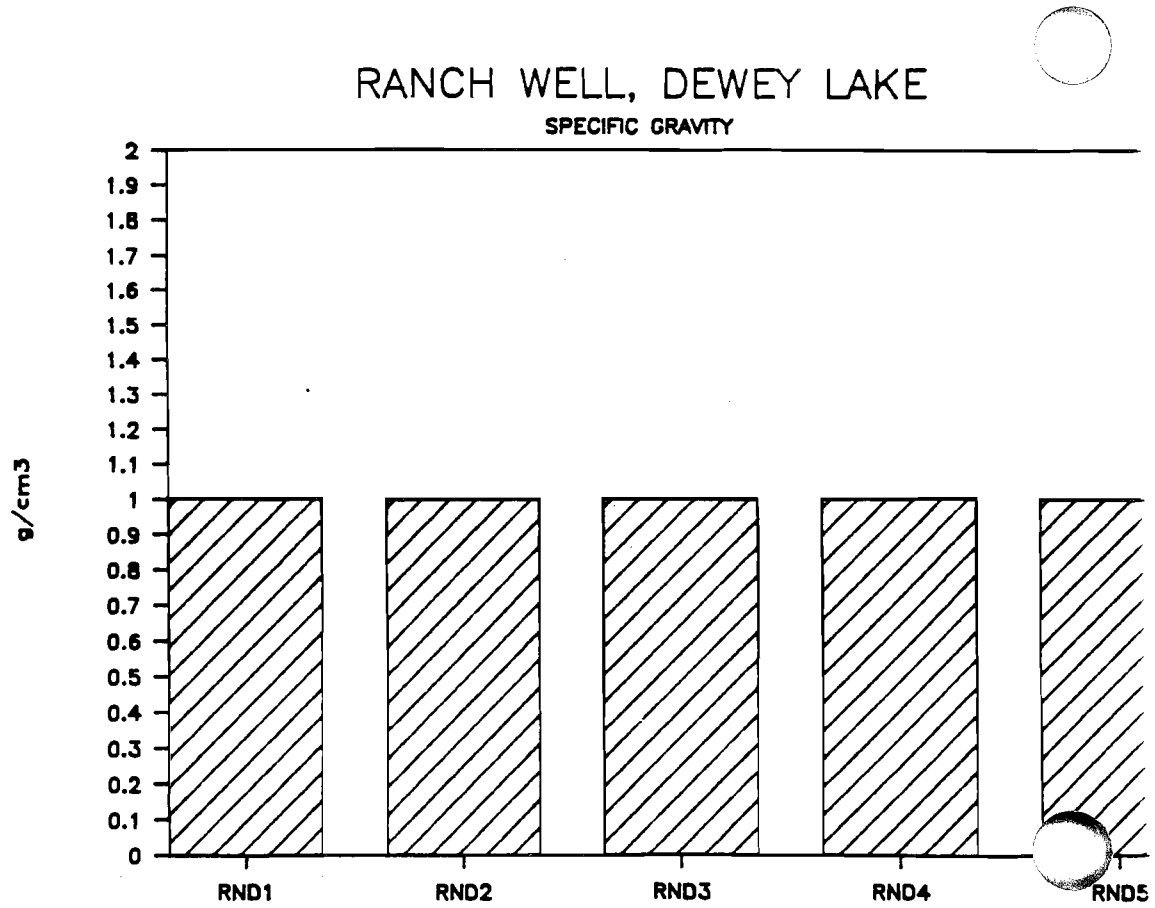

RANCH WELL, DEWEY LAKE
ALKALINITY
CONCENTRATION mg/l
400
350
300
250
200
150
100
50
0
RND1
RND2
RND3
RND4
RND5

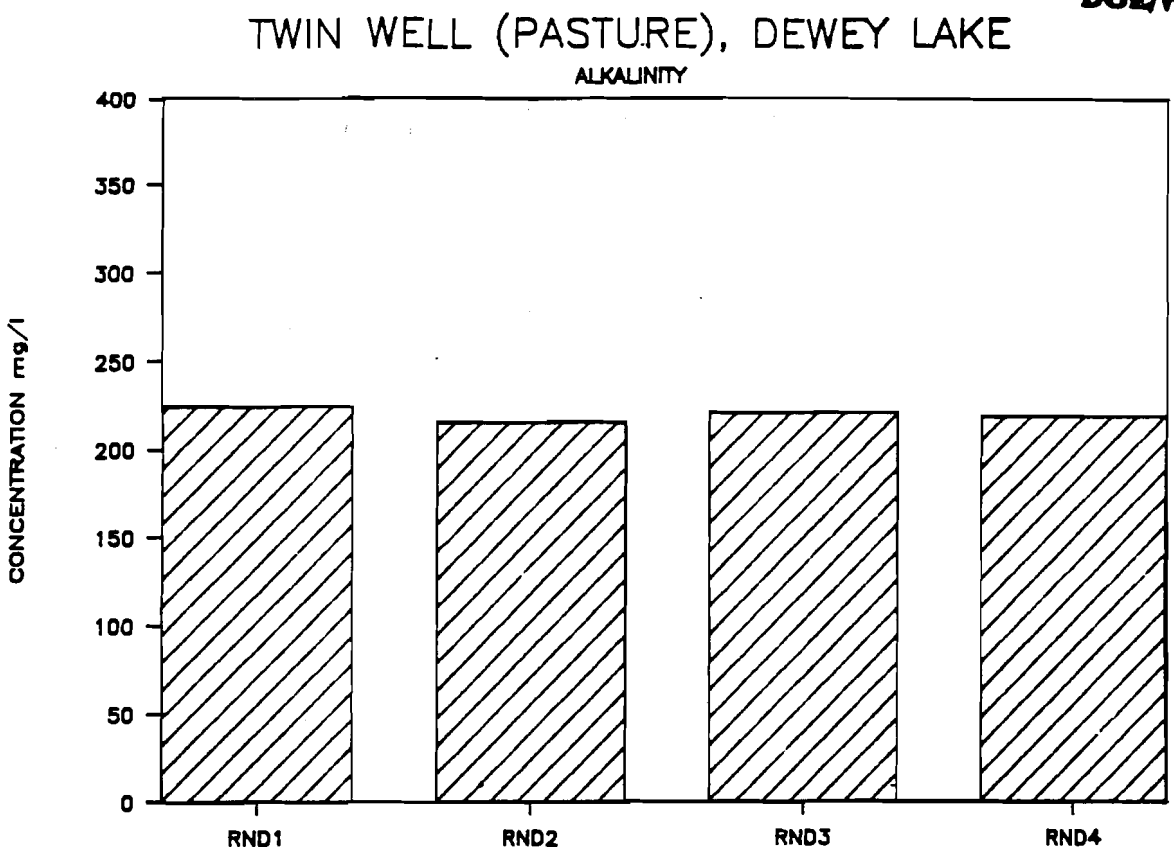

RANCH WELL, DEWEY LAKE
CHLORIDES
CONCENTRATION mg/l
500
400
300
200
100
0
RND1
RND2
RND3
RND4
RND5

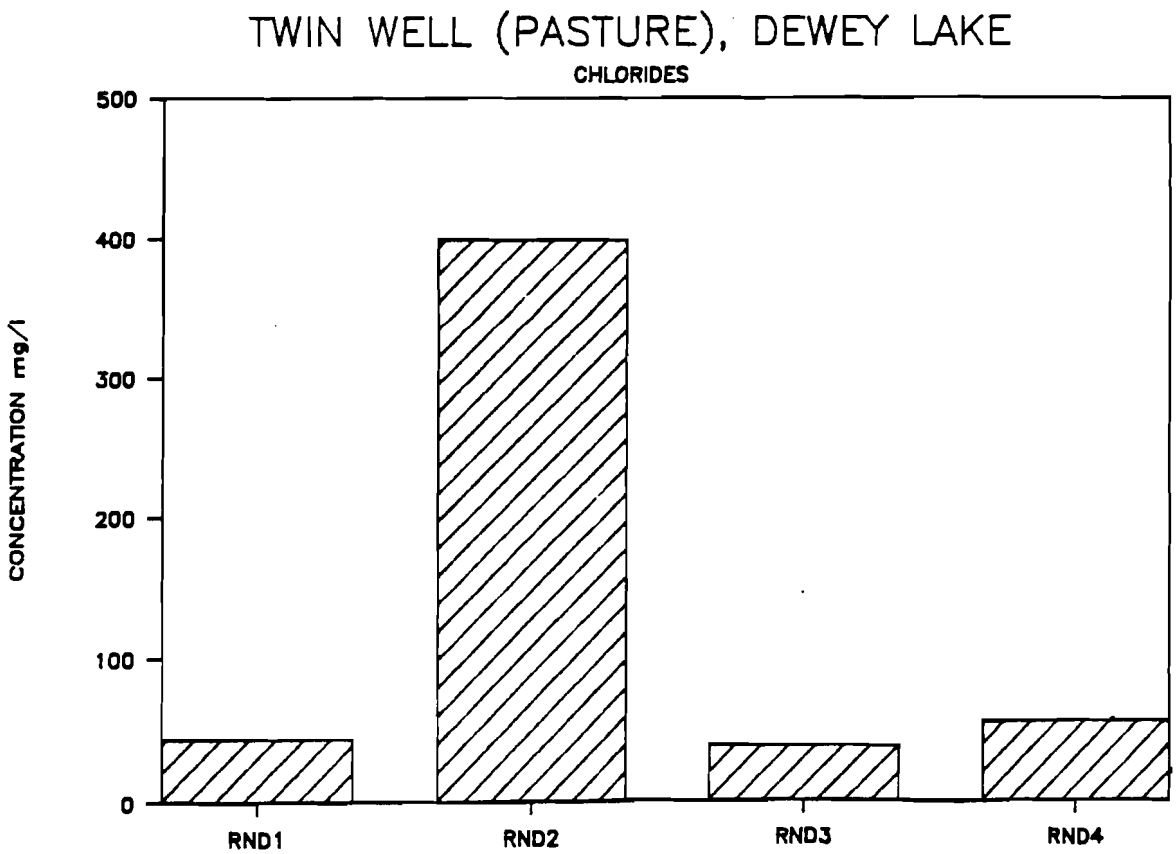

RANCH WELL, DEWEY LAKE
DIVALENT CATIONS
CONCENTRATION meq/l
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5

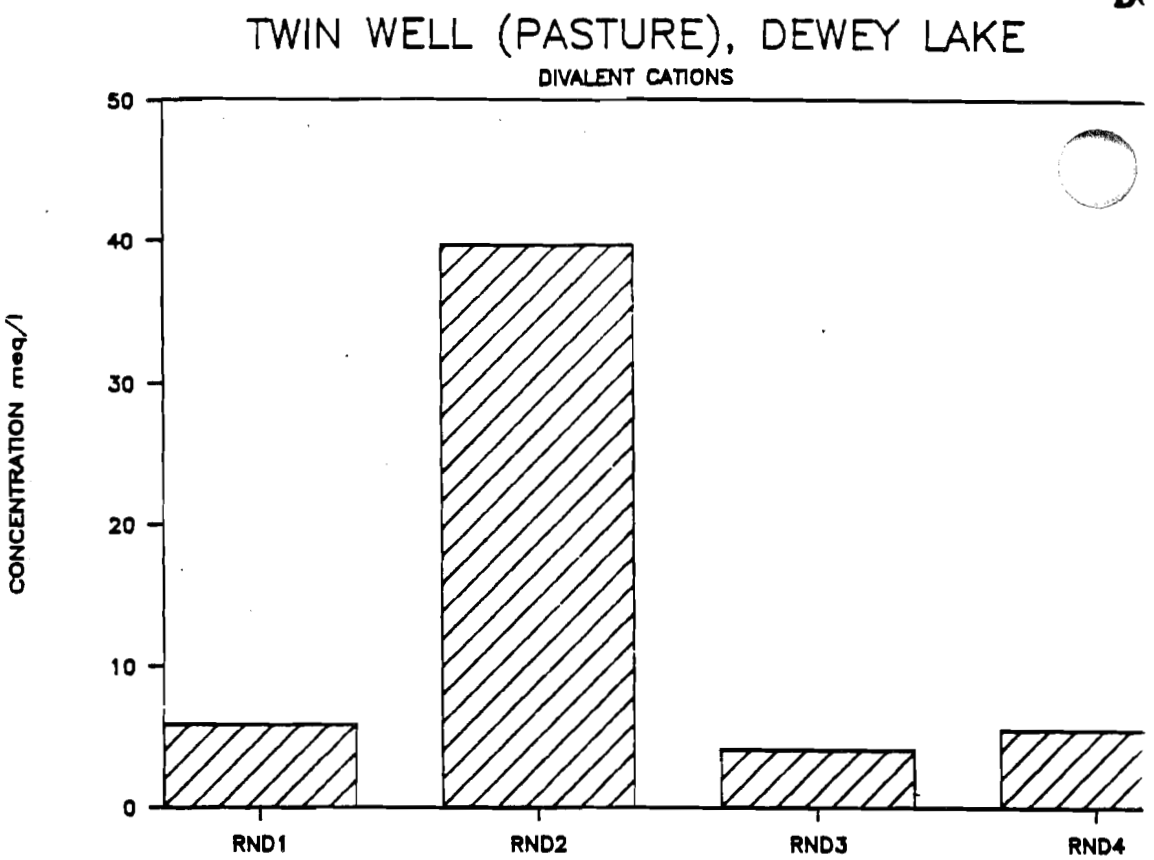

RANCH WELL, DEWEY LAKE
pH
STANDARD UNITS
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5

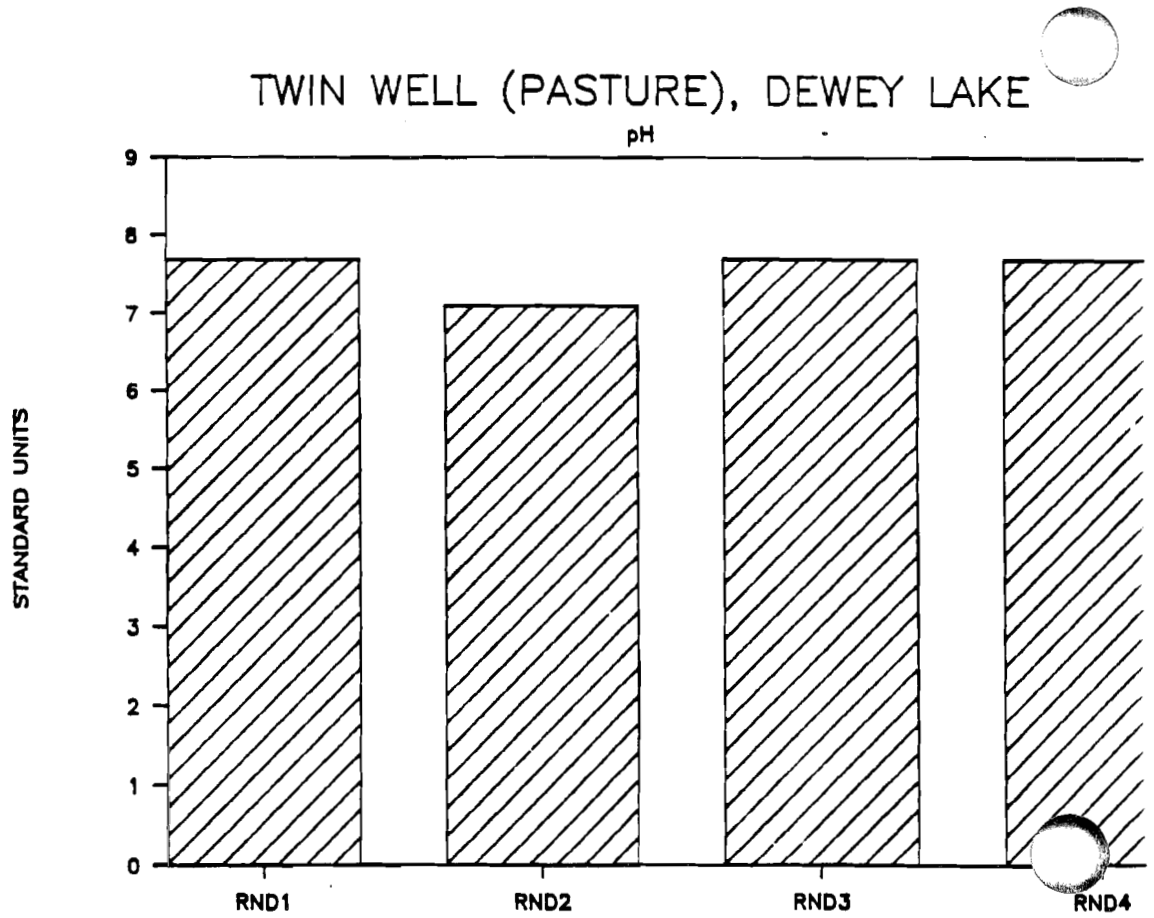

RANCH WELL, DEWEY LAKE
SPECIFIC CONDUCTIVITY
uMhos/cm (Thousands)
0
1
2
3
4
5
RND1
RND2
RND3
RND4
RND5

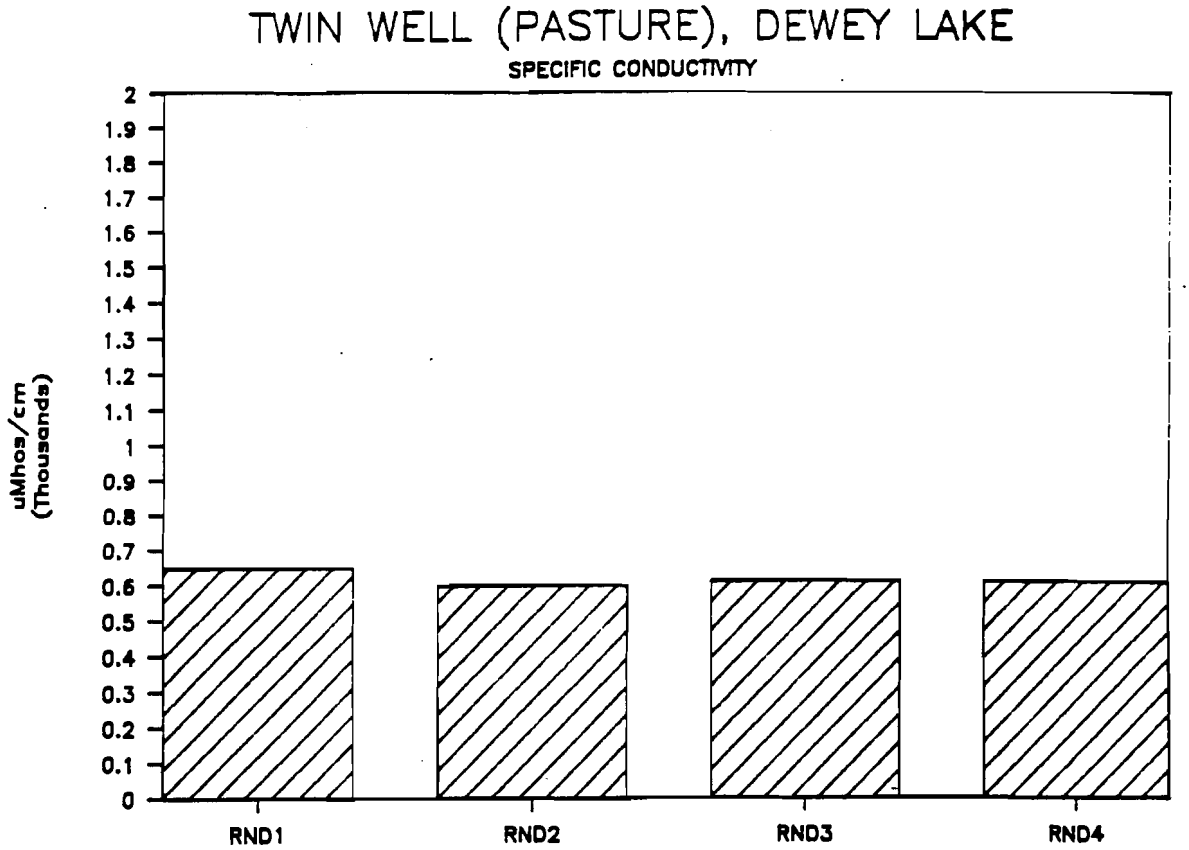

RANCH WELL, DEWEY LAKE
SPECIFIC GRAVITY
g/cm3
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2
RND1
RND2
RND3
RND4
RND5

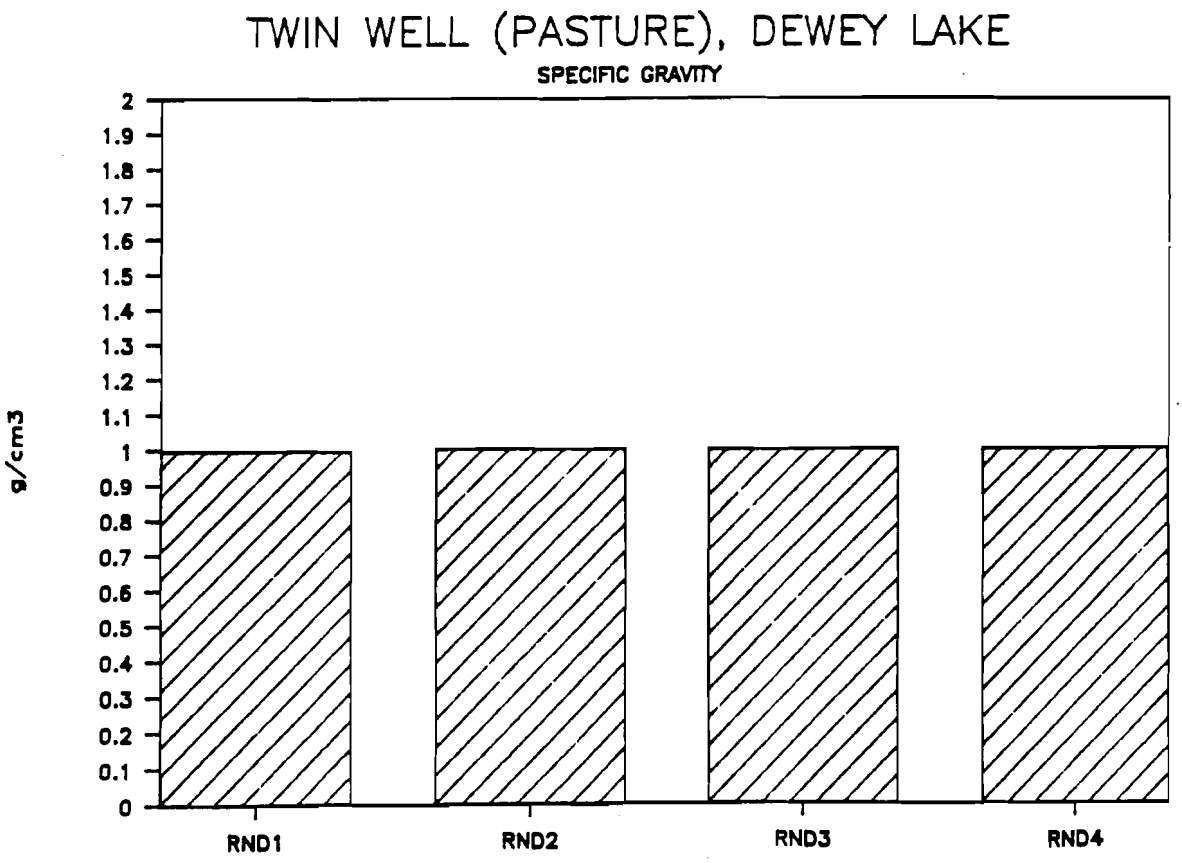

TWIN WELL (PASTURE), DEWEY LAKE
ALKALINITY
CONCENTRATION mg/l
400
350
300
250
200
150
100
50
0
RND1
RND2
RND3
RND4

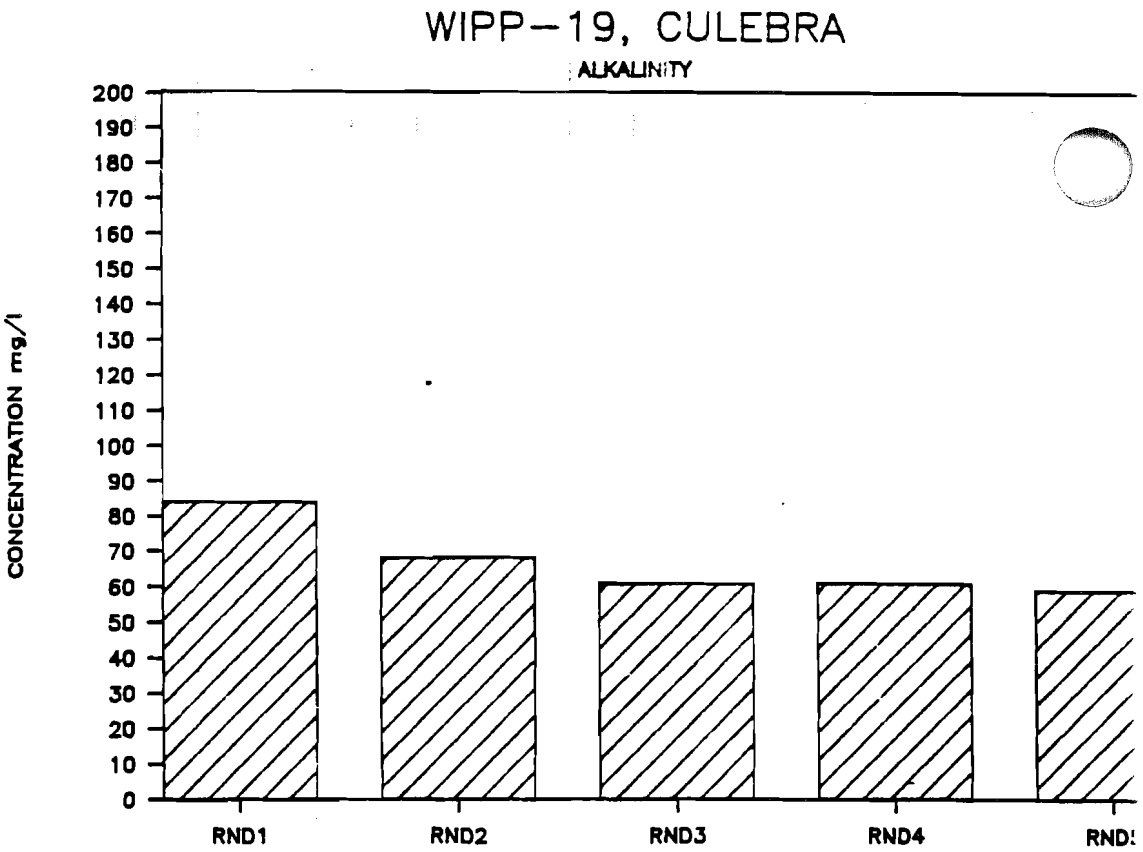

TWIN WELL (PASTURE), DEWEY LAKE
CHLORIDES
CONCENTRATION mg/l
500
400
300
200
100
0
RND1
RND2
RND3
RND4

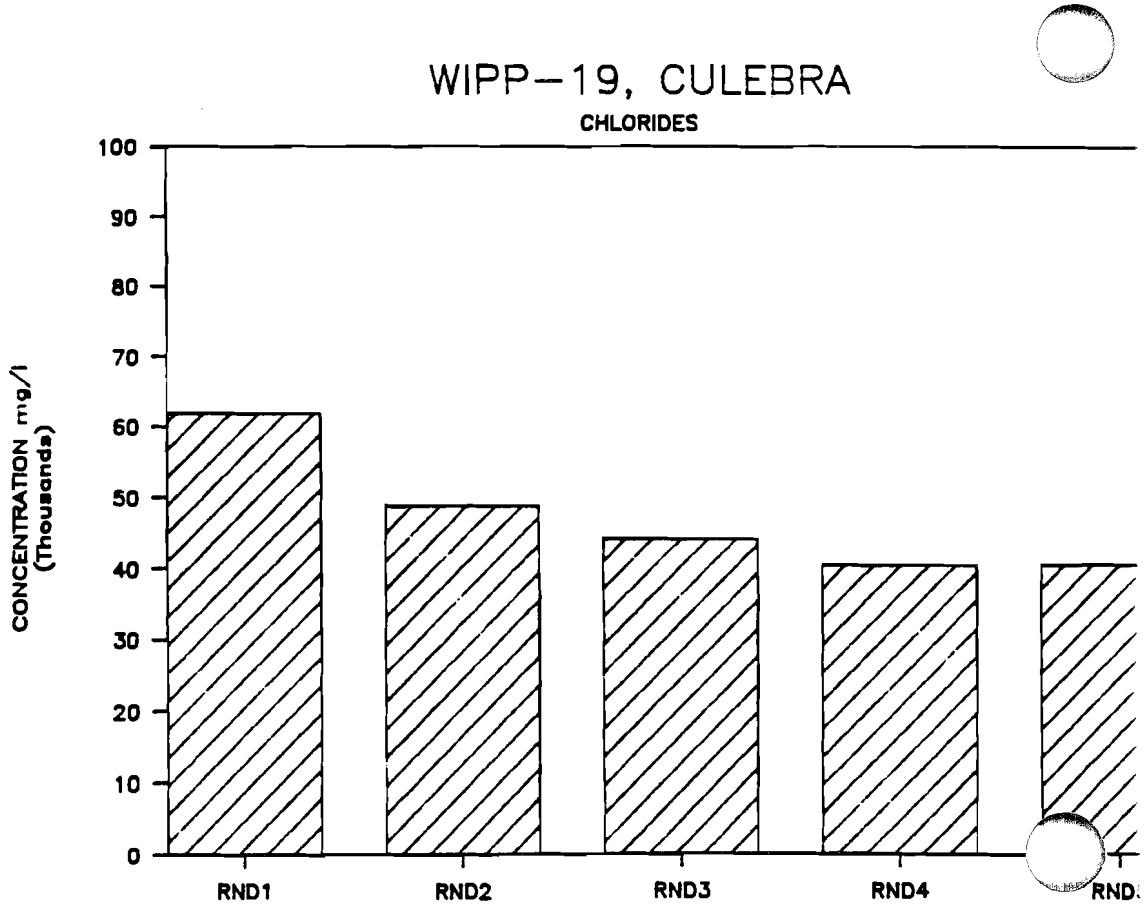

TWIN WELL (PASTURE), DEWEY LAKE
DIVALENT CATIONS
CONCENTRATION meq/l
50
40
30
20
10
0
RND1
RND2
RND3
RND4

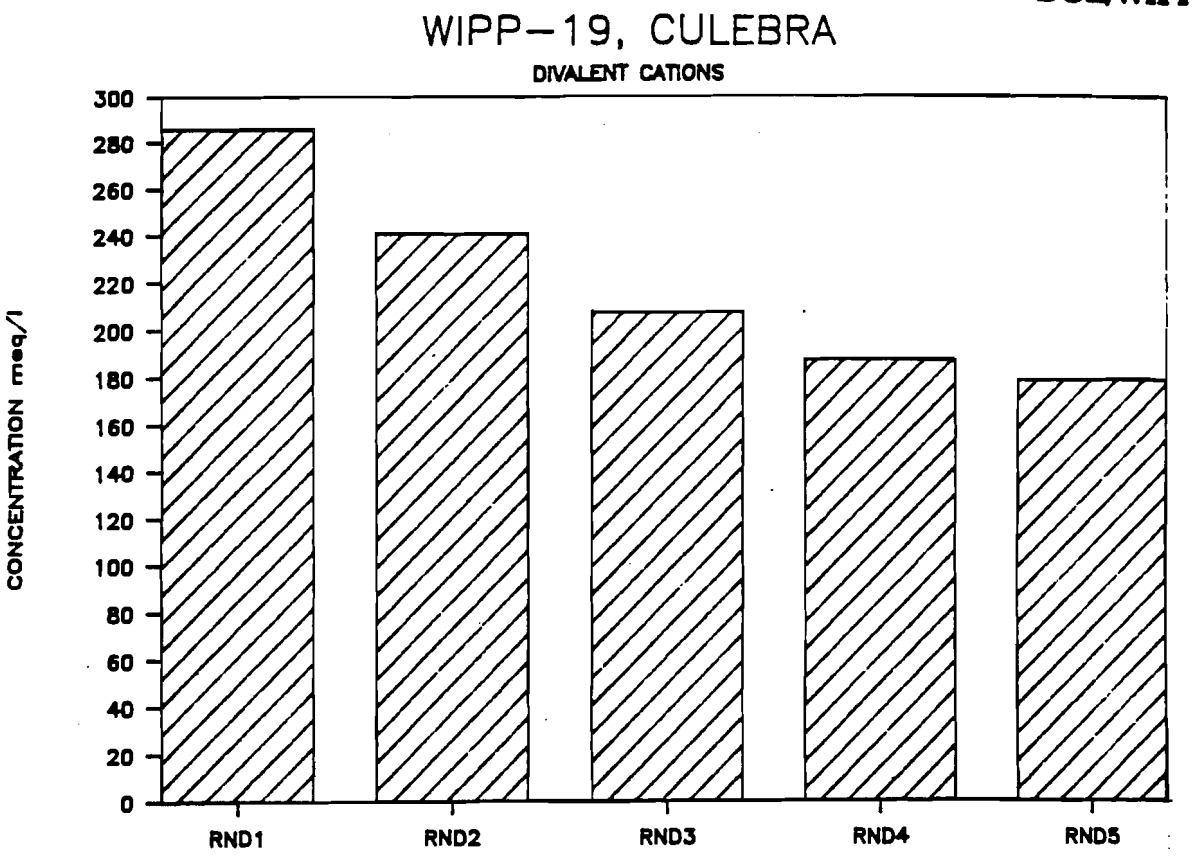

TWIN WELL (PASTURE), DEWEY LAKE
pH
STANDARD UNITS
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4

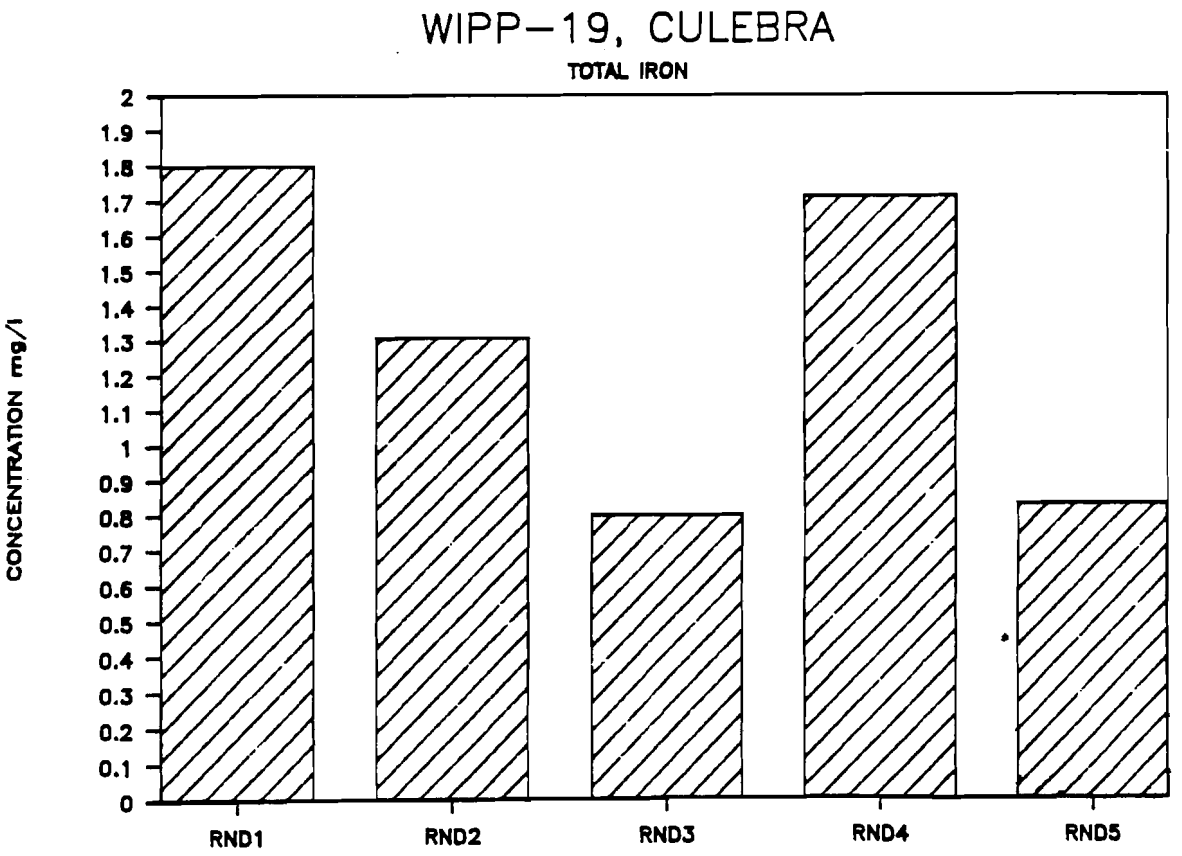

TWIN WELL (PASTURE), DEWEY LAKE
SPECIFIC CONDUCTIVITY
uMhos/cm
(Thousands)
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4

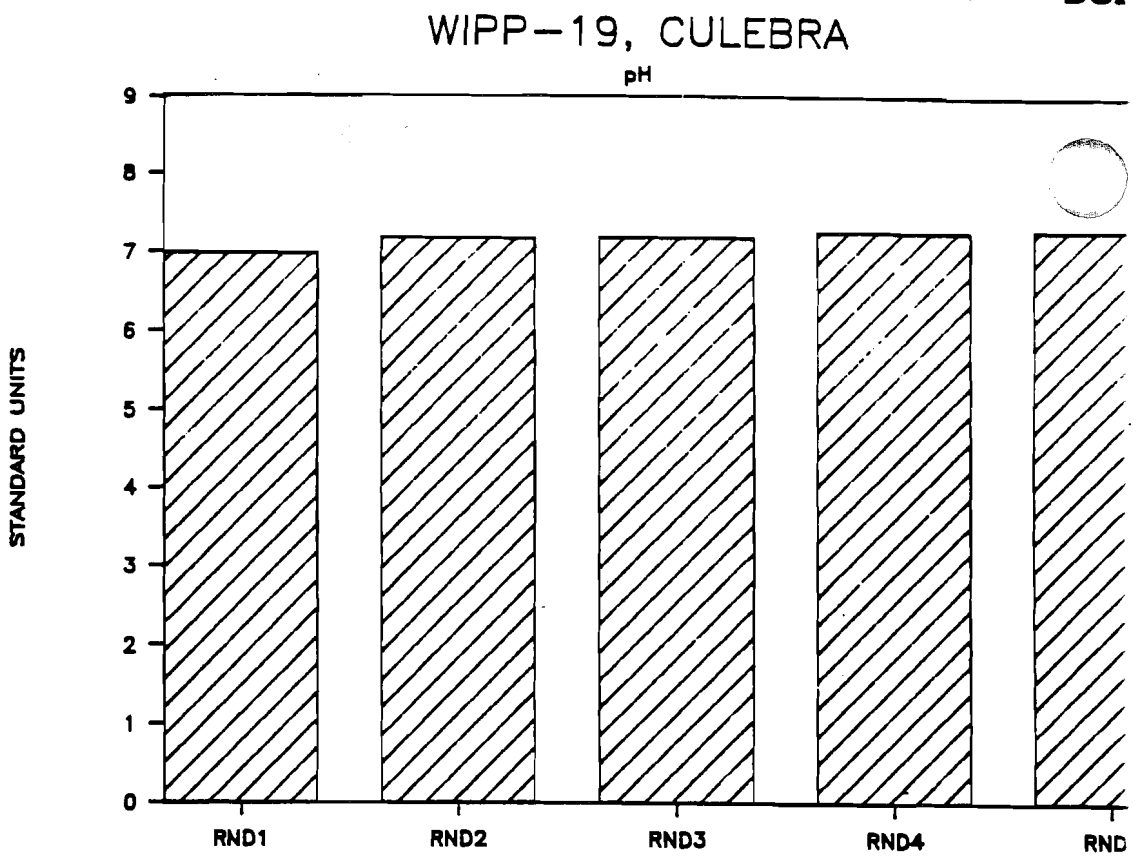

TWIN WELL (PASTURE), DEWEY LAKE
SPECIFIC GRAVITY
g/cm3
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4

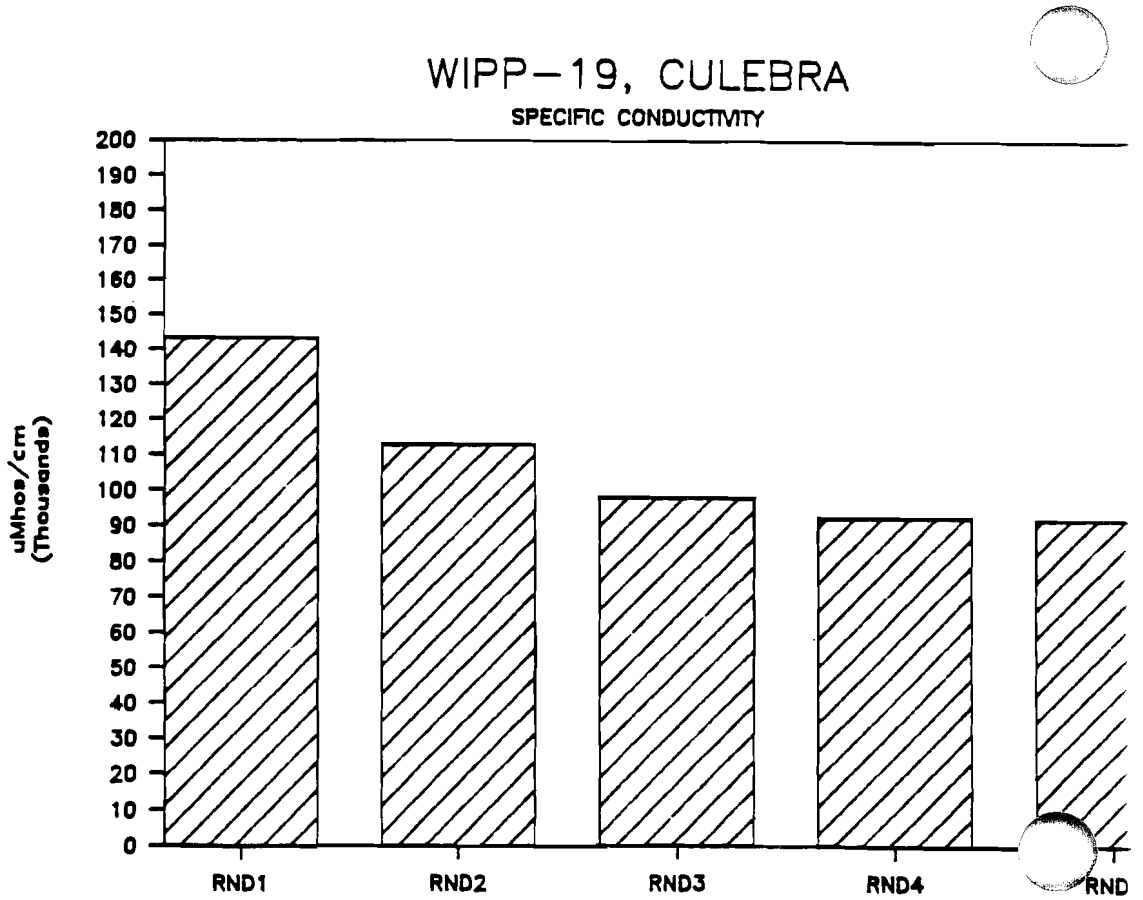

WIPP-19, CULEBRA
ALKALINITY
CONCENTRATION mg/l
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5

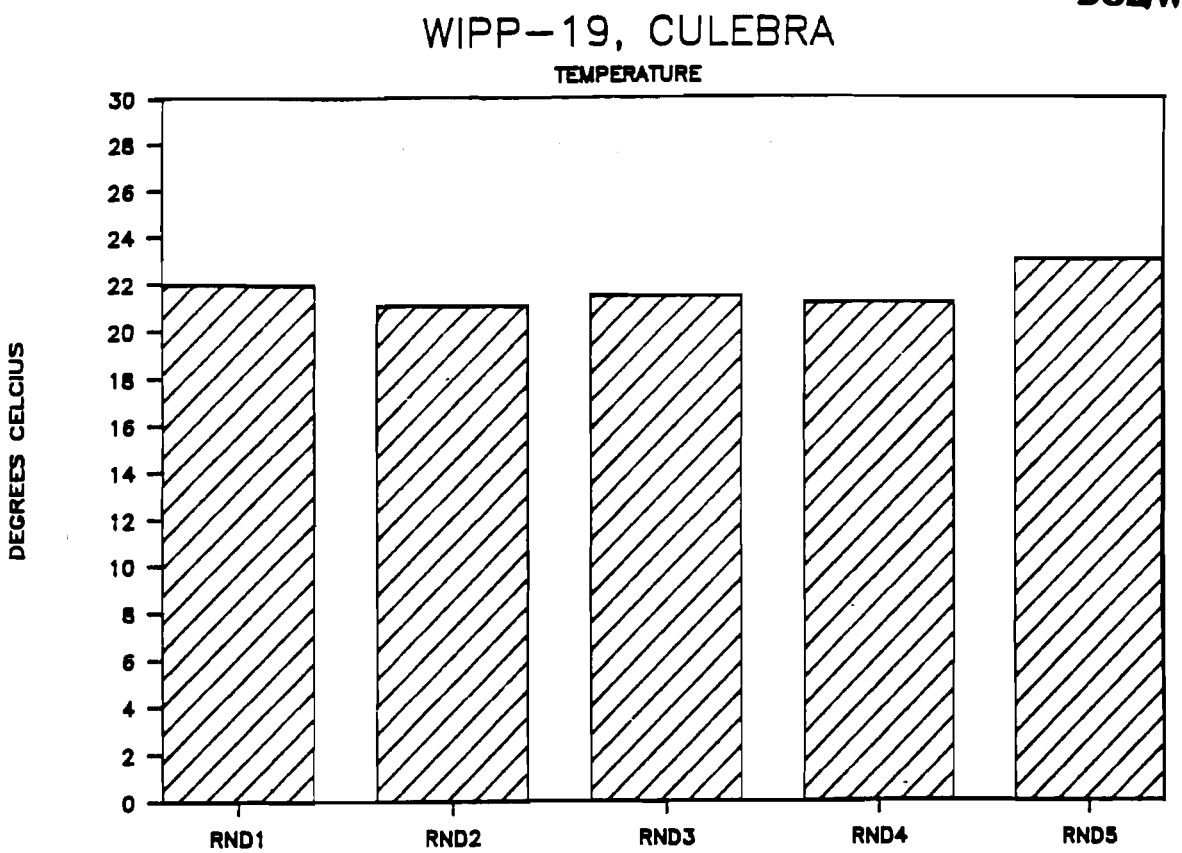

WIPP-19, CULEBRA
CHLORIDES
CONCENTRATION mg/l
(Thousands)
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5

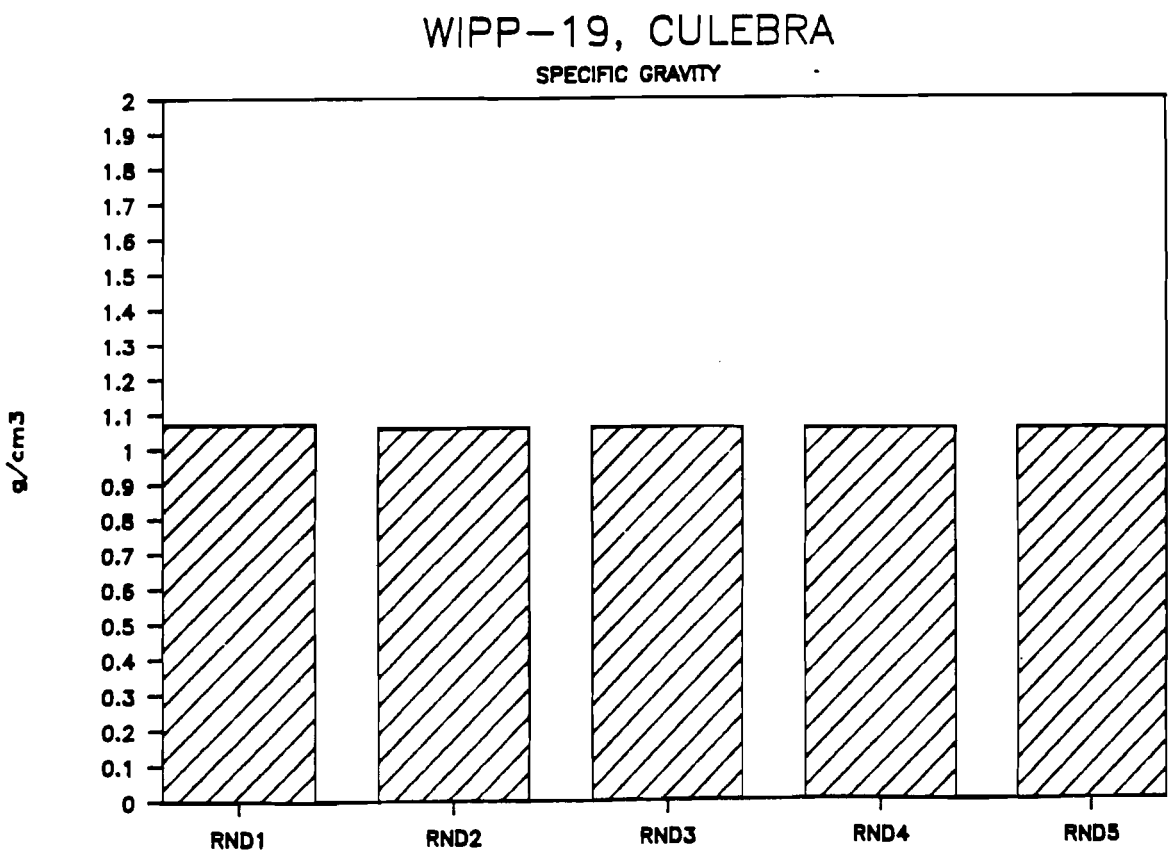

WIPP-19, CULEBRA
DIVALENT CATIONS
CONCENTRATION meq/l
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
RND1
RND2
RND3
RND4
RND5


WIPP-19, CULEBRA
TOTAL IRON
CONCENTRATION mg/l
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5


WIPP-19, CULEBRA
pH
STANDARD UNITS
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND


WIPP-19, CULEBRA
SPECIFIC CONDUCTIVITY
uMhos/cm
(Thousands)
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND


WIPP-19, CULEBRA
TEMPERATURE
DEGREES CELCIUS
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
RND1
RND2
RND3
RND4
RND5


WIPP-19, CULEBRA
SPECIFIC GRAVITY
g/cm3
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5

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APPENDIX IX
MAJOR CATION AND ANION GRAPHS

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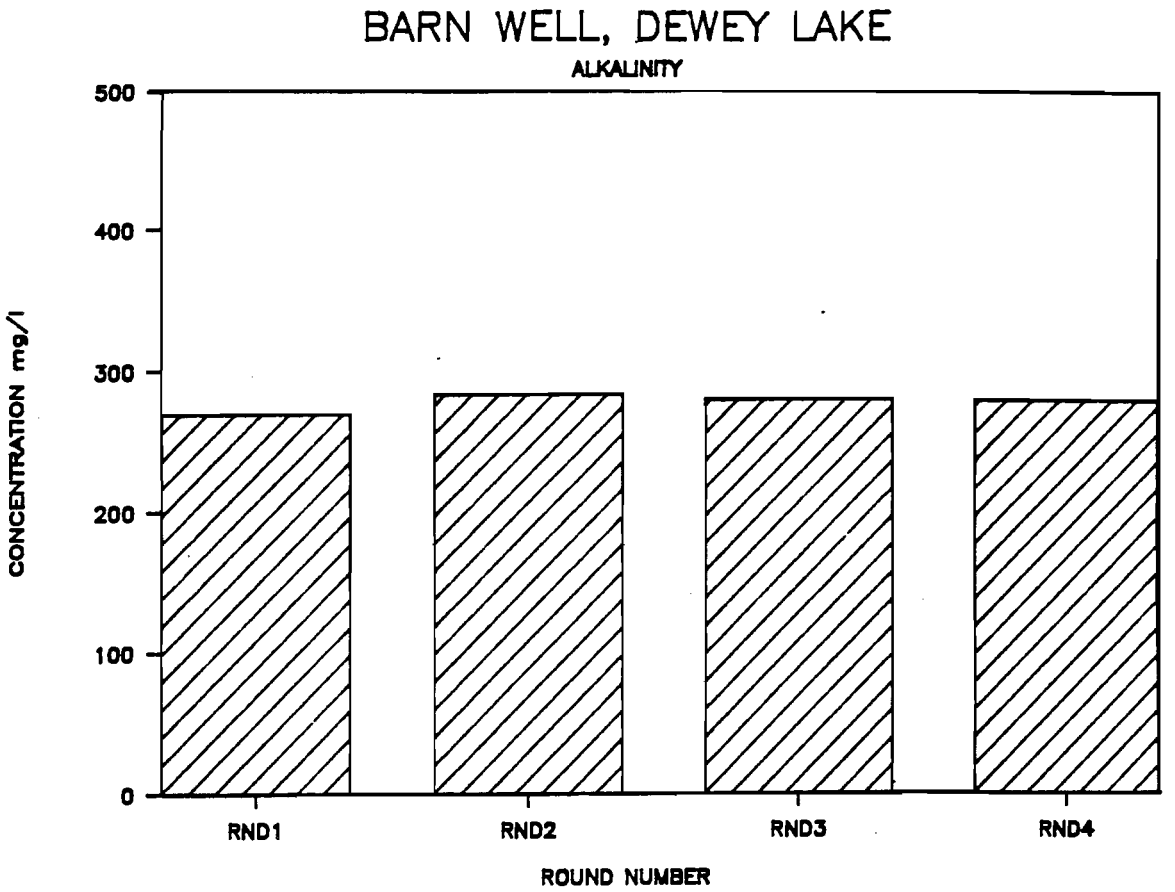
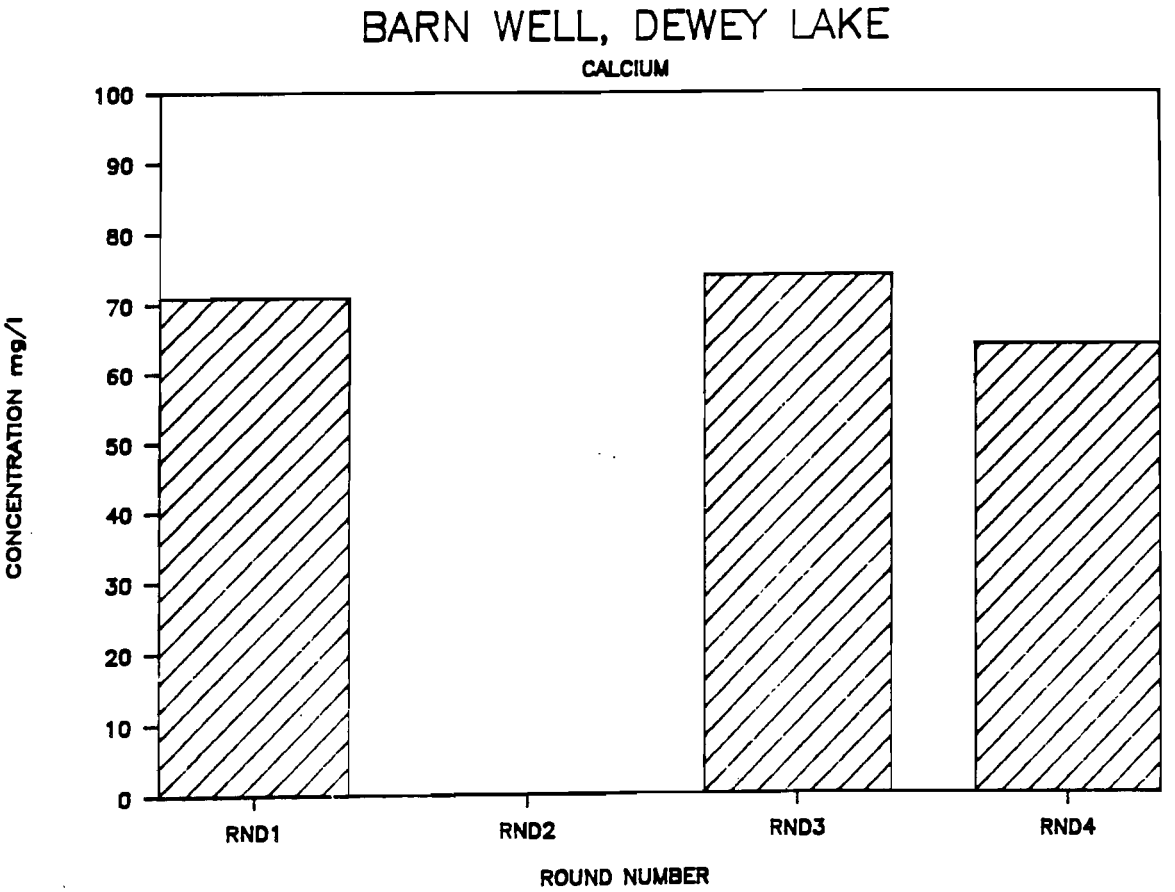
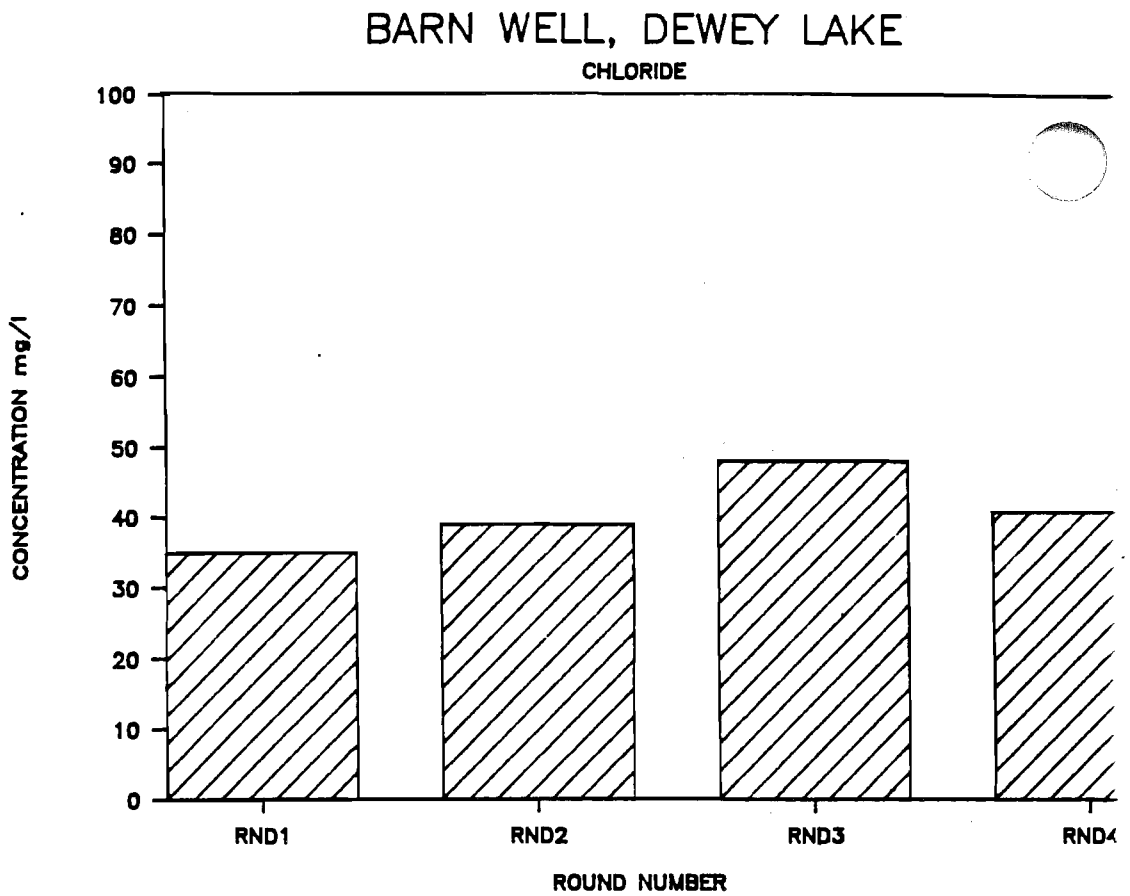
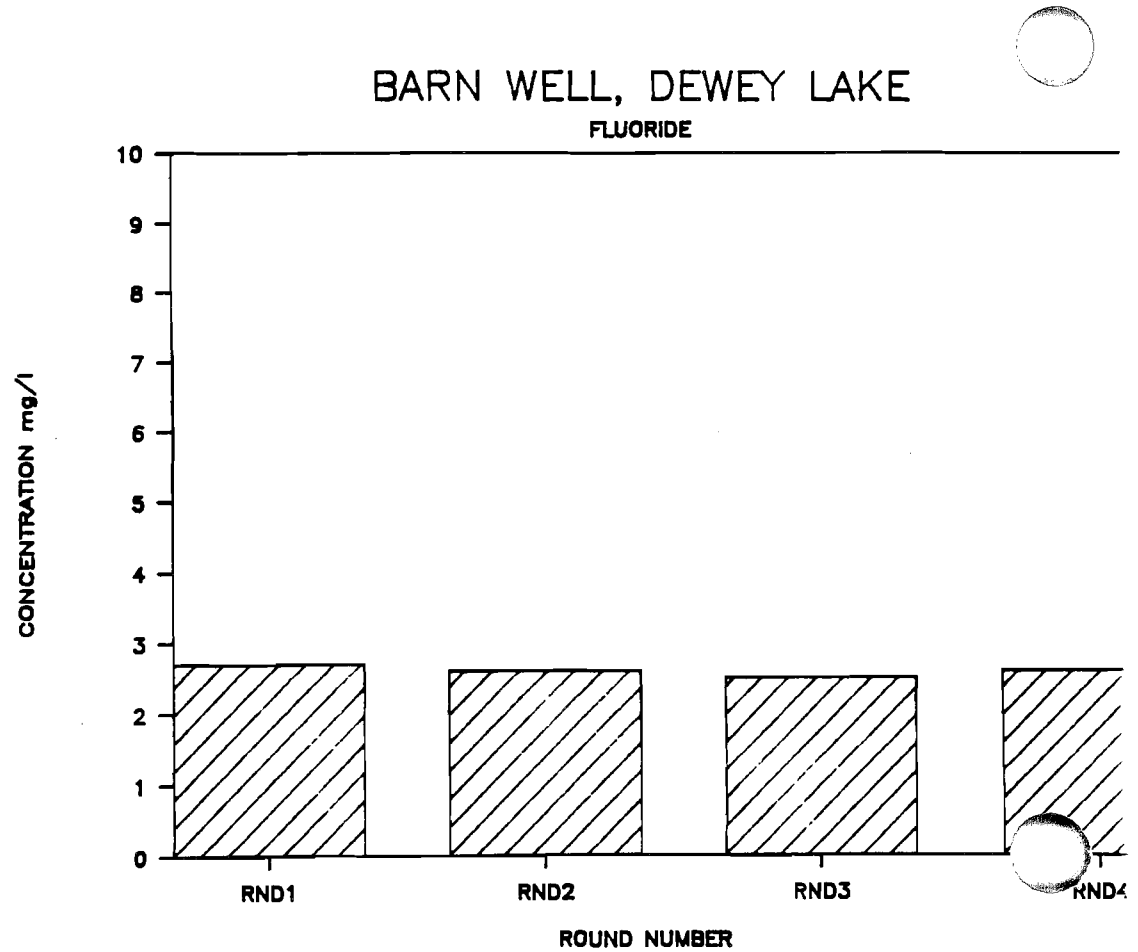
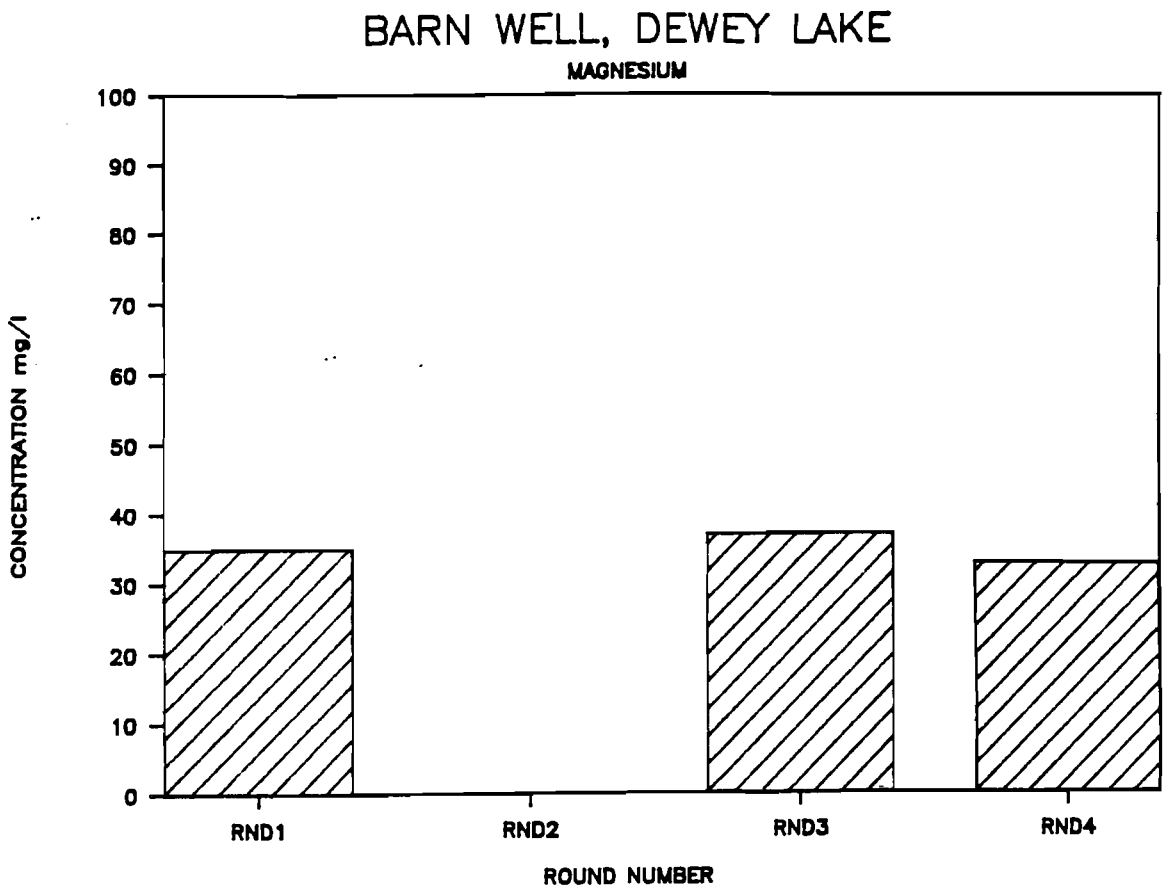
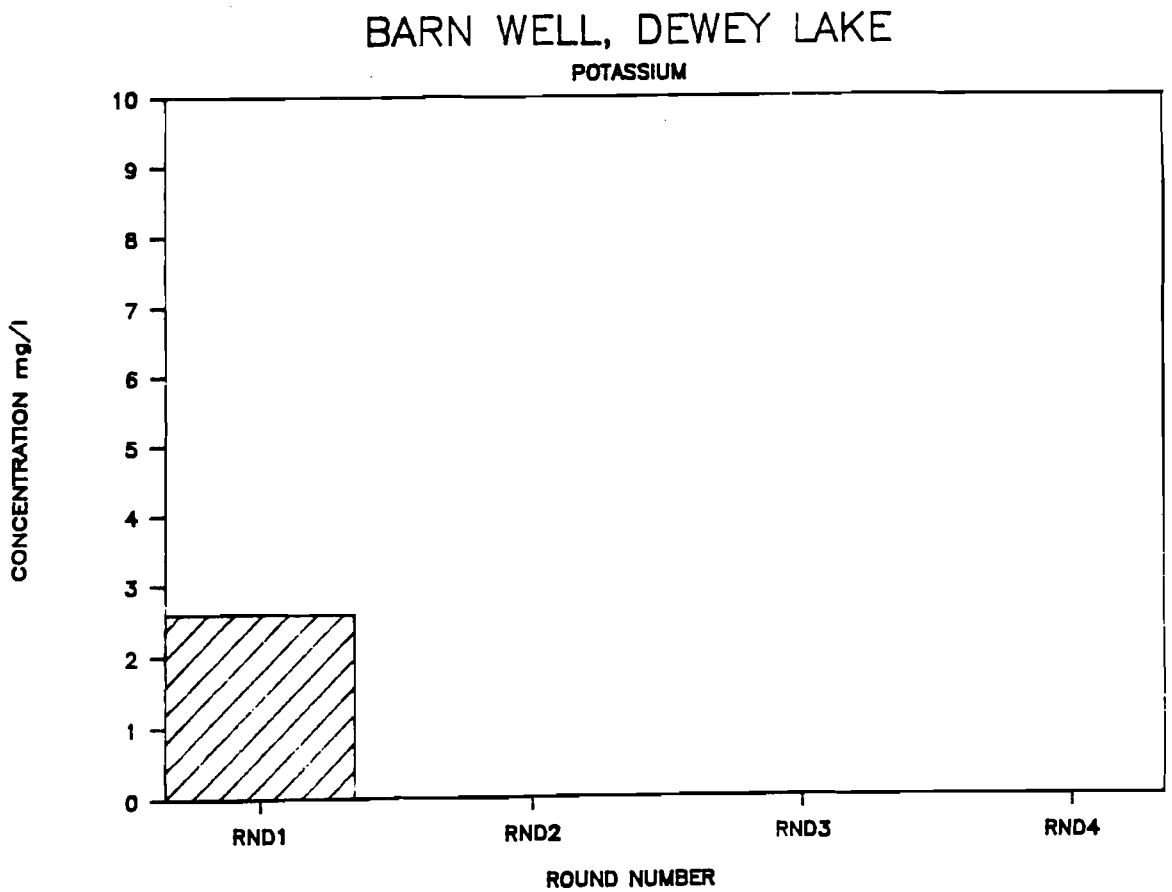

BARN WELL, DEWEY LAKE
ALKALINITY
CONCENTRATION mg/l
500
400
300
200
100
0
RND1
RND2
RND3
RND4
ROUND NUMBER

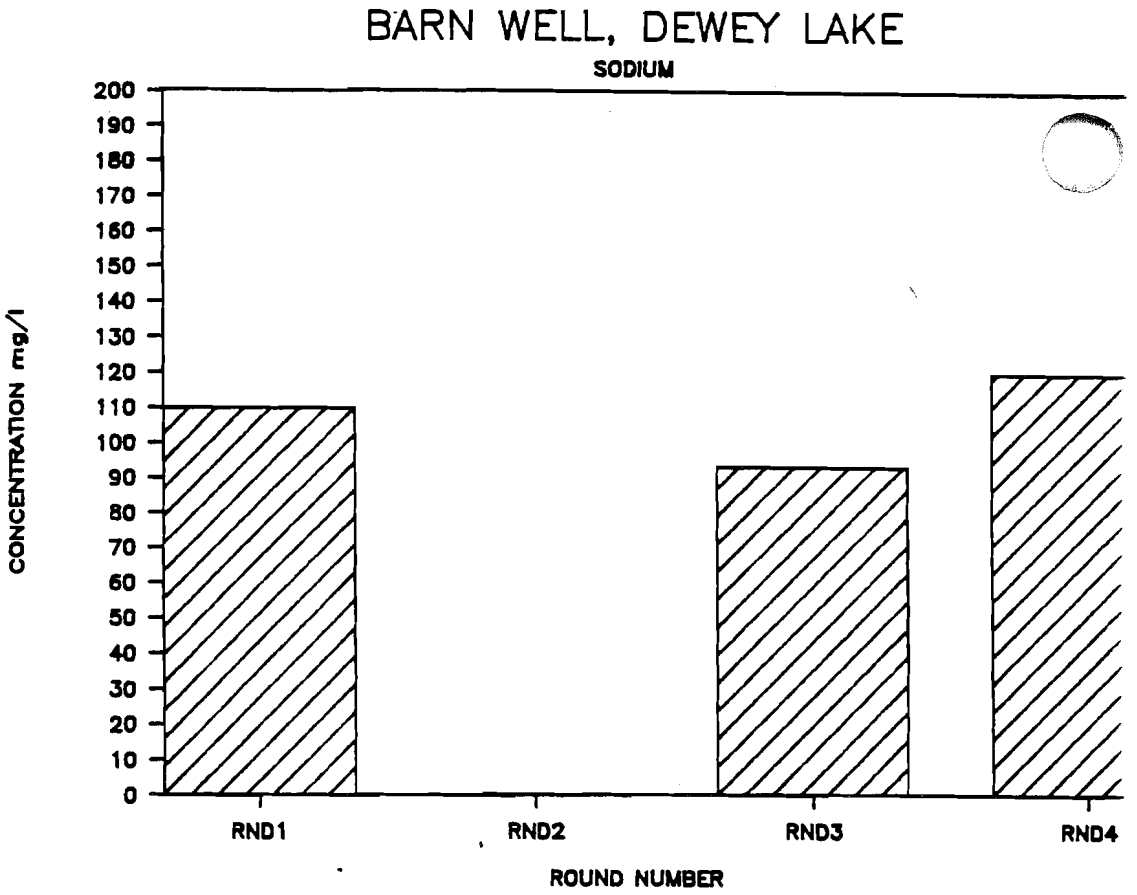

BARN WELL, DEWEY LAKE
CALCIUM
CONCENTRATION mg/l
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
ROUND NUMBER

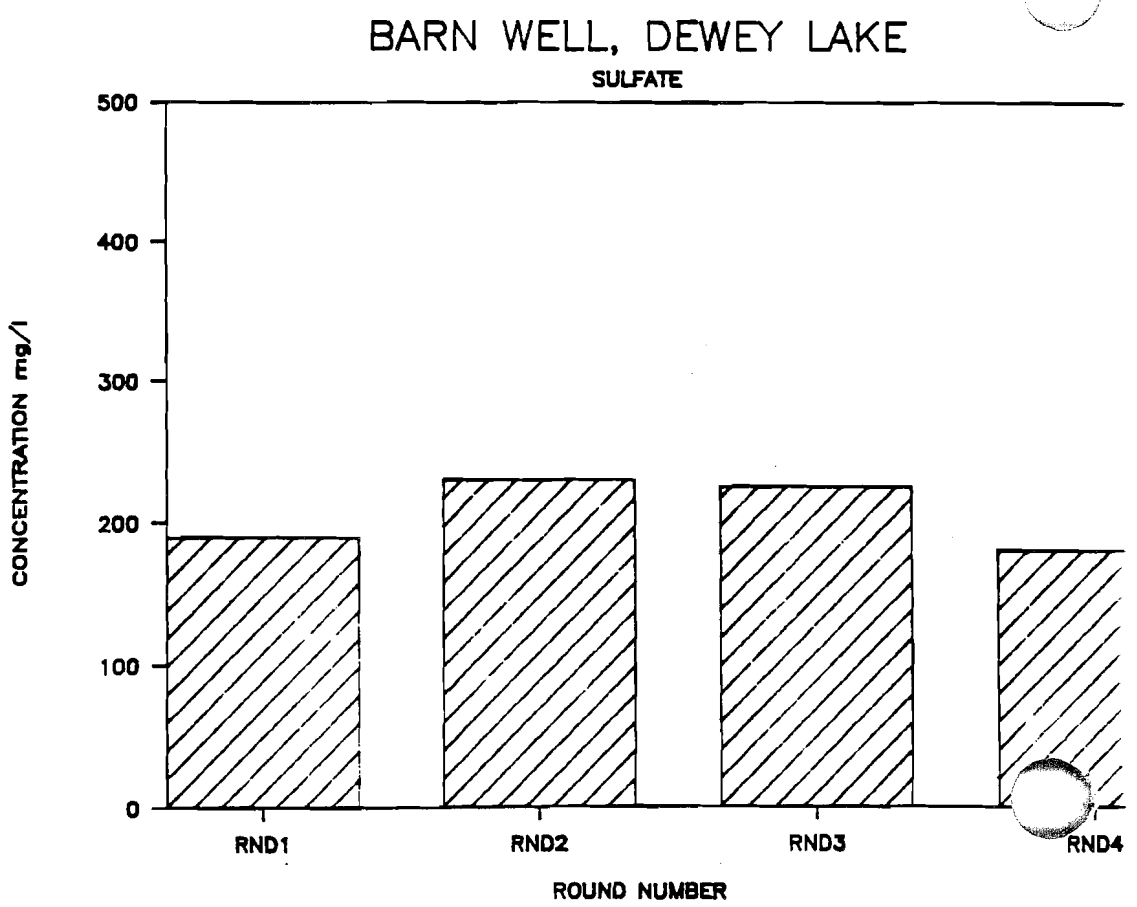

BARN WELL, DEWEY LAKE
CHLORIDE
CONCENTRATION mg/l
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
ROUND NUMBER

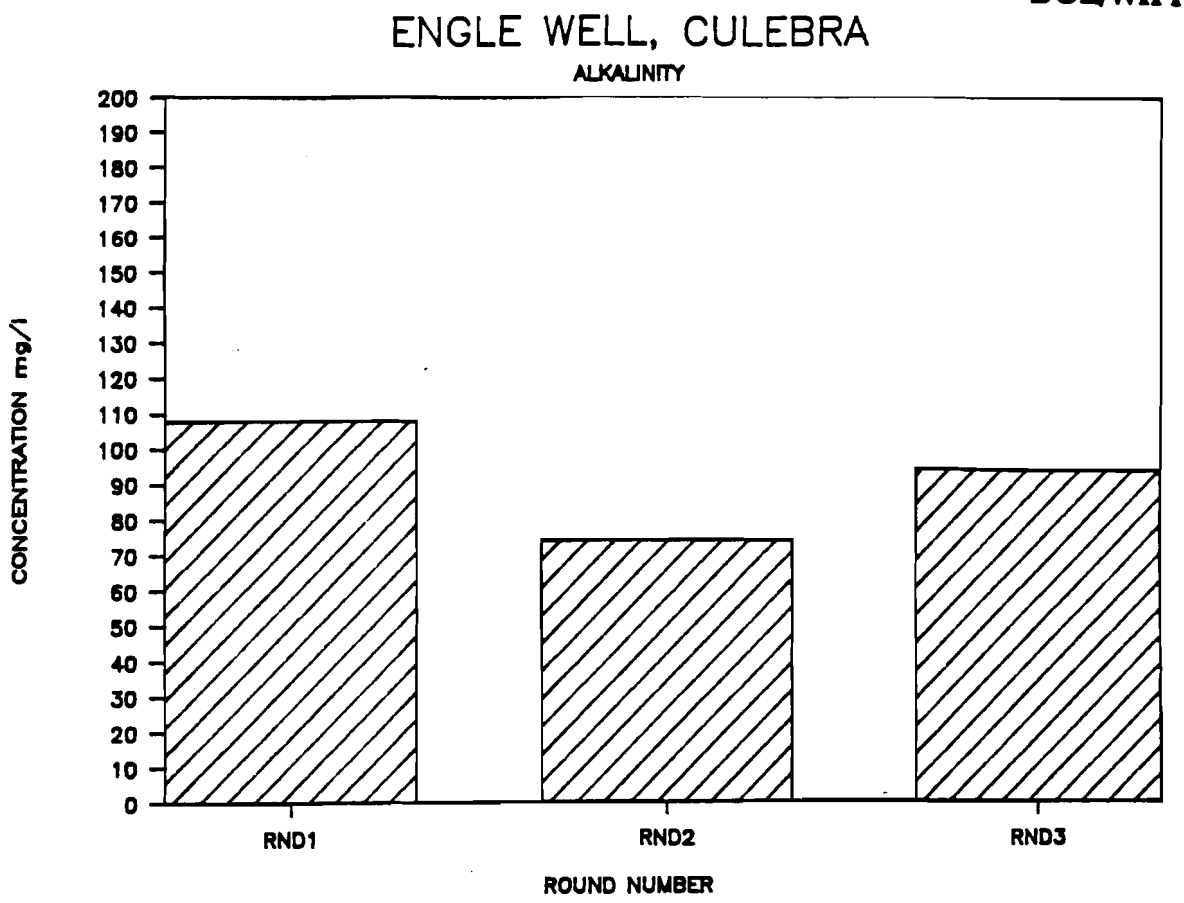

BARN WELL, DEWEY LAKE
FLUORIDE
CONCENTRATION mg/l
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
ROUND NUMBER

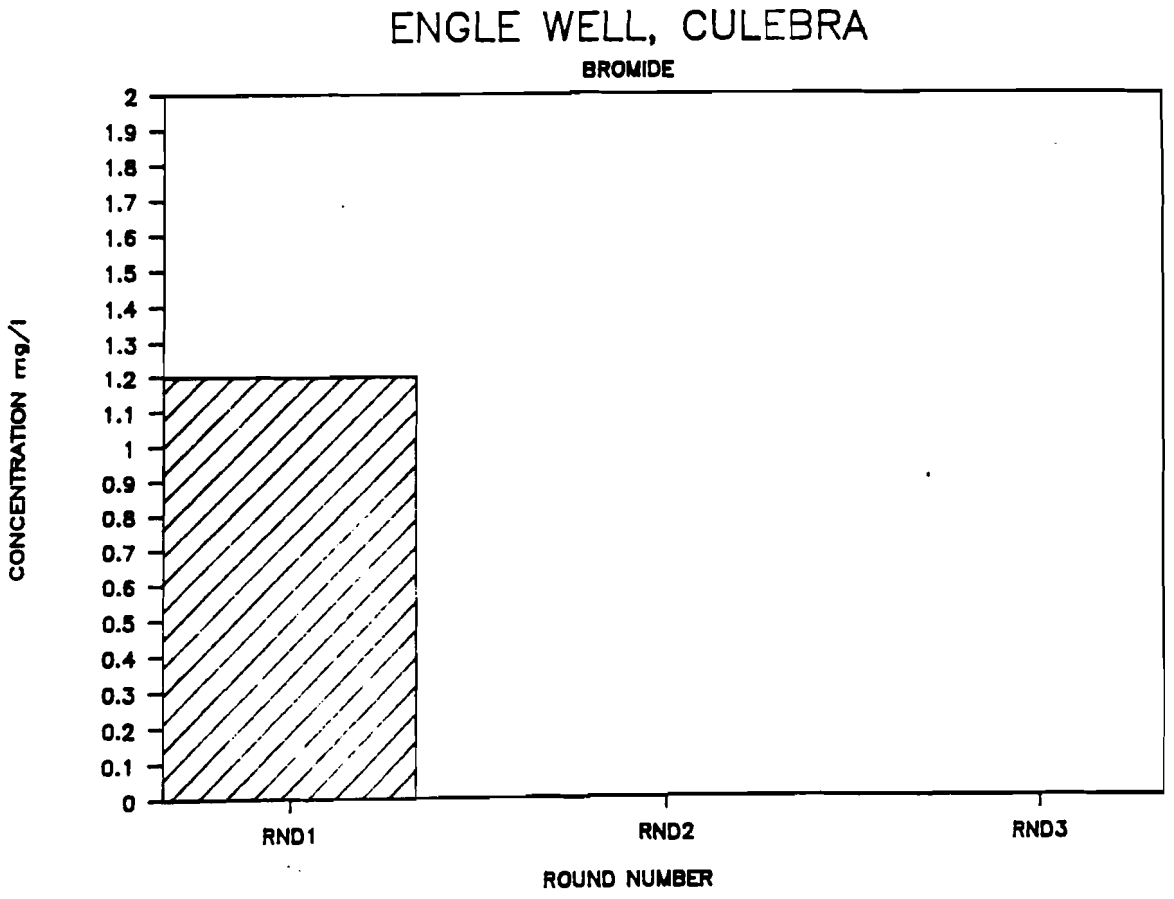

BARN WELL, DEWEY LAKE
MAGNESIUM
CONCENTRATION mg/l
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
ROUND NUMBER

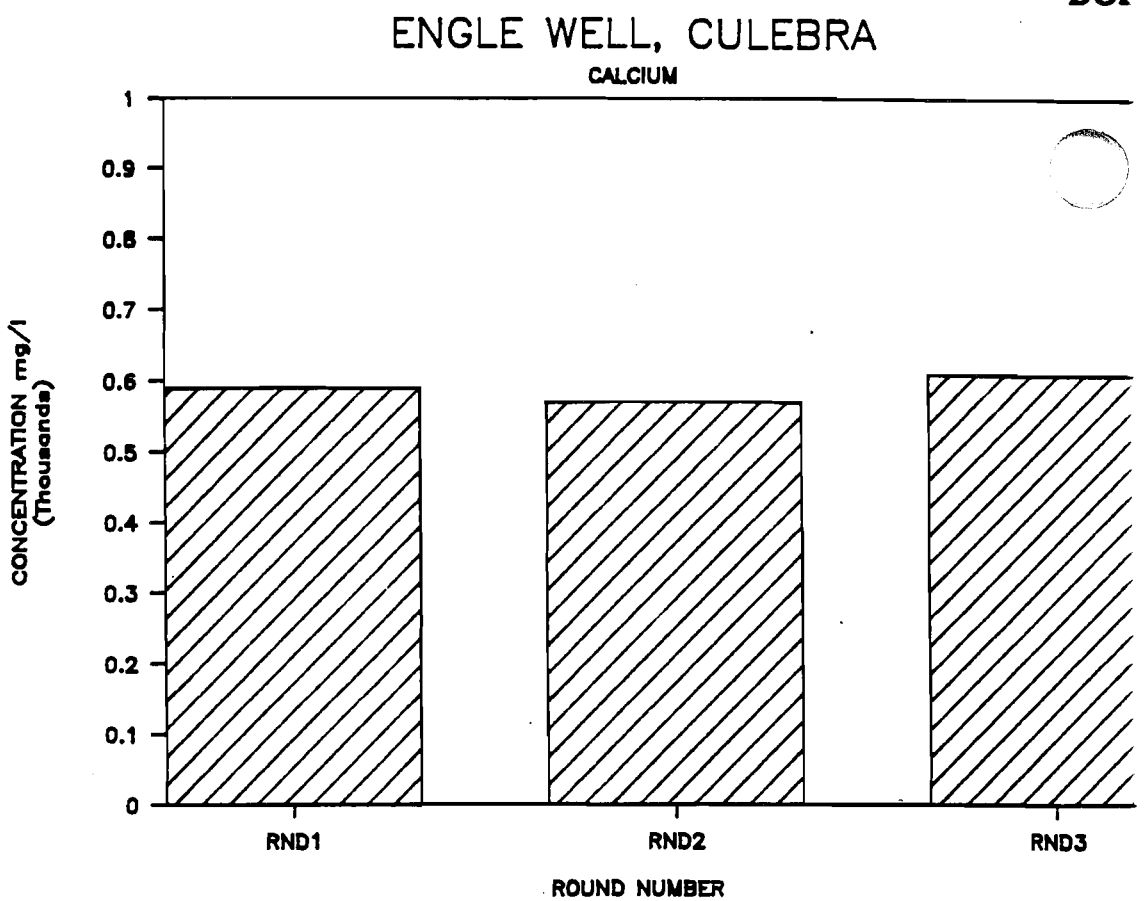

BARN WELL, DEWEY LAKE
POTASSIUM
CONCENTRATION mg/l
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
ROUND NUMBER

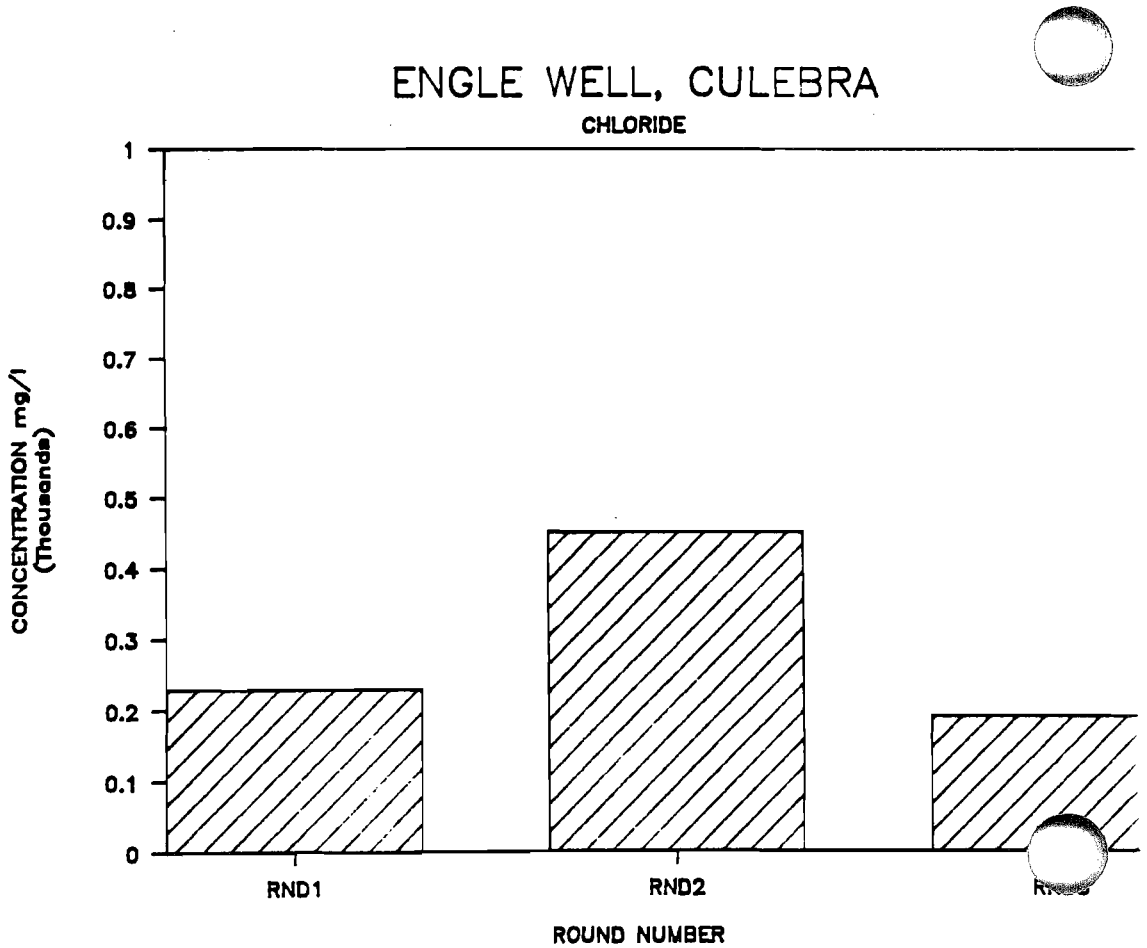

BARN WELL, DEWEY LAKE
SODIUM
CONCENTRATION mg/l
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
ROUND NUMBER

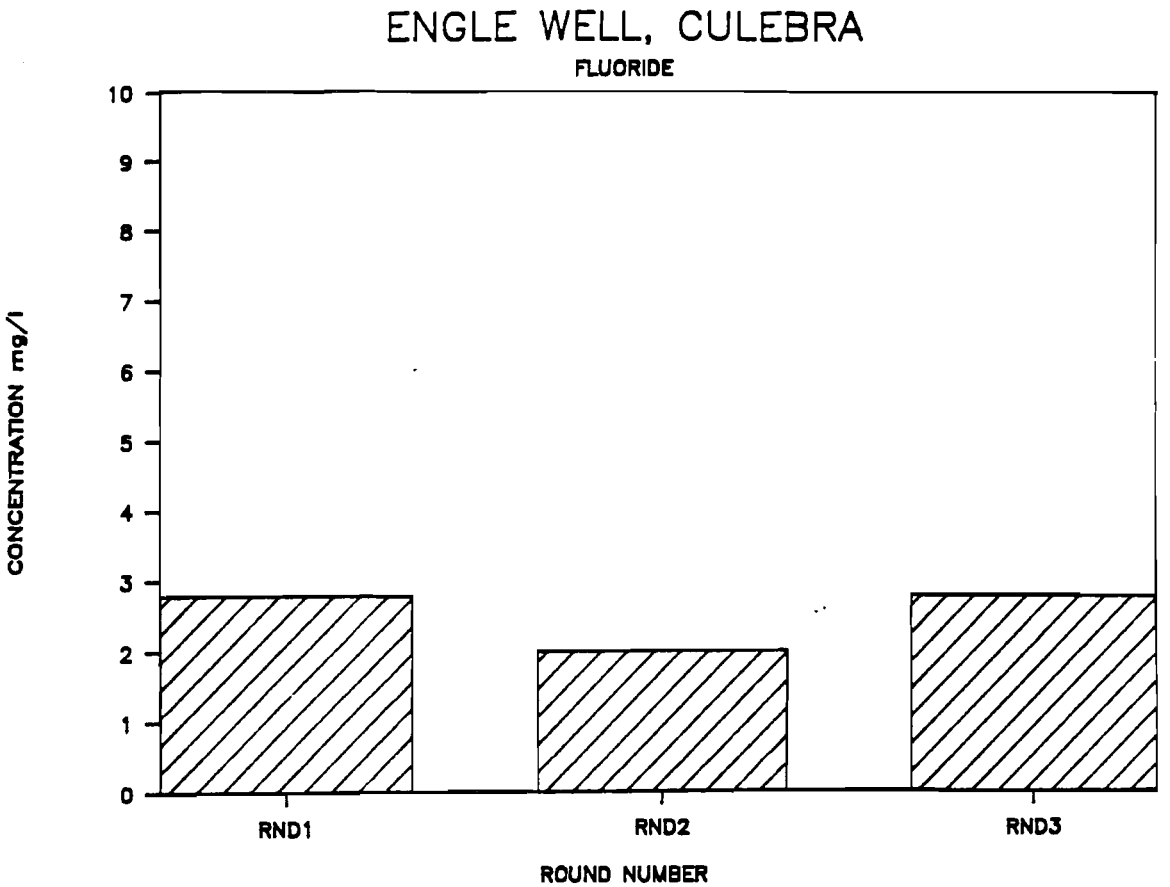

BARN WELL, DEWEY LAKE
SULFATE
CONCENTRATION mg/l
500
400
300
200
100
0
RND1
RND2
RND3
RND4
ROUND NUMBER

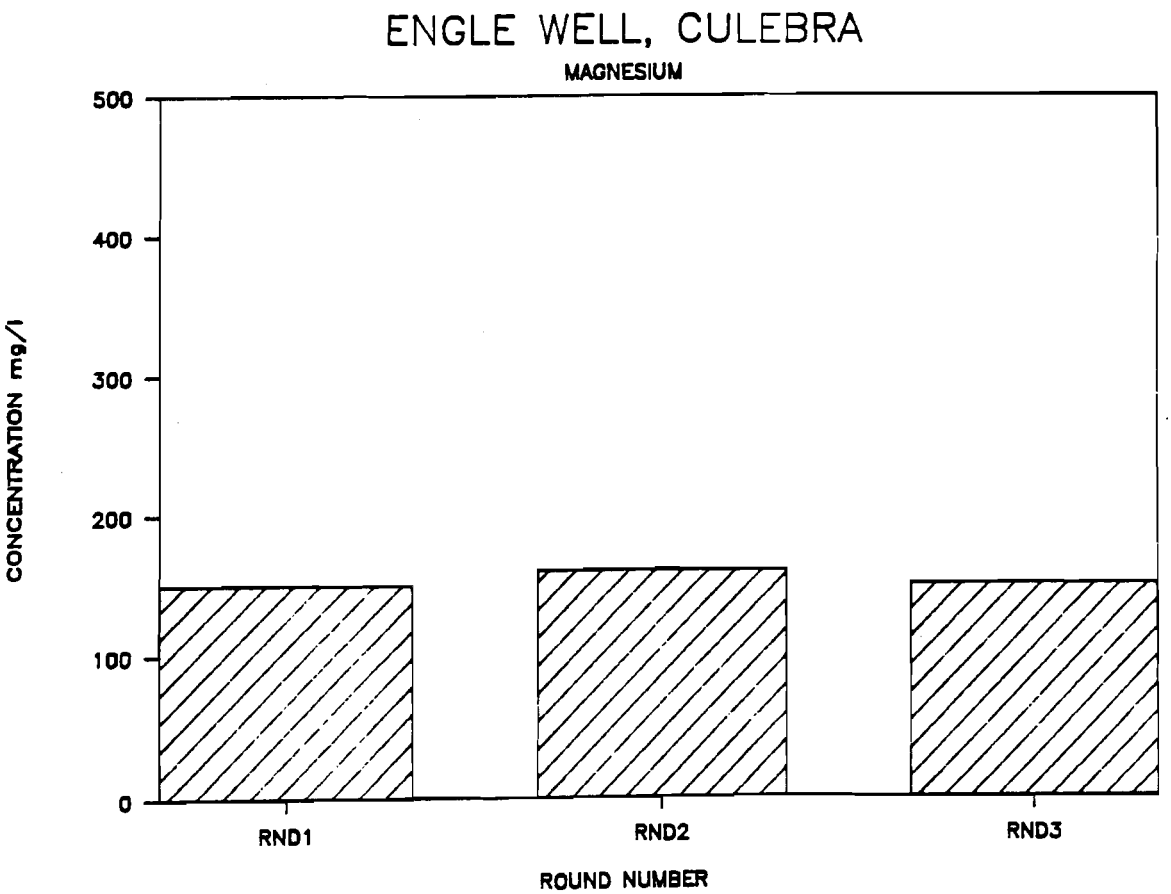

ENGLE WELL, CULEBRA
ALKALINITY
CONCENTRATION mg/l
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
ROUND NUMBER

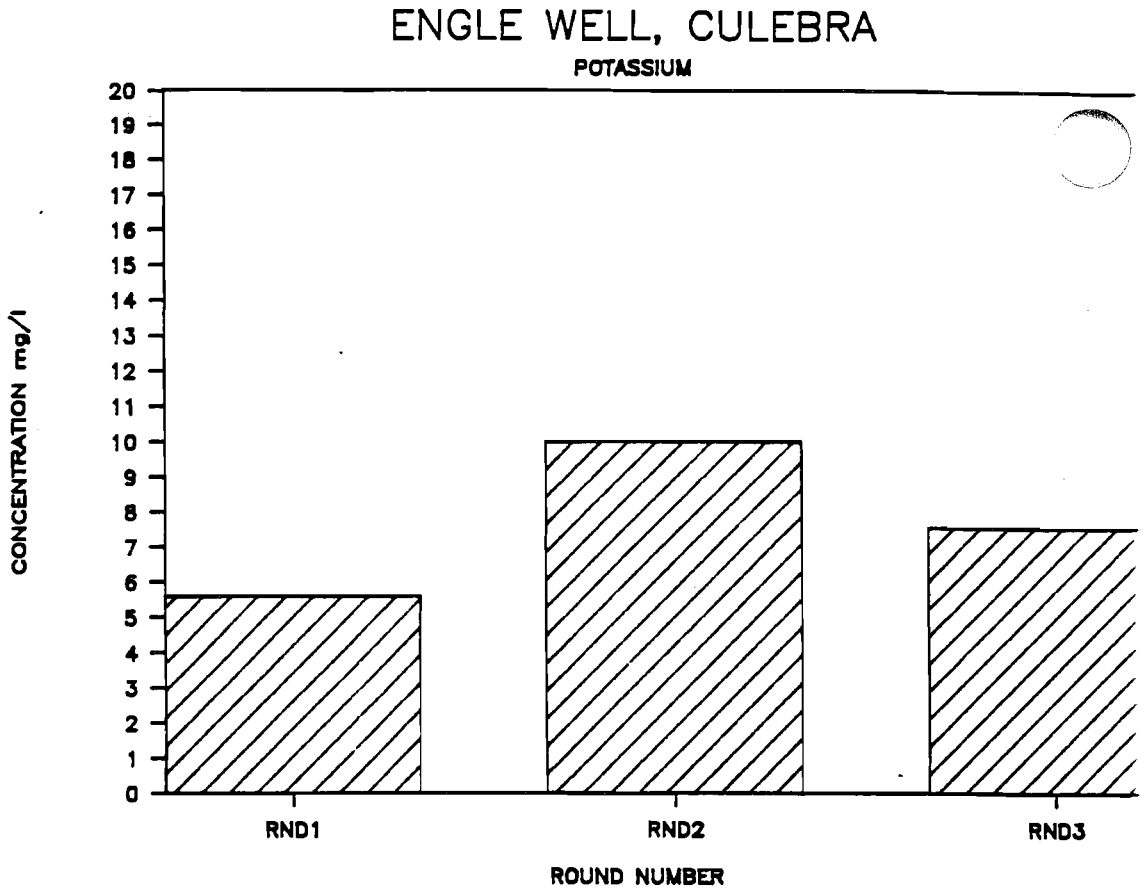

ENGLE WELL, CULEBRA
BROMIDE
CONCENTRATION mg/l
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
ROUND NUMBER

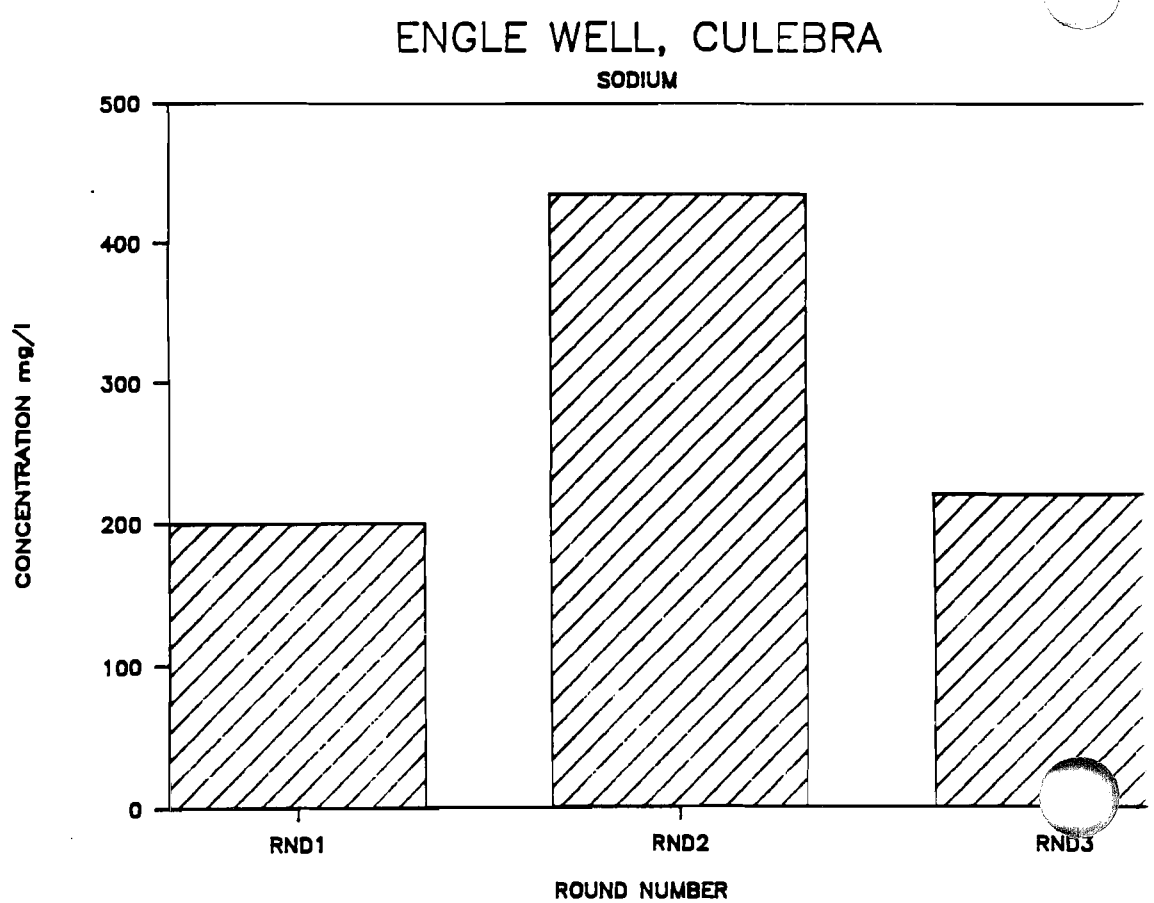

ENGLE WELL, CULEBRA
CALCIUM
CONCENTRATION mg/l (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
ROUND NUMBER

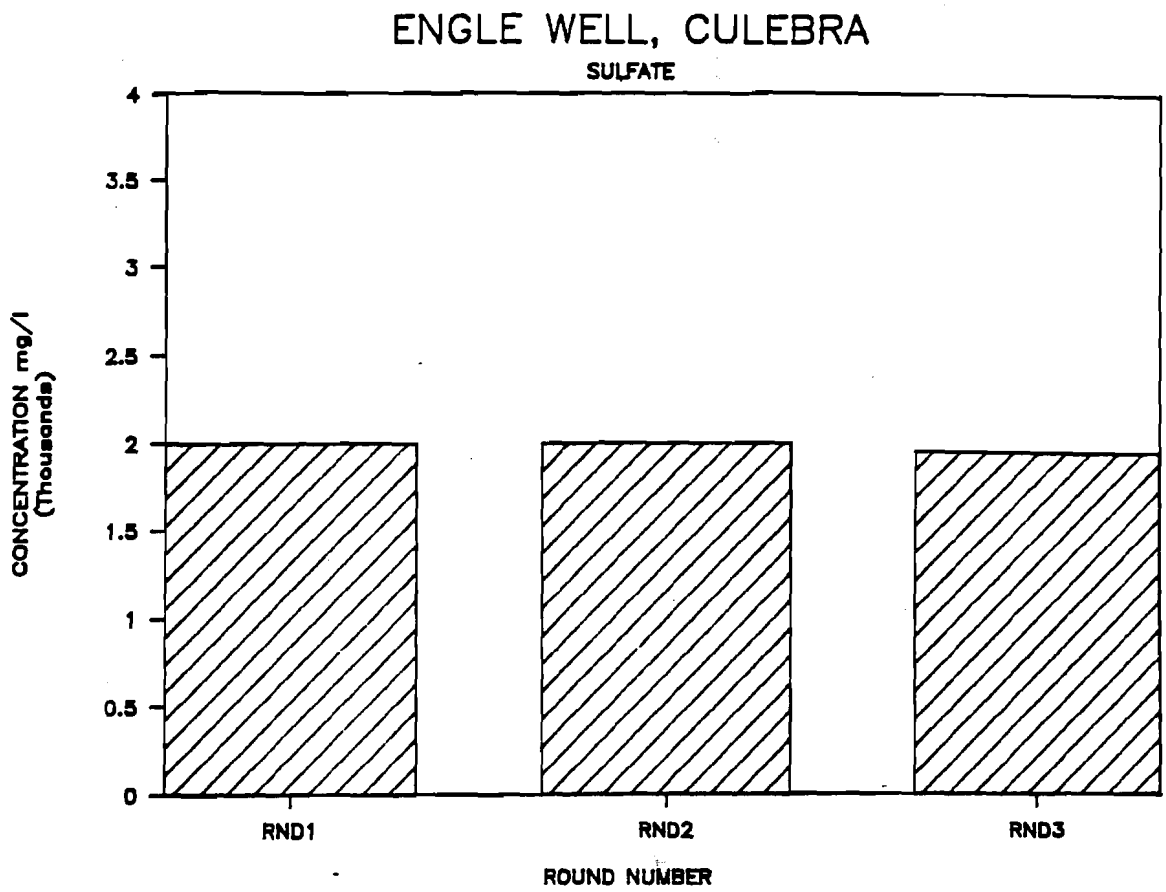

ENGLE WELL, CULEBRA
CHLORIDE
CONCENTRATION mg/l (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
ROUND NUMBER

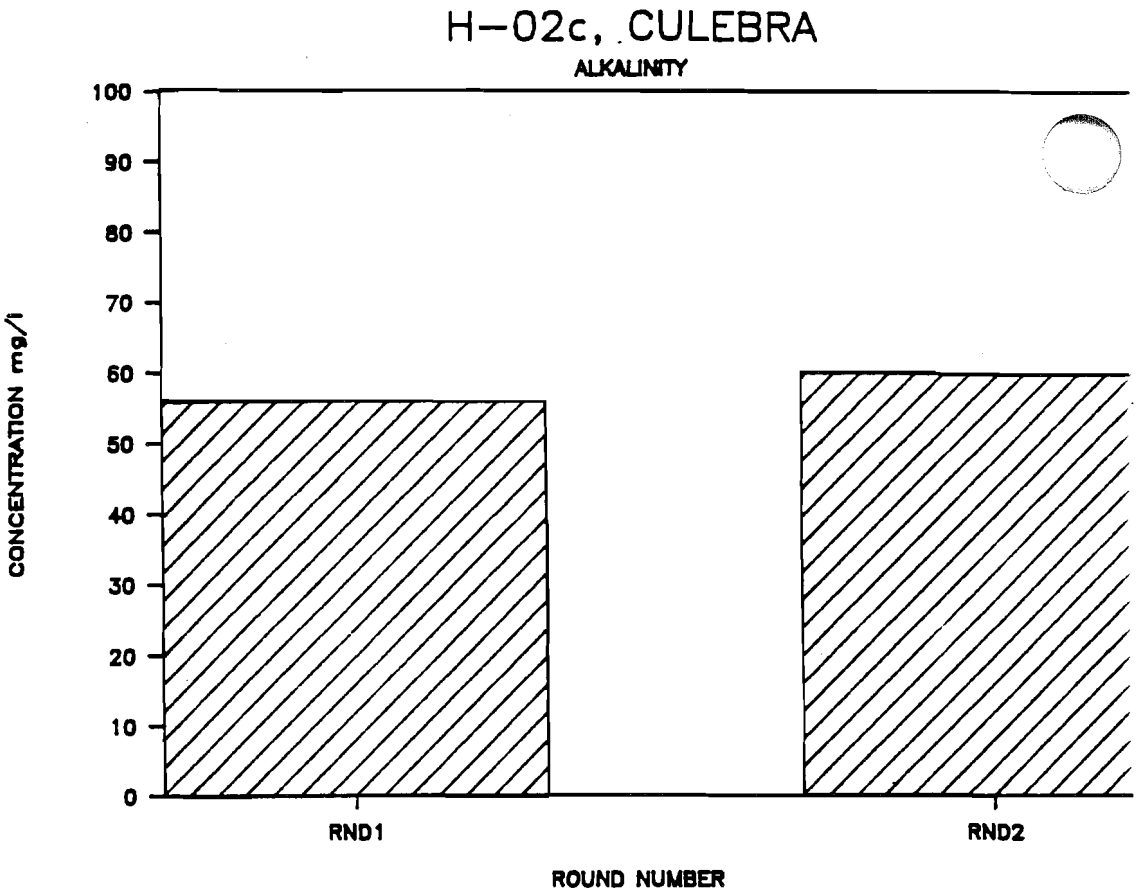

ENGLE WELL, CULEBRA
FLUORIDE
CONCENTRATION mg/l
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
ROUND NUMBER

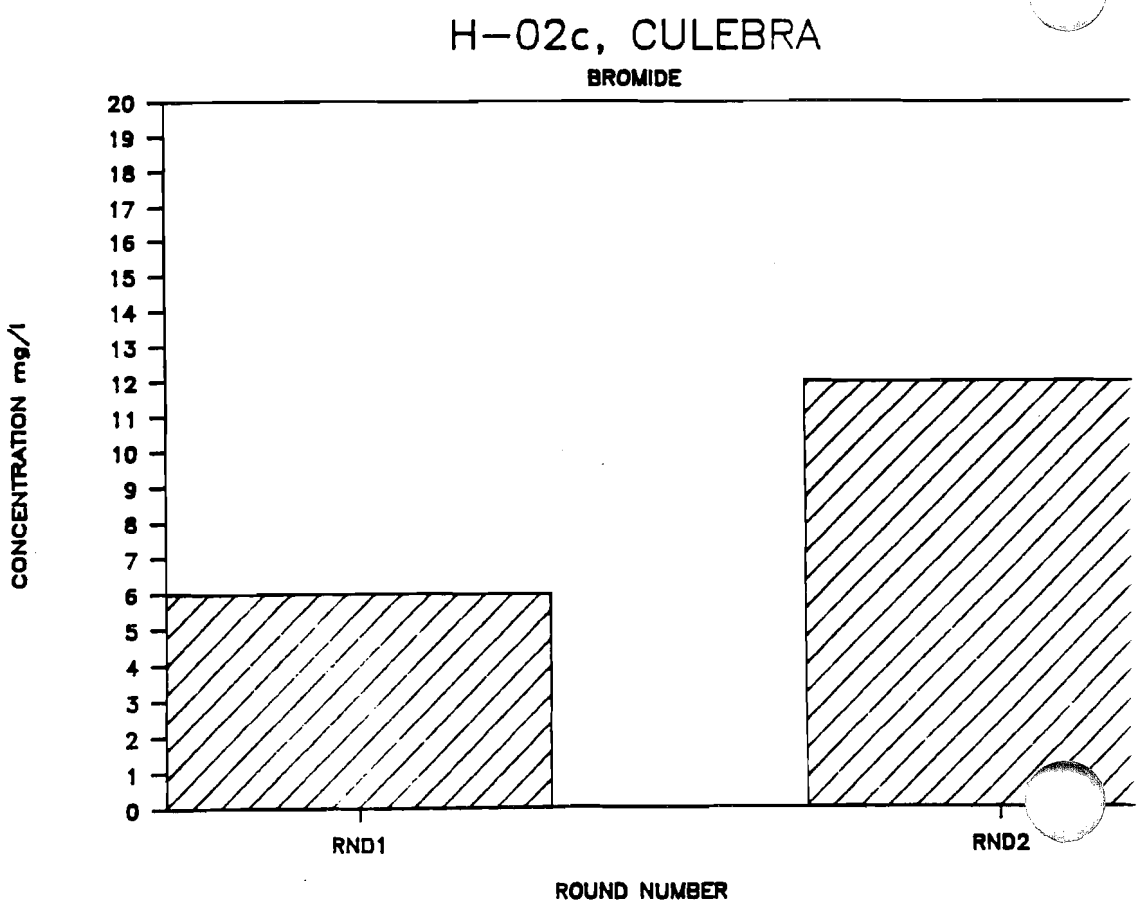

ENGLE WELL, CULEBRA
MAGNESIUM
CONCENTRATION mg/l
500
400
300
200
100
0
RND1
RND2
RND3
ROUND NUMBER

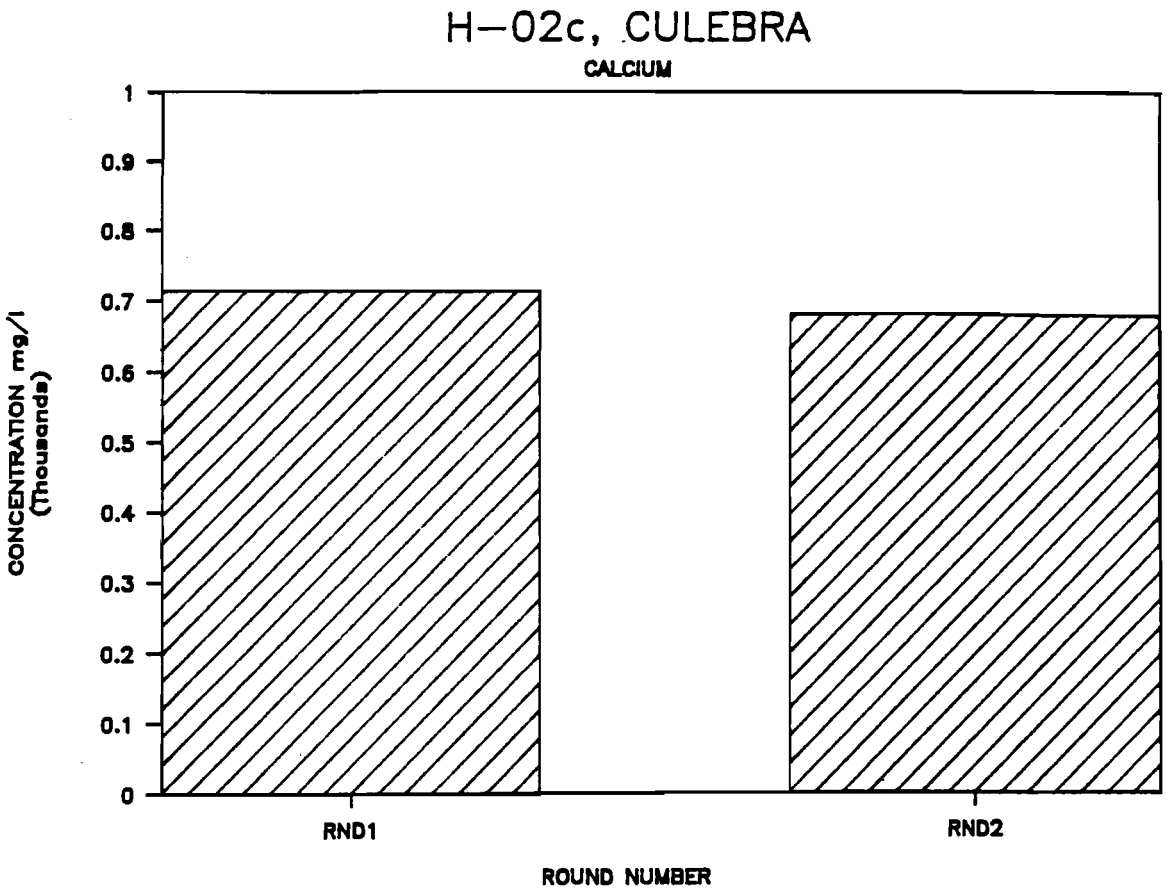

ENGLE WELL, CULEBRA
POTASSIUM
CONCENTRATION mg/l
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
ROUND NUMBER

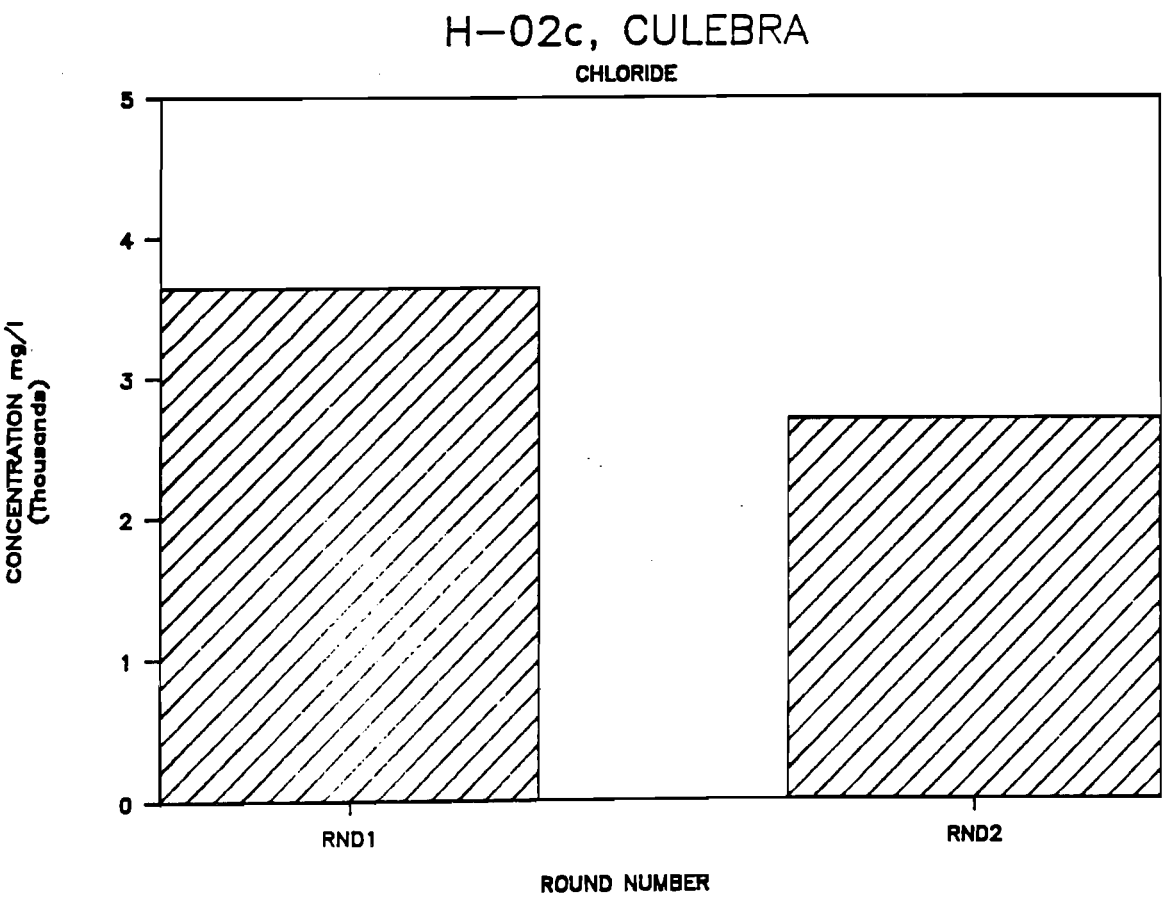

ENGLE WELL, CULEBRA
SODIUM
CONCENTRATION mg/l
500
400
300
200
100
0
RND1
RND2
RND3
ROUND NUMBER

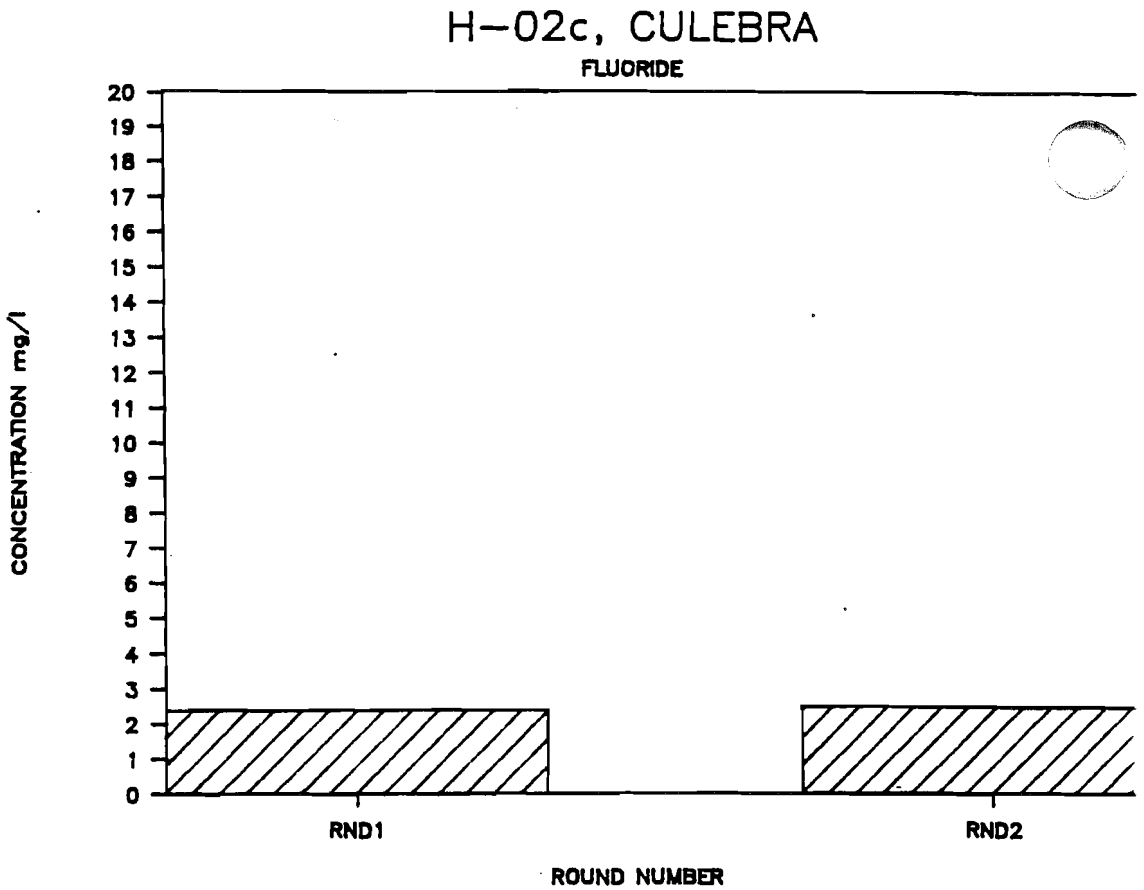

ENGLE WELL, CULEBRA
SULFATE
CONCENTRATION mg/l
(Thousands)
4
3.5
3
2.5
2
1.5
1
0.5
0
RND1
RND2
RND3
ROUND NUMBER

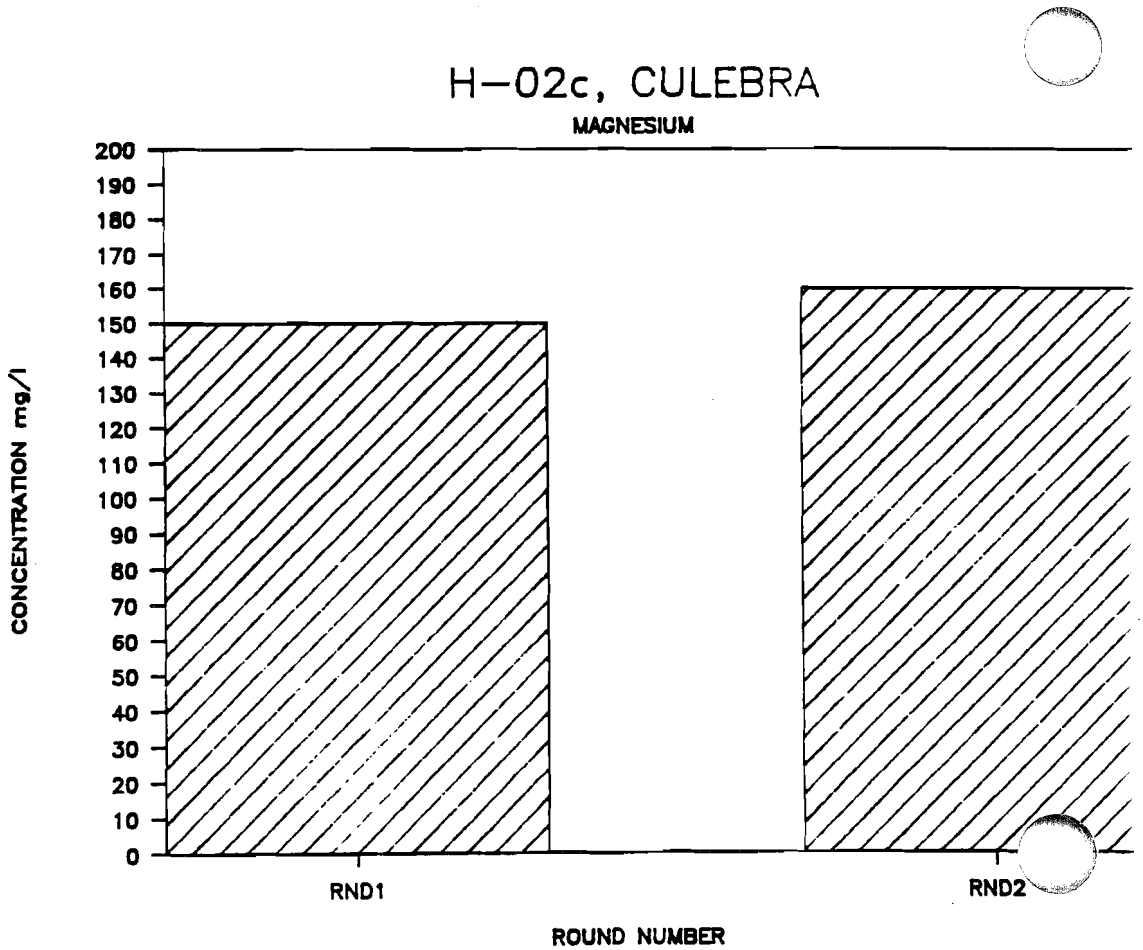

H-02c, CULEBRA
ALKALINITY
CONCENTRATION mg/l
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
ROUND NUMBER

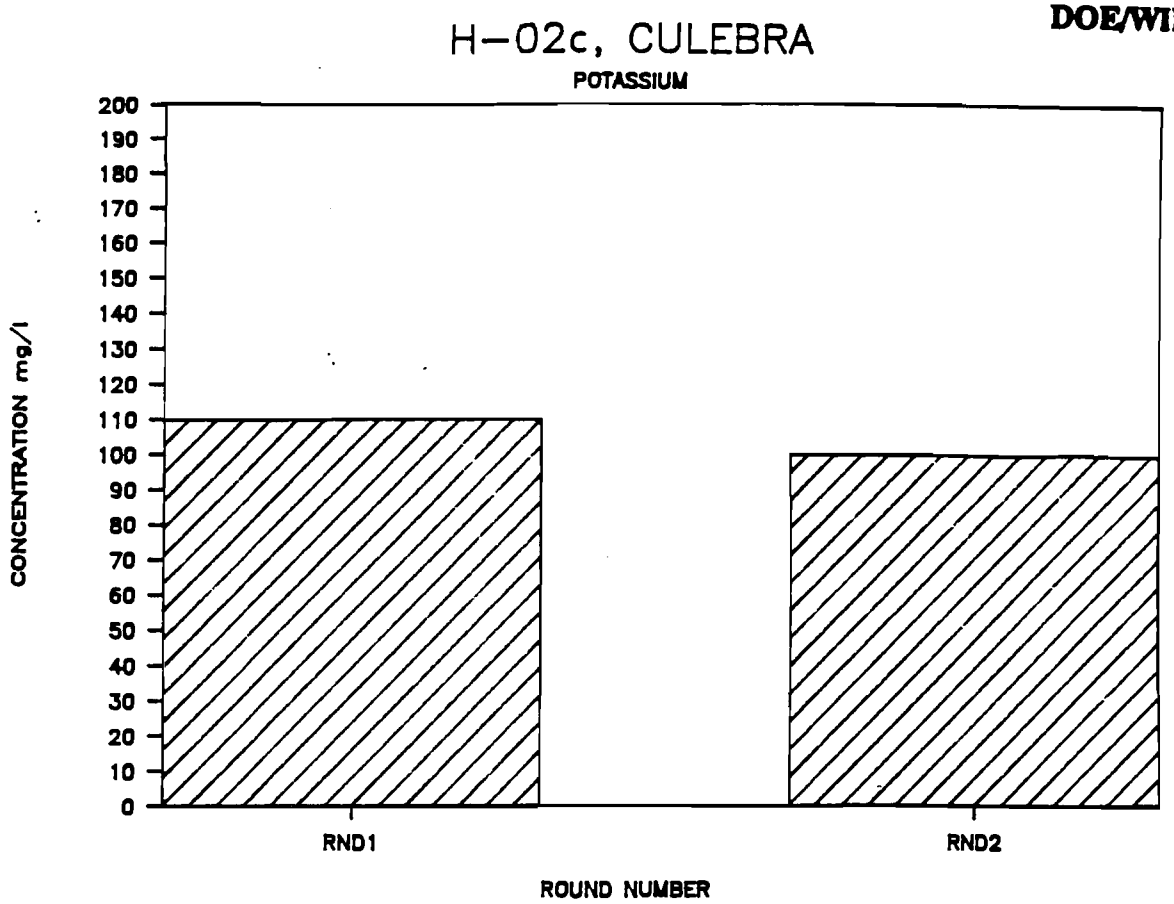

H-02c, CULEBRA
BROMIDE
CONCENTRATION mg/l
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
ROUND NUMBER

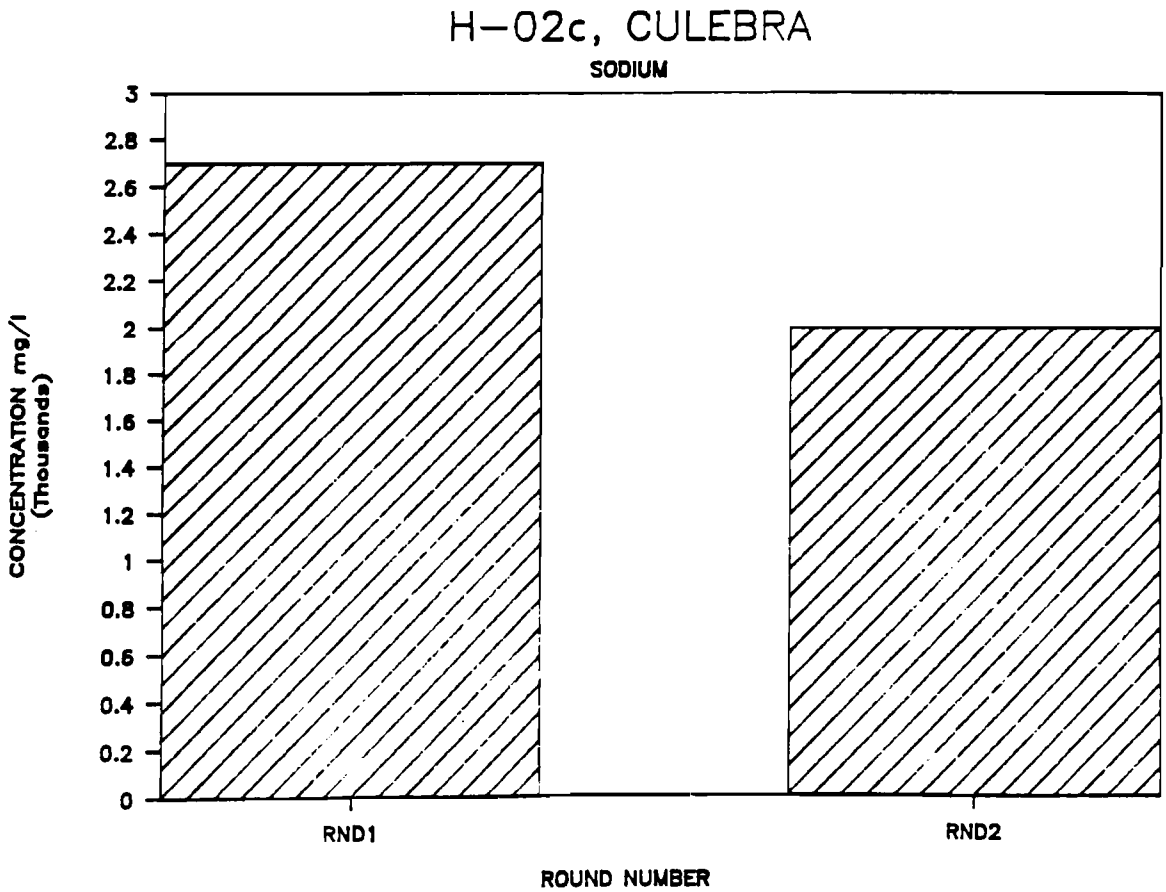

H-02c, CULEBRA
CALCIUM
CONCENTRATION mg/l (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
ROUND NUMBER

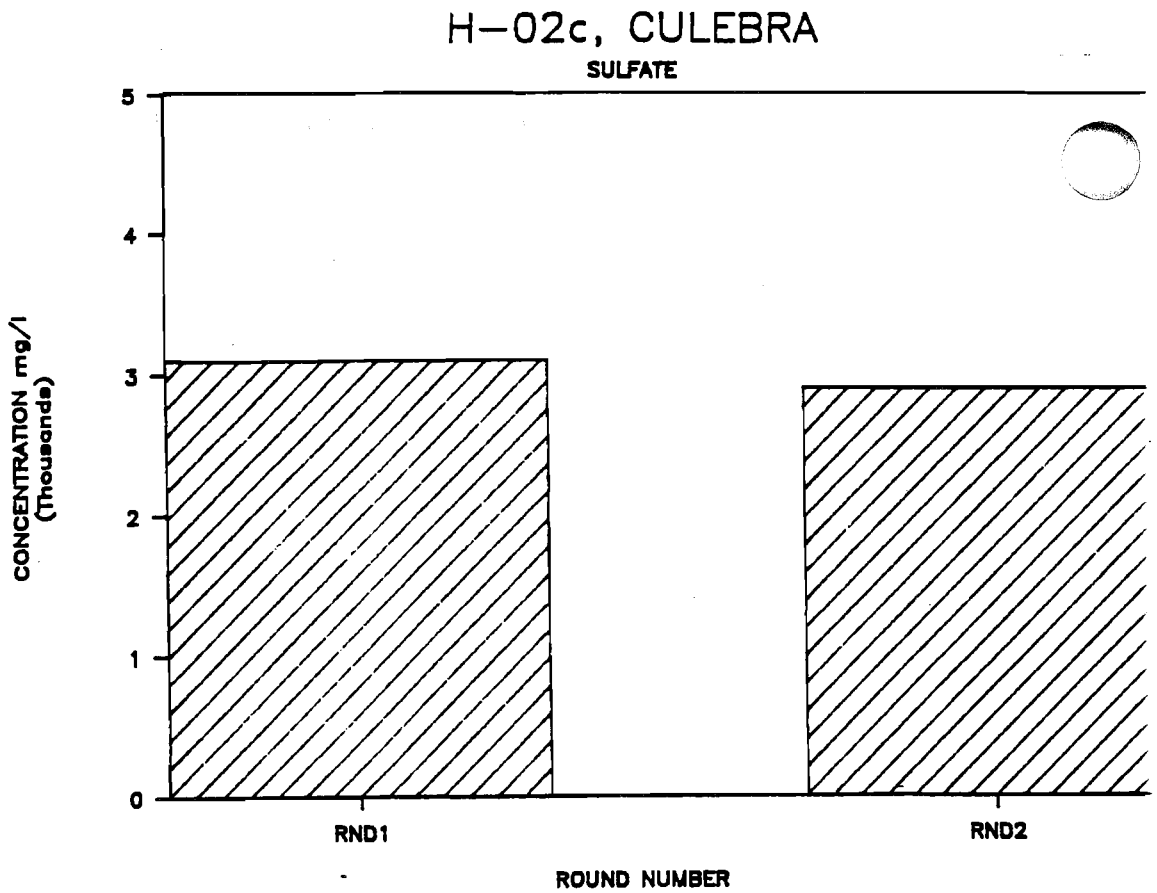

H-02c, CULEBRA
CHLORIDE
CONCENTRATION mg/l (Thousands)
5
4
3
2
1
0
RND1
RND2
ROUND NUMBER

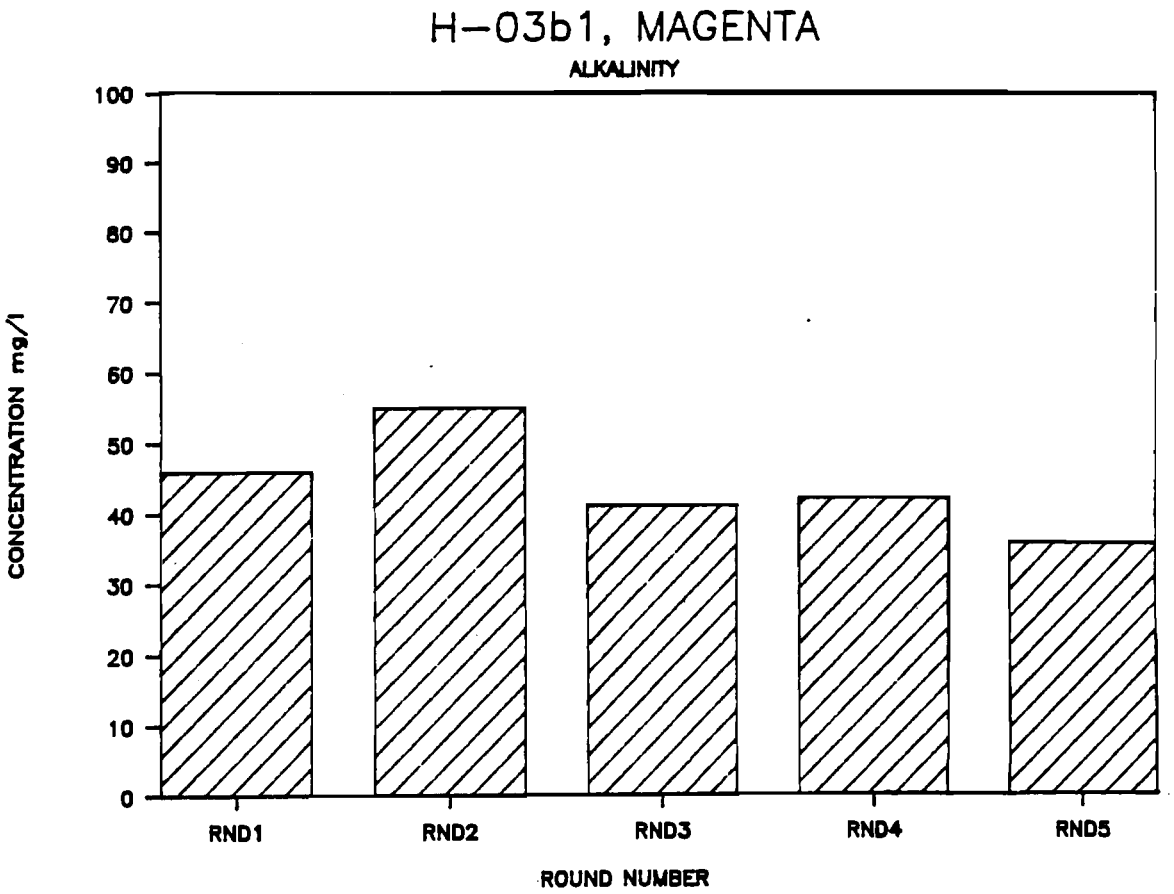

H-02c, CULEBRA
FLUORIDE
CONCENTRATION mg/l
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
ROUND NUMBER

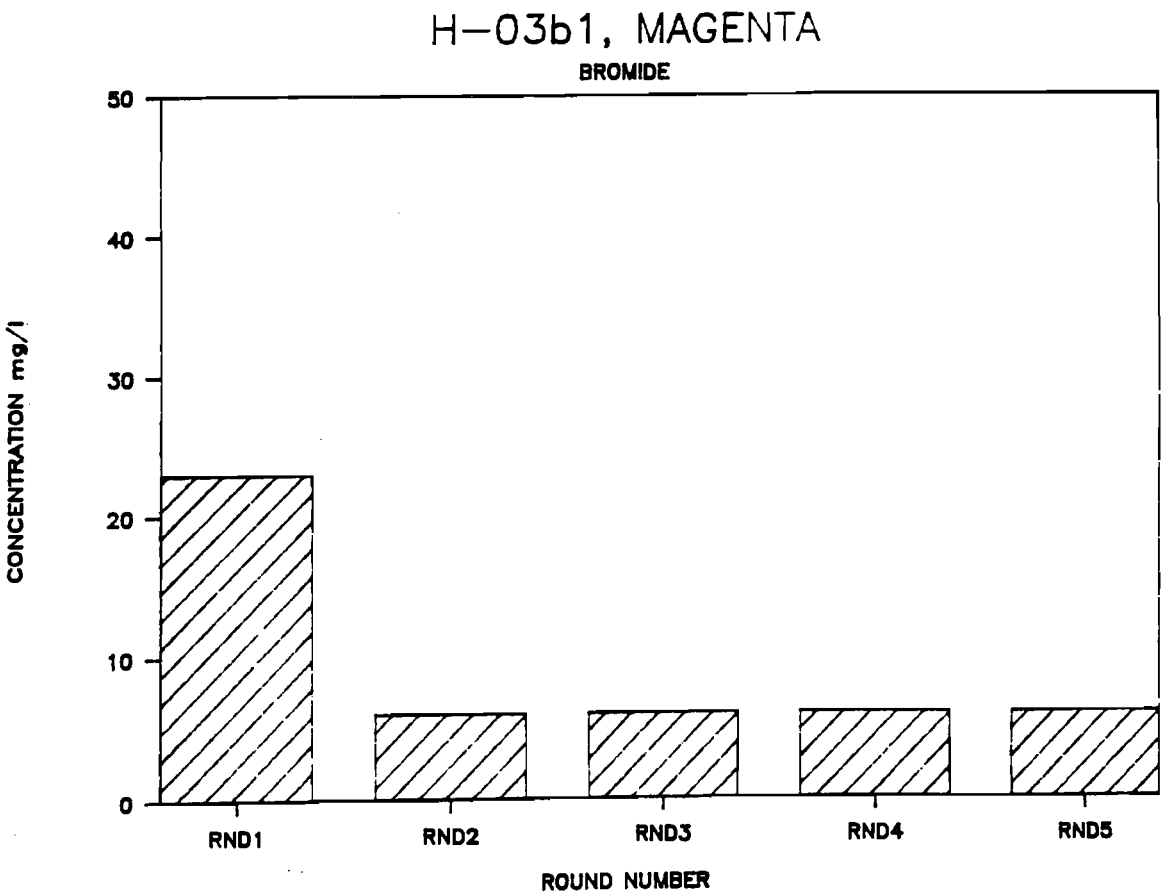

H-02c, CULEBRA
MAGNESIUM
CONCENTRATION mg/l
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
ROUND NUMBER

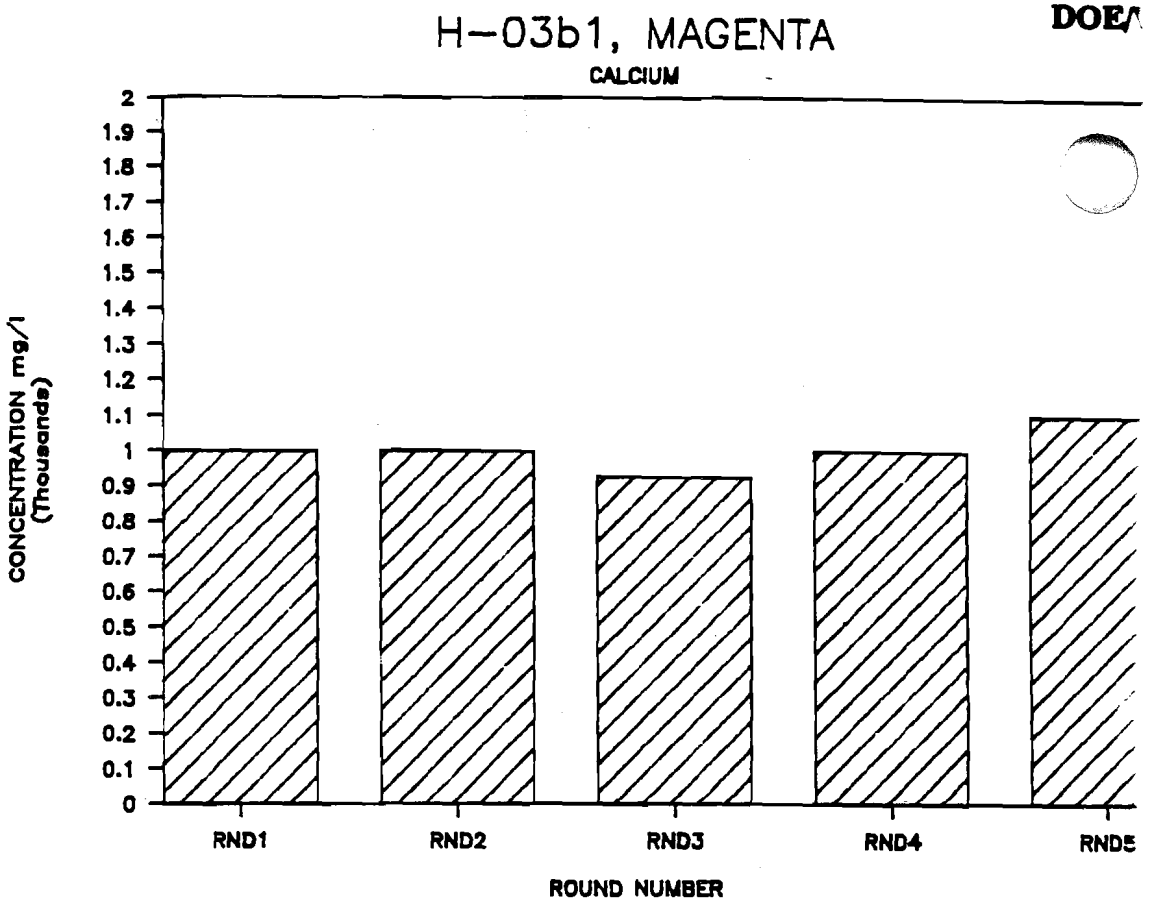

H-02c, CULEBRA
POTASSIUM
CONCENTRATION mg/l
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
ROUND NUMBER

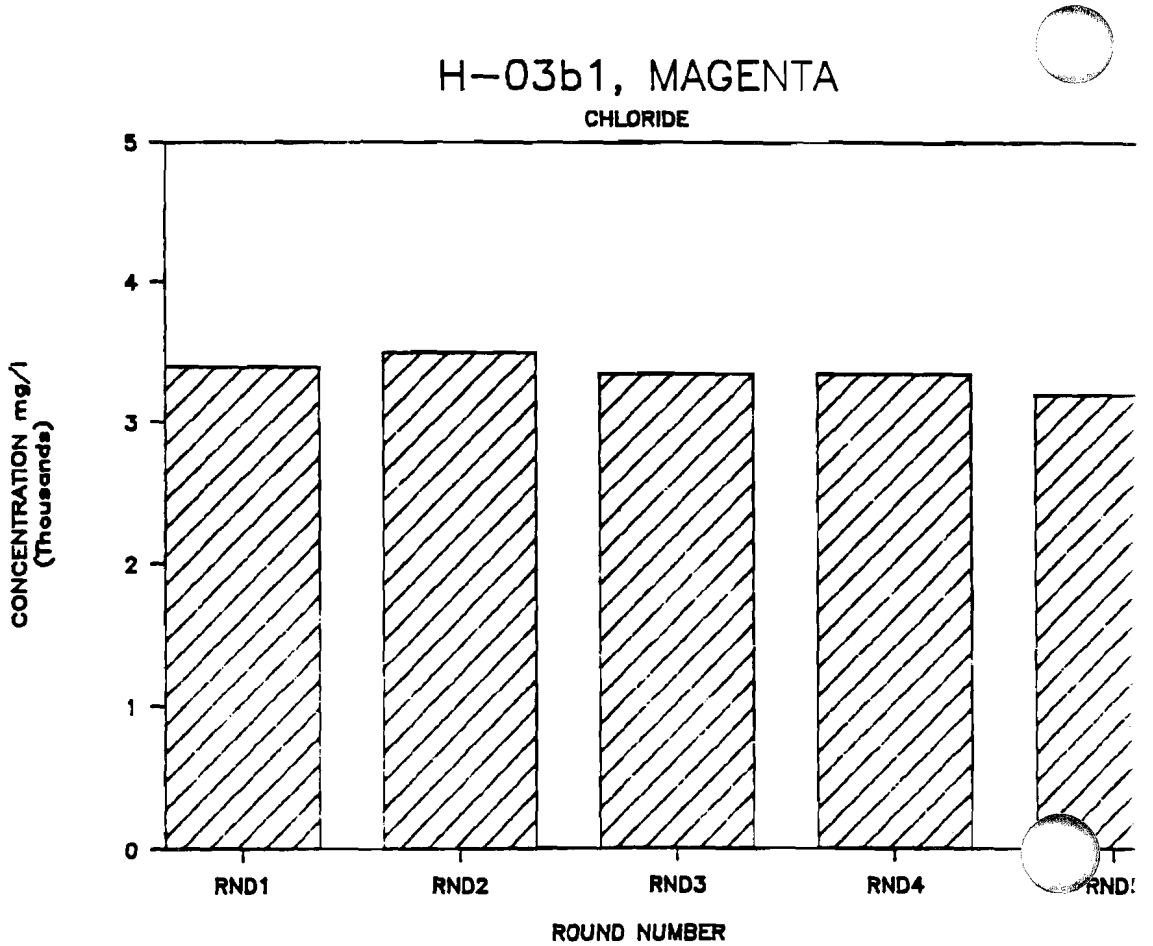

H-02c, CULEBRA
SODIUM
CONCENTRATION mg/l
(Thousands)
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
RND1
RND2
ROUND NUMBER

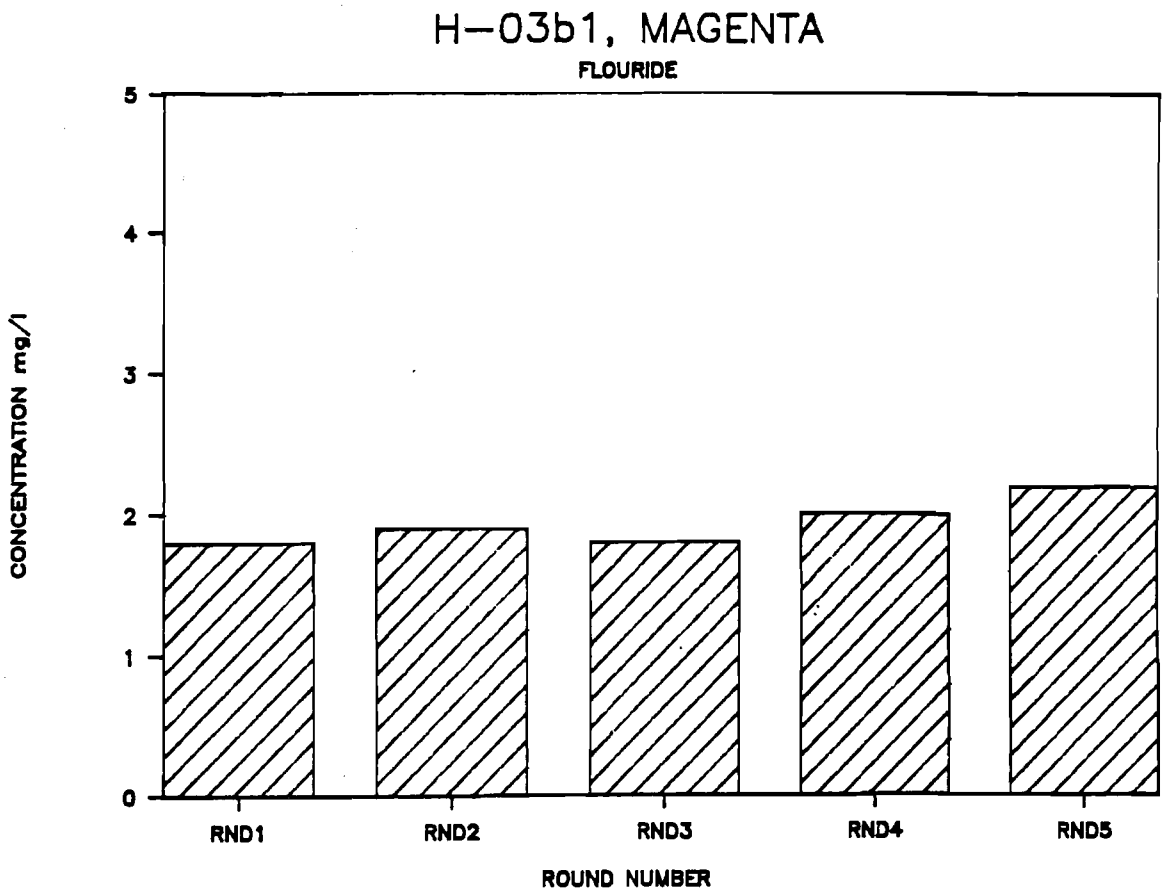

H-02c, CULEBRA
SULFATE
CONCENTRATION mg/l
(Thousands)
5
4
3
2
1
0
RND1
RND2
ROUND NUMBER

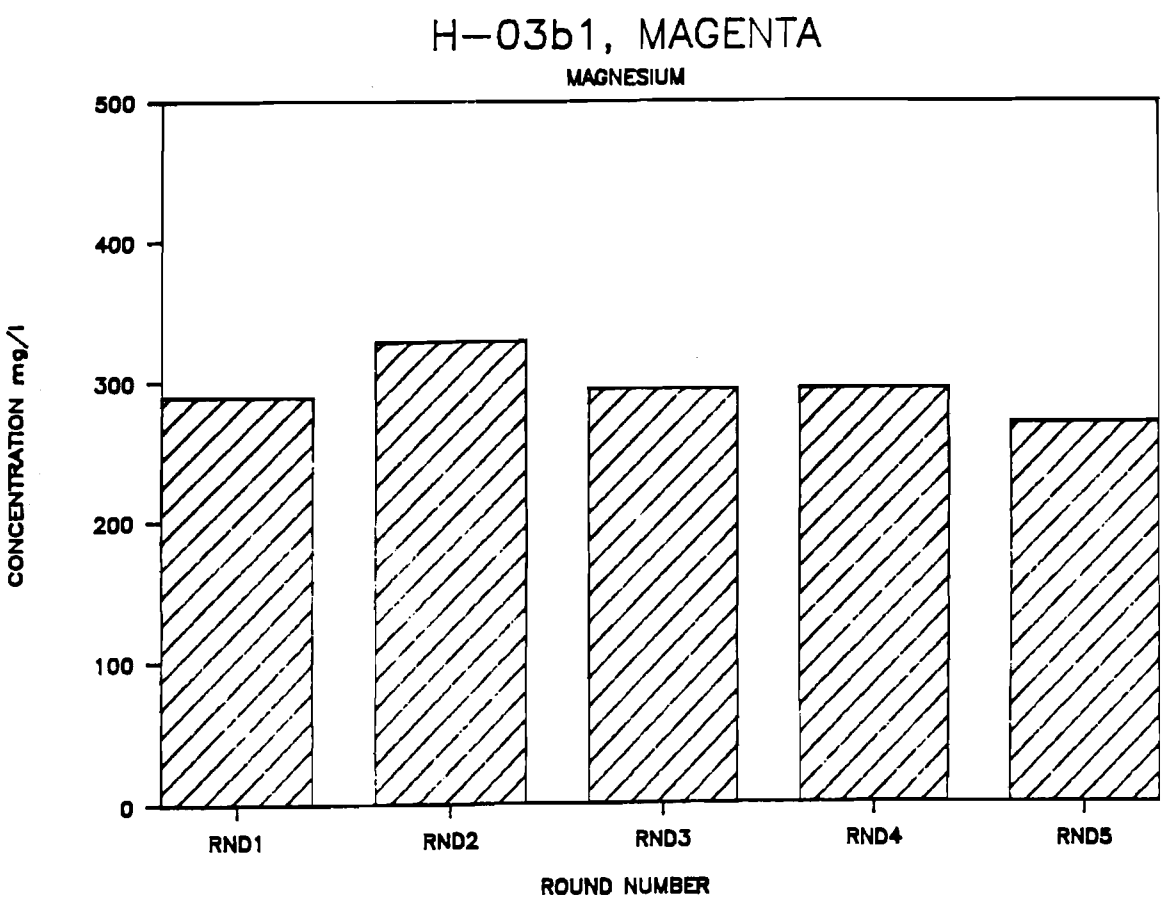

H-03b1, MAGENTA
ALKALINITY
CONCENTRATION mg/l
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

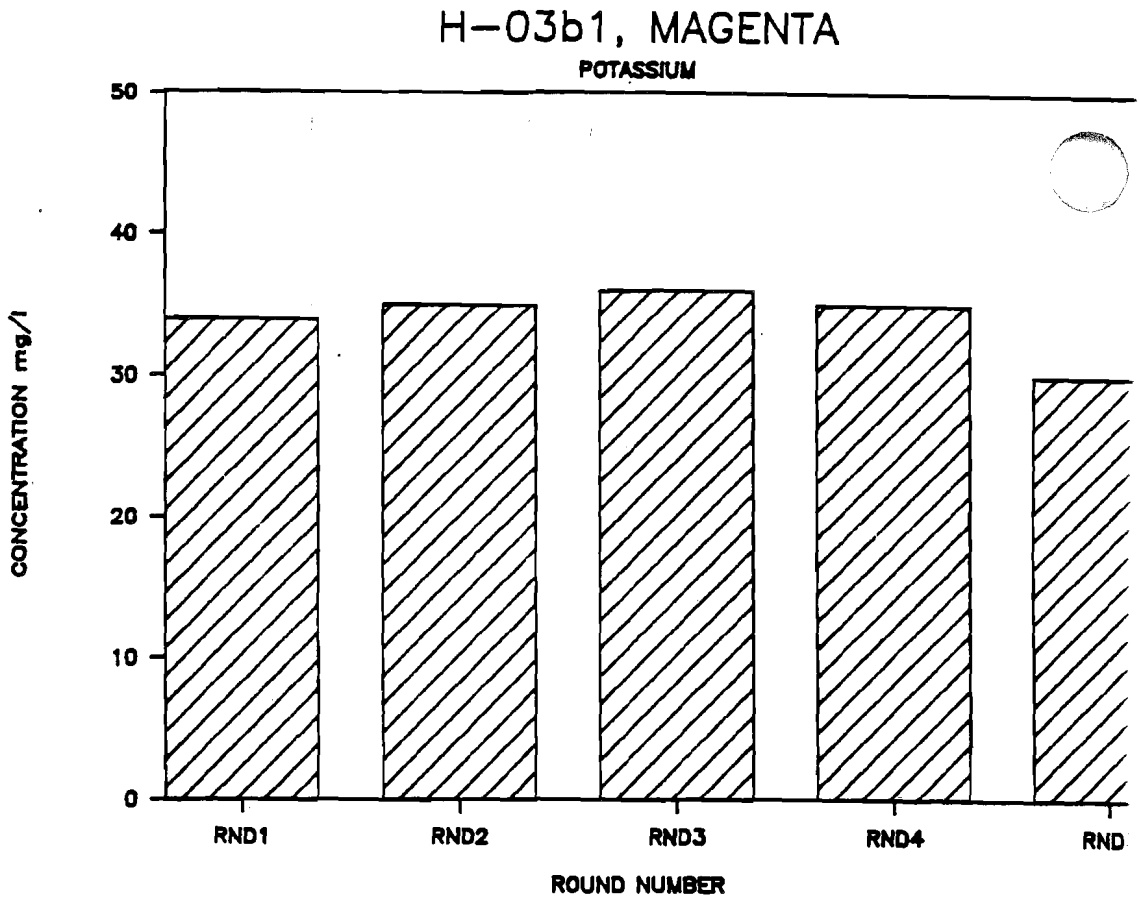

H-03b1, MAGENTA
BROMIDE
CONCENTRATION mg/l
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

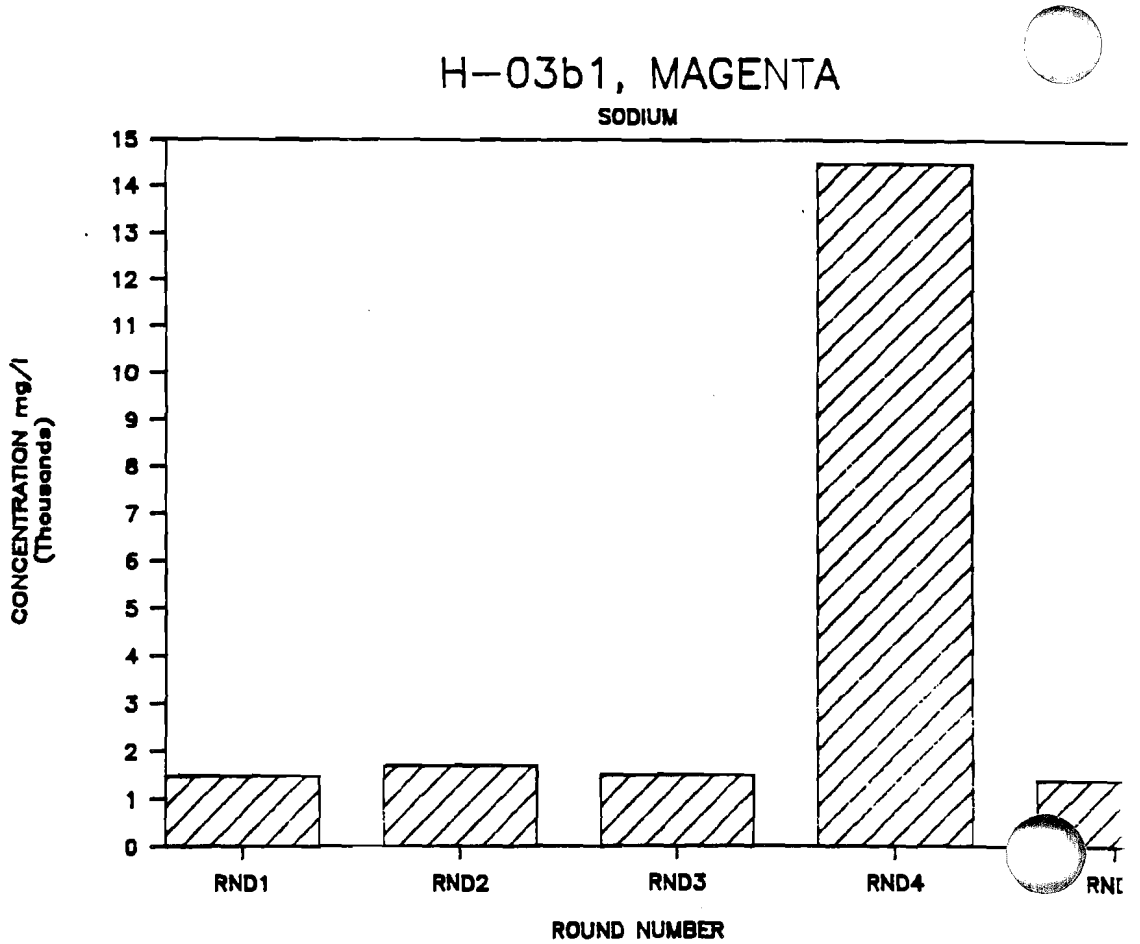

H-03b1, MAGENTA
CALCIUM
CONCENTRATION mg/l (Thousands)
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

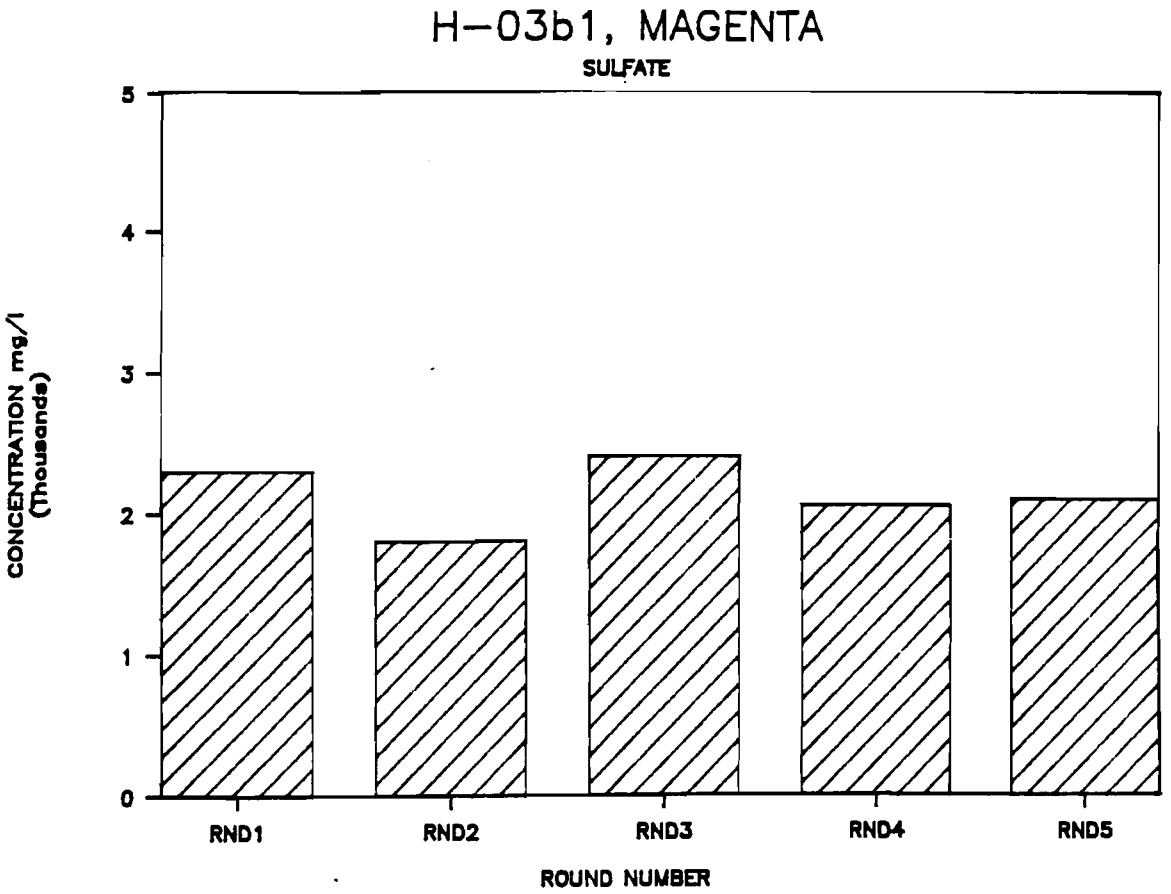

H-03b1, MAGENTA
CHLORIDE
CONCENTRATION mg/l (Thousands)
5
4
3
2
1
0
RND1
RND2
RND3
RND4
ROUND NUMBER

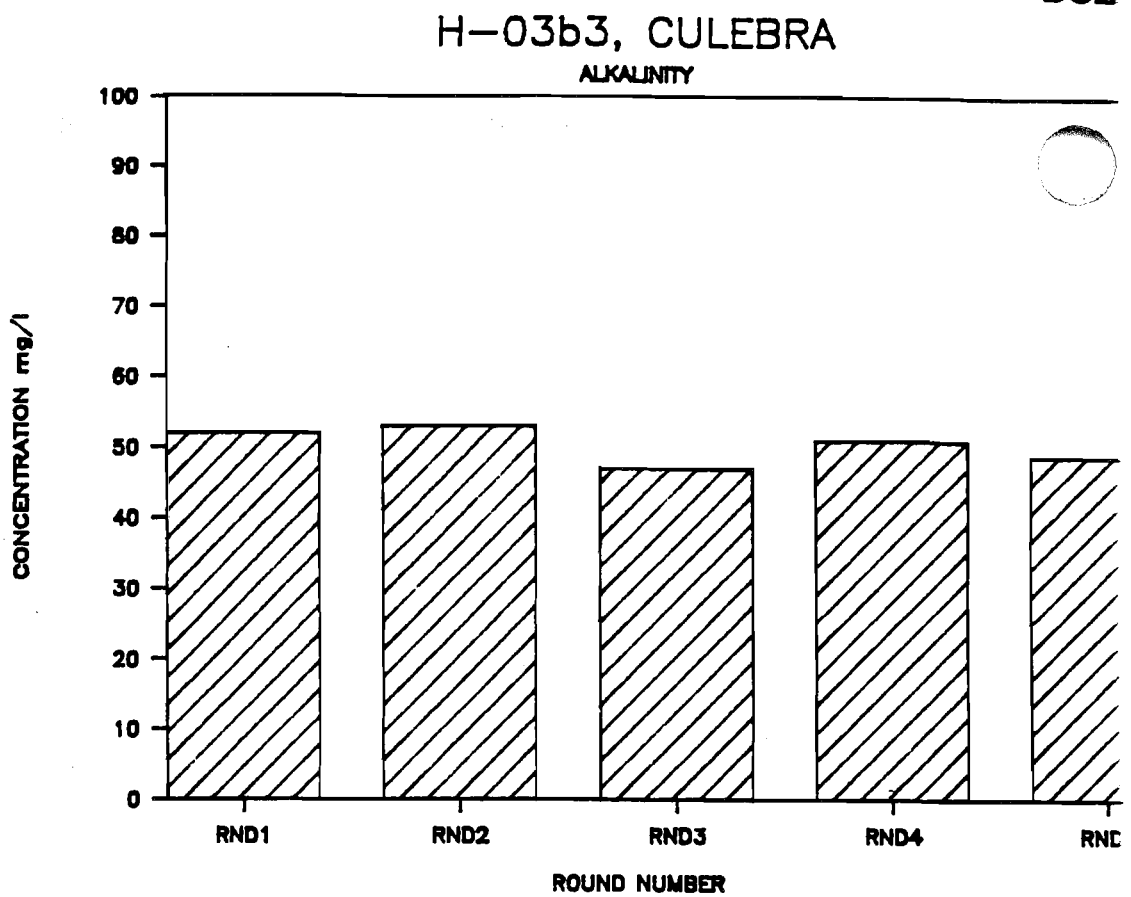

H-03b1, MAGENTA
FLOURIDE
CONCENTRATION mg/l
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

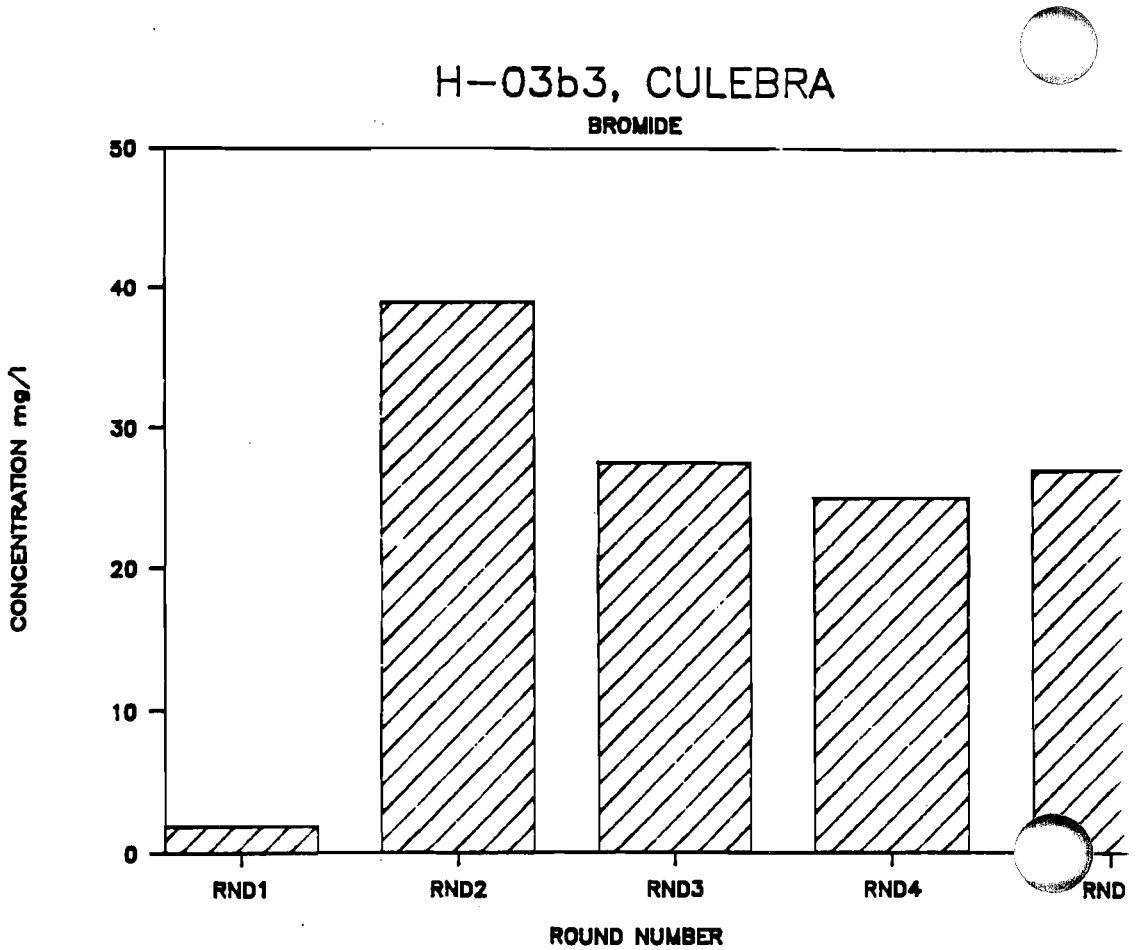

H-03b1, MAGENTA
MAGNESIUM
CONCENTRATION mg/l
500
400
300
200
100
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

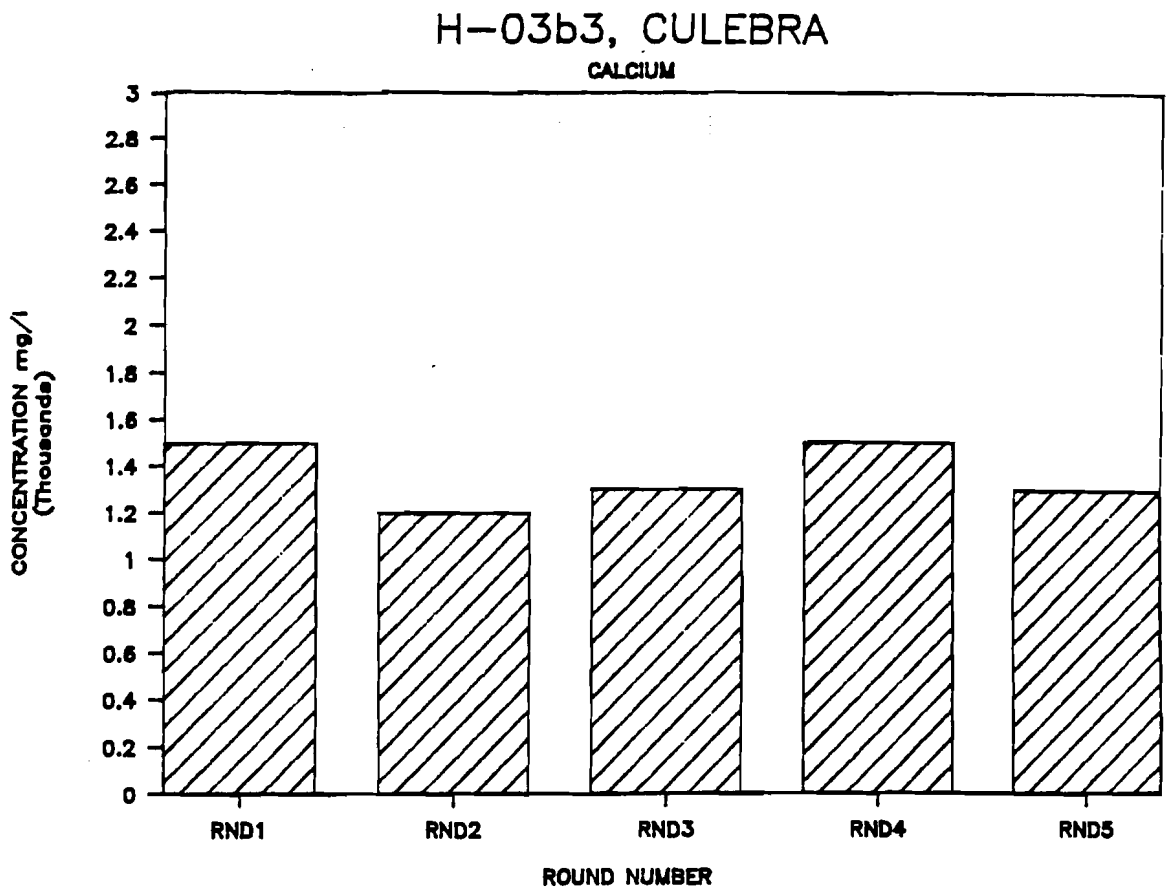

H-03b1, MAGENTA
POTASSIUM
CONCENTRATION mg/l
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND
ROUND NUMBER

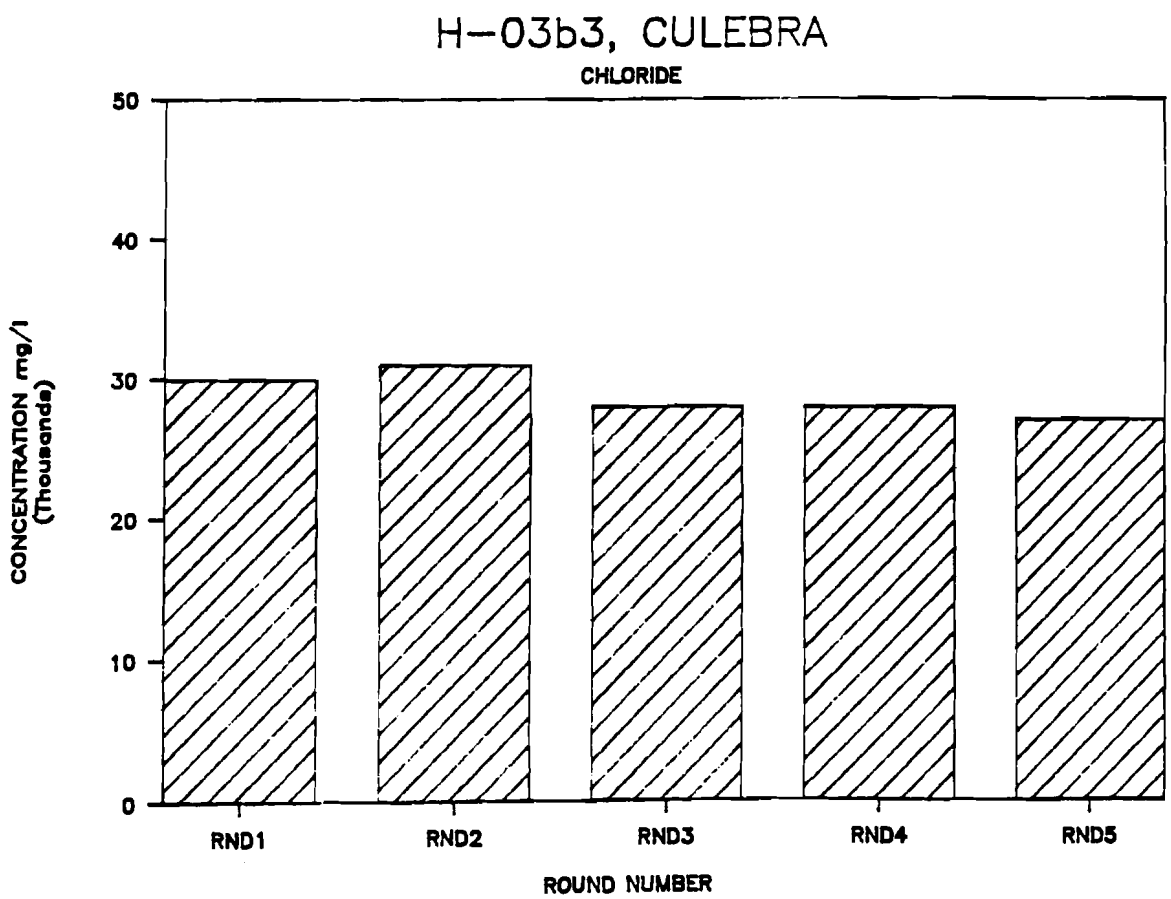

H-03b1, MAGENTA
SODIUM
CONCENTRATION mg/l
(Thousands)
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RNI
ROUND NUMBER

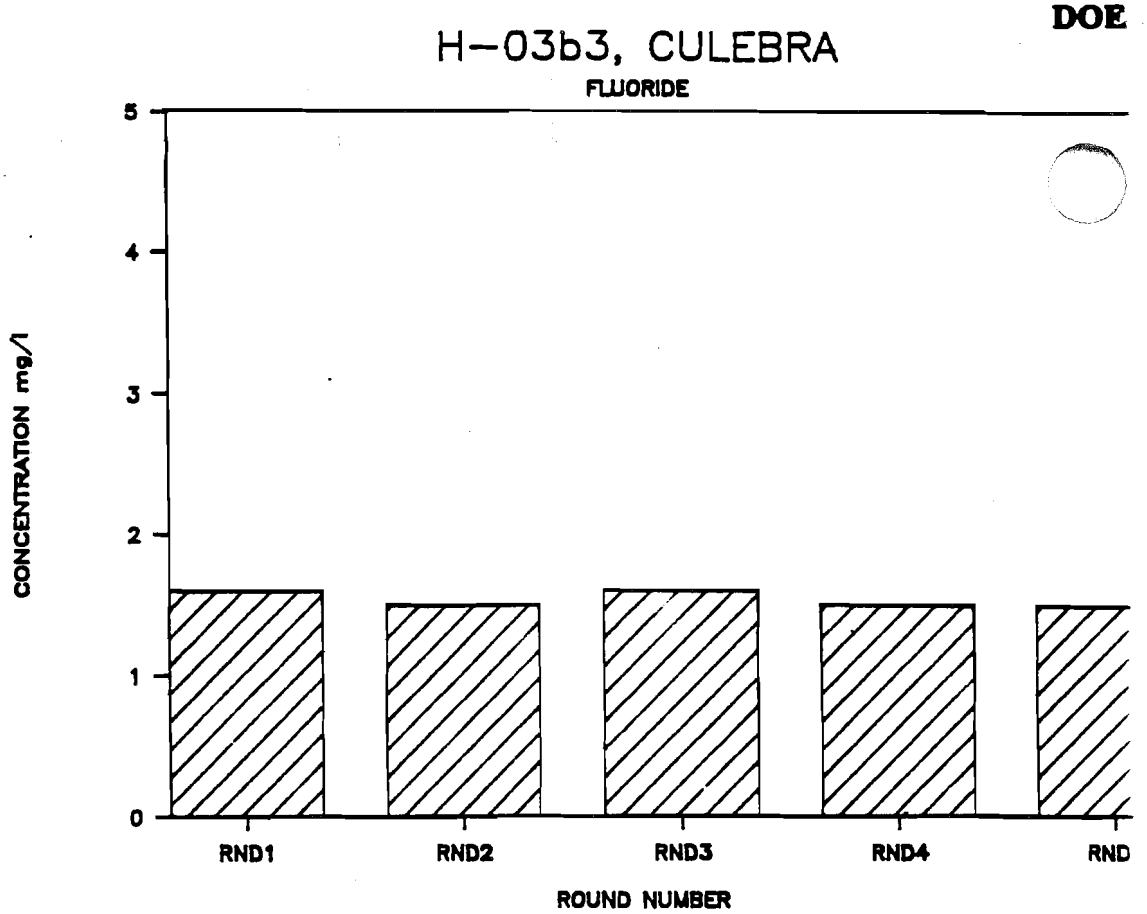

H-03b1, MAGENTA
SULFATE
CONCENTRATION mg/l
(Thousands)
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

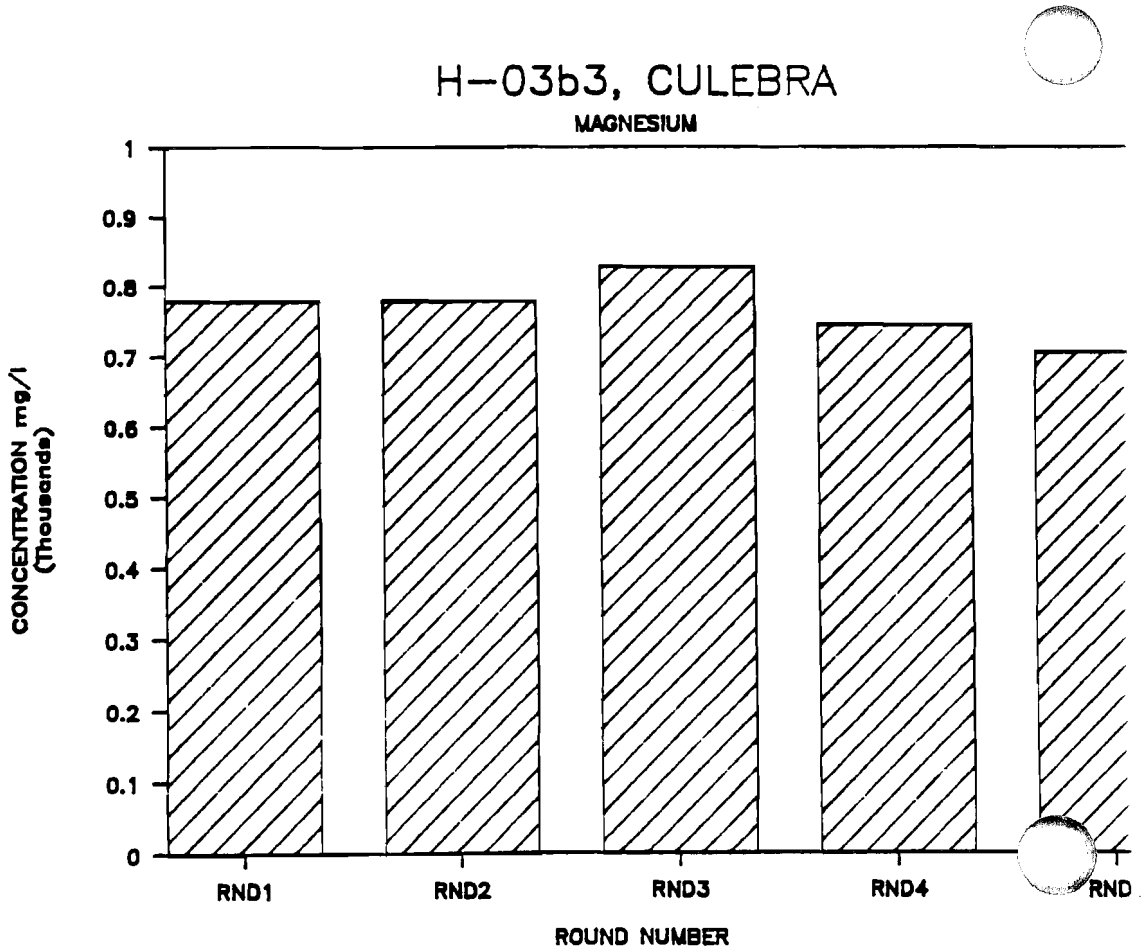

H-03b3, CULEBRA
ALKALINITY
CONCENTRATION mg/l
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND
ROUND NUMBER

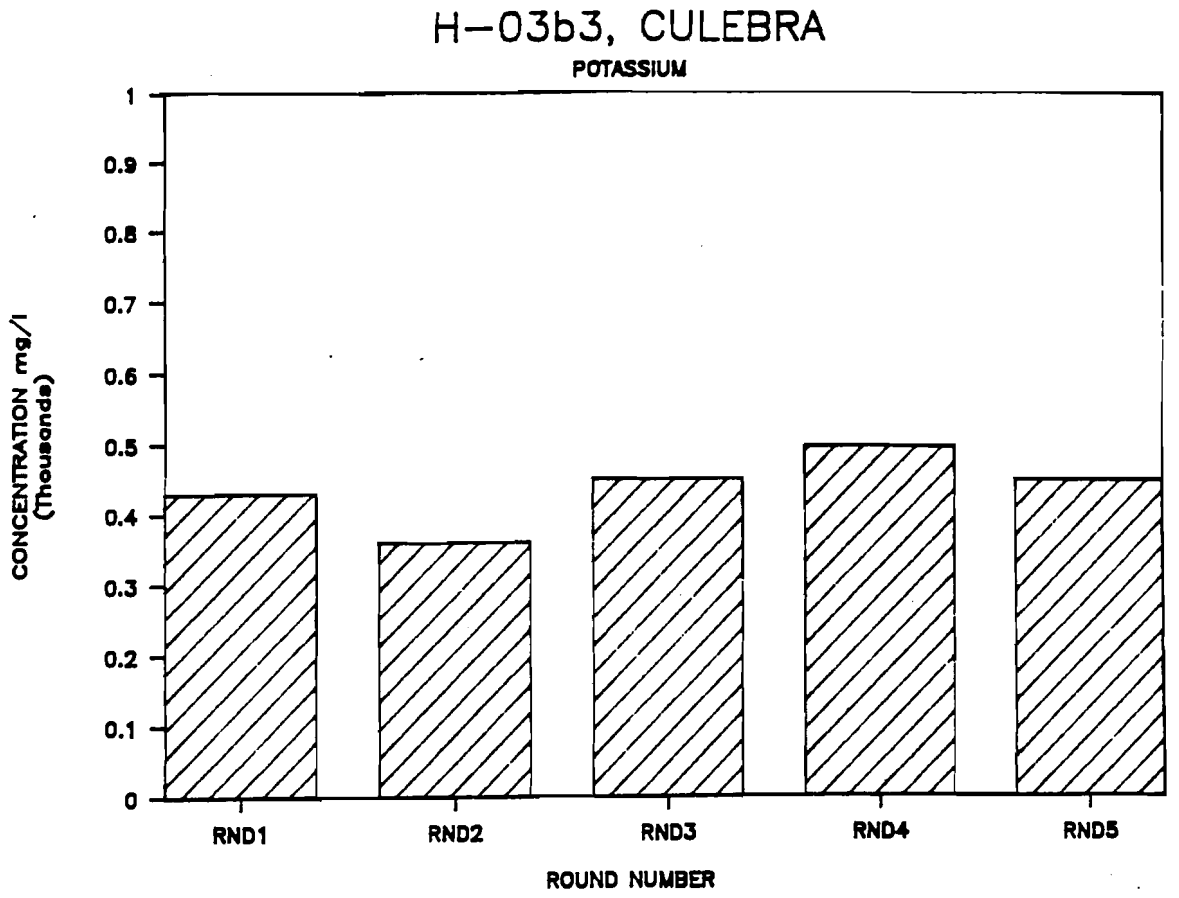

H-03b3, CULEBRA
BROMIDE
CONCENTRATION mg/l
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND
ROUND NUMBER

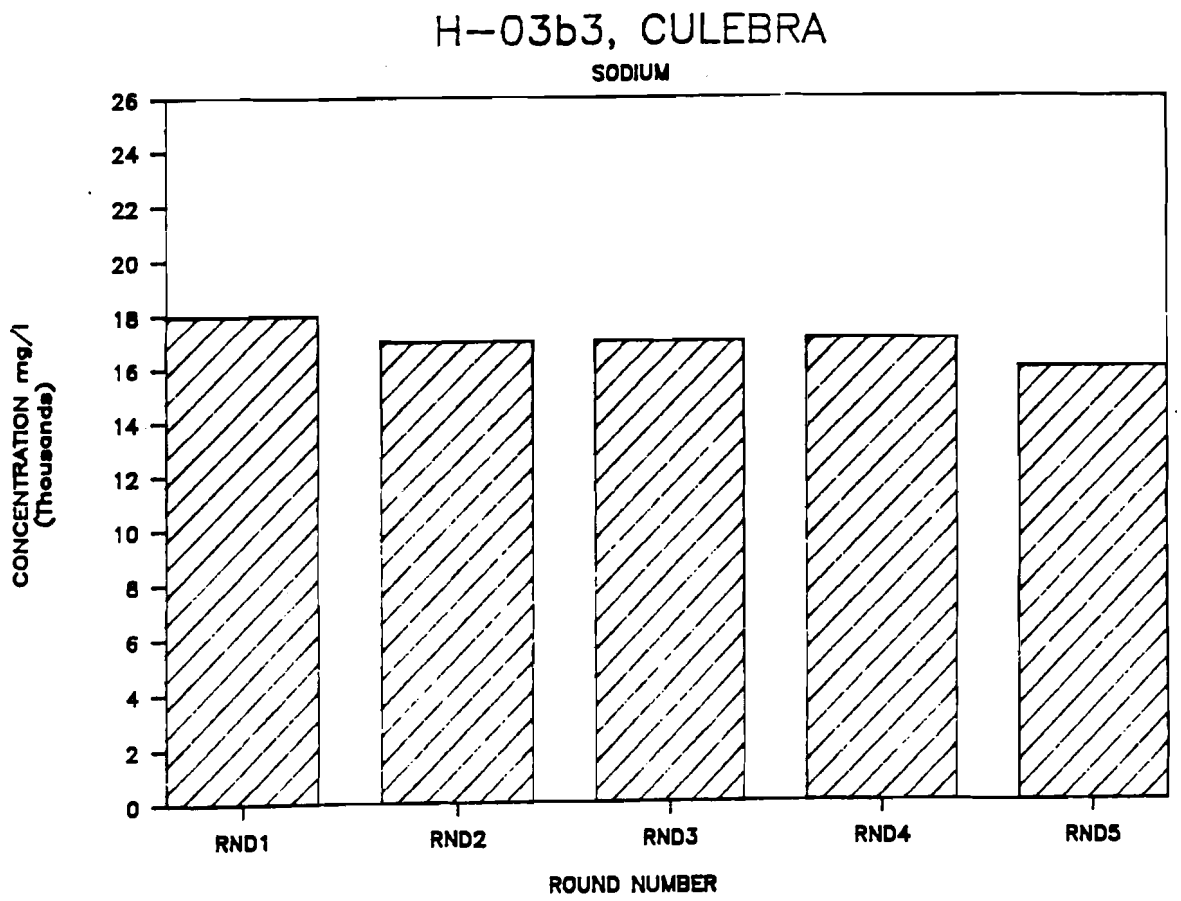

H-03b3, CULEBRA
CALCIUM
CONCENTRATION mg/l (Thousands)
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

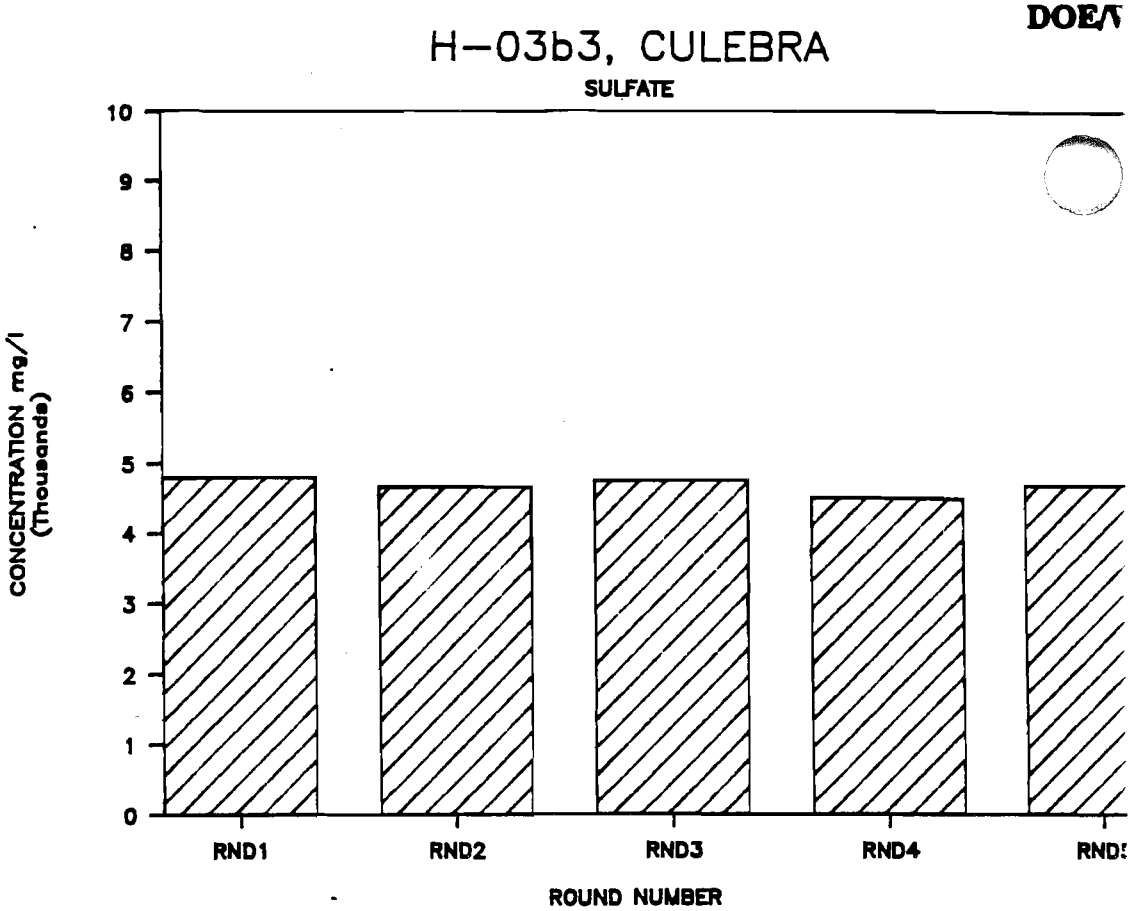

H-03b3, CULEBRA
CHLORIDE
CONCENTRATION mg/l (Thousands)
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

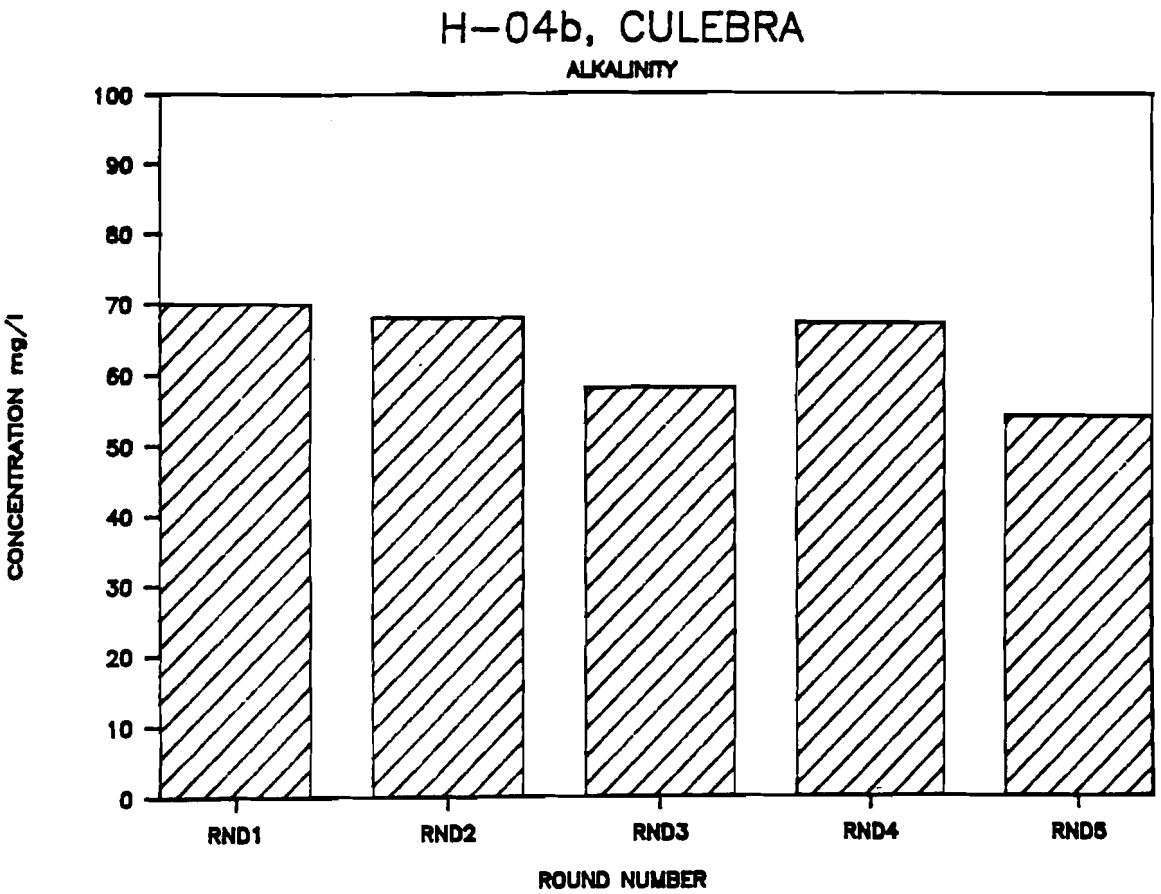

H-03b3, CULEBRA
FLUORIDE
CONCENTRATION mg/l
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND
ROUND NUMBER

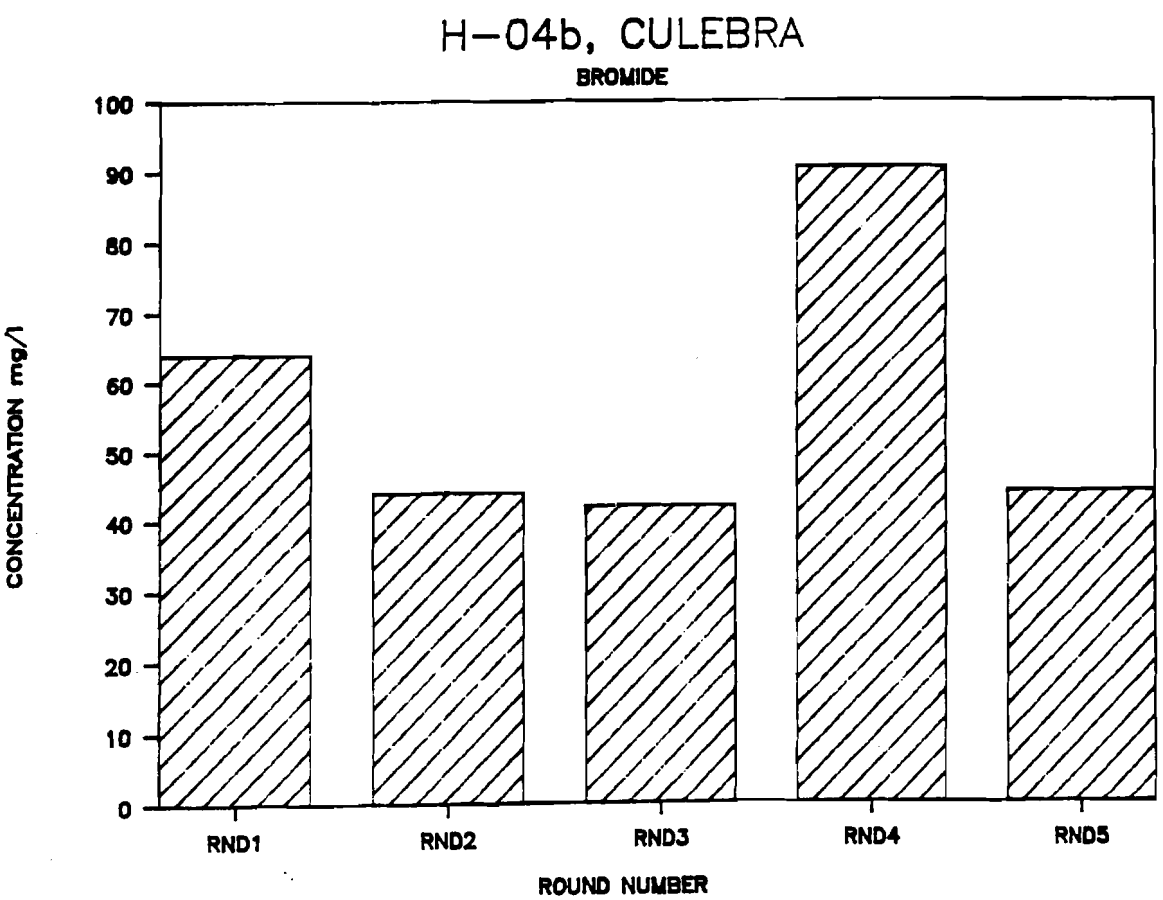

H-03b3, CULEBRA
MAGNESIUM
CONCENTRATION mg/l
(Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND
ROUND NUMBER

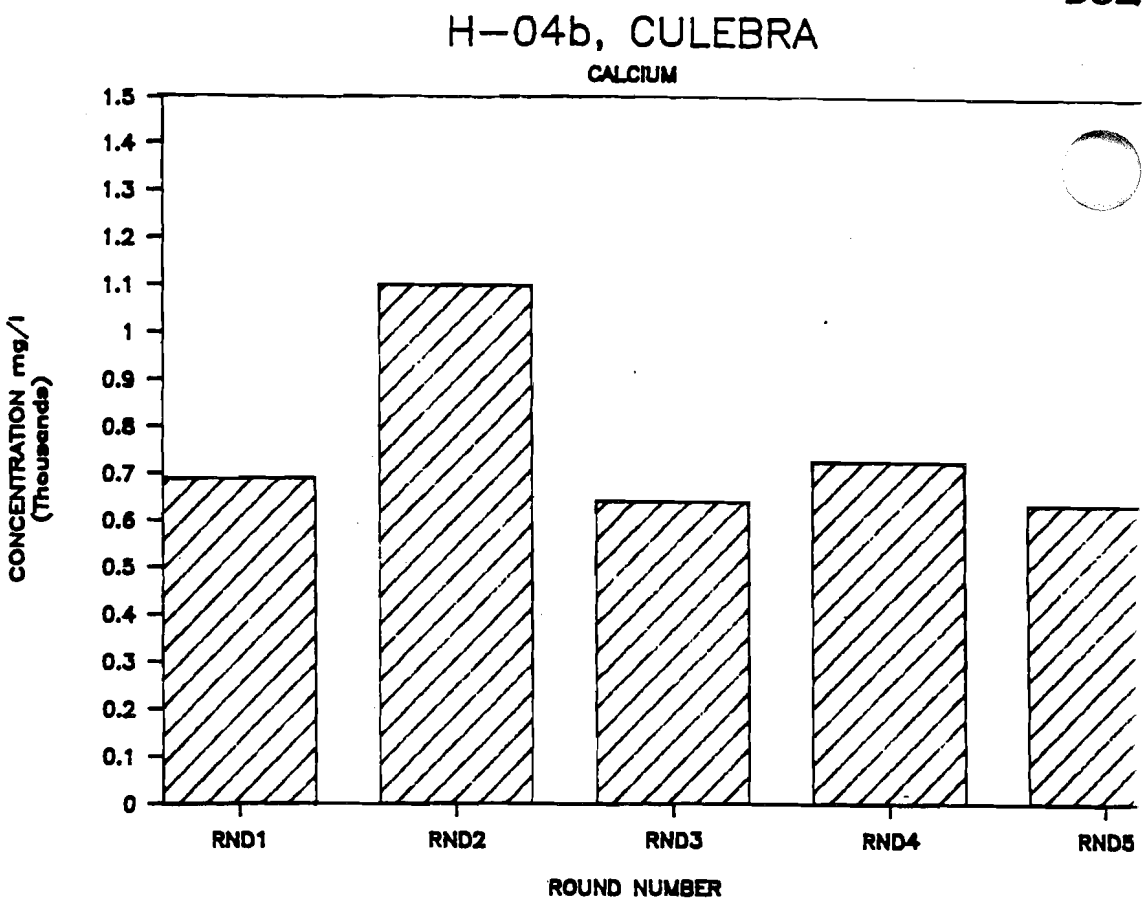

H-03b3, CULEBRA
POTASSIUM
CONCENTRATION mg/l (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

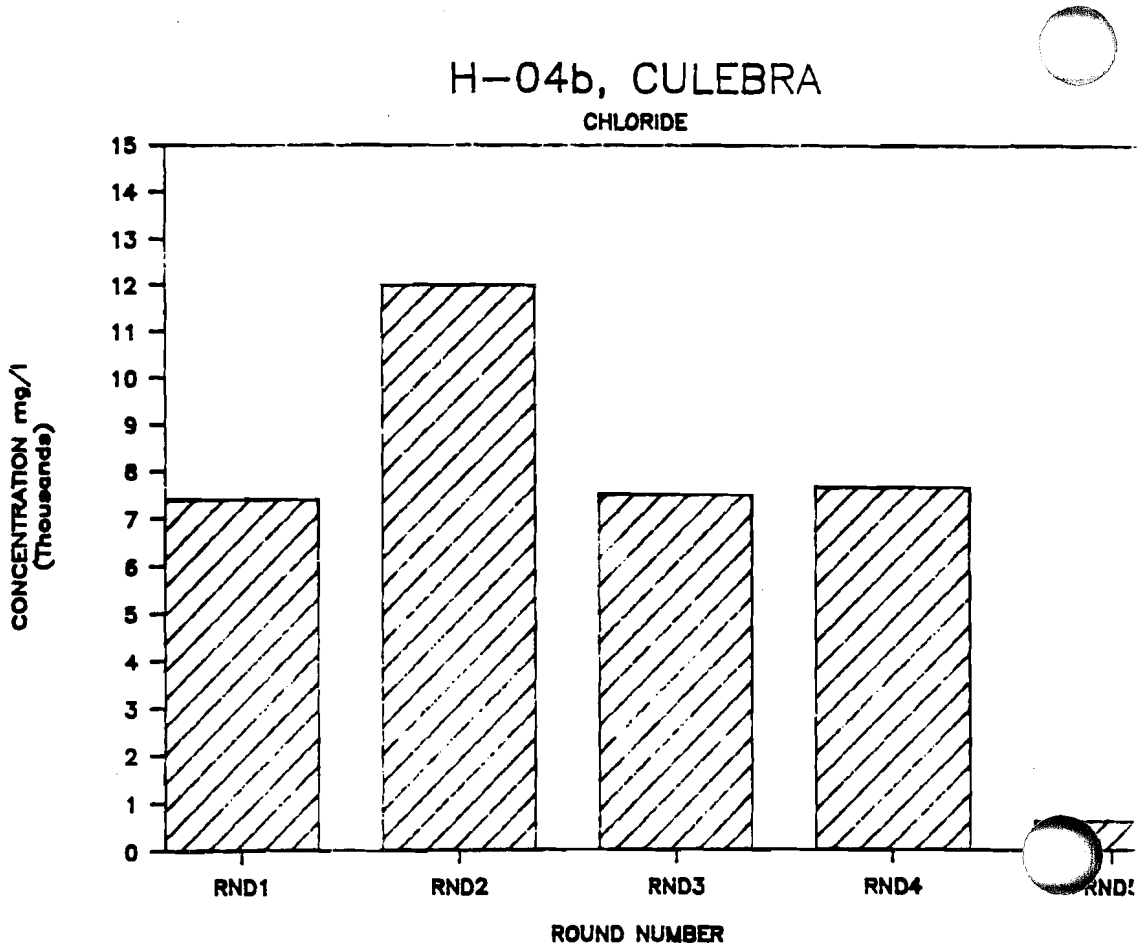

H-03b3, CULEBRA
SODIUM
CONCENTRATION mg/l (Thousands)
26
24
22
20
18
16
14
12
10
8
6
4
2
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

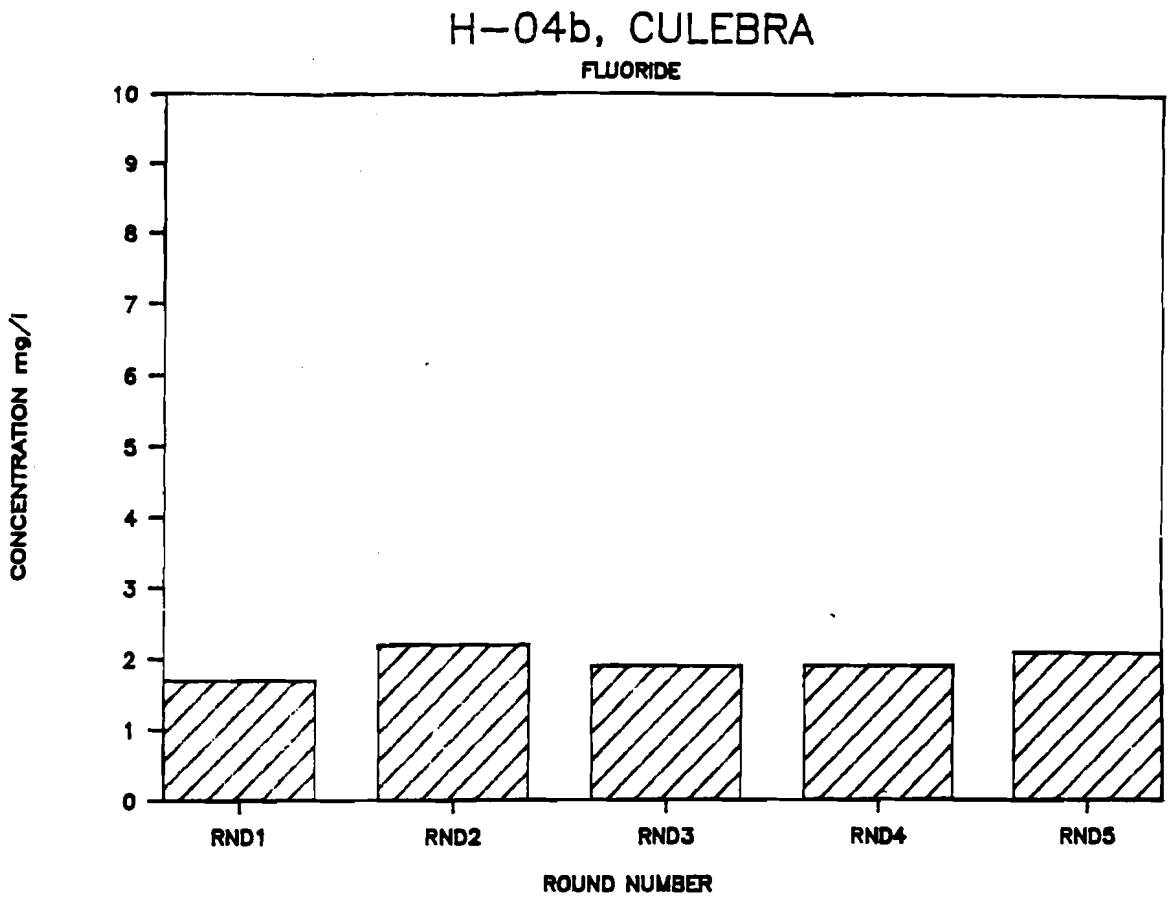

H-03b3, CULEBRA
SULFATE
CONCENTRATION mg/l
(Thousands)
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

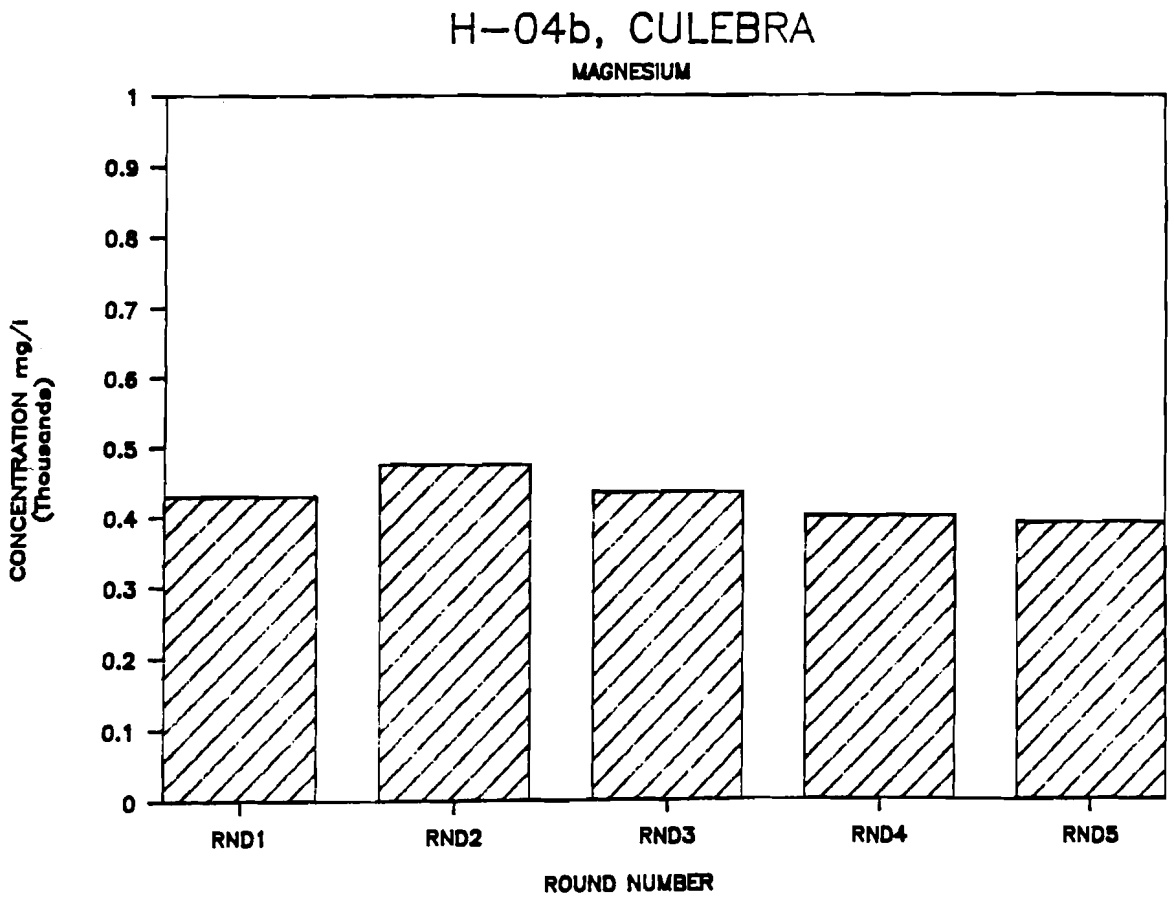

H-04b, CULEBRA
ALKALINITY
CONCENTRATION mg/l
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

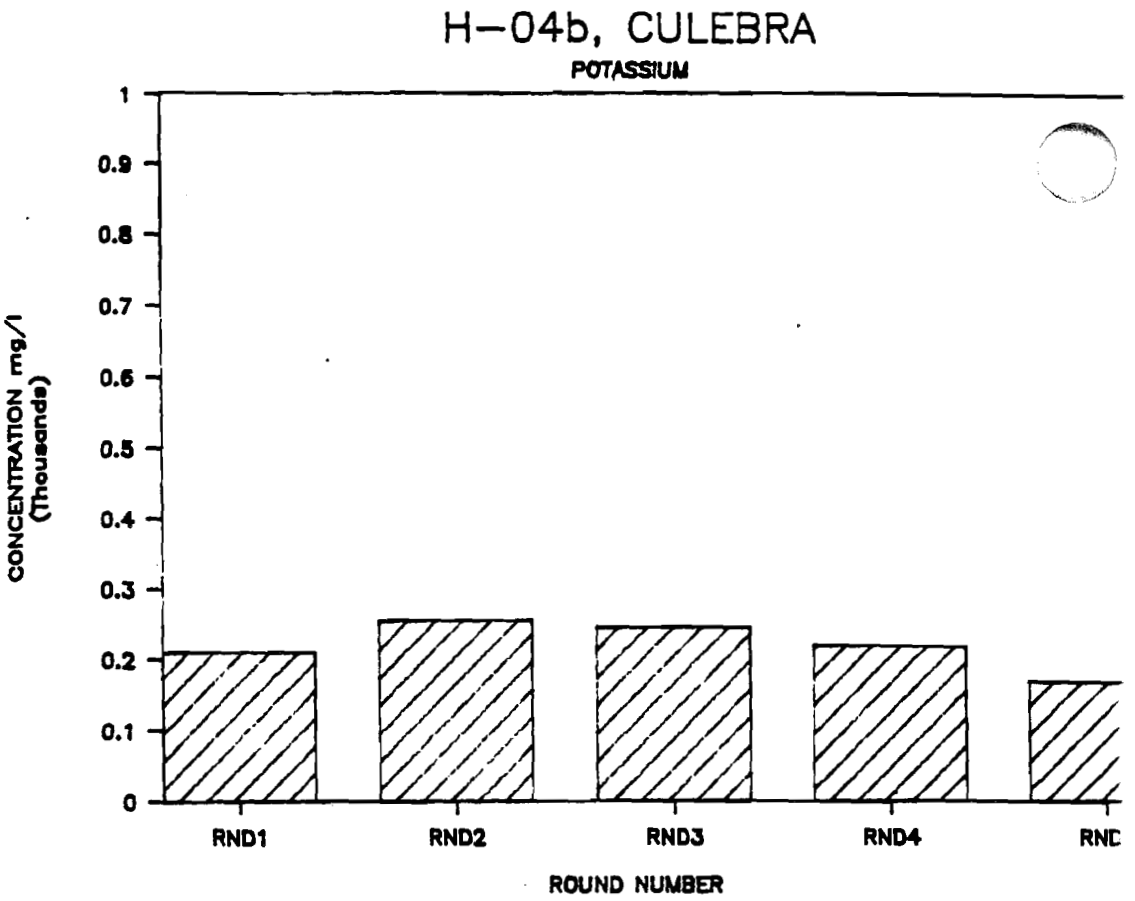

H-04b, CULEBRA
BROMIDE
CONCENTRATION mg/l
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

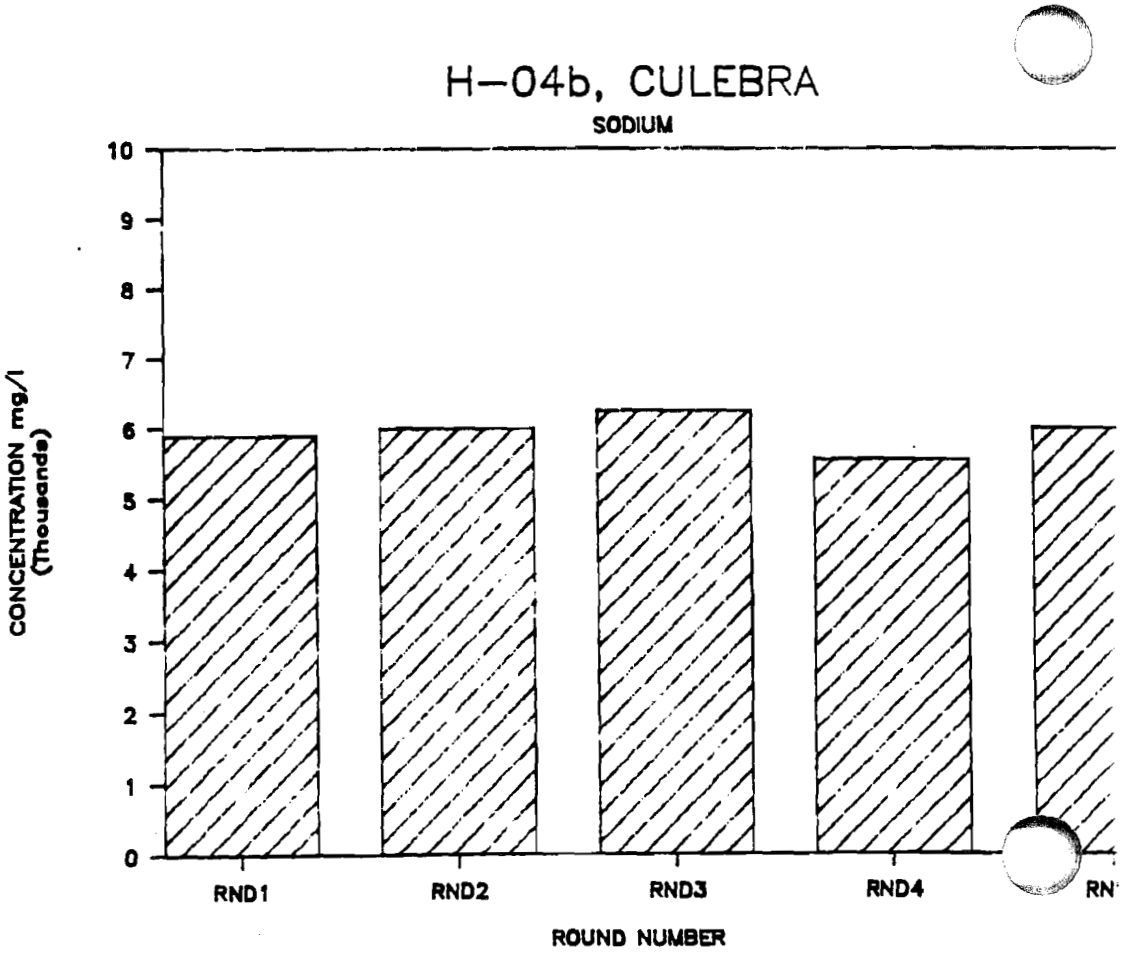

H-04b, CULEBRA
CALCIUM
CONCENTRATION mg/l (Thousands)
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

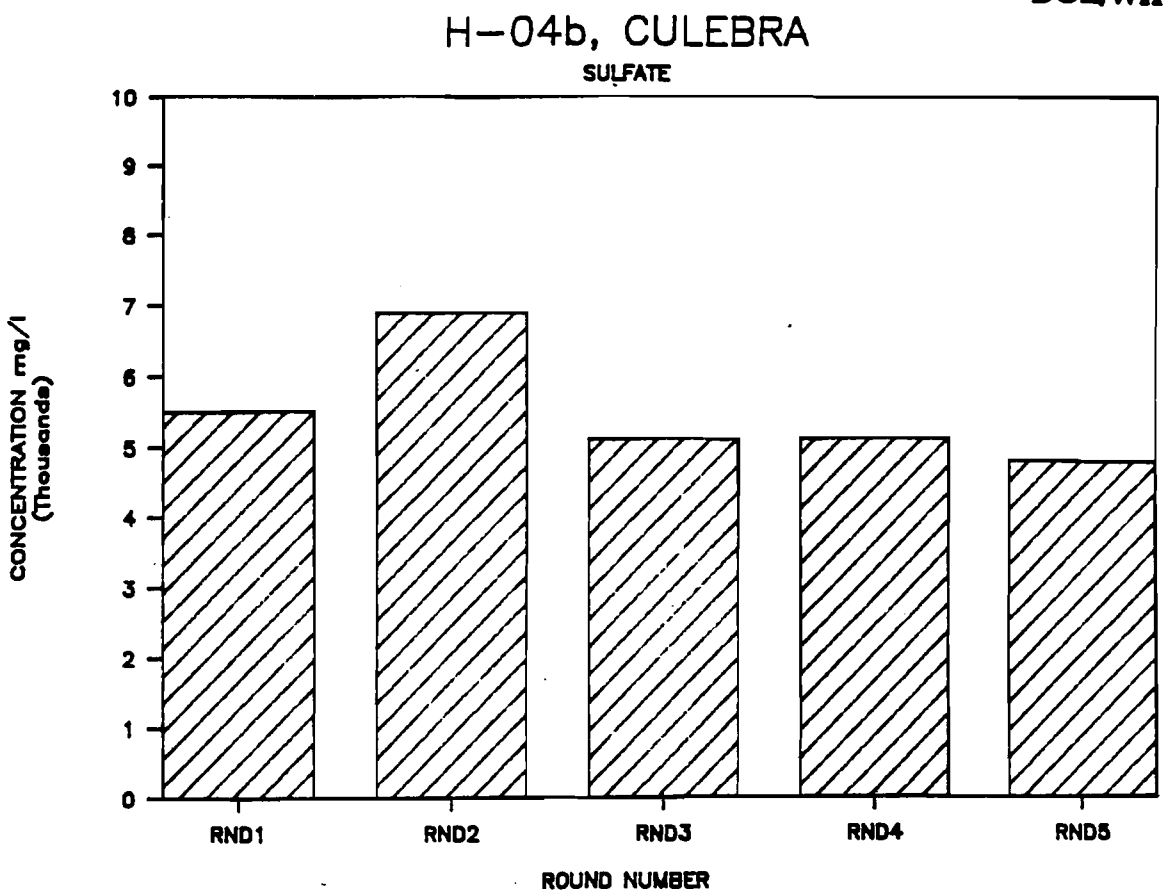

H-04b, CULEBRA
CHLORIDE
CONCENTRATION mg/l (Thousands)
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
ROUND NUMBER

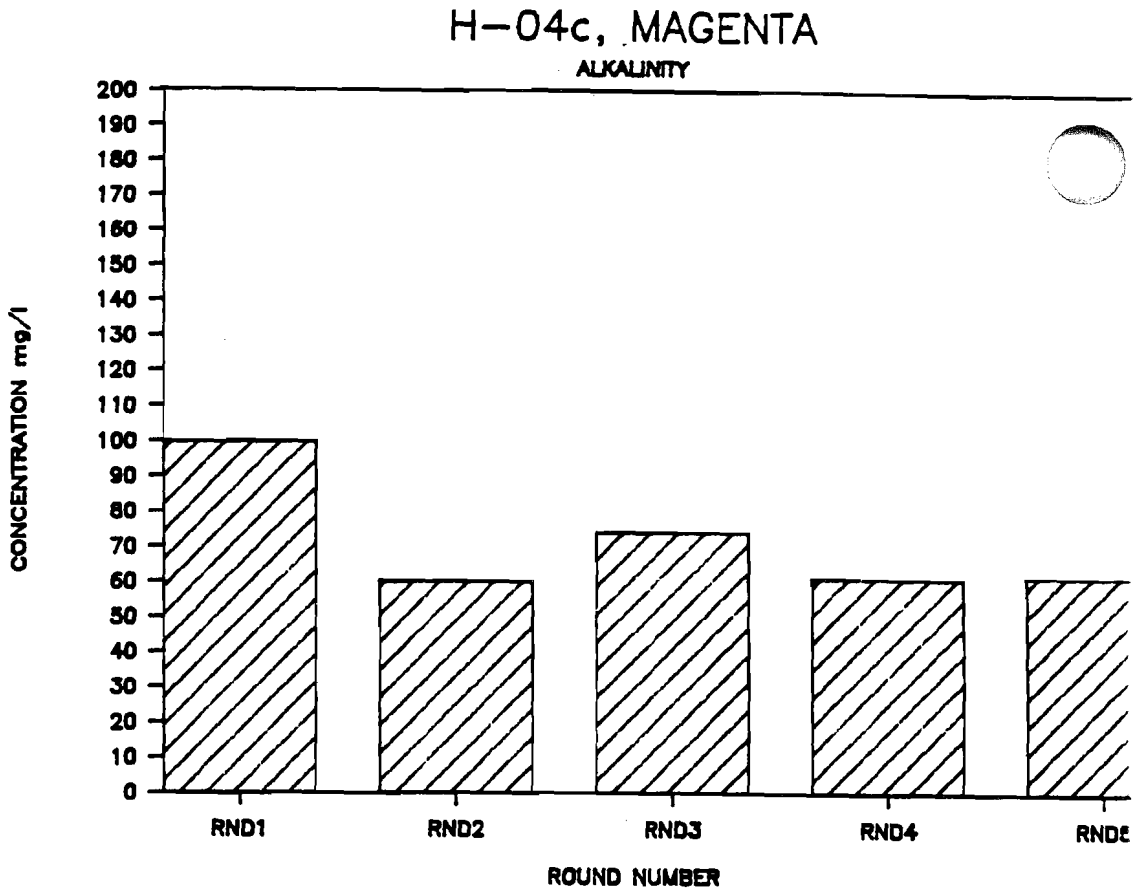

H-04b, CULEBRA
FLUORIDE
CONCENTRATION mg/l
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

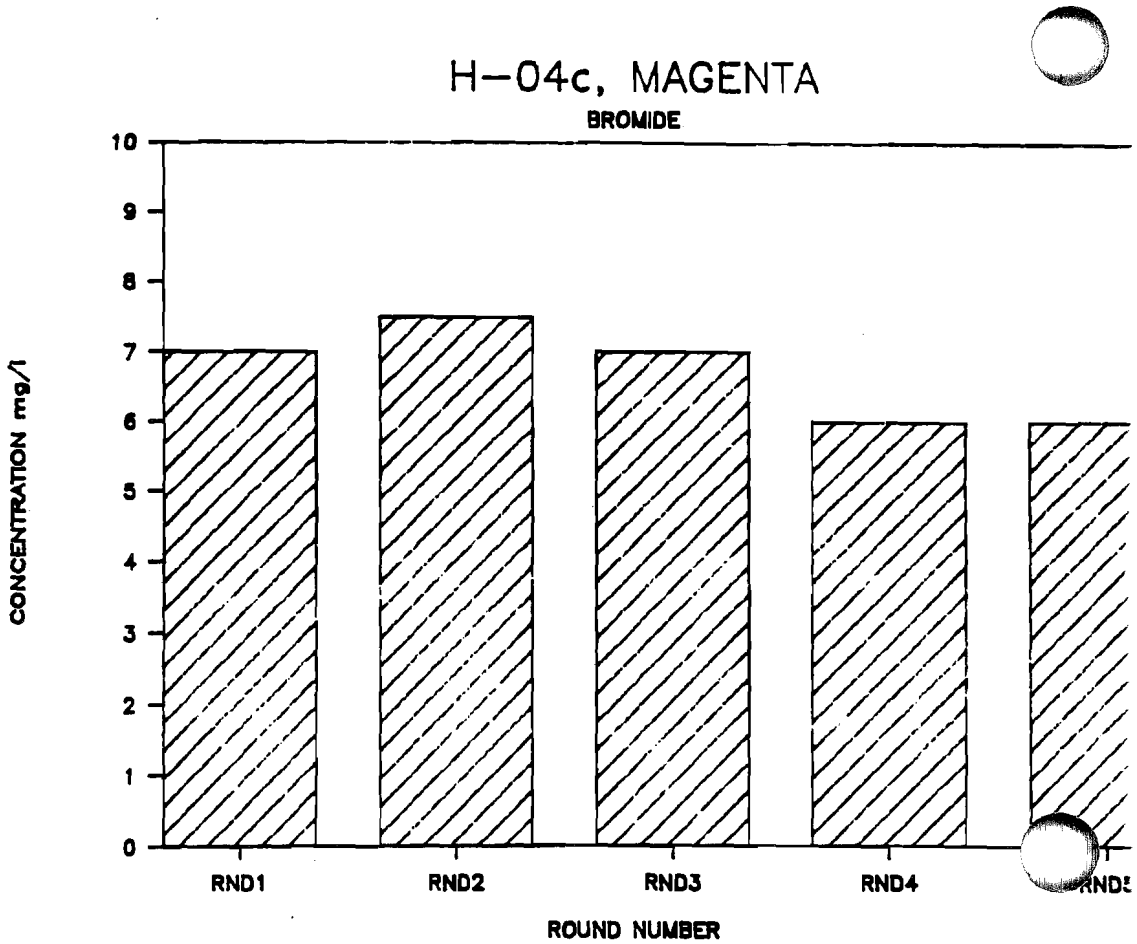

H-04b, CULEBRA
MAGNESIUM
CONCENTRATION mg/l
(Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

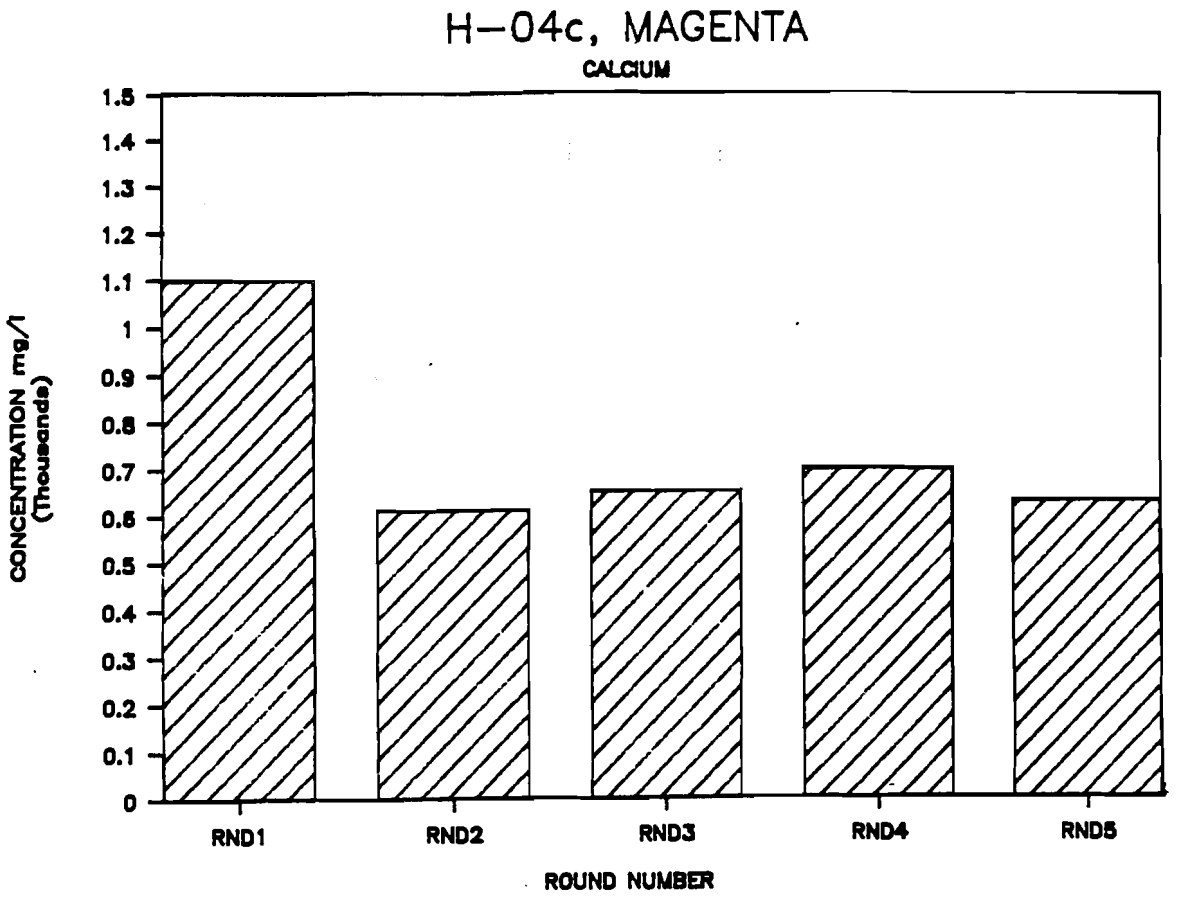

H-04b, CULEBRA
POTASSIUM
CONCENTRATION mg/l (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND
ROUND NUMBER

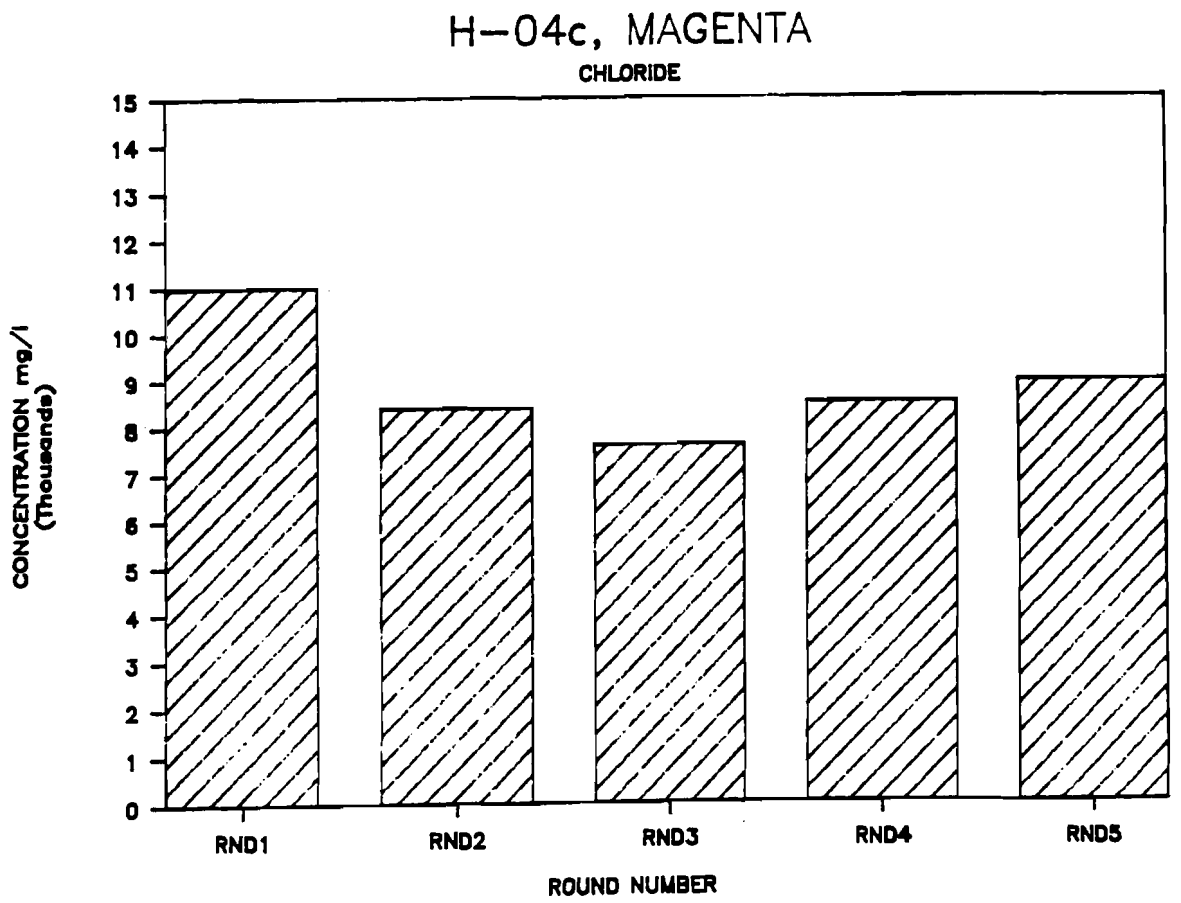

H-04b, CULEBRA
SODIUM
CONCENTRATION mg/l (Thousands)
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RN
ROUND NUMBER

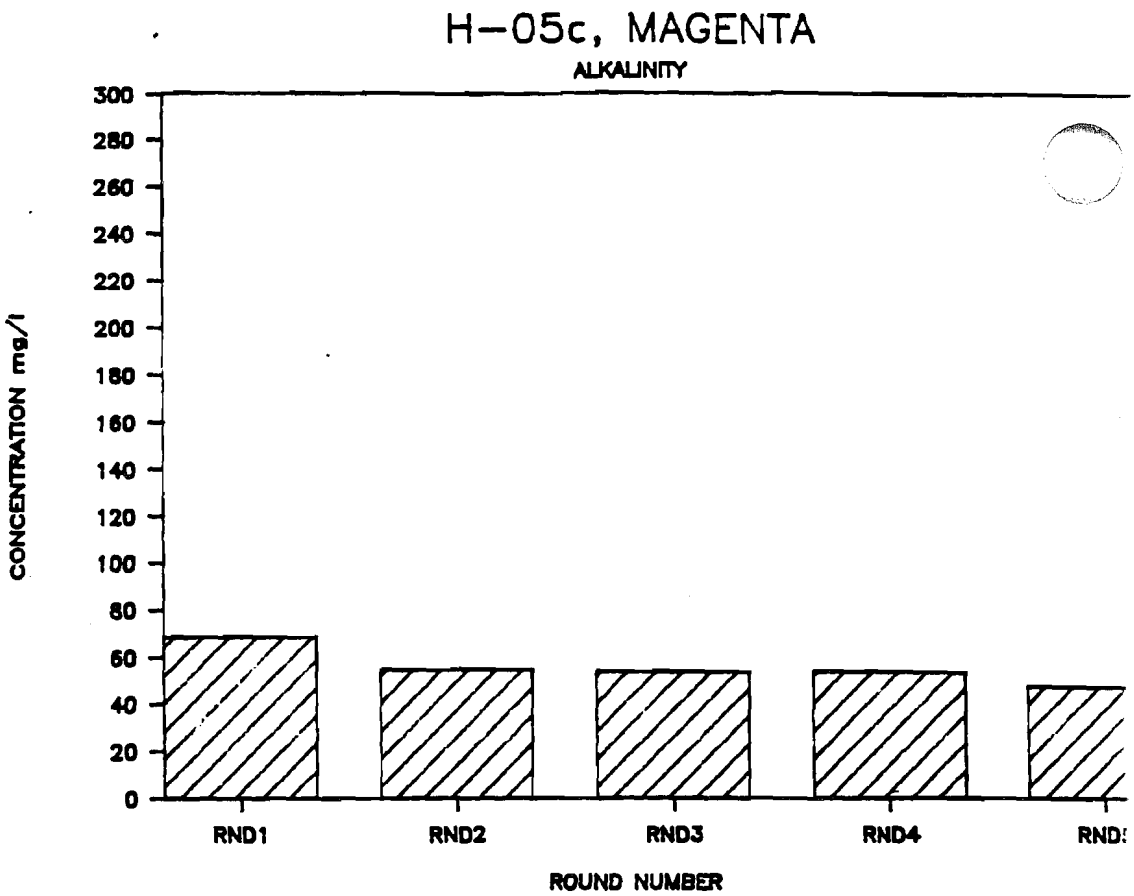

H-04b, CULEBRA
SULFATE
CONCENTRATION mg/l
(Thousands)
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

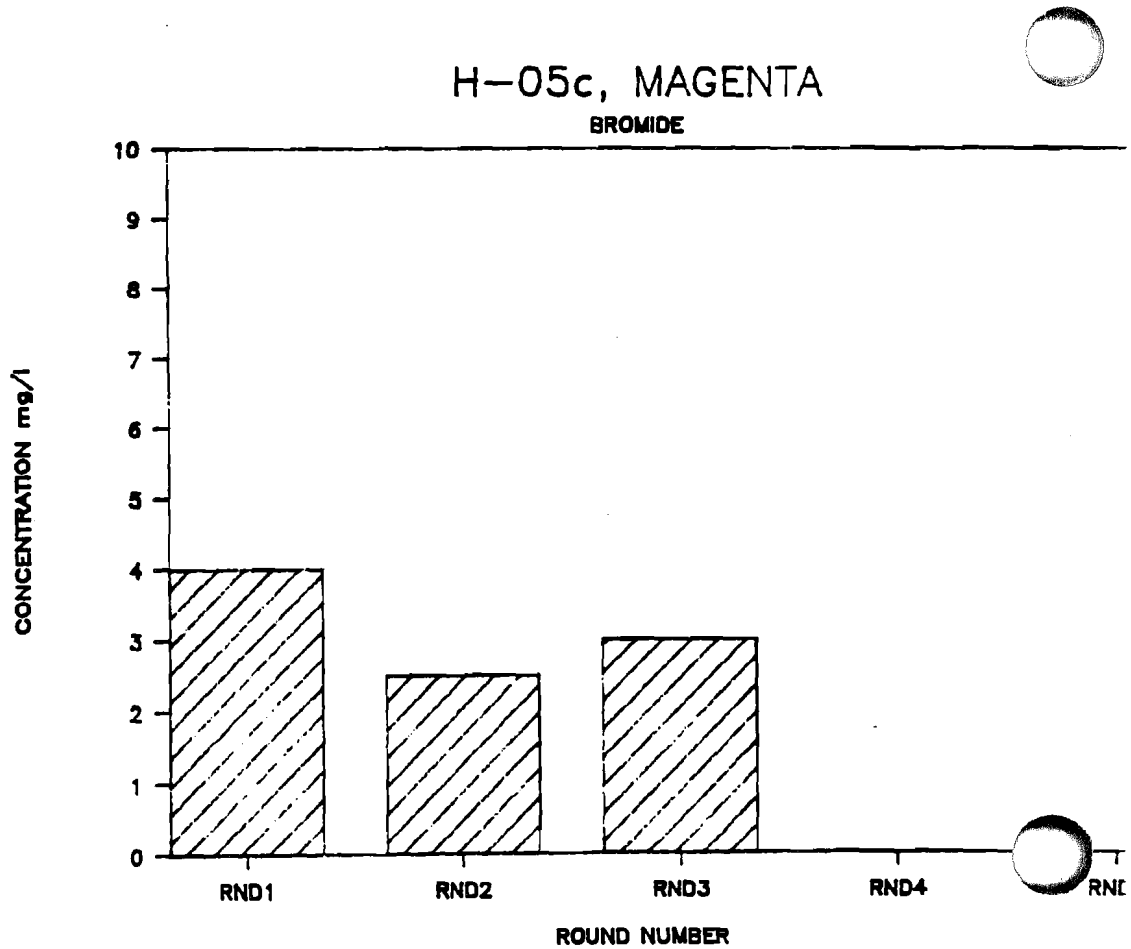

H-04c, MAGENTA
ALKALINITY
CONCENTRATION mg/l
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

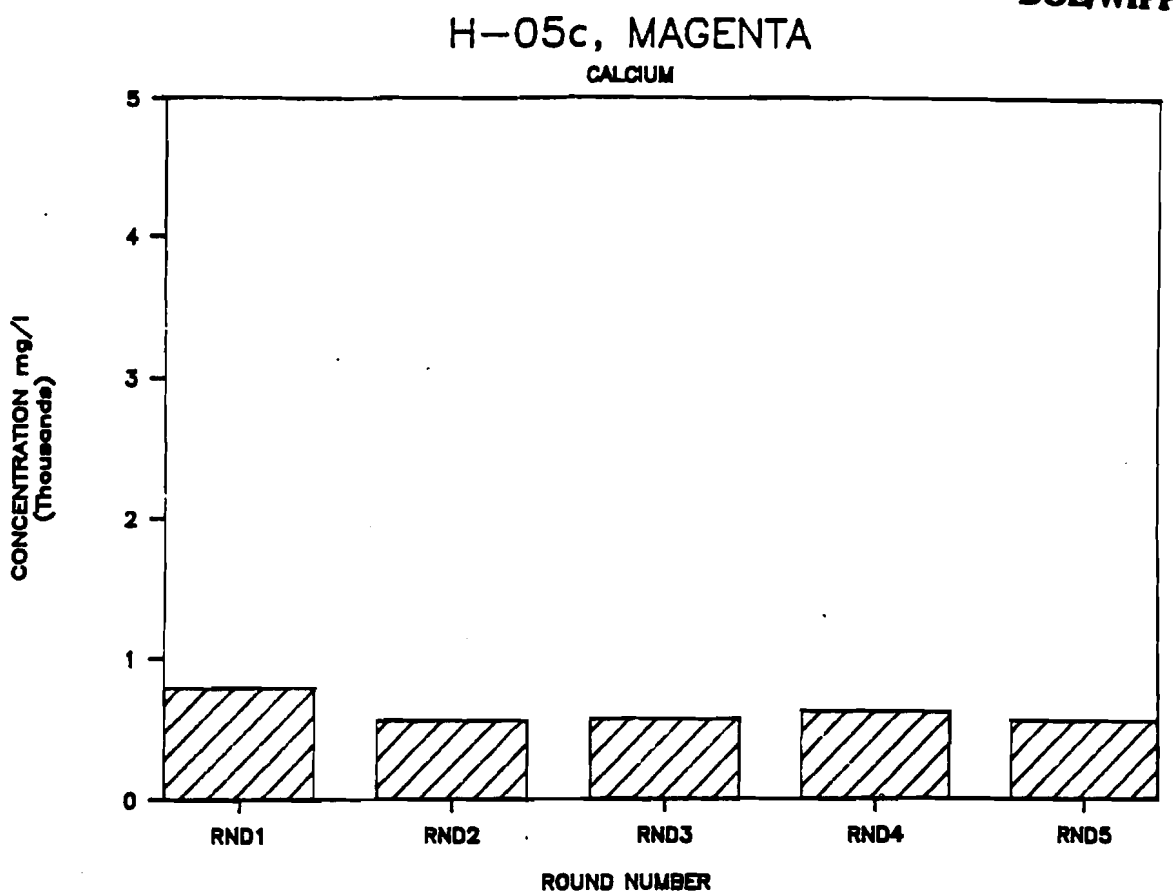

H-04c, MAGENTA
BROMIDE
CONCENTRATION mg/l
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

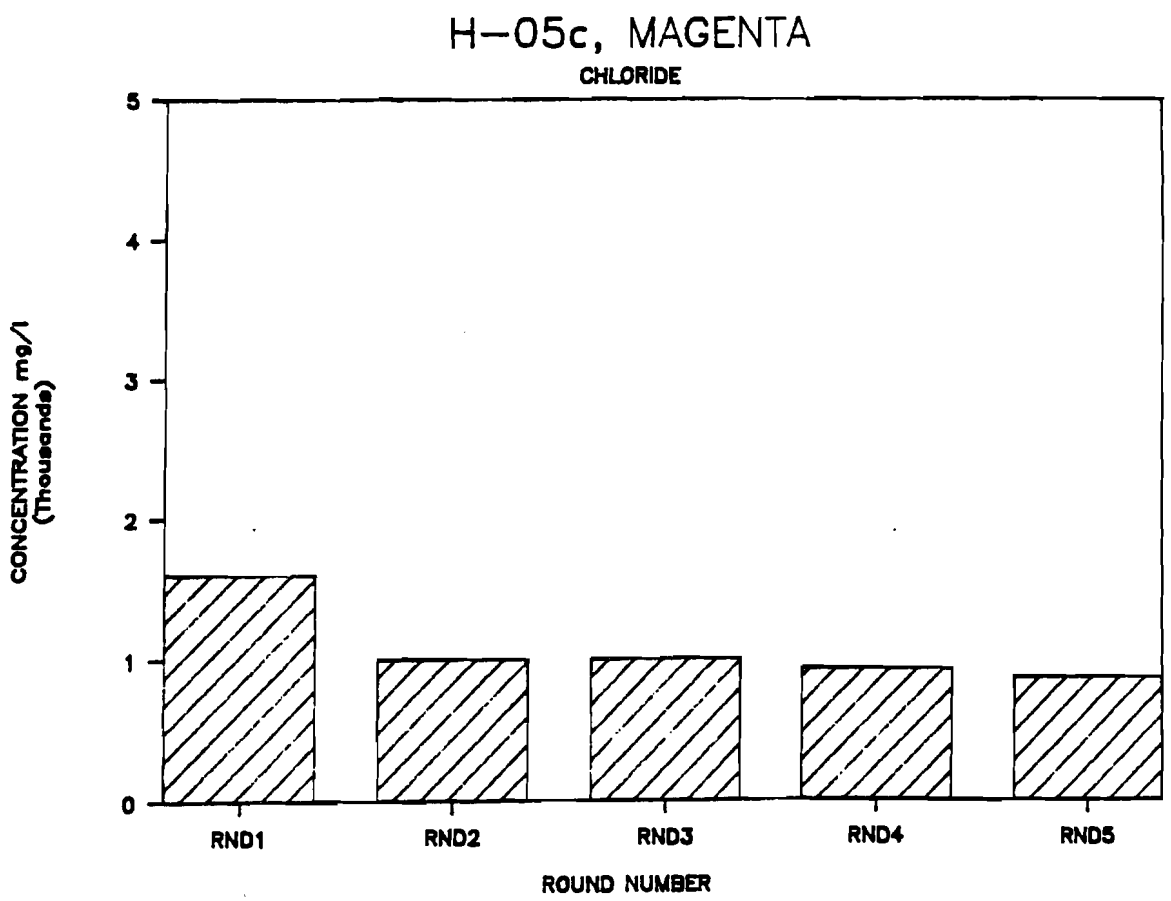

H-04c, MAGENTA
CALCIUM
CONCENTRATION mg/l (Thousands)
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

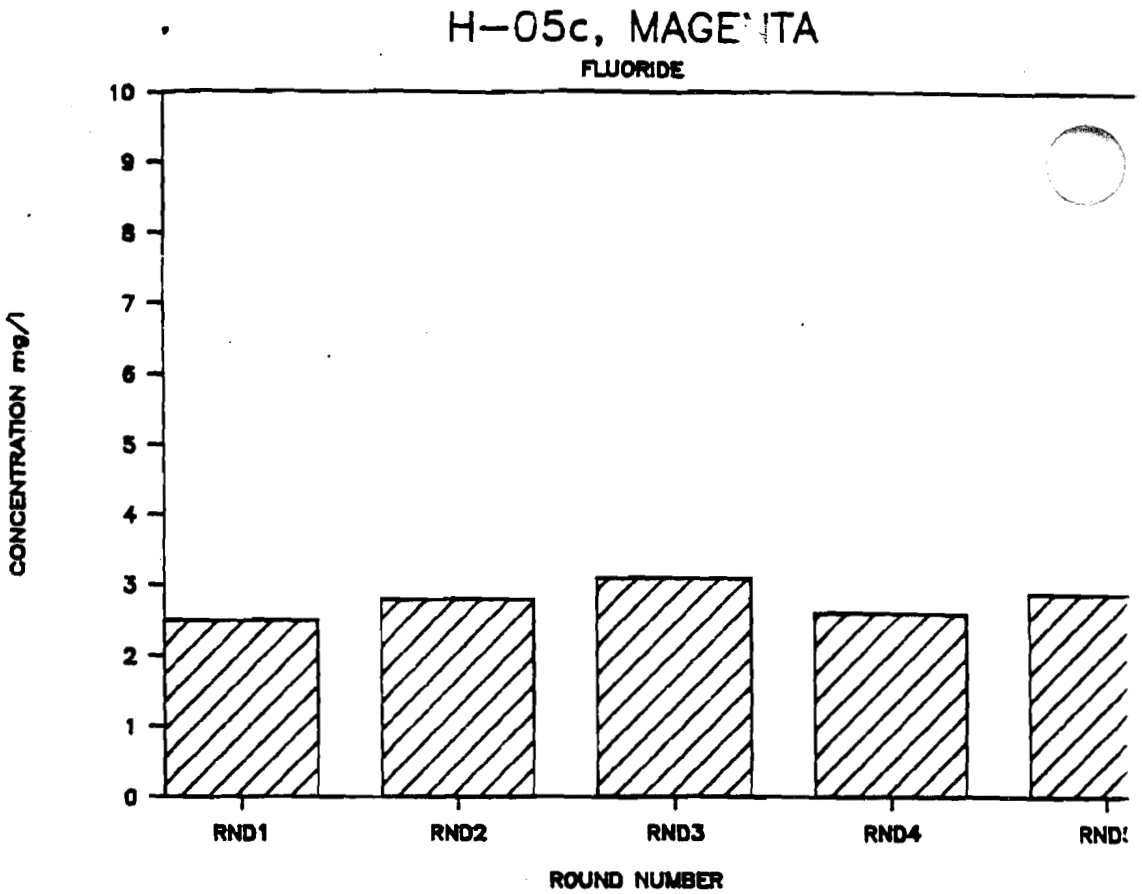

H-04c, MAGENTA
CHLORIDE
CONCENTRATION mg/l (Thousands)
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

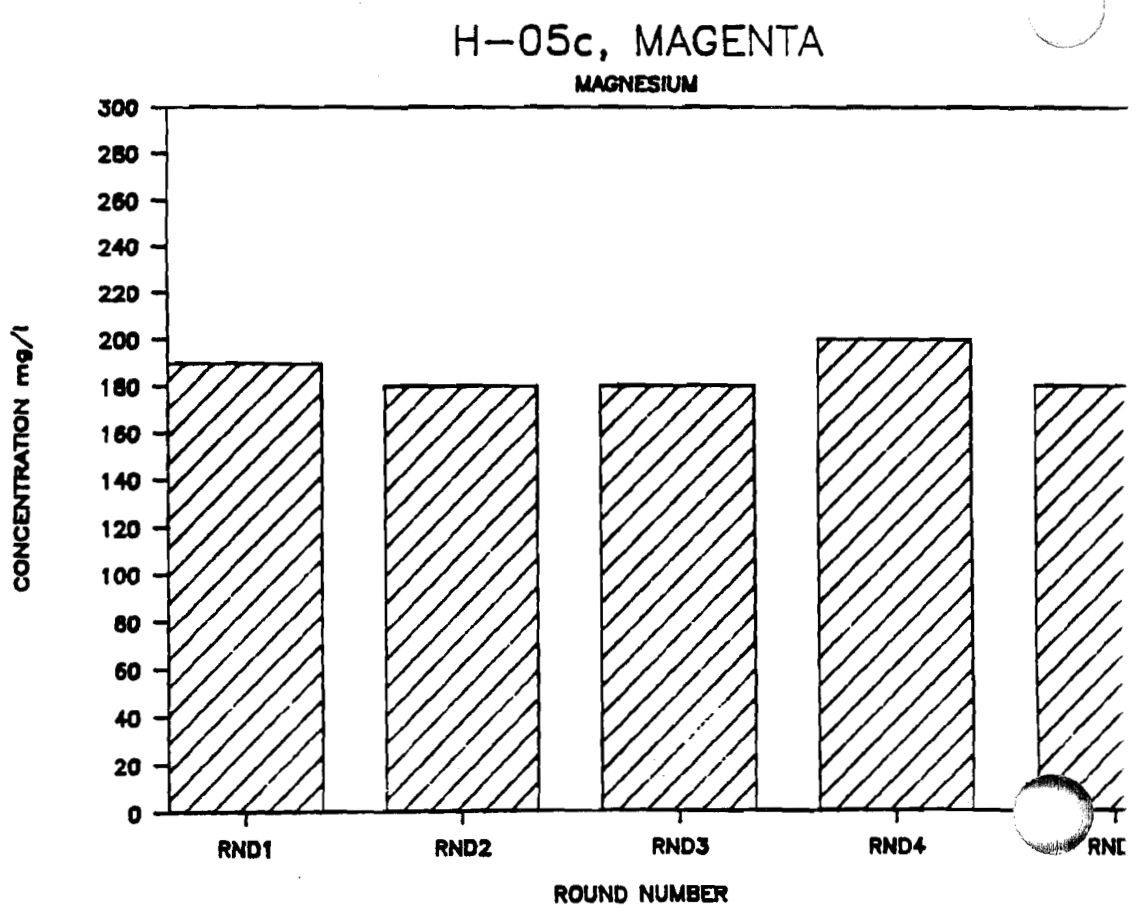

H-05c, MAGENTA
ALKALINITY
CONCENTRATION mg/l
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
RND1
RND2
RND3
RND4
ROUND NUMBER

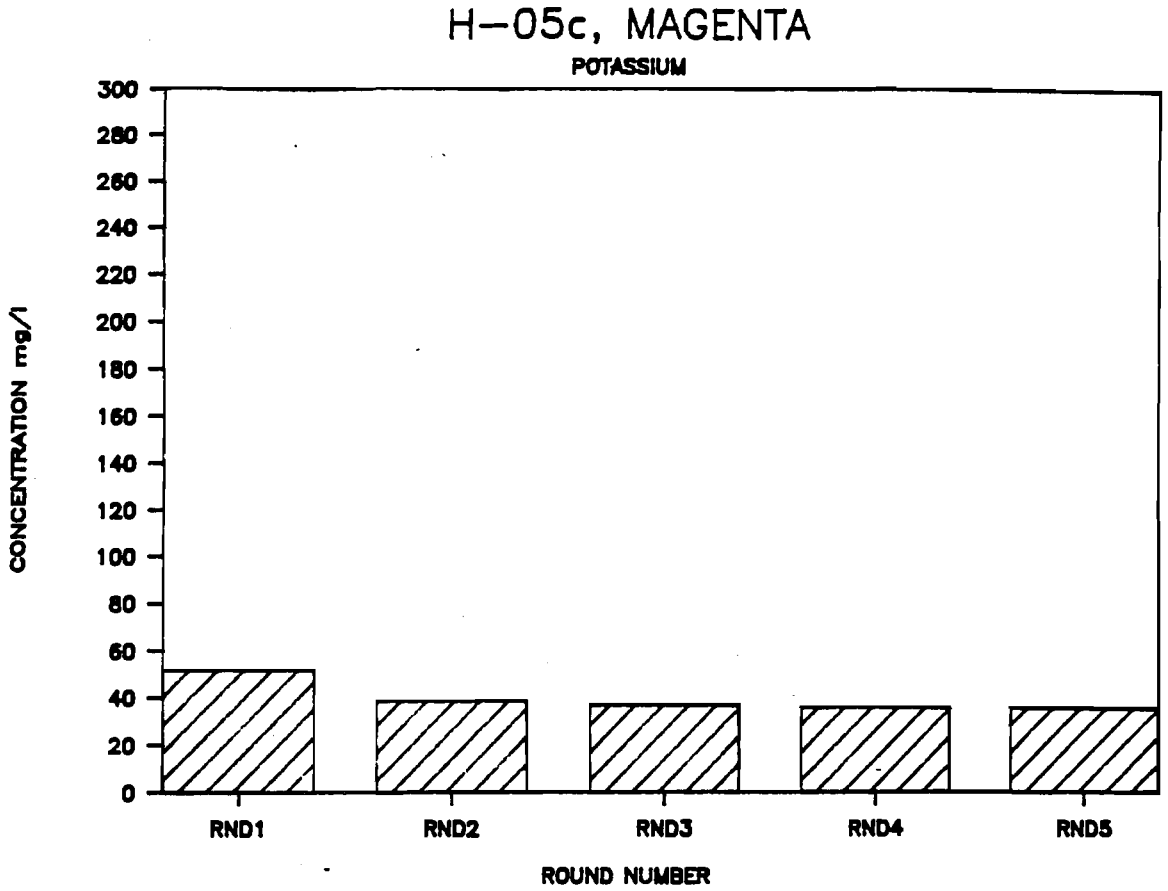

H-05c, MAGENTA
BROMIDE
CONCENTRATION mg/l
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
ROUND NUMBER

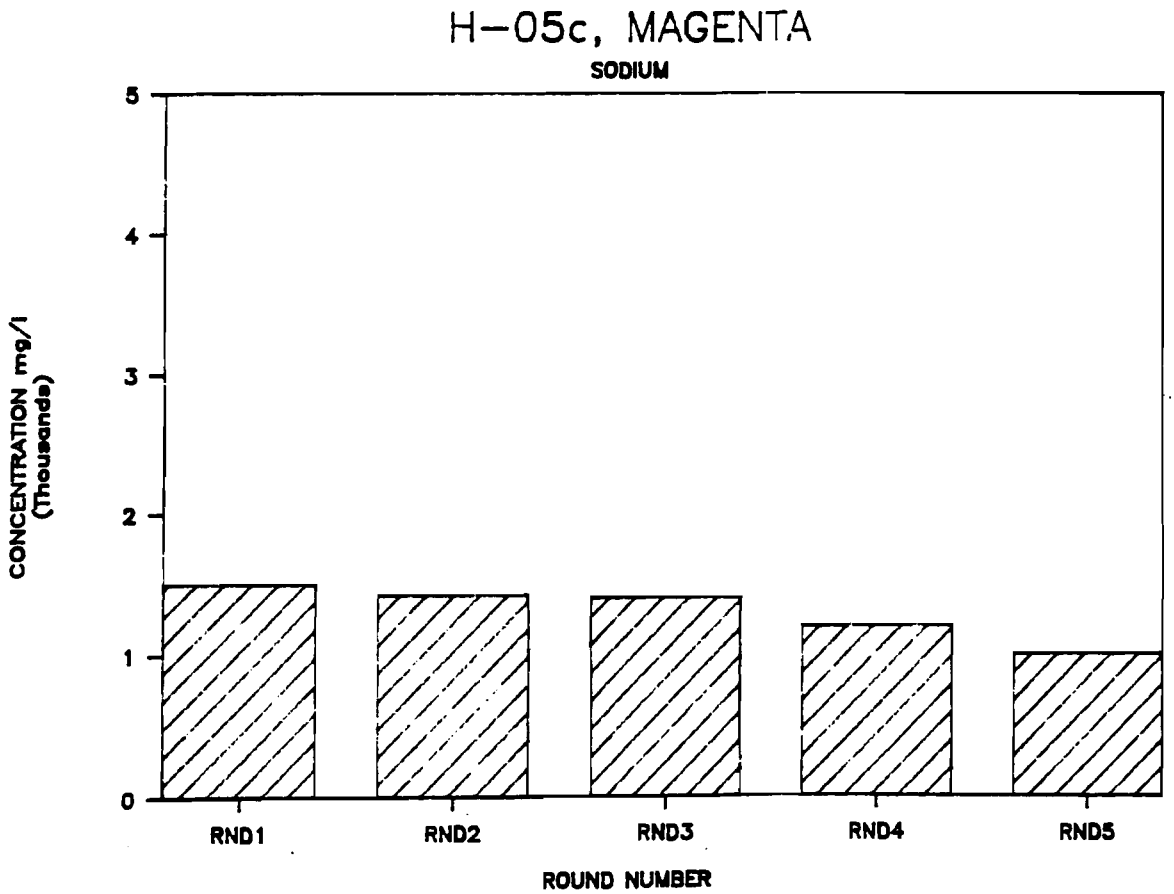

H-05c, MAGENTA
CALCIUM
CONCENTRATION mg/l (Thousands)
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

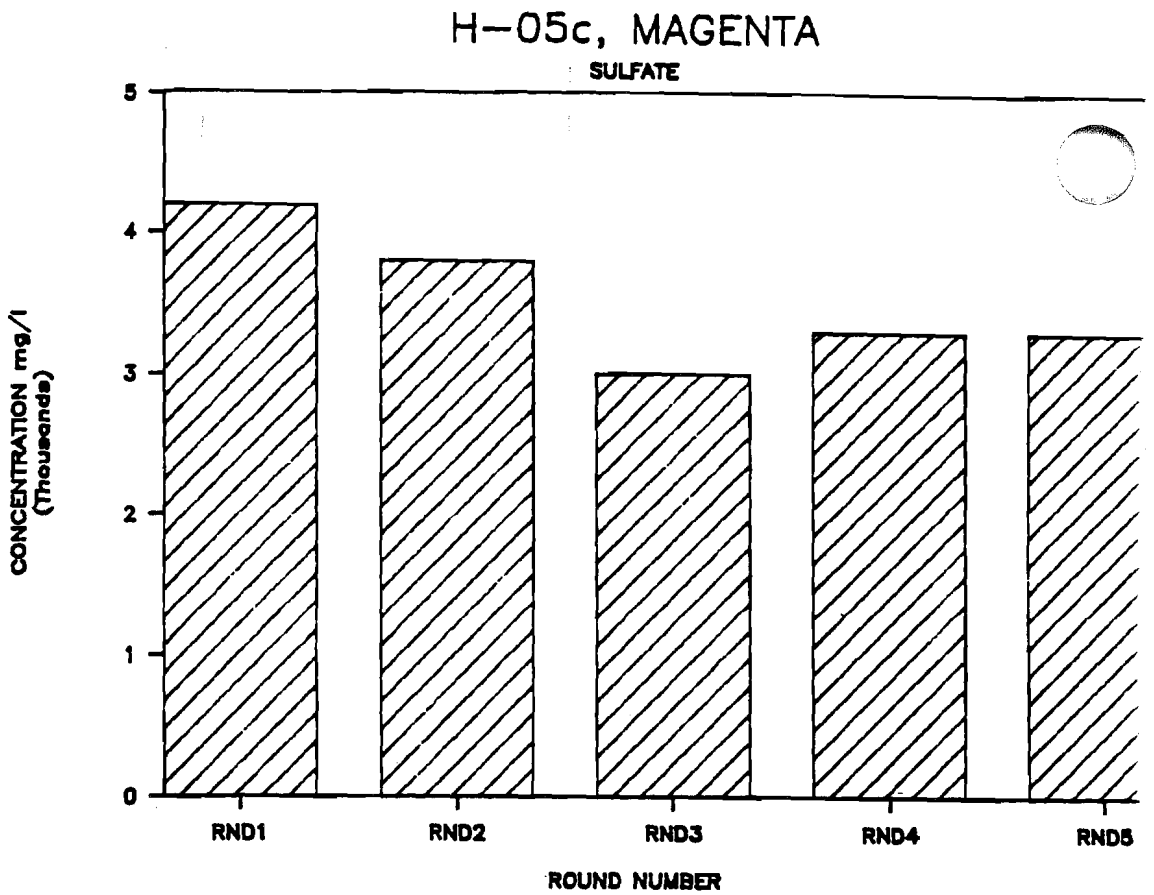

H-05c, MAGENTA
CHLORIDE
CONCENTRATION mg/l (Thousands)
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

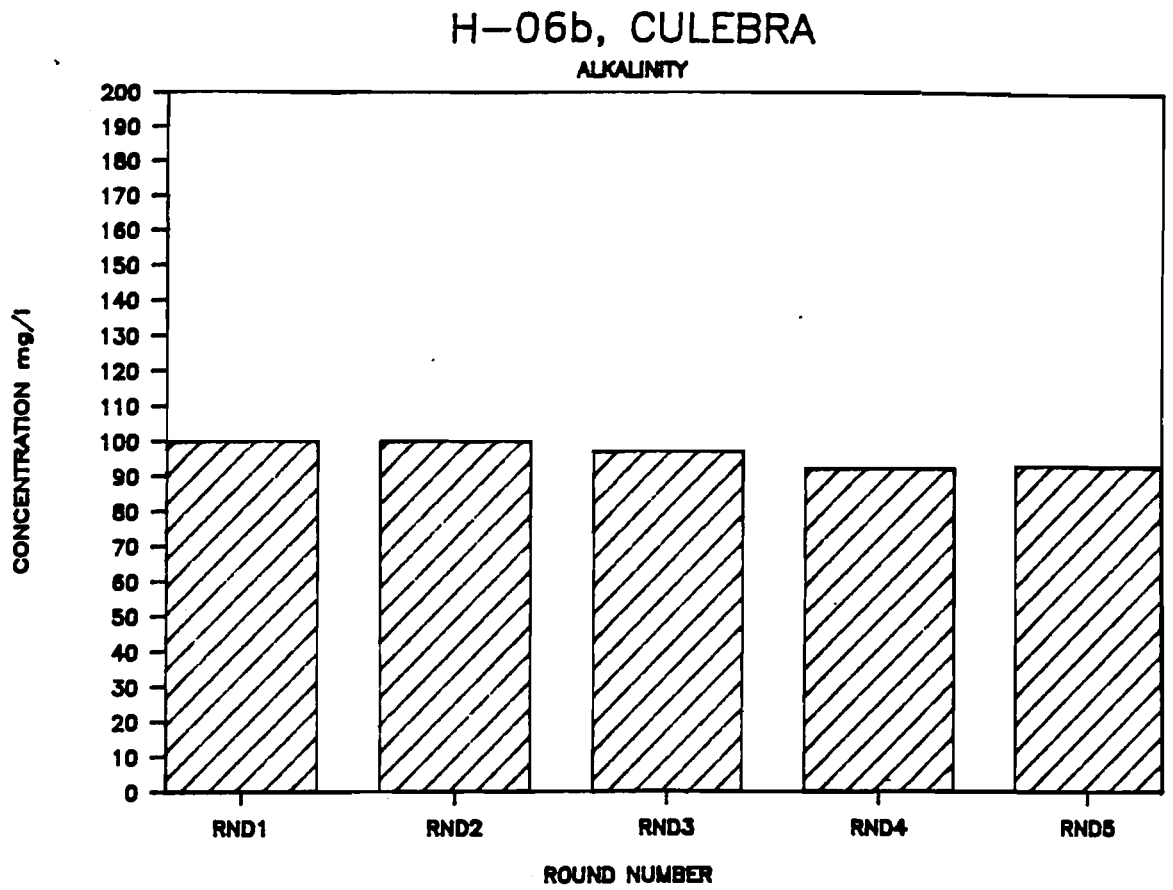

H-05c, MAGENTA
FLUORIDE
CONCENTRATION mg/l
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

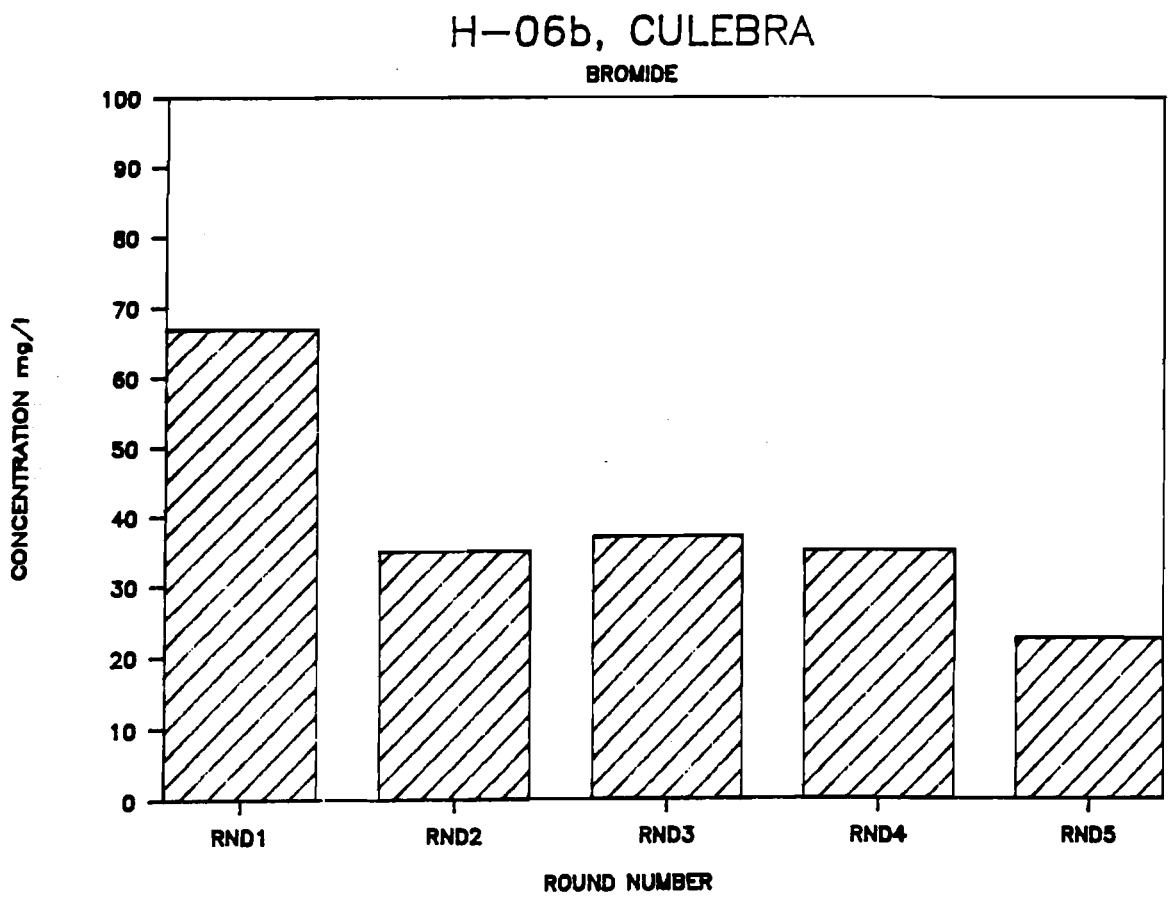

H-05c, MAGENTA
MAGNESIUM
CONCENTRATION mg/l
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
RND1
RND2
RND3
RND4
RND
ROUND NUMBER

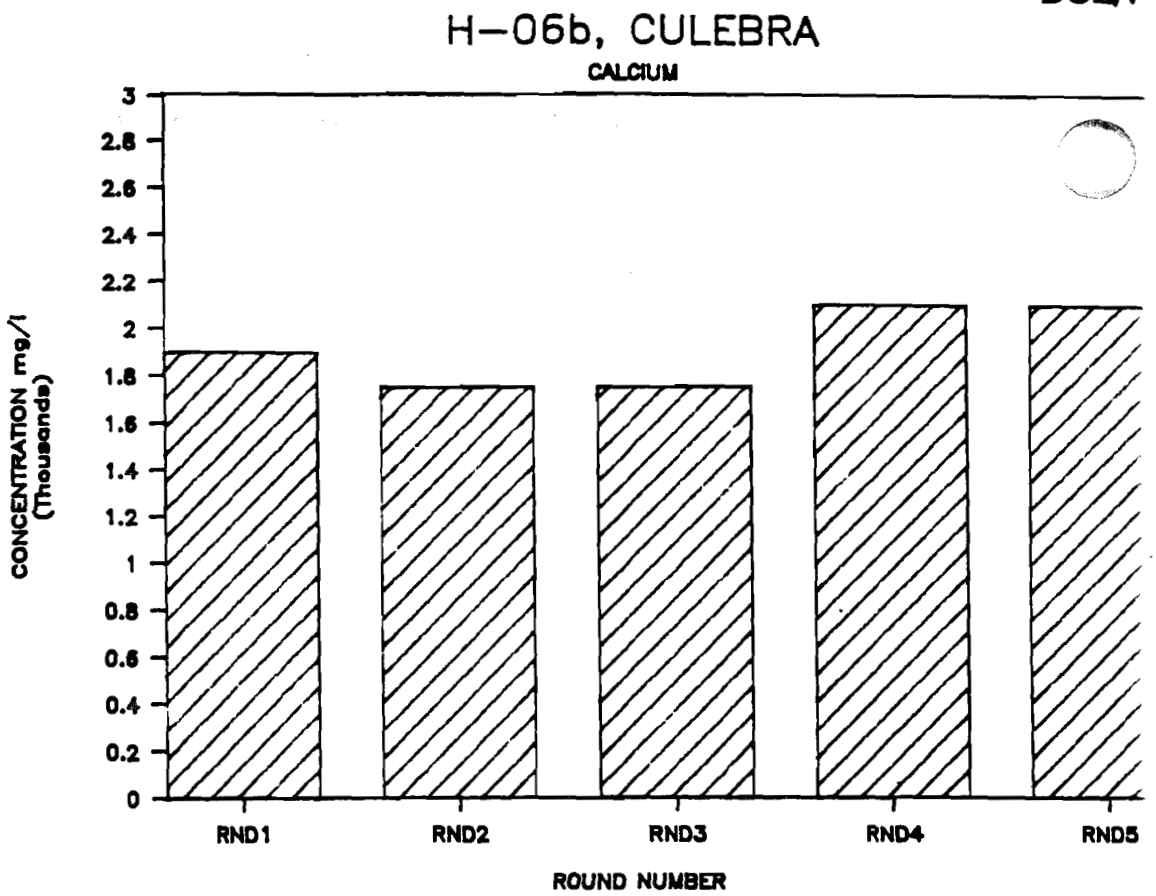

H-05c, MAGENTA
POTASSIUM
CONCENTRATION mg/l
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

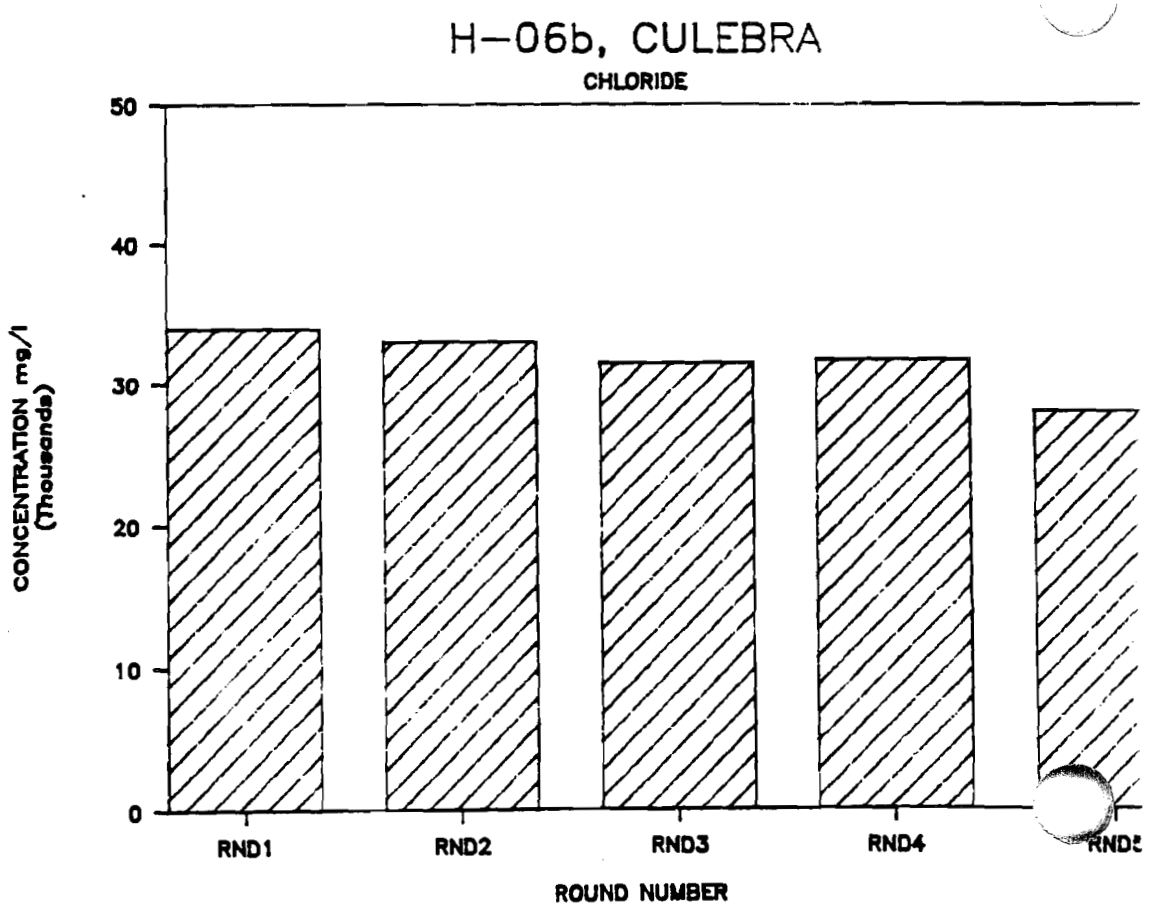

H-05c, MAGENTA
SODIUM
CONCENTRATION mg/l
(Thousands)
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

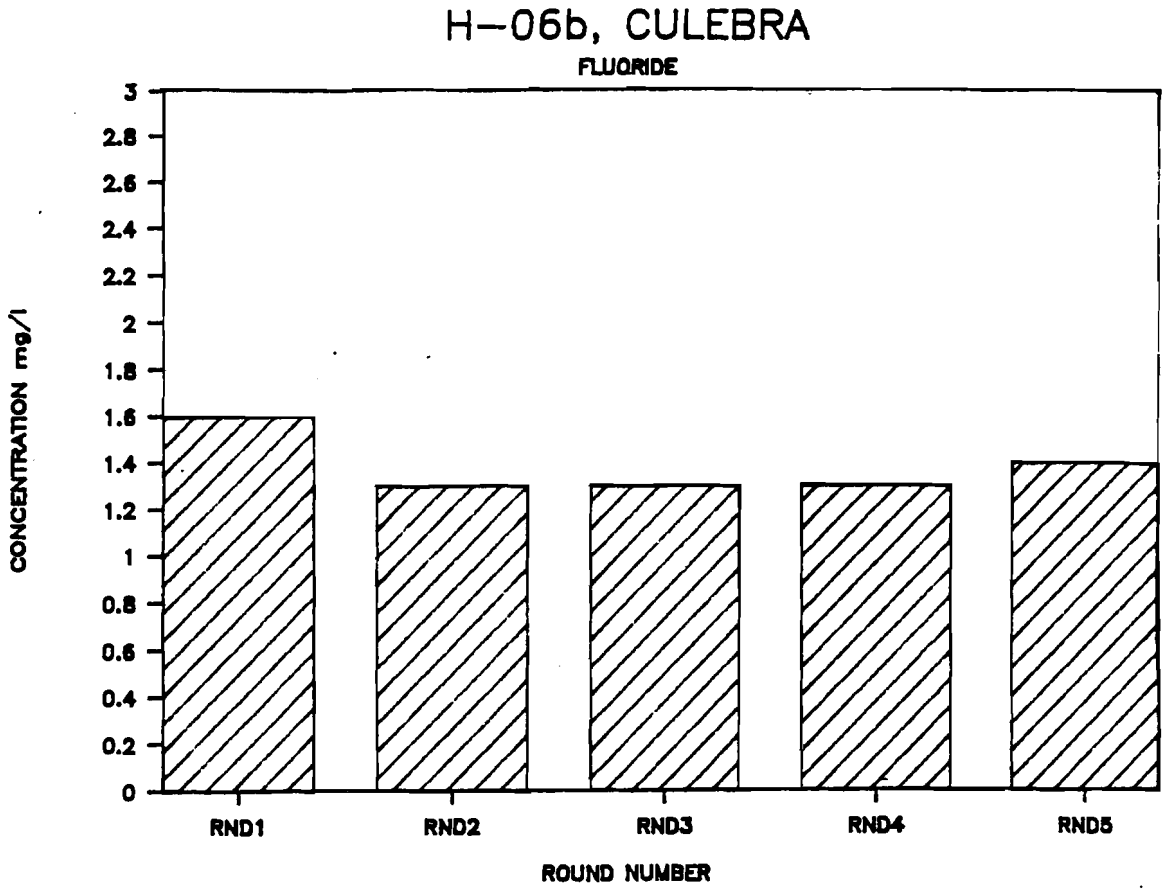

H-05c, MAGENTA
SULFATE
CONCENTRATION mg/l
(Thousands)
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

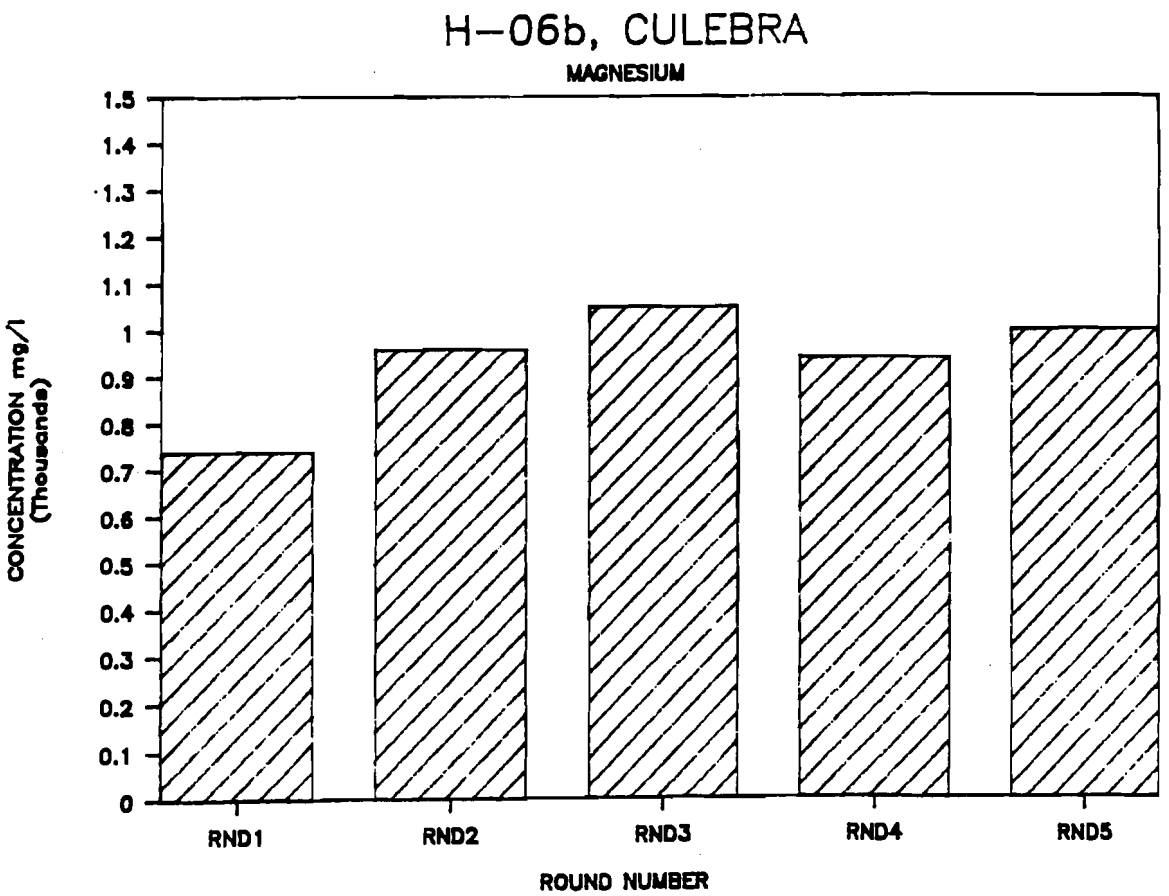

H-06b, CULEBRA
ALKALINITY
CONCENTRATION mg/l
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

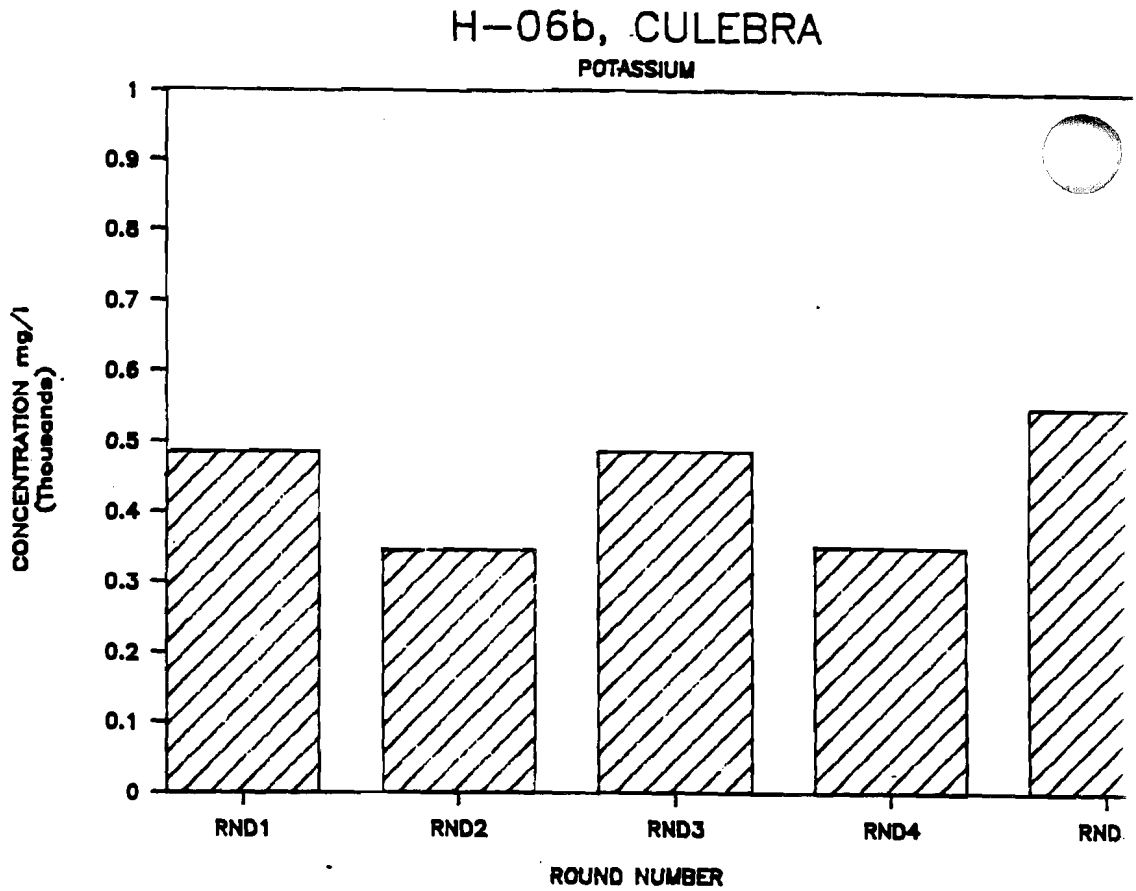

H-06b, CULEBRA
BROMIDE
CONCENTRATION mg/l
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

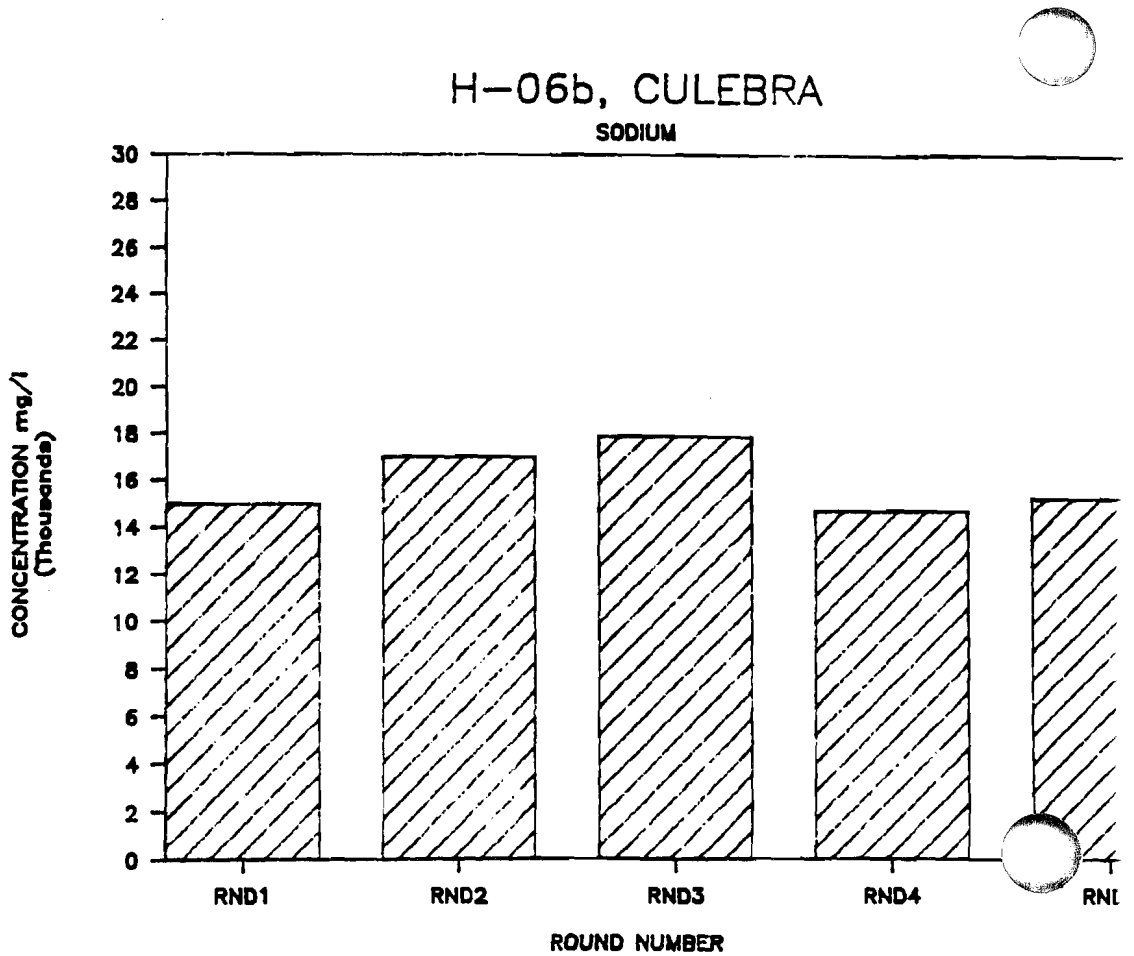

H-06b, CULEBRA
CALCIUM
CONCENTRATION mg/l (Thousands)
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

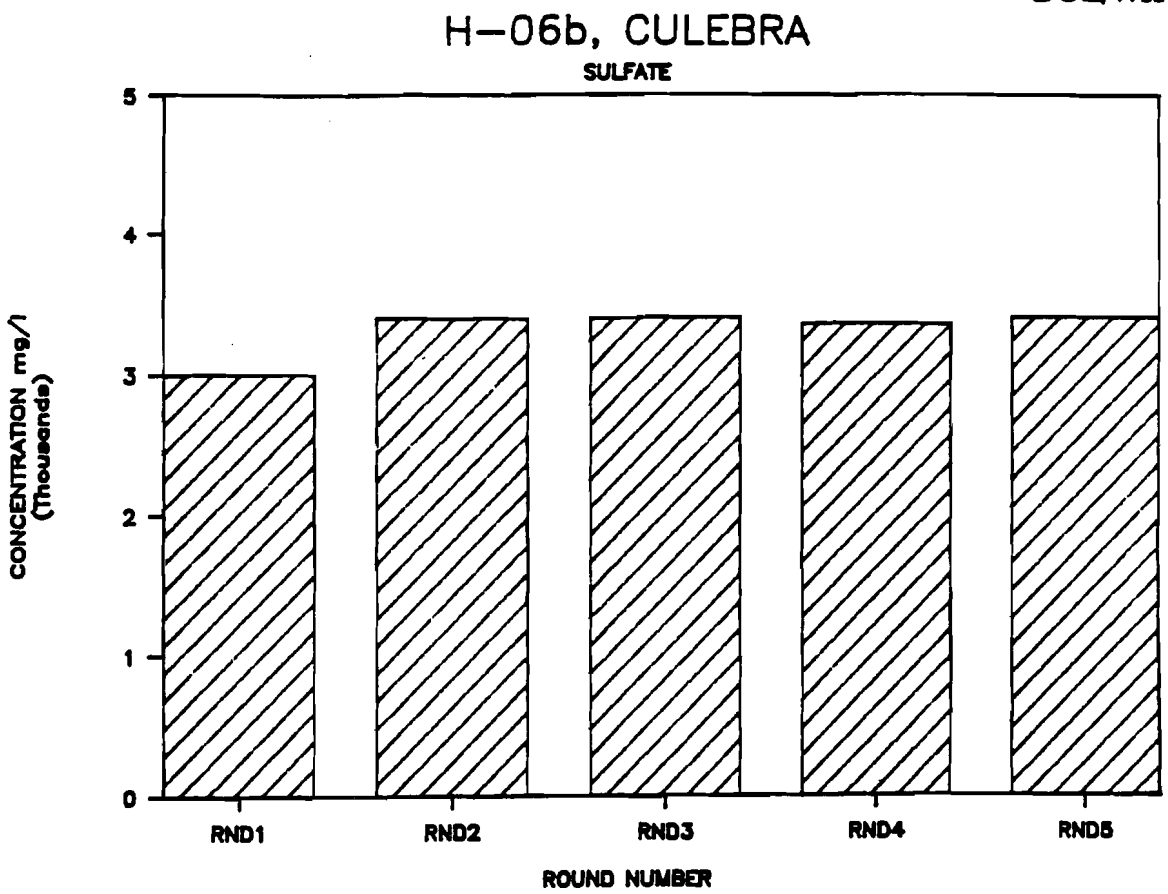

H-06b, CULEBRA
CHLORIDE
CONCENTRATION mg/l (Thousands)
50
40
30
20
10
0
RND1
RND2
RND3
RND4
ROUND NUMBER

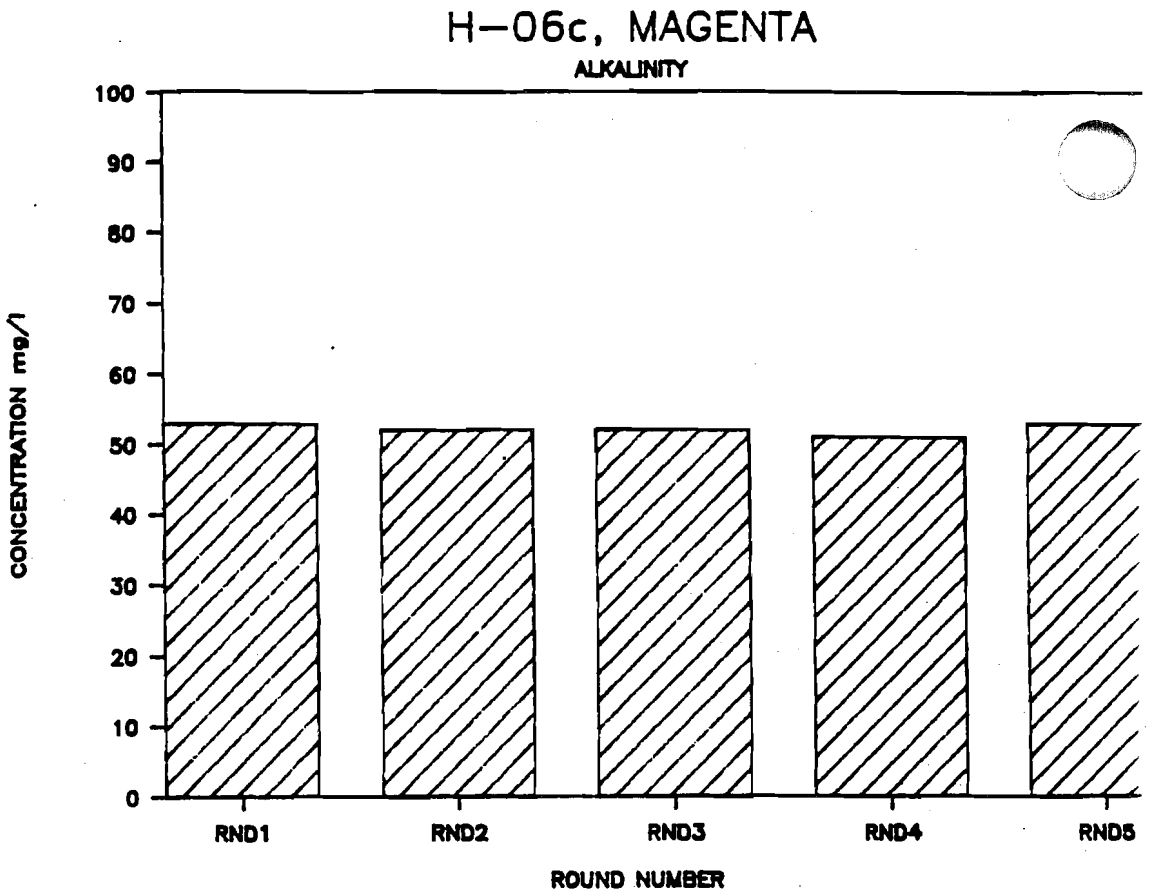

H-06b, CULEBRA
FLUORIDE
CONCENTRATION mg/l
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

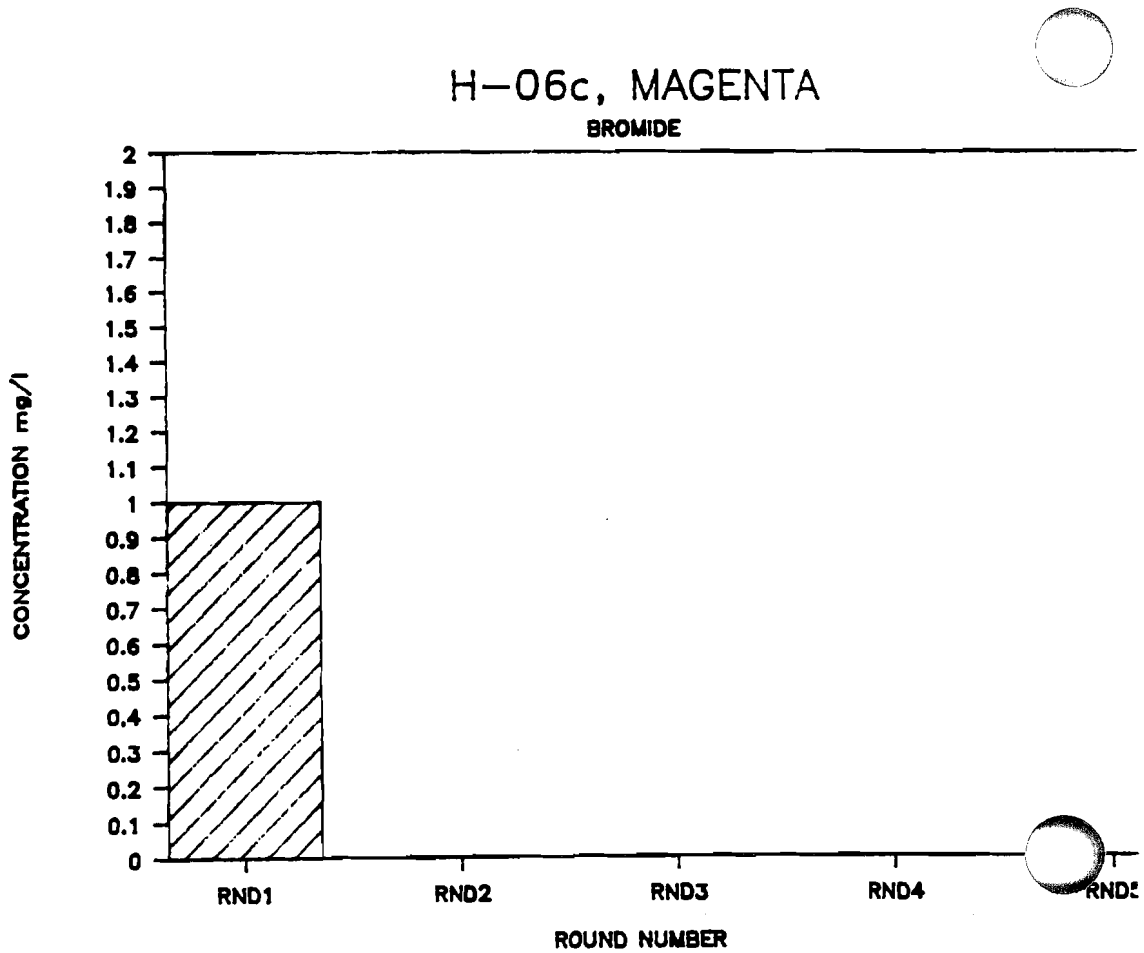

H-06b, CULEBRA
MAGNESIUM
CONCENTRATION mg/l
(Thousands)
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

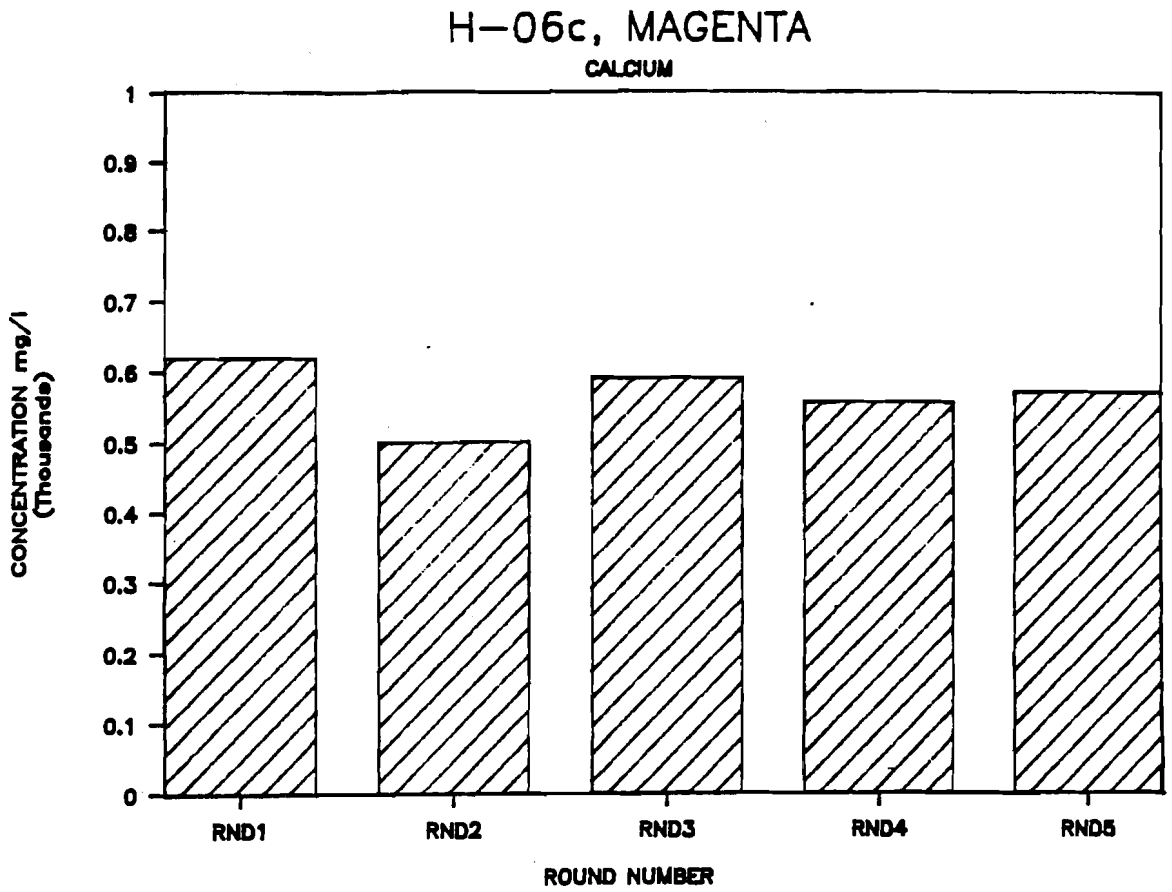

H-06b, CULEBRA
POTASSIUM
CONCENTRATION mg/l (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND
ROUND NUMBER

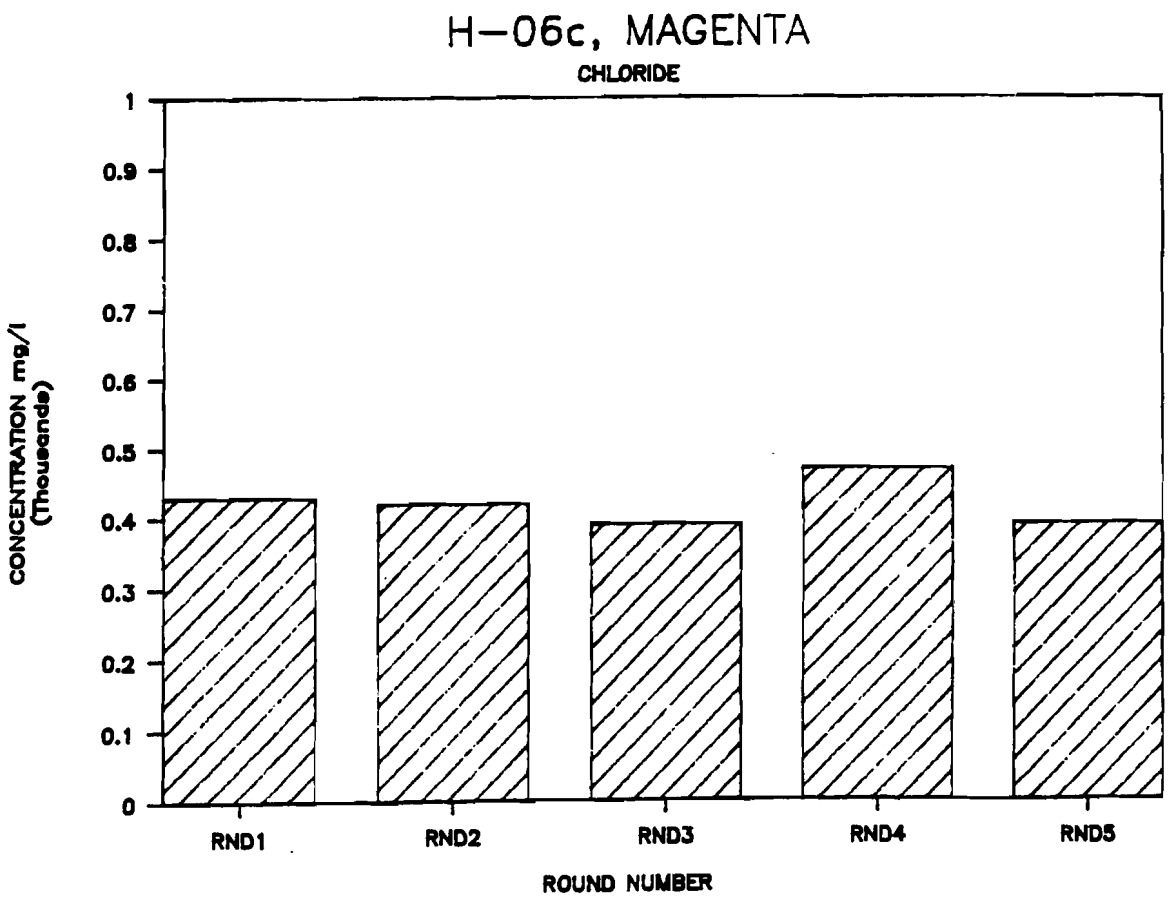

H-06b, CULEBRA
SODIUM
CONCENTRATION mg/l (Thousands)
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
RND1
RND2
RND3
RND4
RNI
ROUND NUMBER

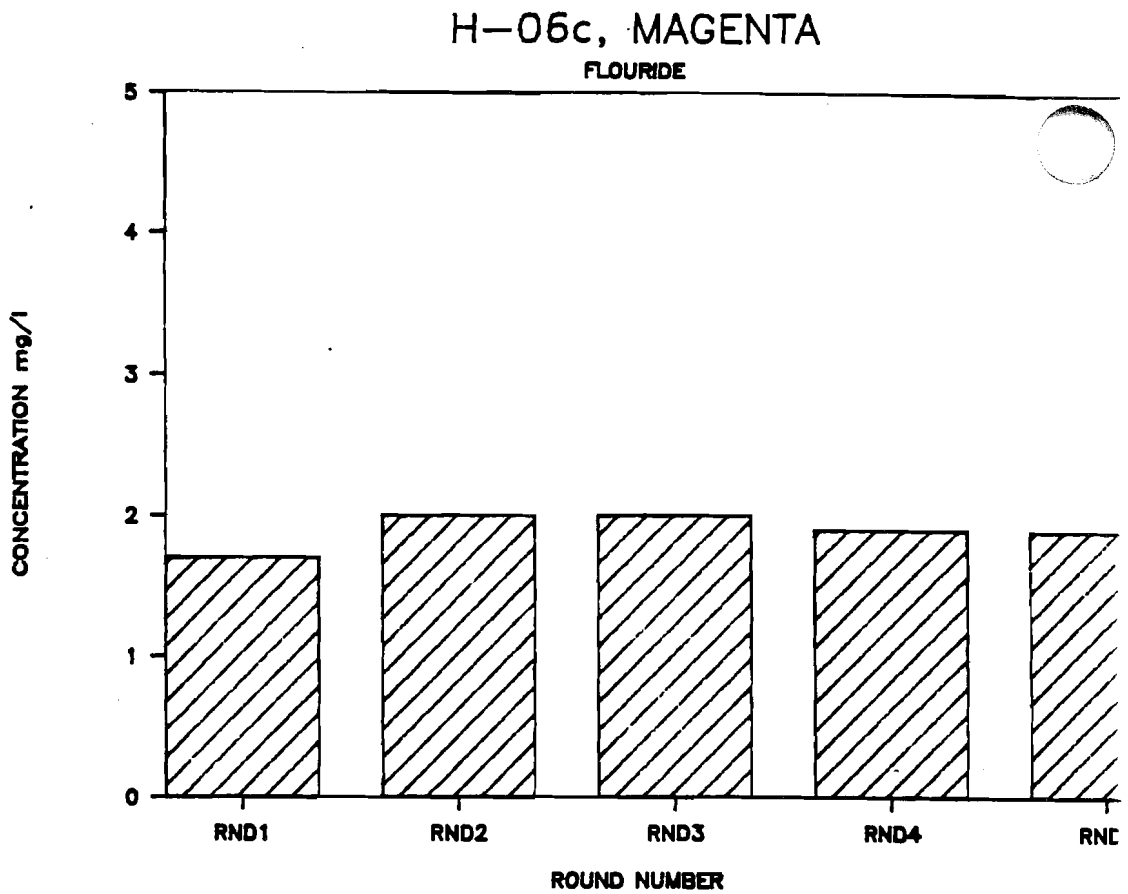

H-06b, CULEBRA
SULFATE
CONCENTRATION mg/l
(Thousands)
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

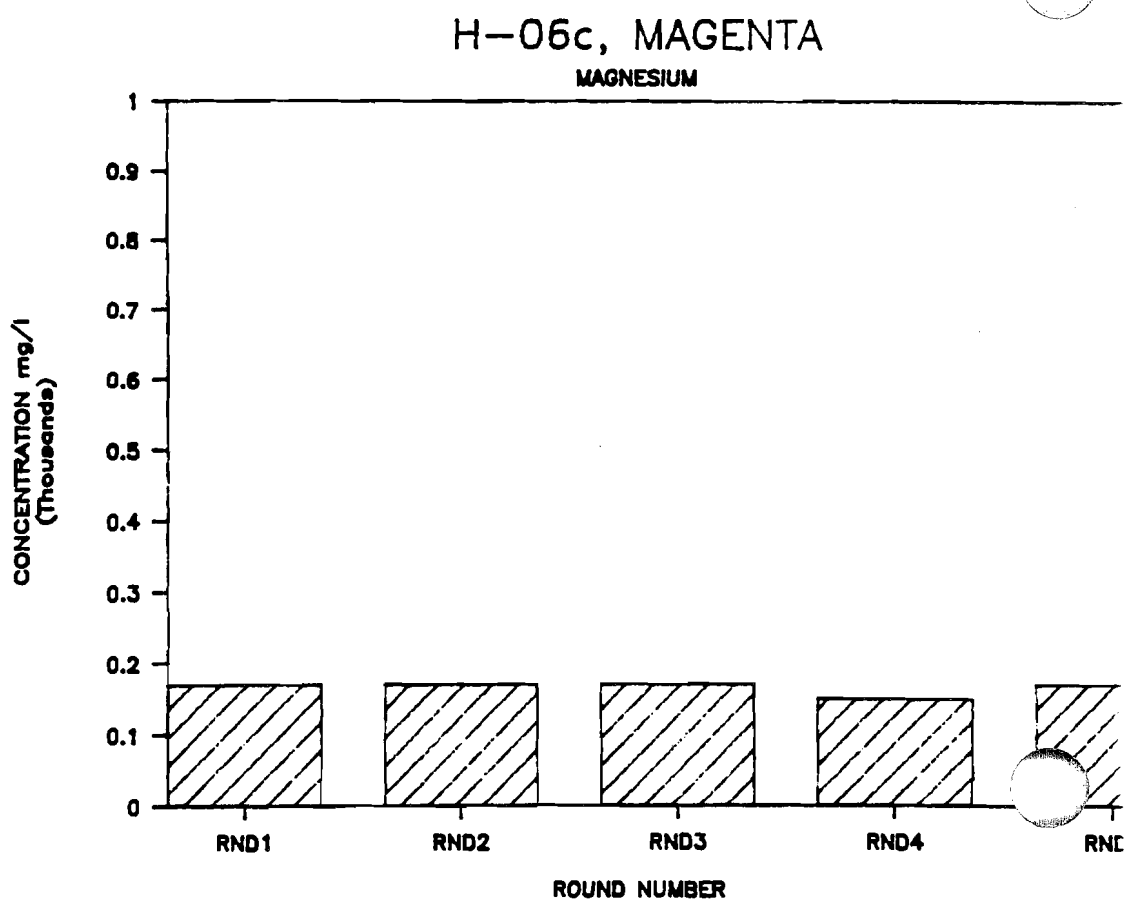

H-06c, MAGENTA
ALKALINITY
CONCENTRATION mg/l
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

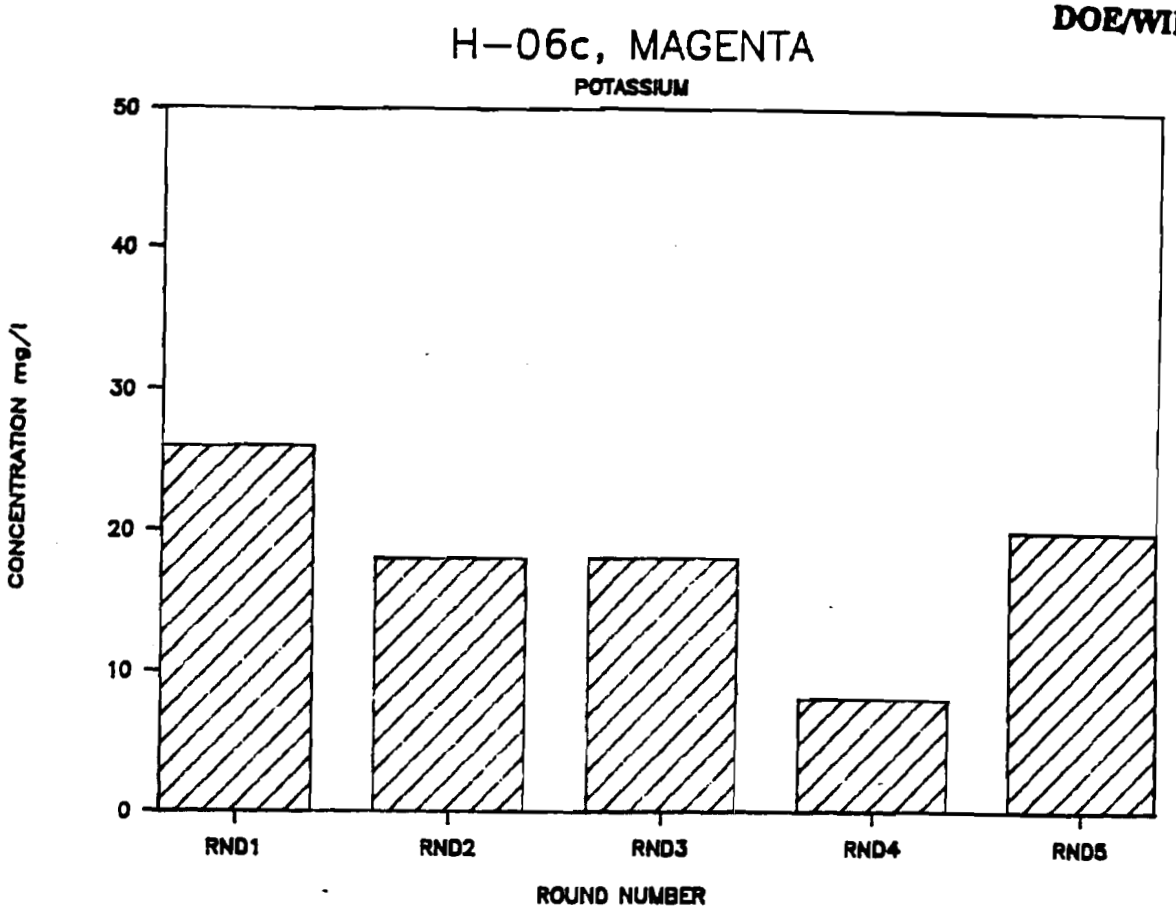

H-06c, MAGENTA
BROMIDE
CONCENTRATION mg/l
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
ROUND NUMBER

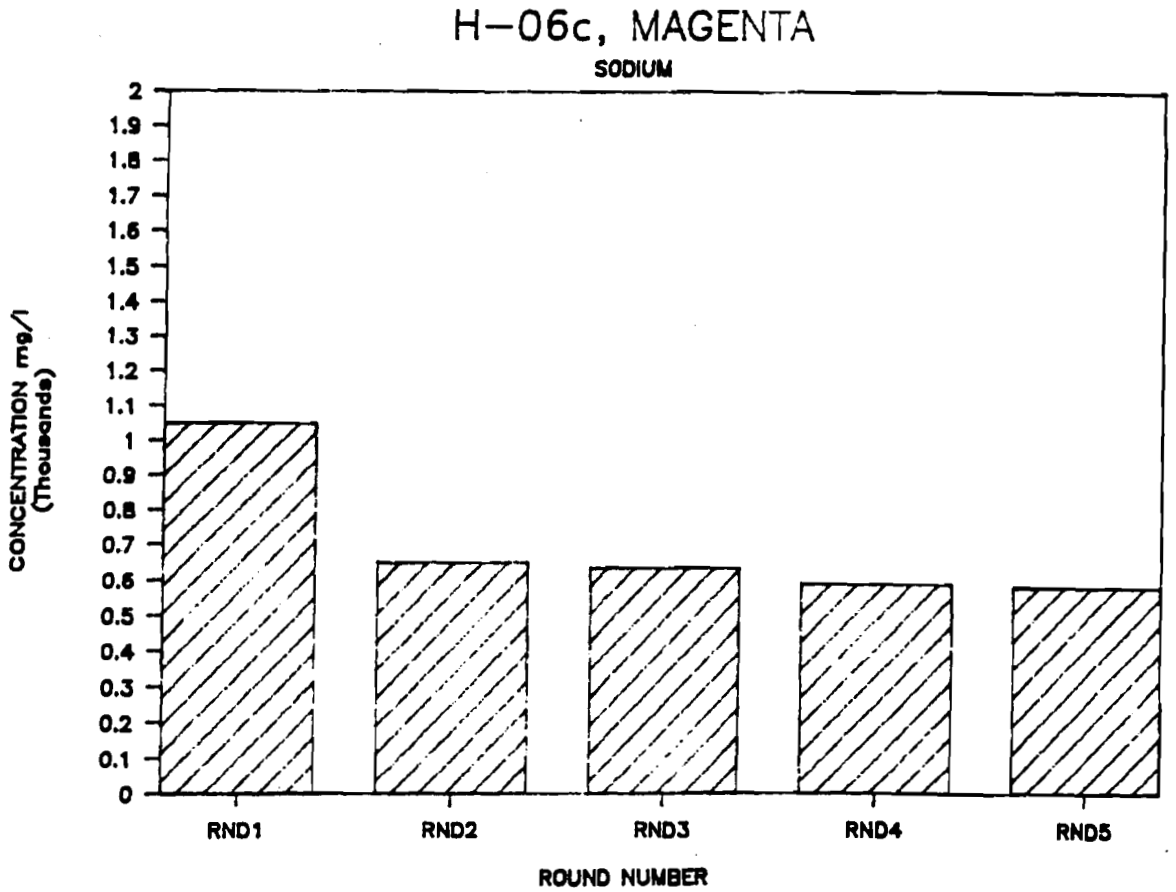

H-06c, MAGENTA
CALCIUM
CONCENTRATION mg/l (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

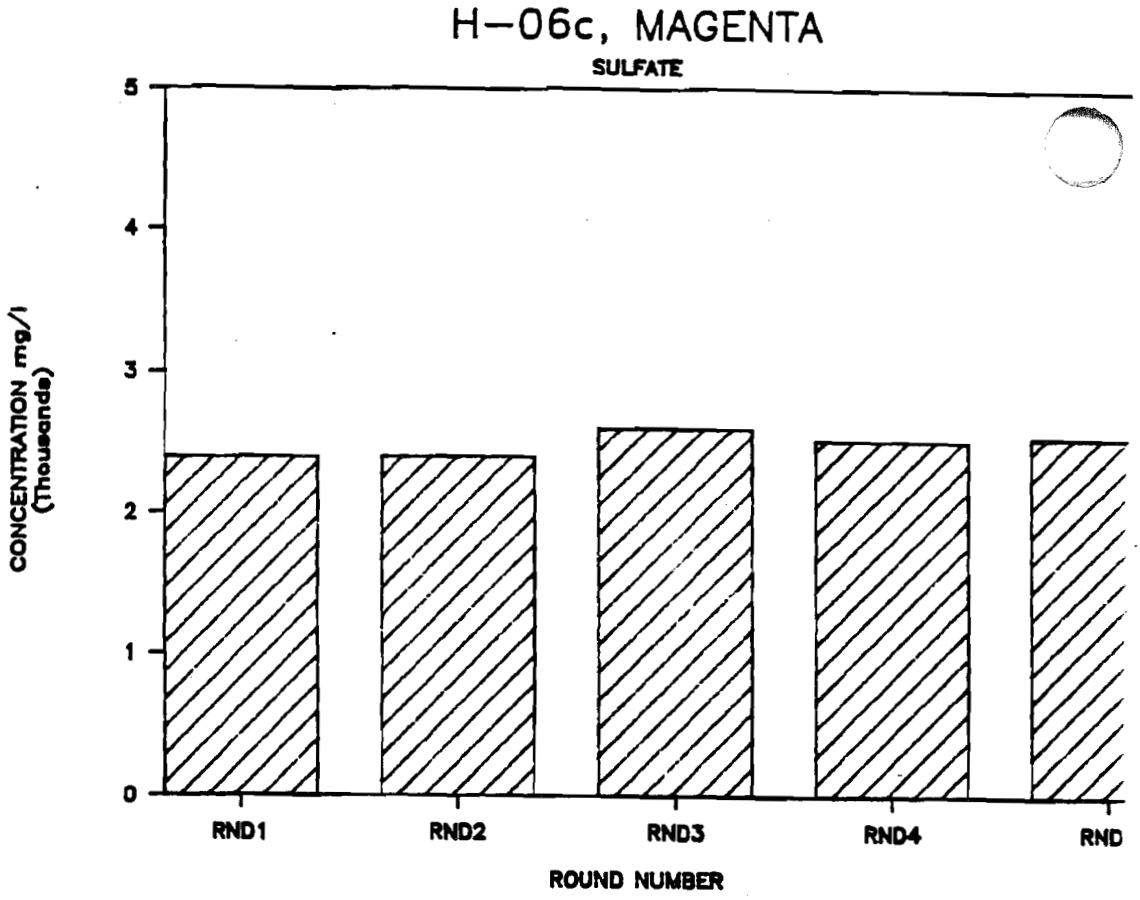

H-06c, MAGENTA
CHLORIDE
CONCENTRATION mg/l (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

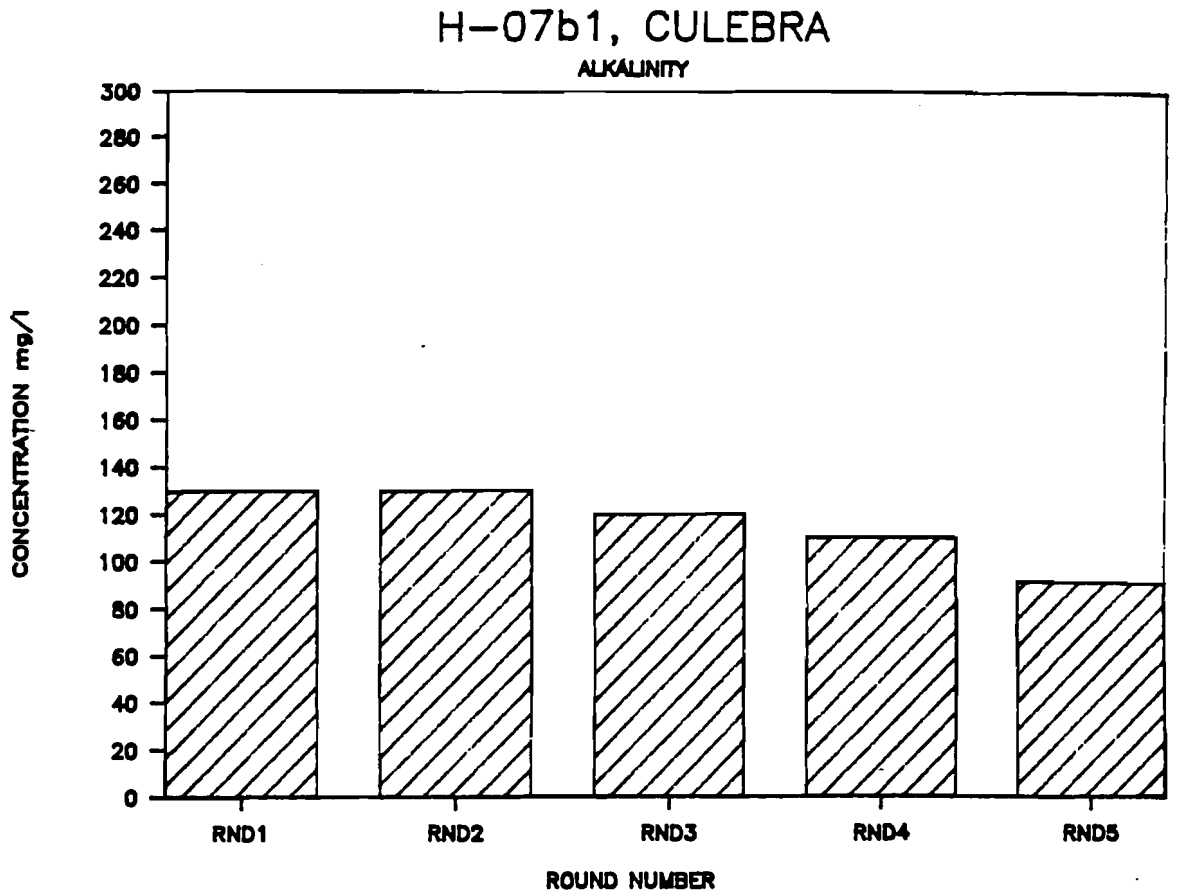

H-06c, MAGENTA
FLOURIDE
CONCENTRATION mg/l
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RNC
ROUND NUMBER

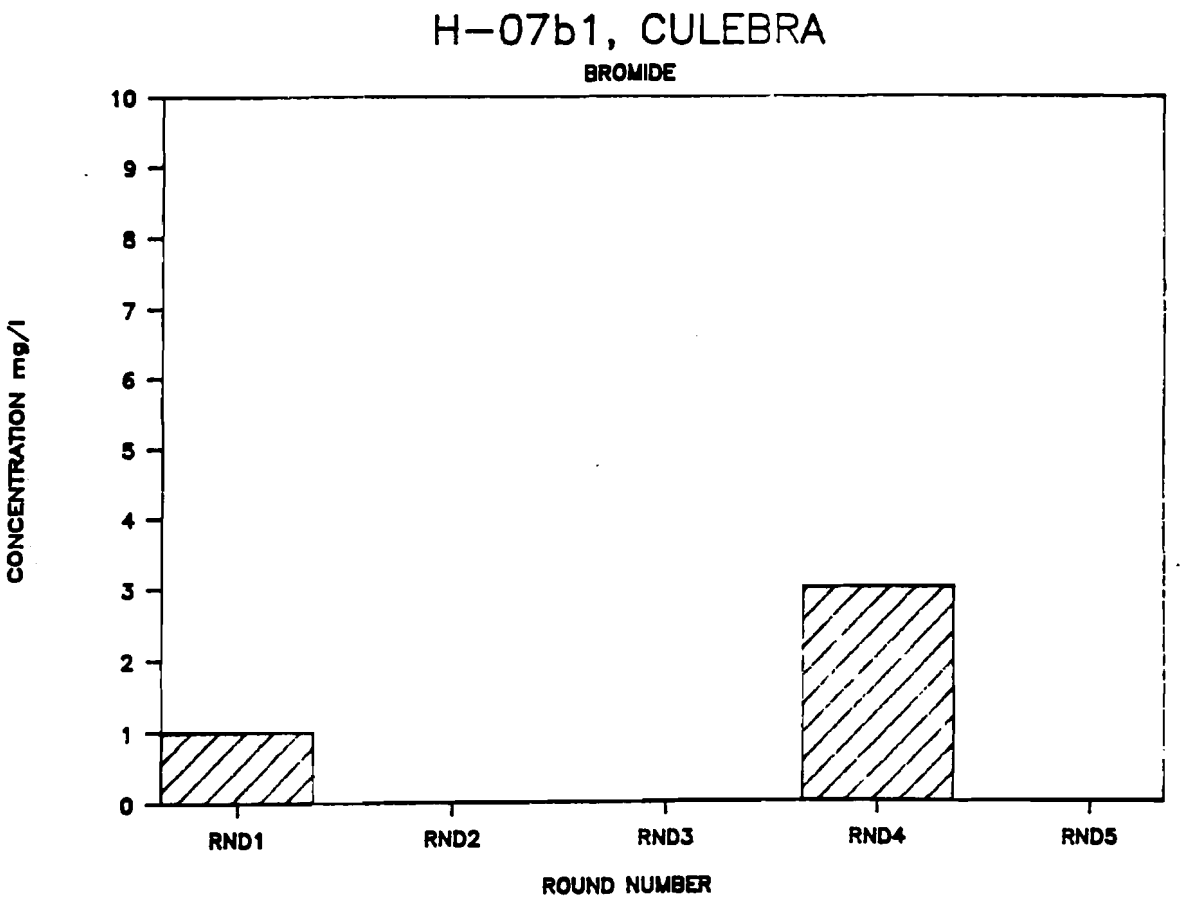

H-06c, MAGENTA
MAGNESIUM
CONCENTRATION mg/l
(Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RNC
ROUND NUMBER

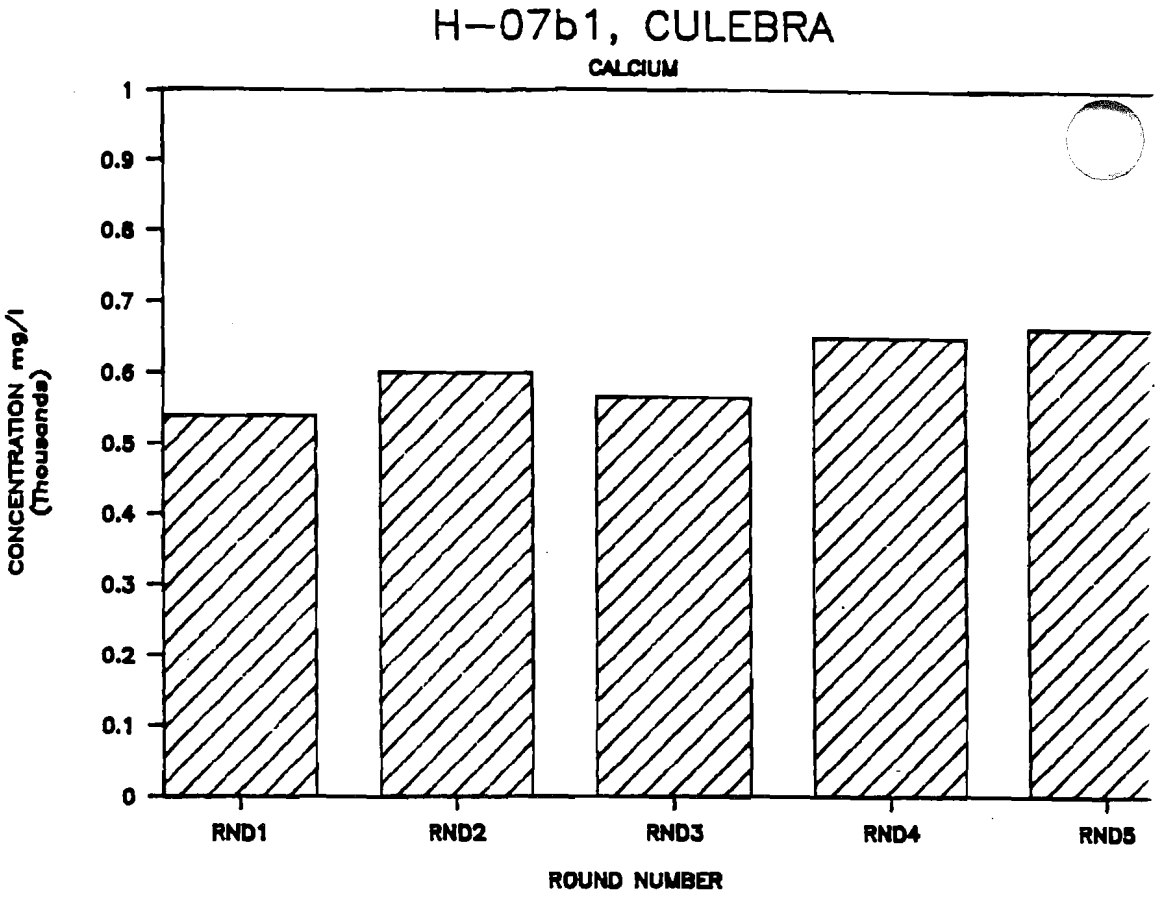

H-06c, MAGENTA
POTASSIUM
CONCENTRATION mg/l
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

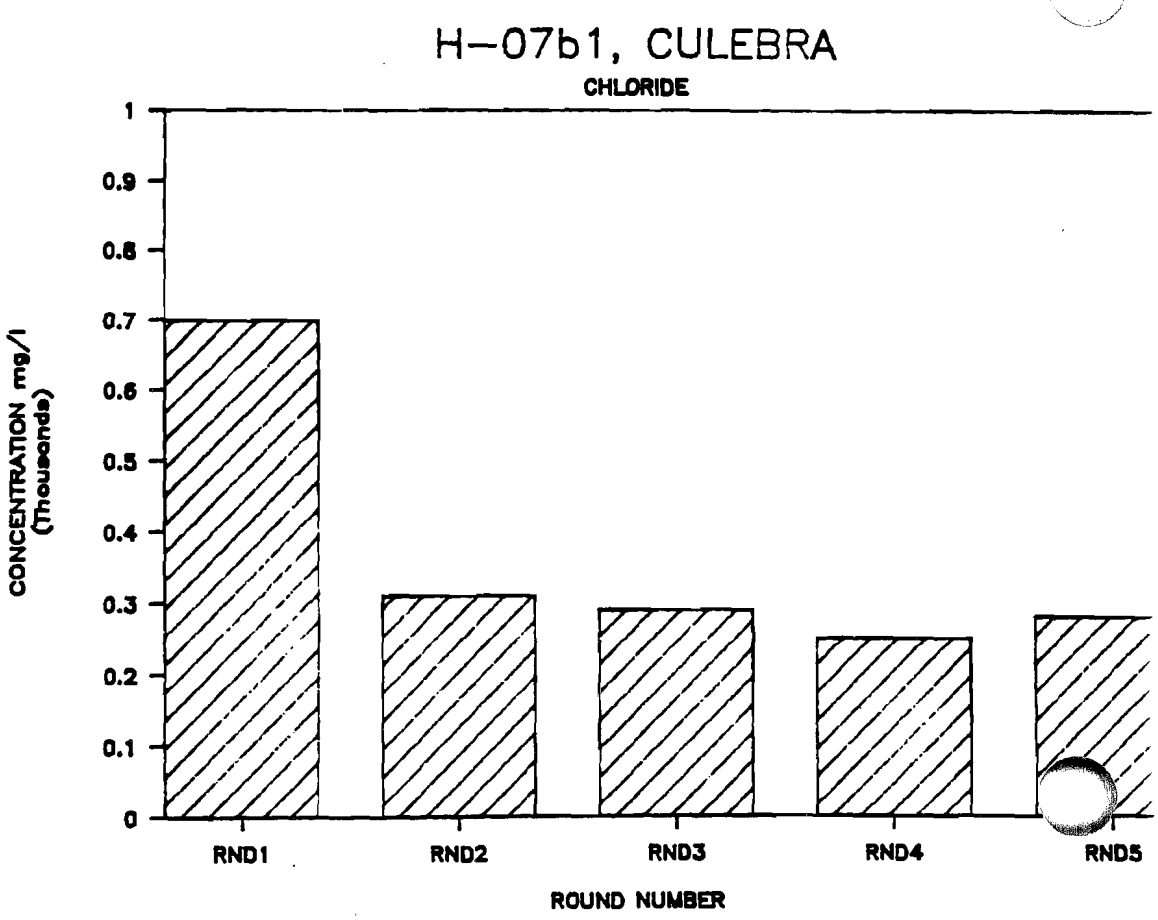

H-06c, MAGENTA
SODIUM
CONCENTRATION mg/l (Thousands)
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

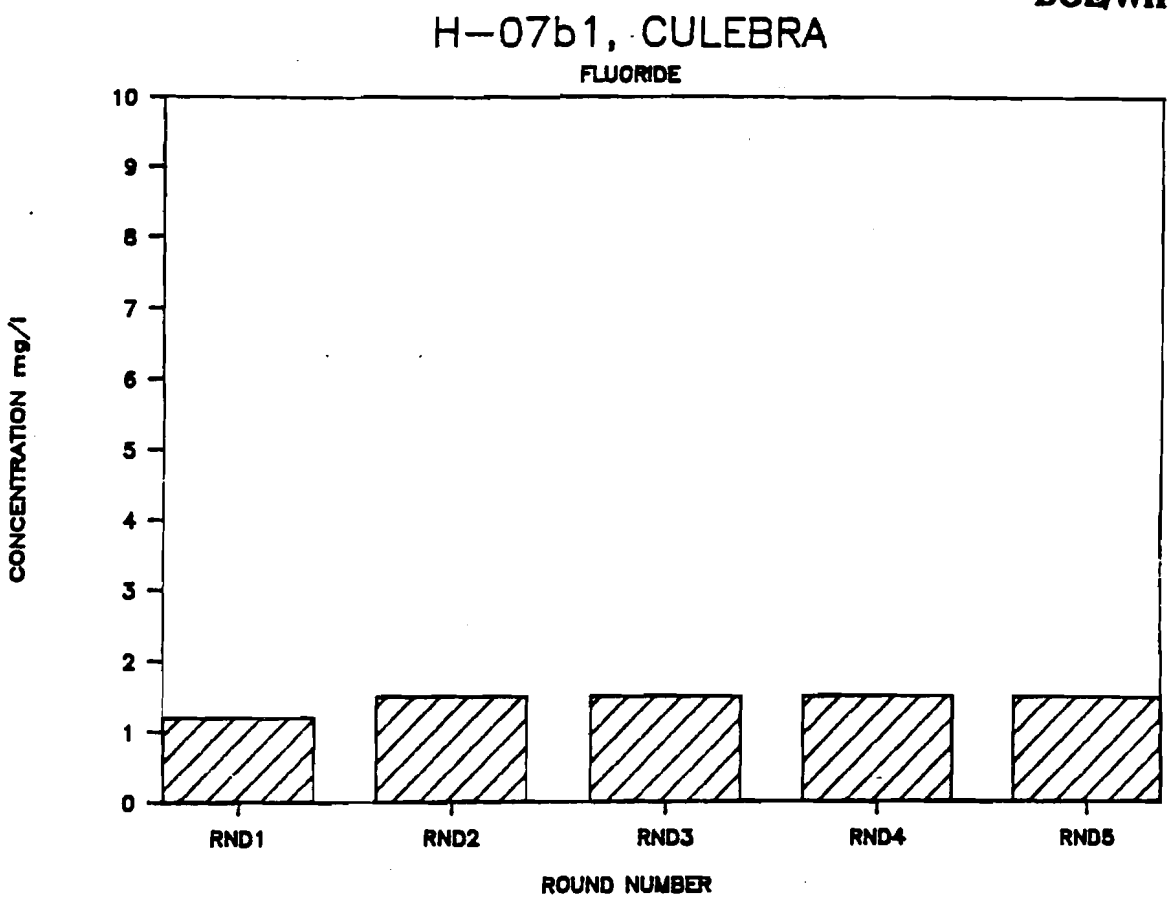

H-06c, MAGENTA
SULFATE
CONCENTRATION mg/l
(Thousands)
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND
ROUND NUMBER

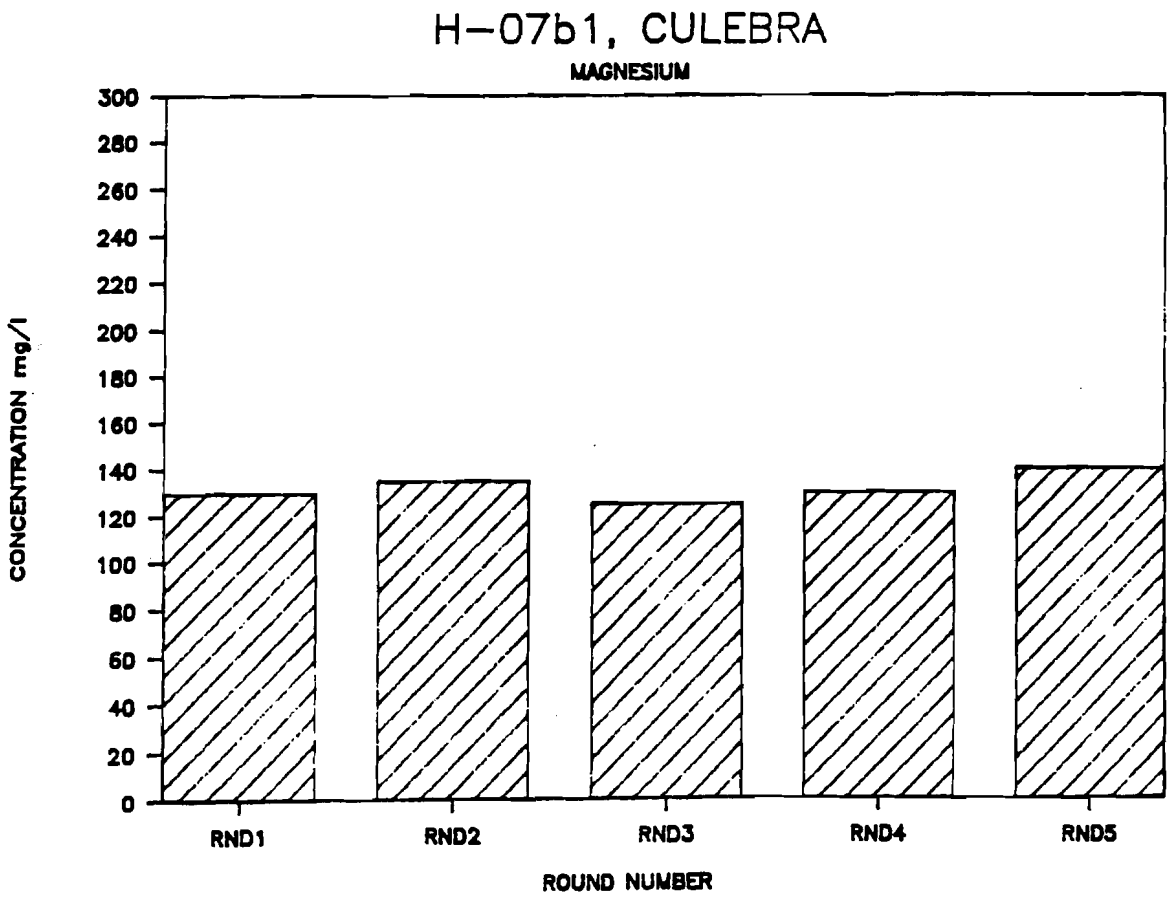

H-07b1, CULEBRA
ALKALINITY
CONCENTRATION mg/l
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

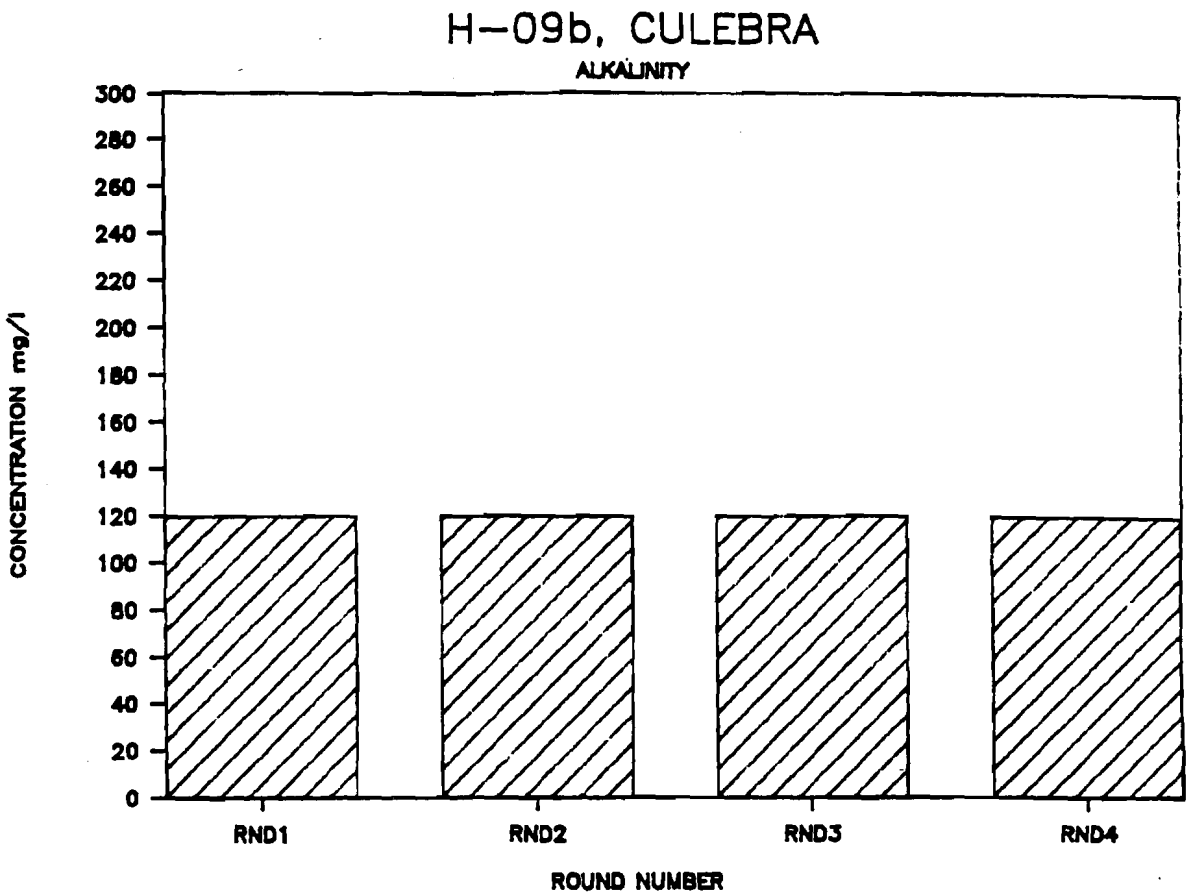

H-07b1, CULEBRA
BROMIDE
CONCENTRATION mg/l
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

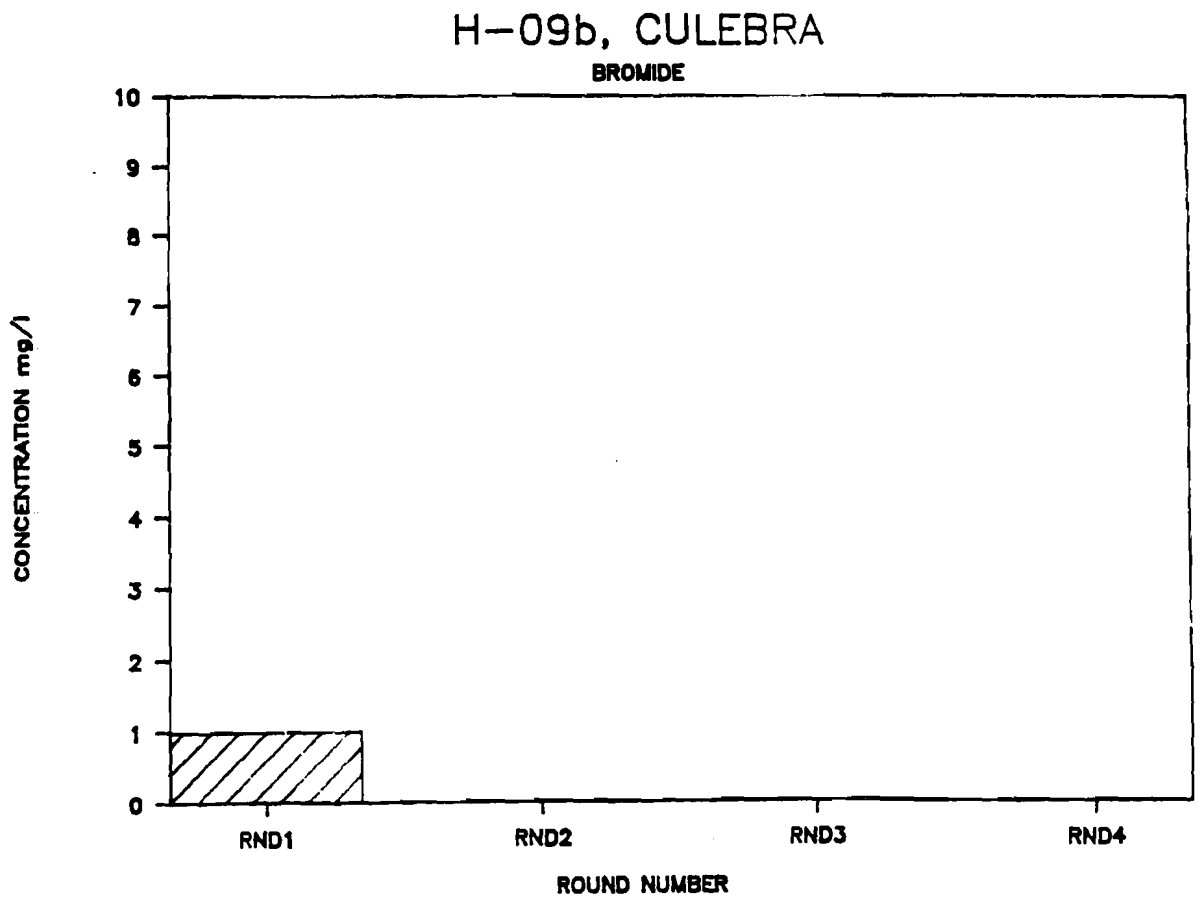

H-07b1, CULEBRA
CALCIUM
CONCENTRATION mg/l
(Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

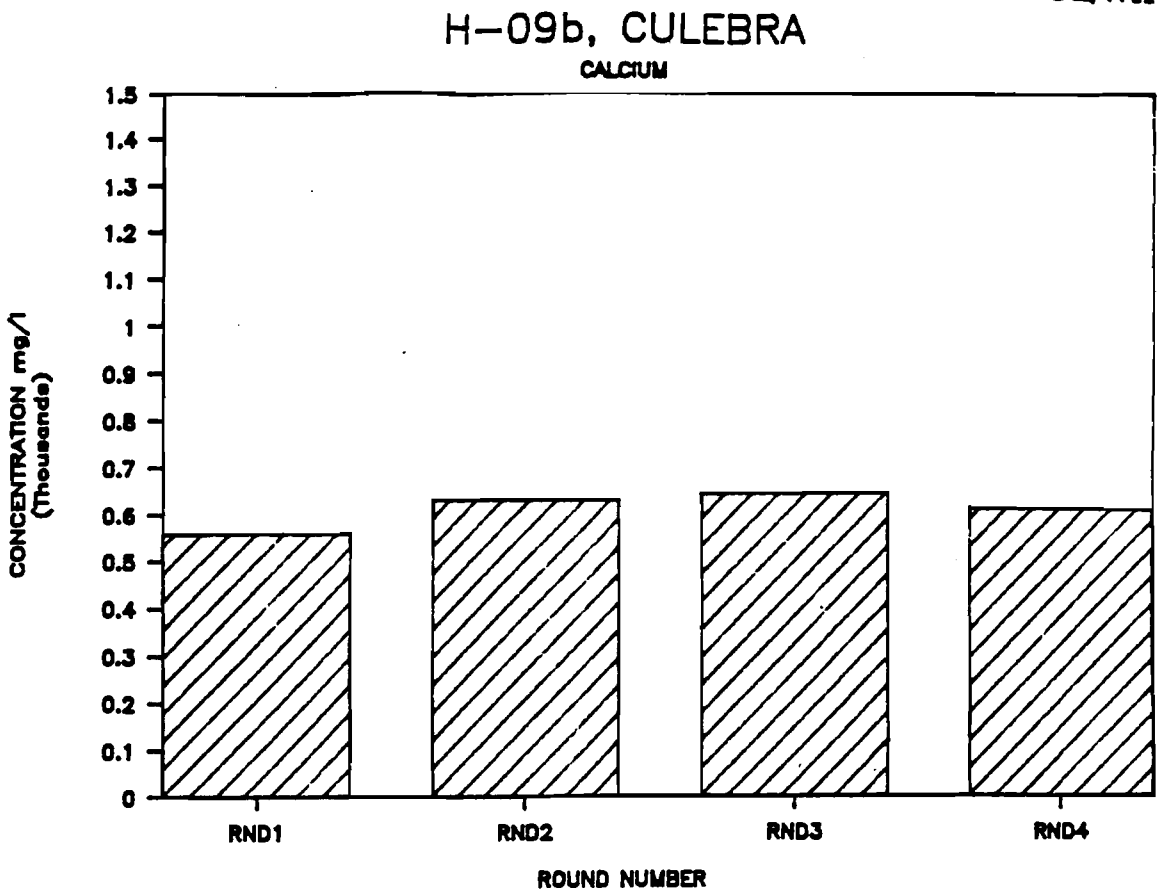

H-07b1, CULEBRA
CHLORIDE
CONCENTRATION mg/l
(Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

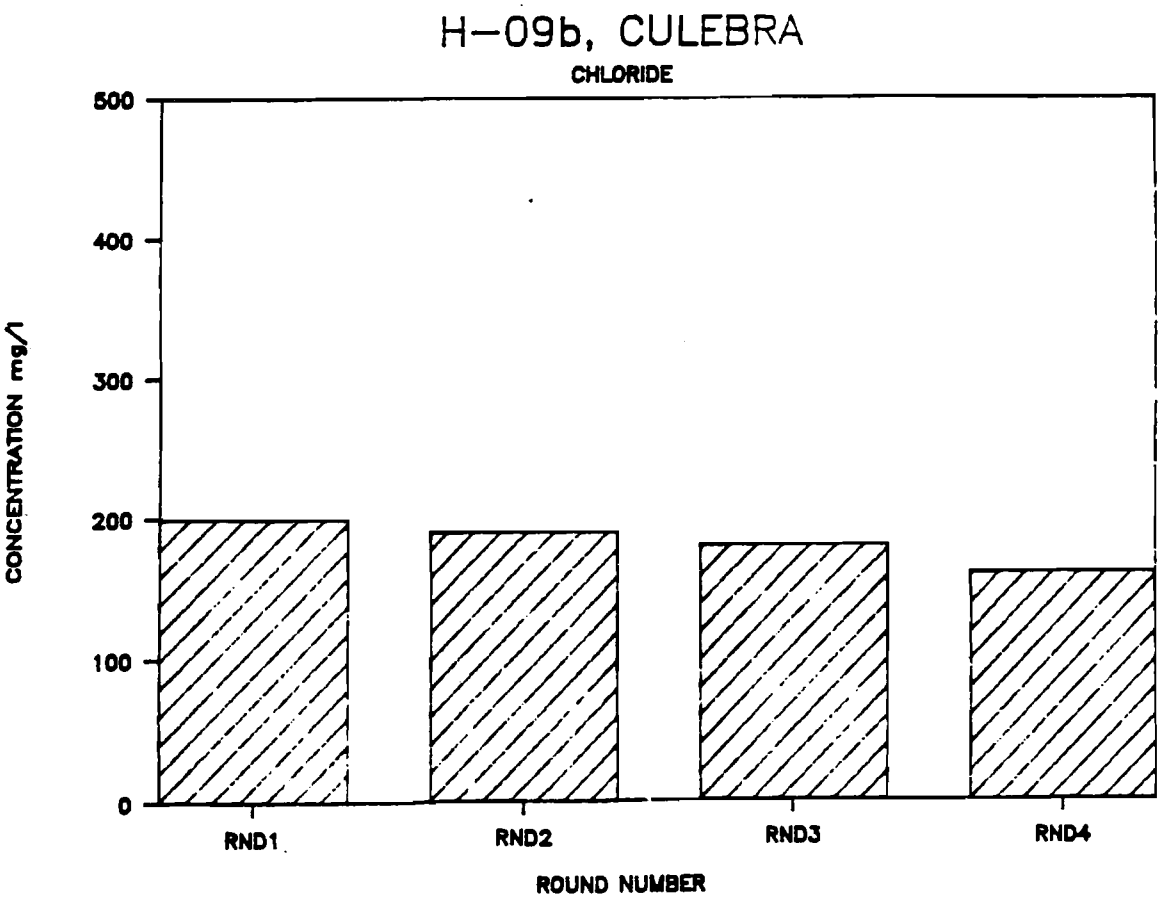

H-07b1, CULEBRA
FLUORIDE
CONCENTRATION mg/l
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

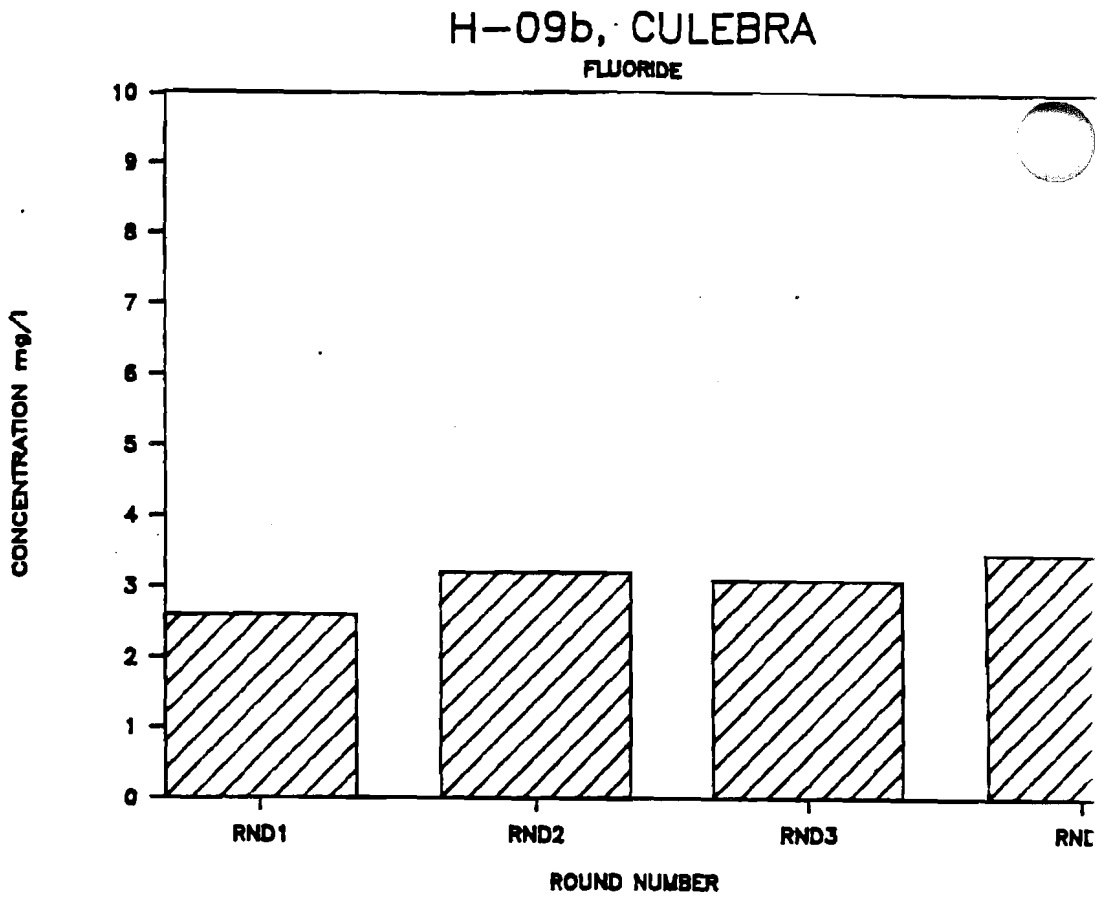

H-07b1, CULEBRA
MAGNESIUM
CONCENTRATION mg/l
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

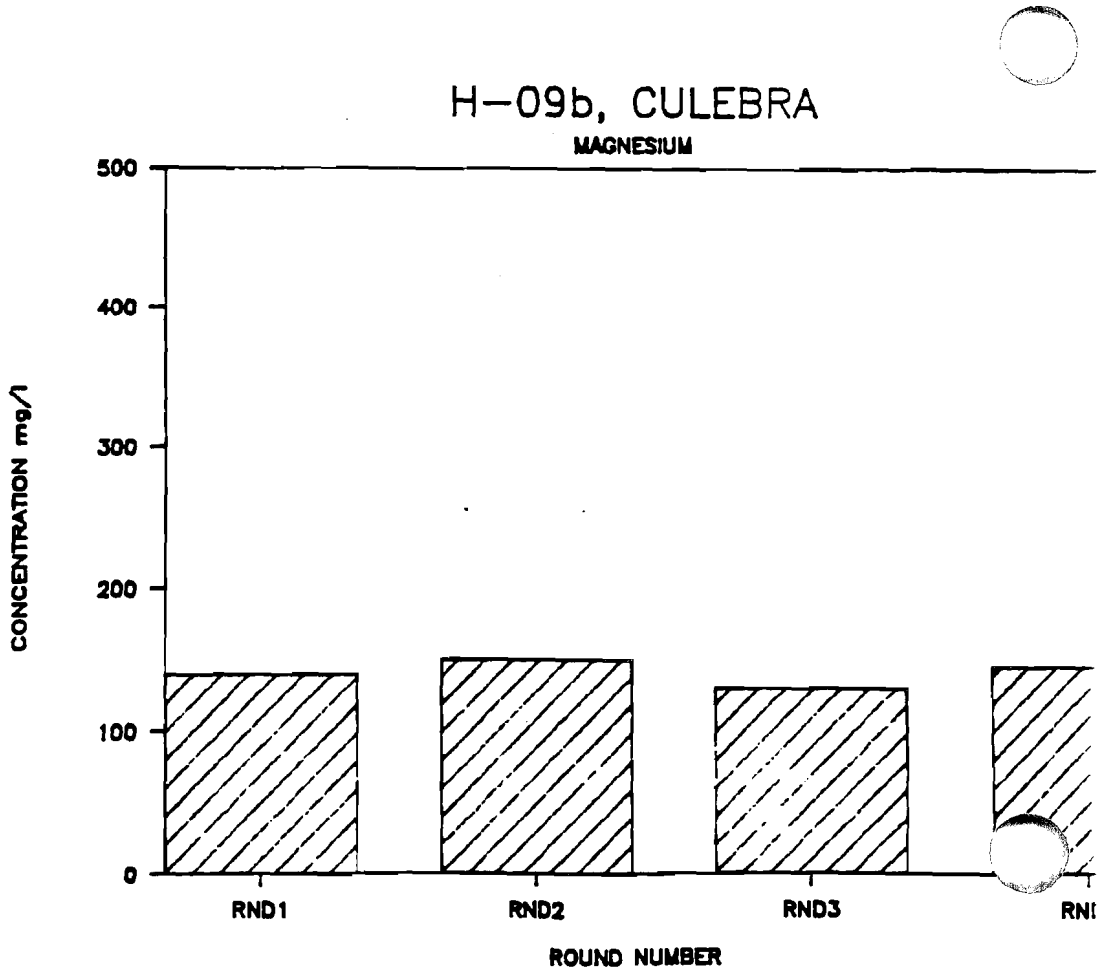

H-09b, CULEBRA
ALKALINITY
CONCENTRATION mg/l
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
RND1
RND2
RND3
RND4
ROUND NUMBER

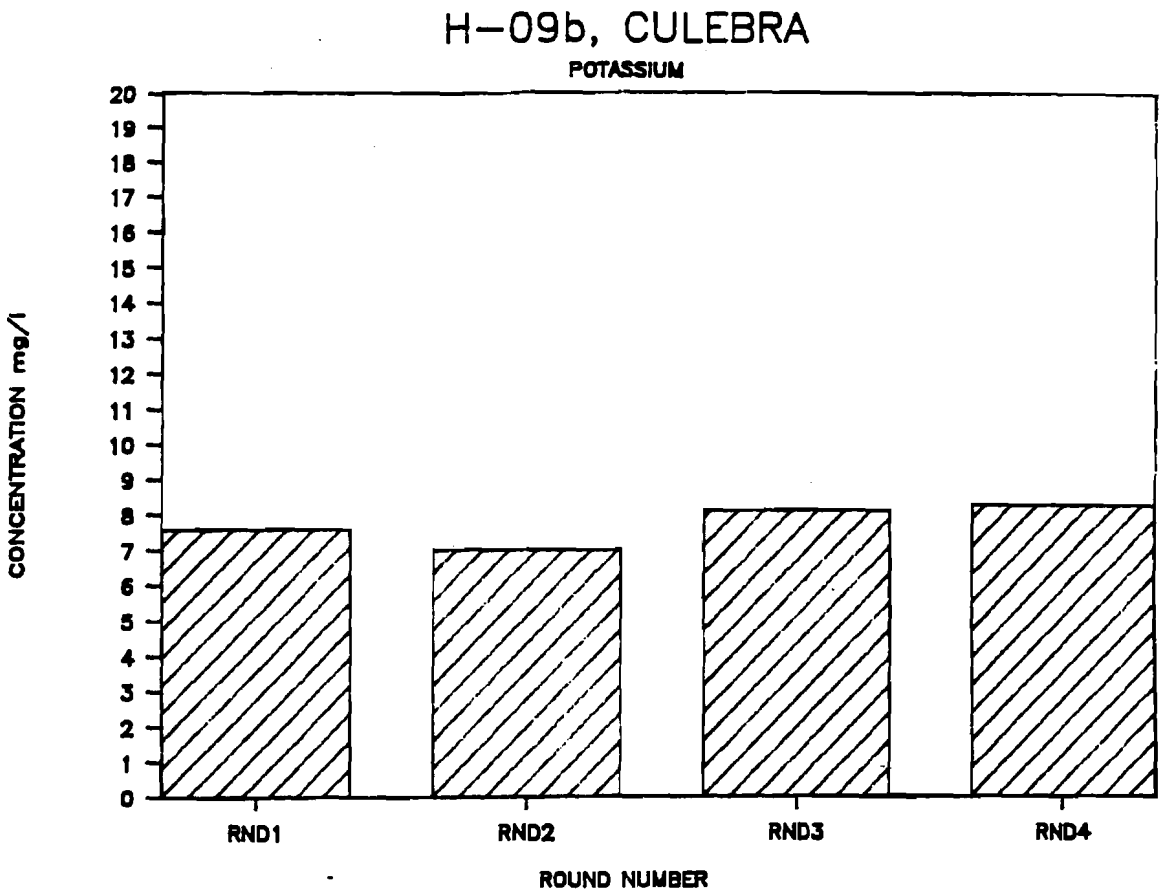

H-09b, CULEBRA
BROMIDE
CONCENTRATION mg/l
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
ROUND NUMBER

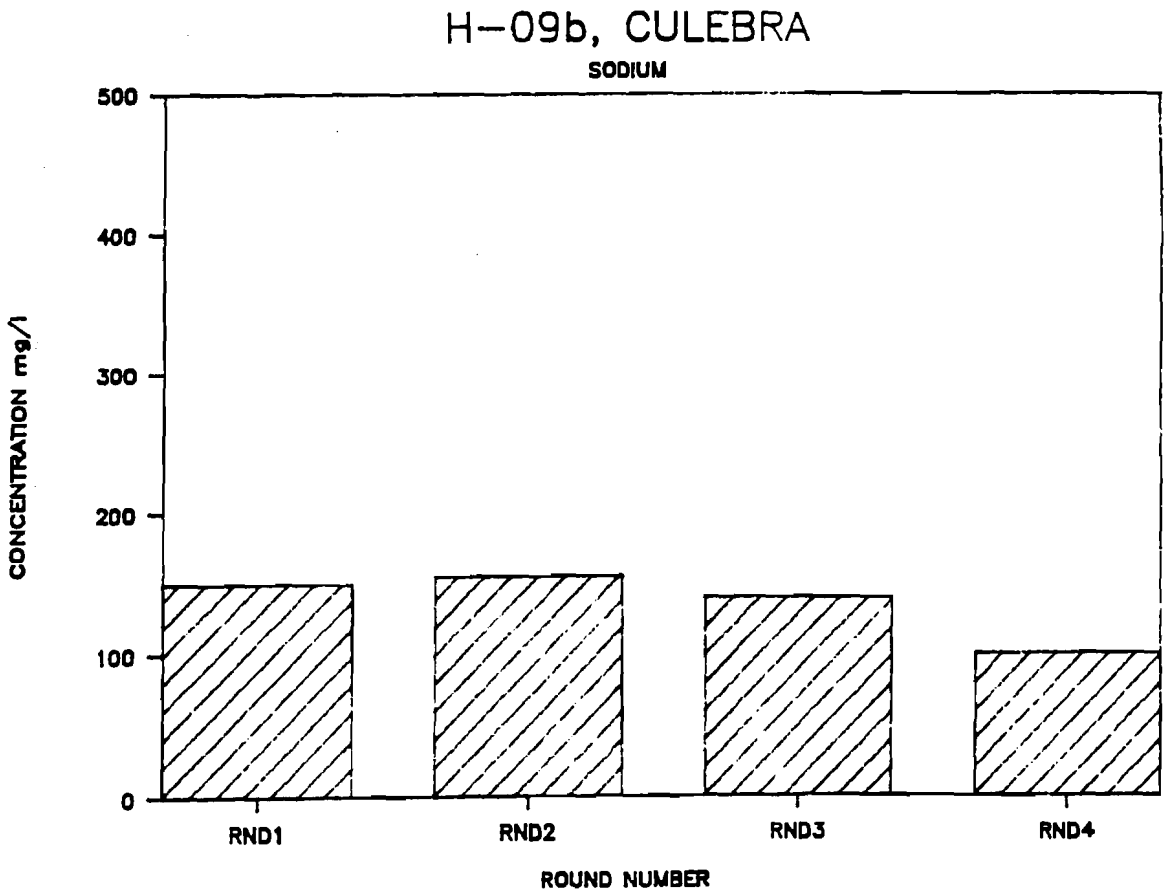

H-09b, CULEBRA
CALCIUM
CONCENTRATION mg/l
(Thousands)
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
ROUND NUMBER

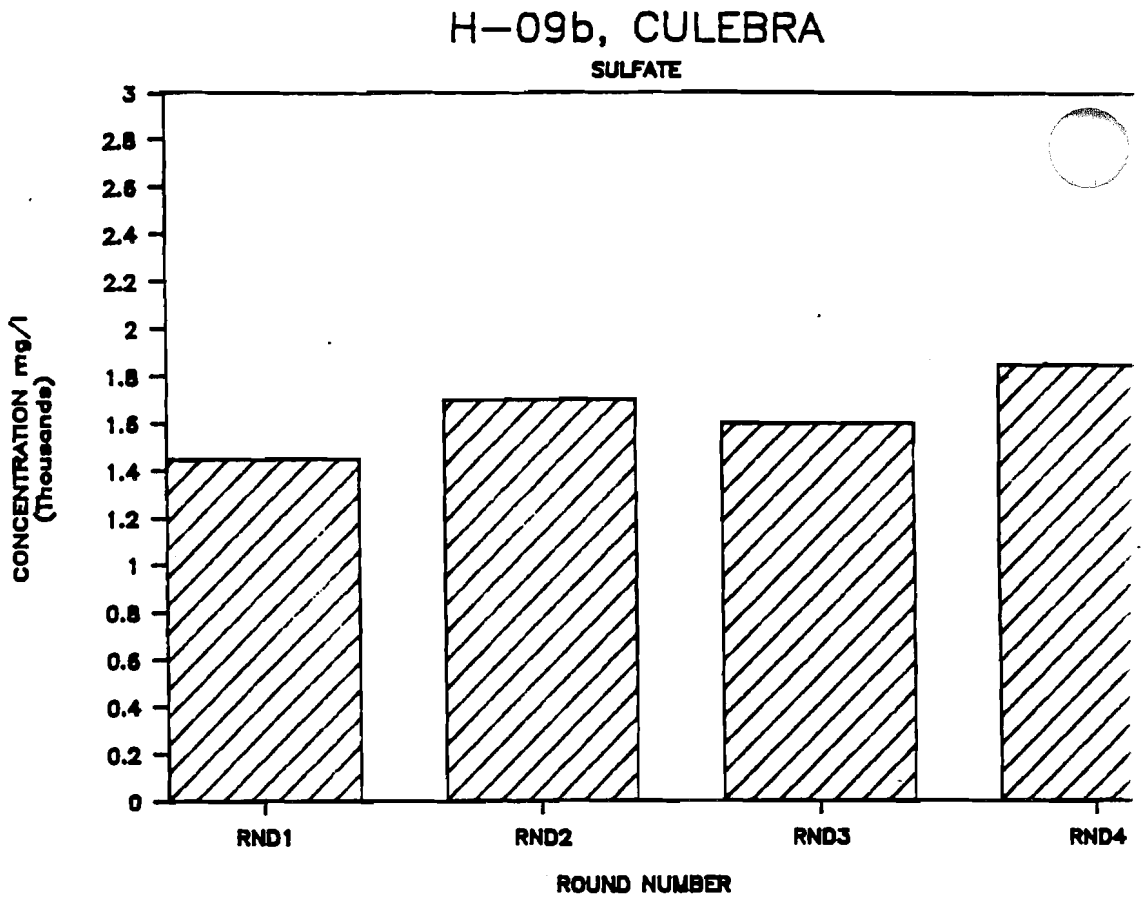

H-09b, CULEBRA
CHLORIDE
CONCENTRATION mg/l
500
400
300
200
100
0
RND1
RND2
RND3
RND4
ROUND NUMBER

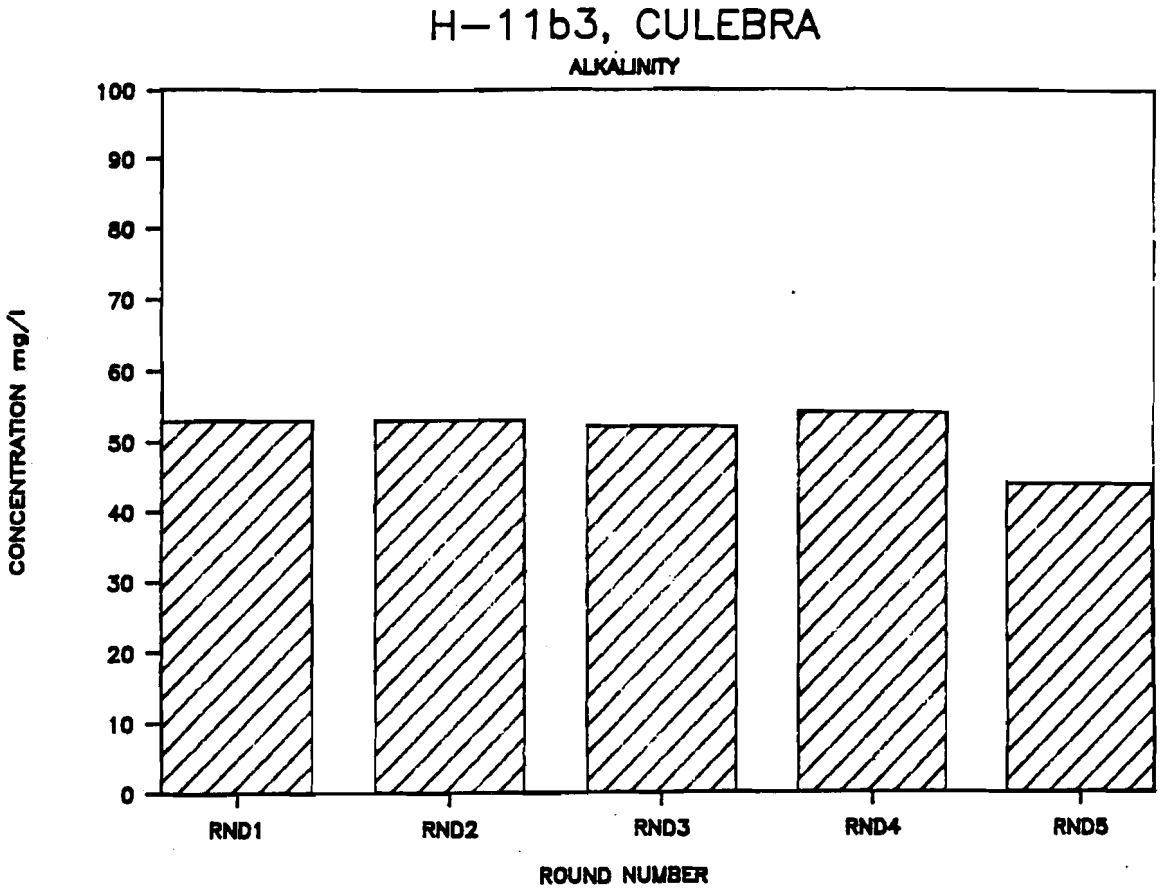

H-09b, CULEBRA
FLUORIDE
CONCENTRATION mg/l
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
ROUND NUMBER

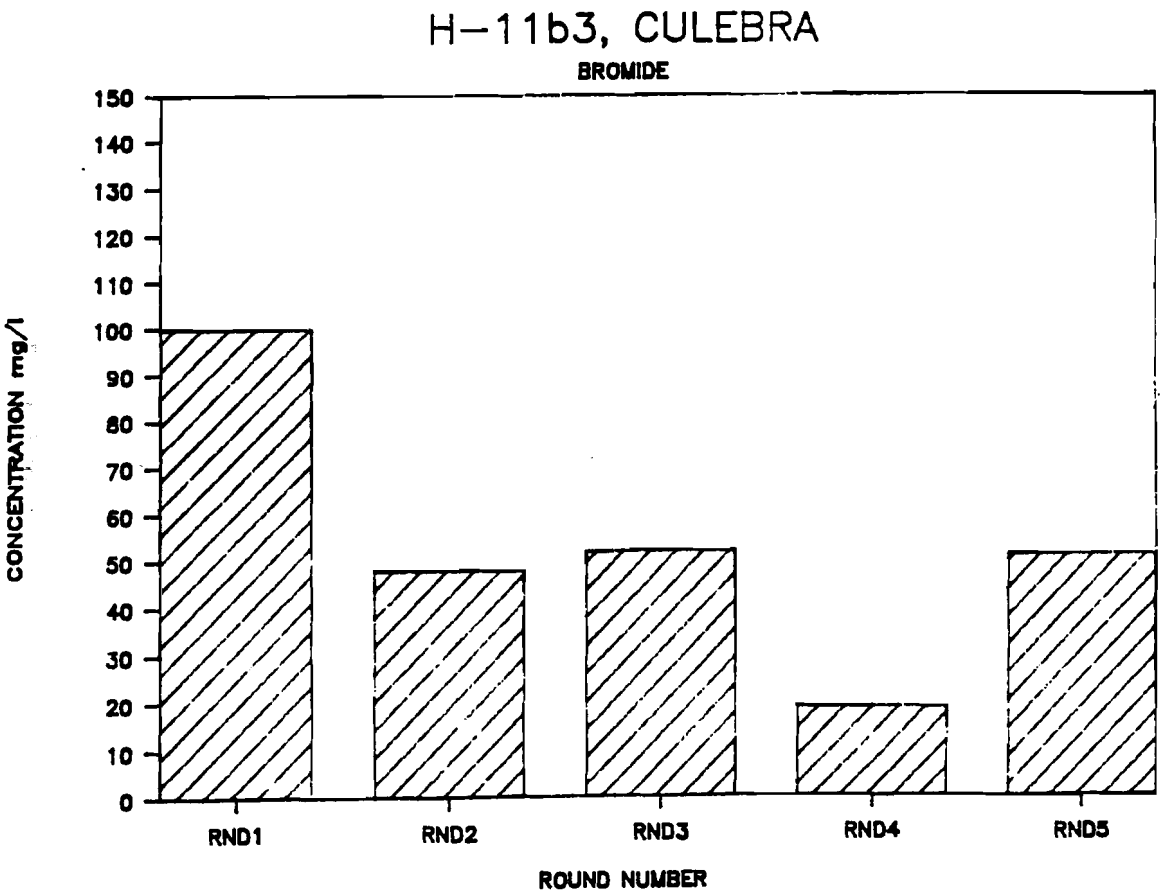

H-09b, CULEBRA
MAGNESIUM
CONCENTRATION mg/l
500
400
300
200
100
0
RND1
RND2
RND3
ROUND NUMBER

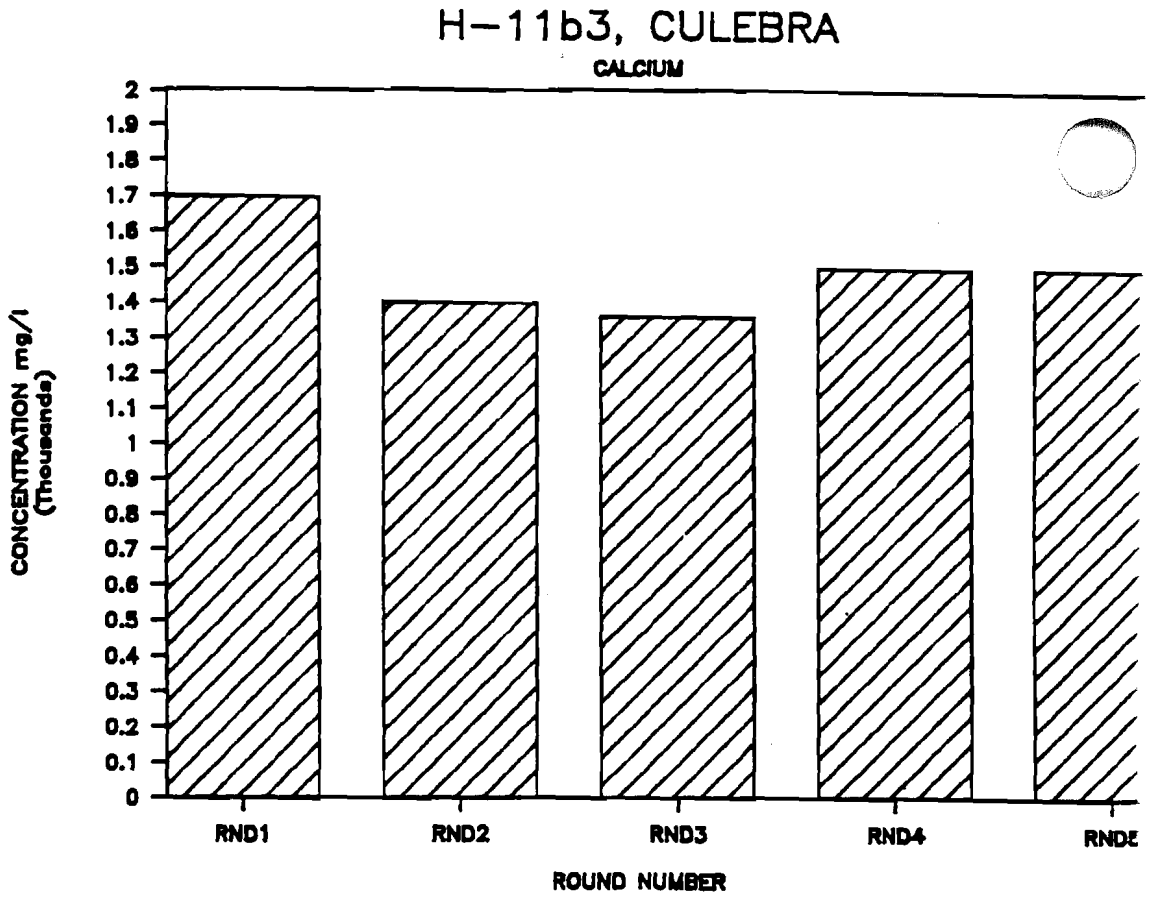

H-09b, CULEBRA
POTASSIUM
CONCENTRATION mg/l
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
ROUND NUMBER

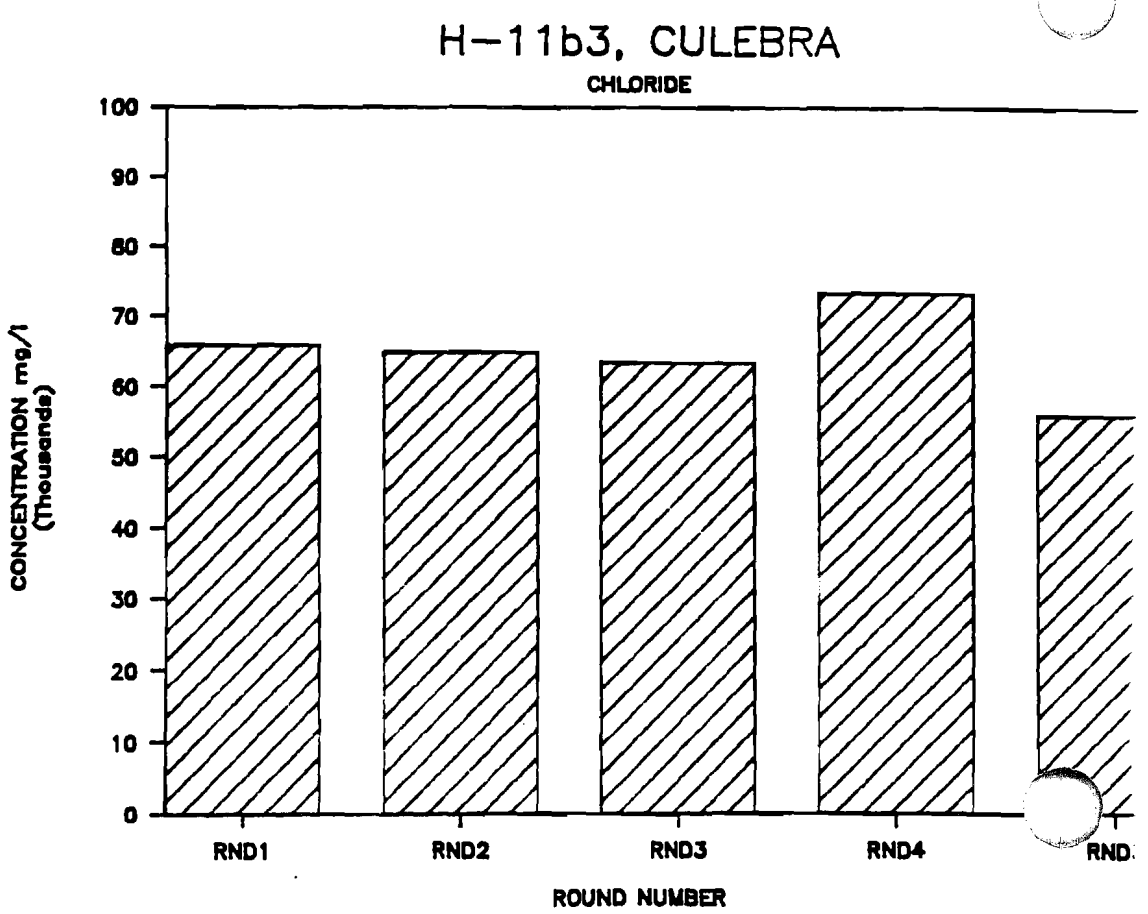

H-09b, CULEBRA
SODIUM
CONCENTRATION mg/l
500
400
300
200
100
0
RND1
RND2
RND3
RND4
ROUND NUMBER

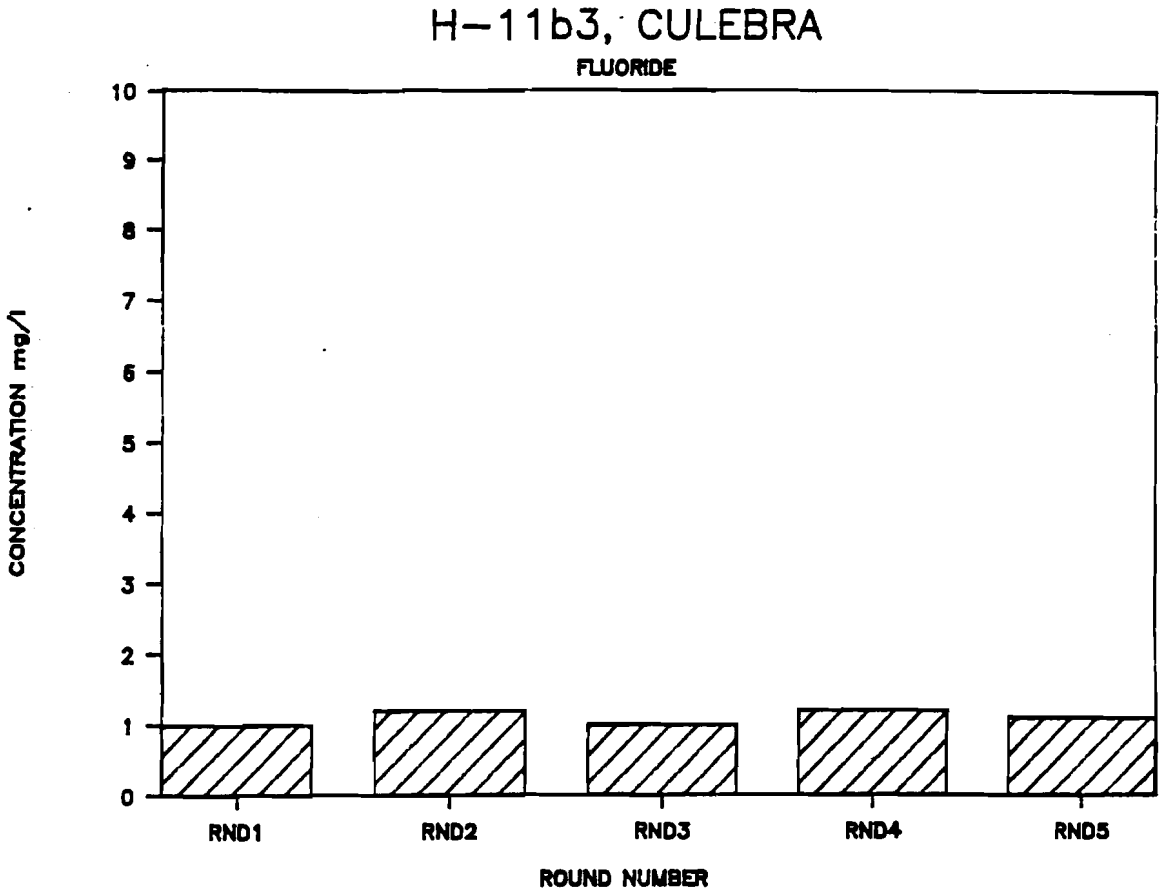

H-09b, CULEBRA
SULFATE
CONCENTRATION mg/l
(Thousands)
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
RND1
RND2
RND3
RND4
ROUND NUMBER

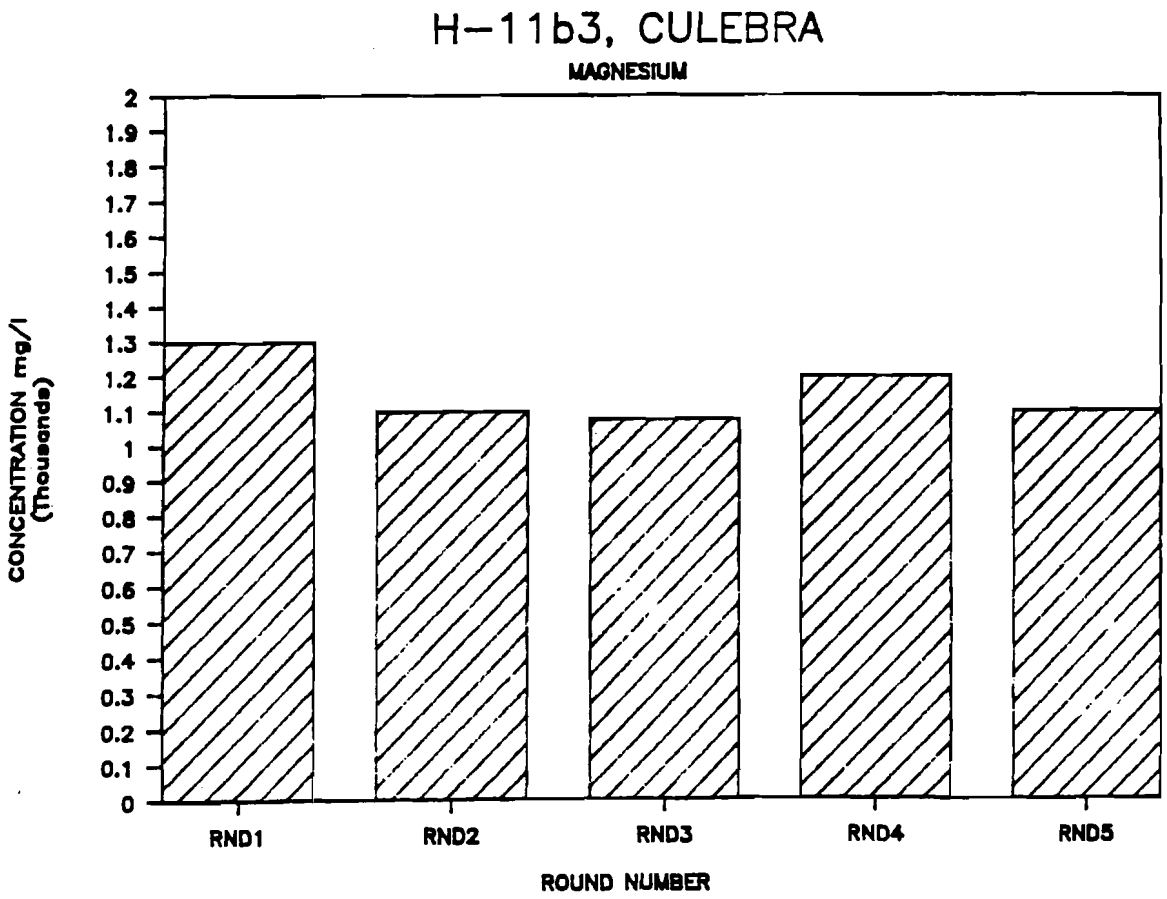

H-11b3, CULEBRA
ALKALINITY
CONCENTRATION mg/l
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

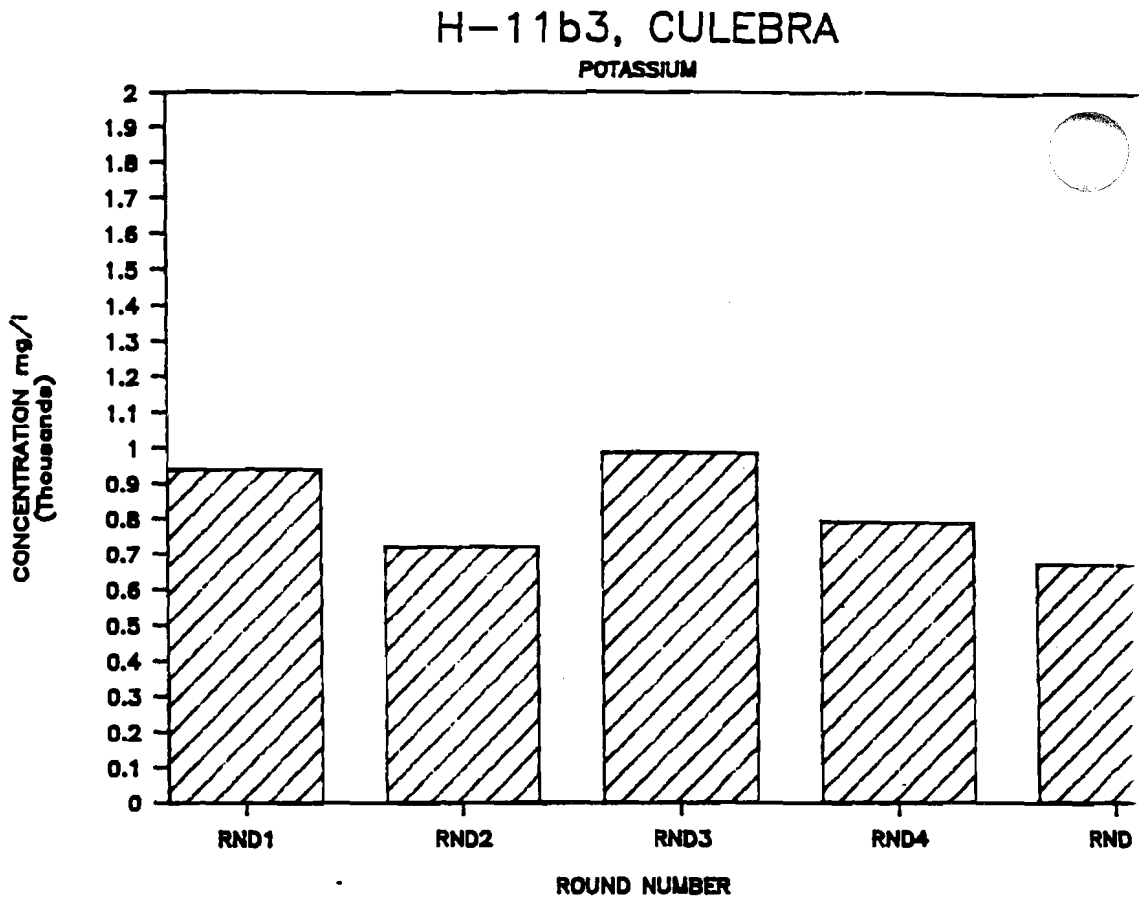

H-11b3, CULEBRA
BROMIDE
CONCENTRATION mg/l
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

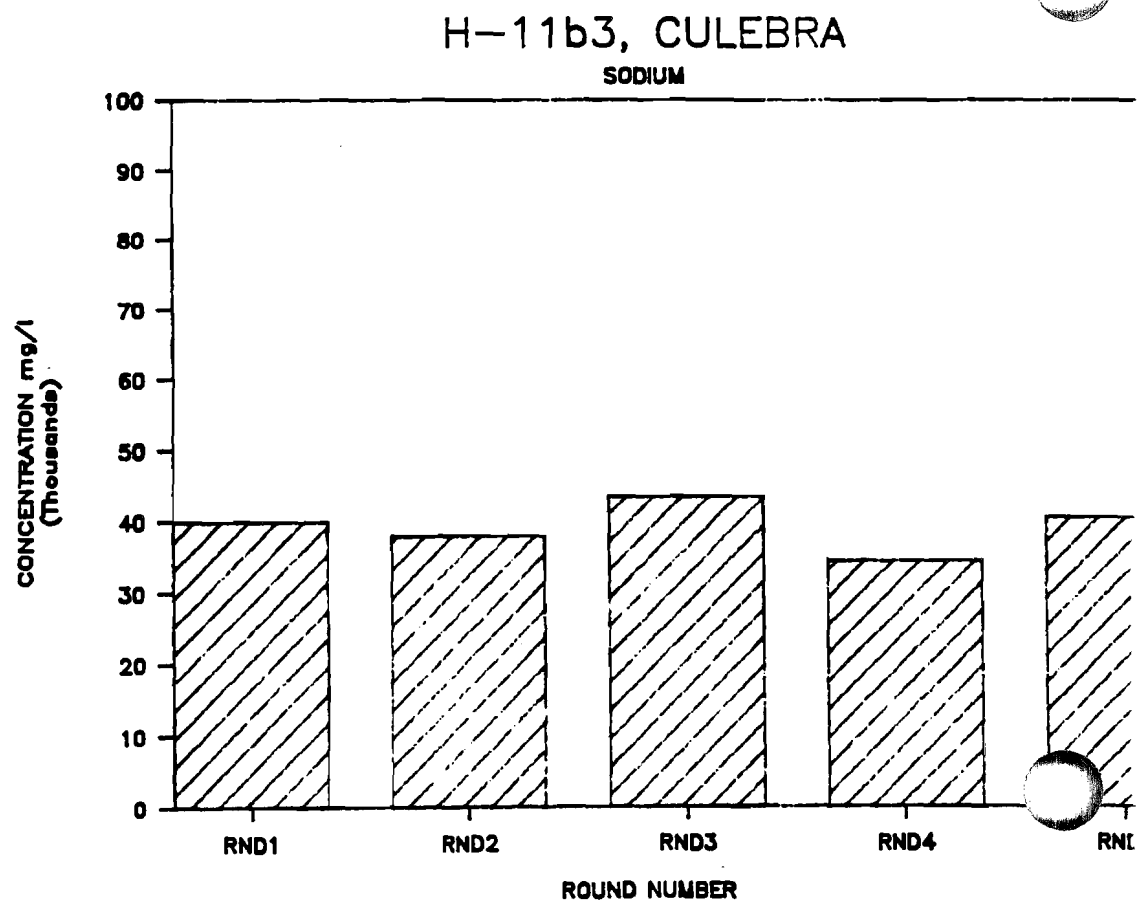

H-11b3, CULEBRA
CALCIUM
CONCENTRATION mg/l (Thousands)
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
ROUND NUMBER

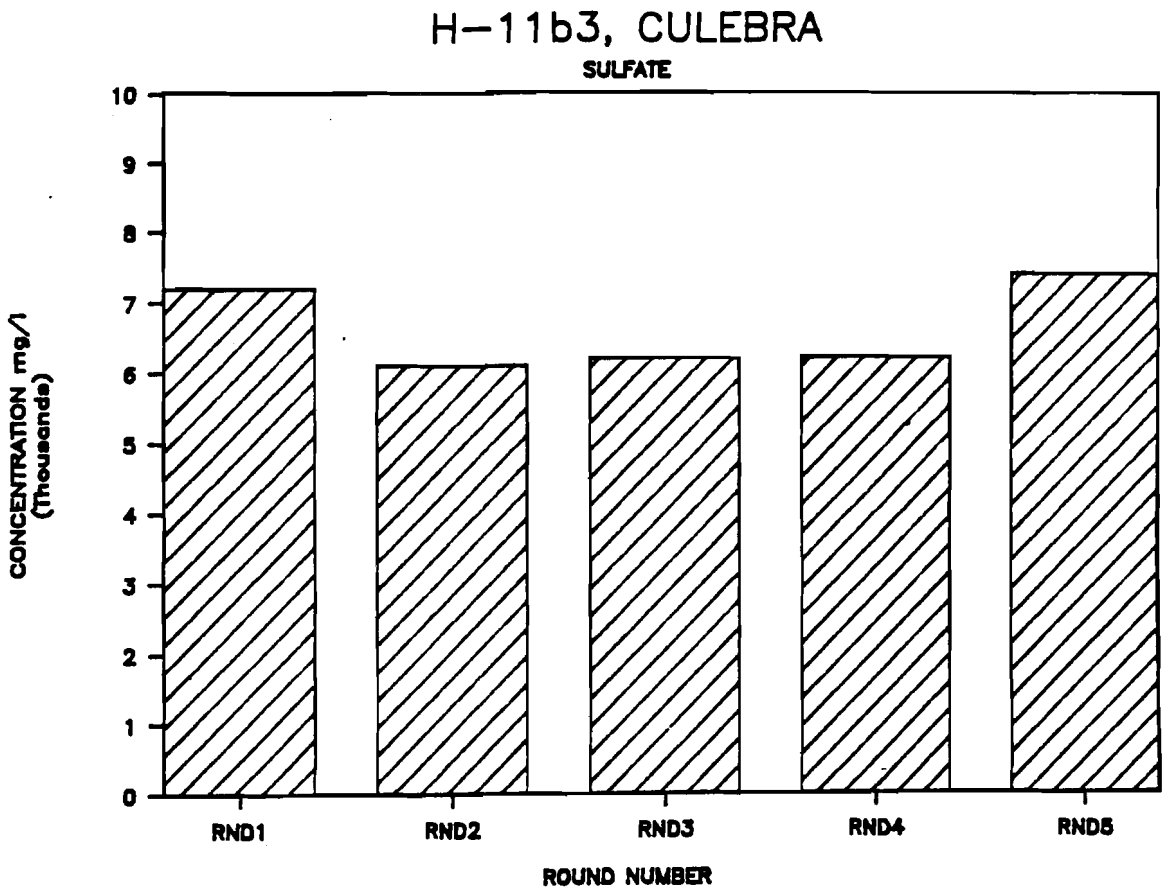

H-11b3, CULEBRA
CHLORIDE
CONCENTRATION mg/l (Thousands)
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
ROUND NUMBER

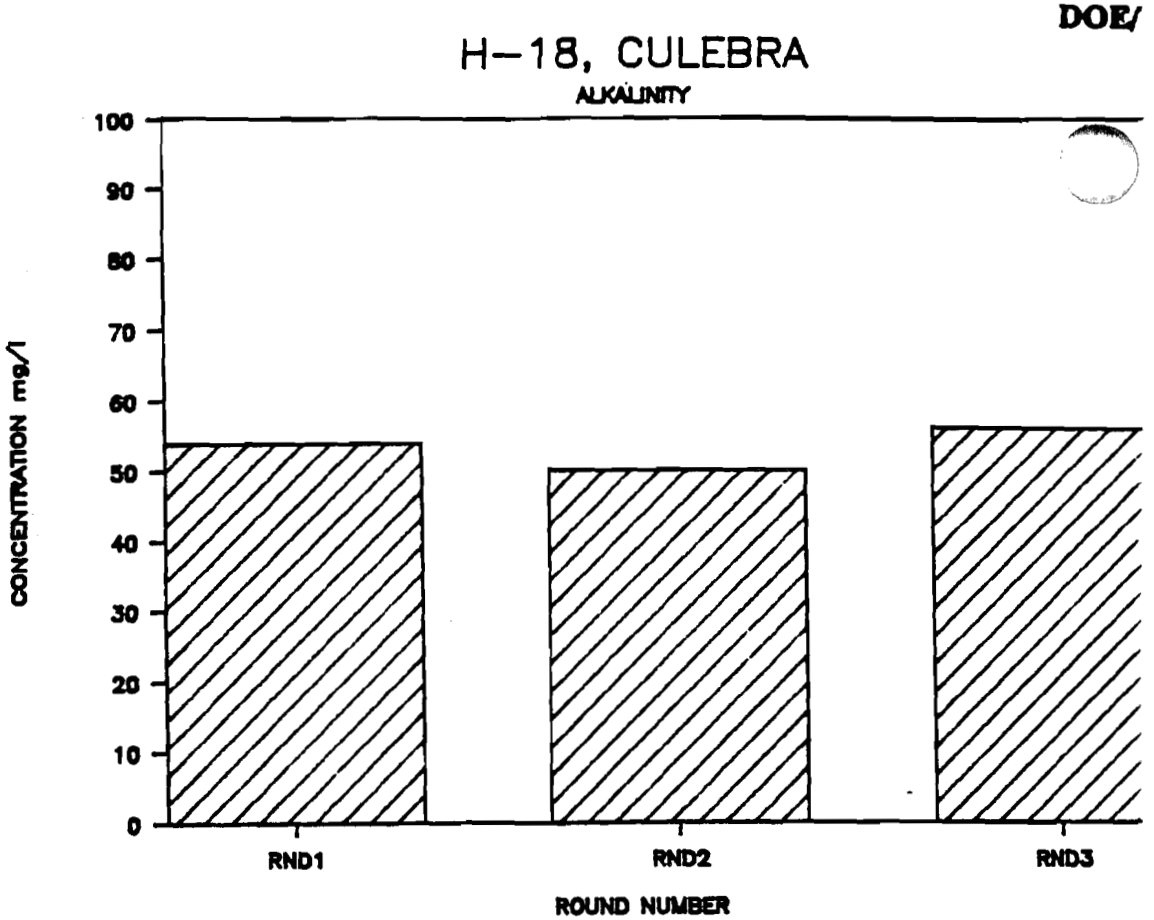

H-11b3, CULEBRA
FLUORIDE
CONCENTRATION mg/l
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

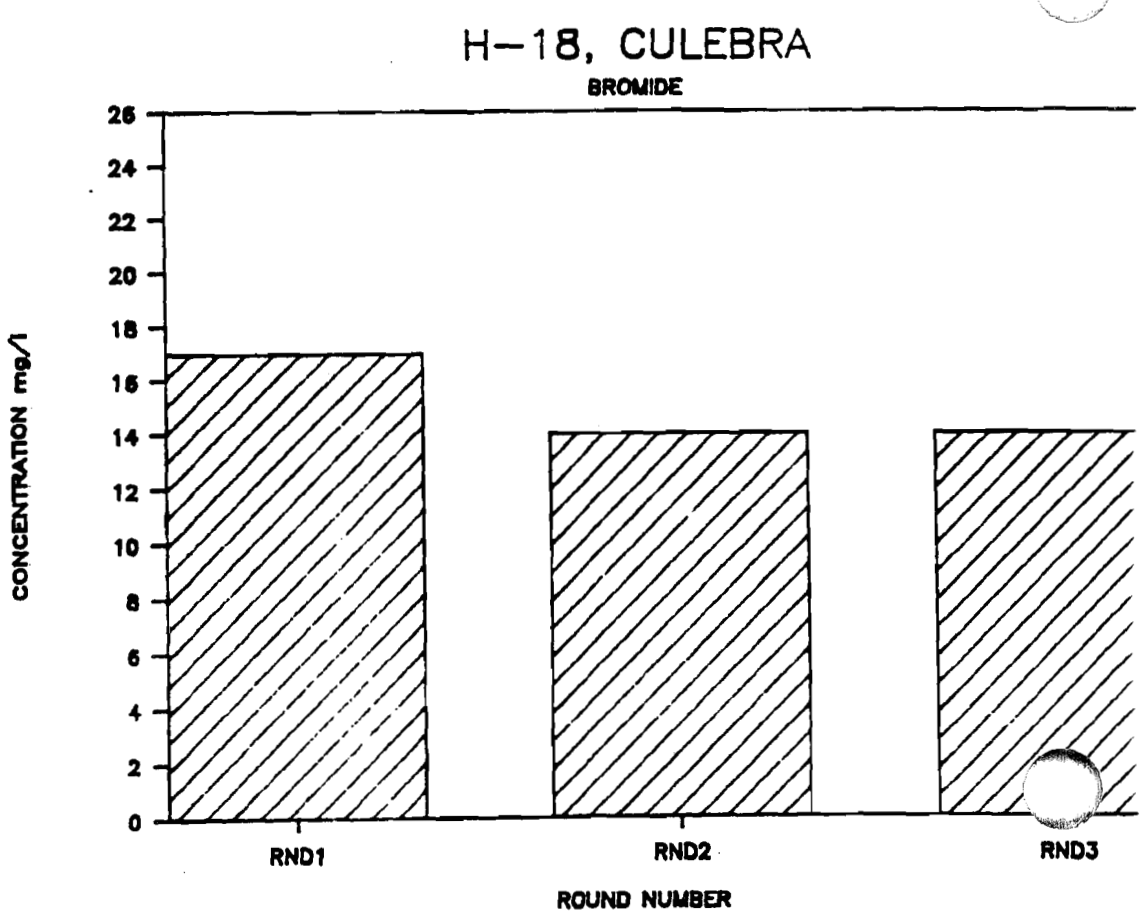

H-11b3, CULEBRA
MAGNESIUM
CONCENTRATION mg/l
(Thousands)
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

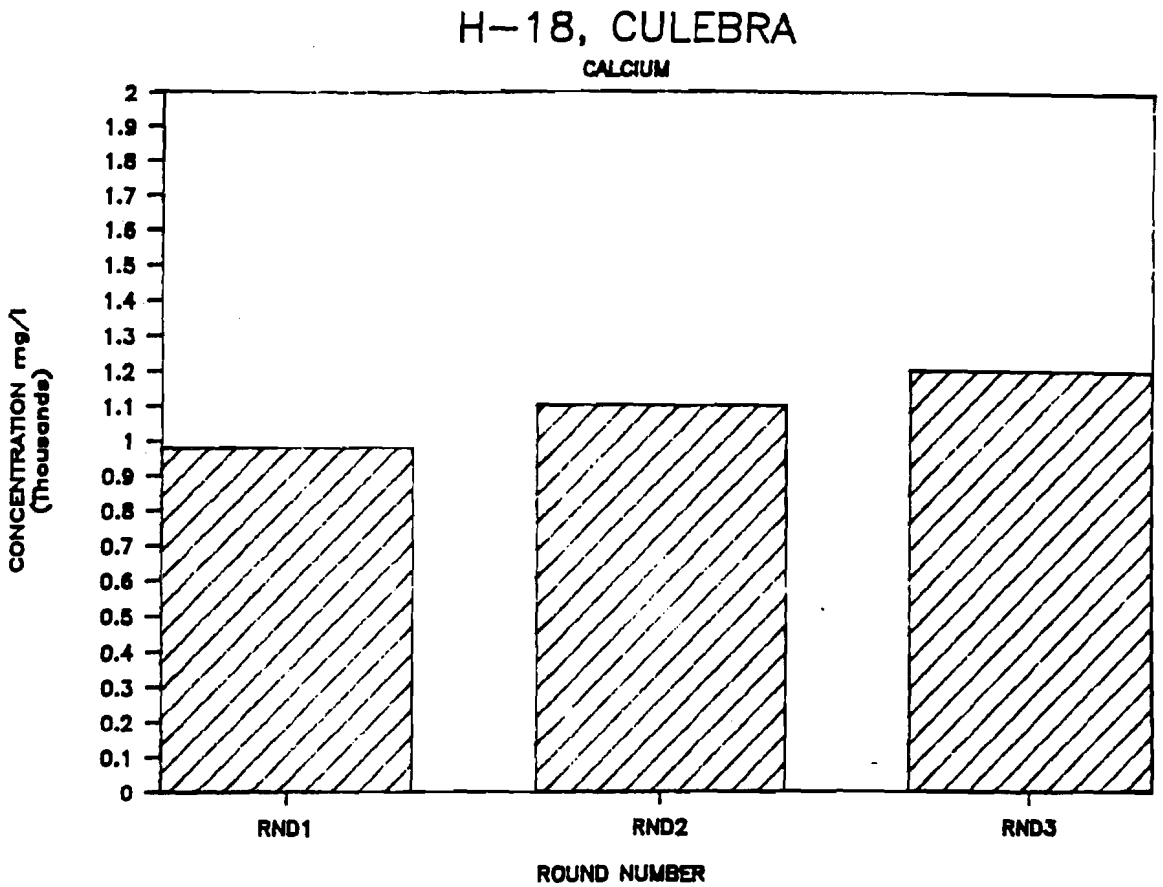

H-11b3, CULEBRA
POTASSIUM
CONCENTRATION mg/l (Thousands)
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND
ROUND NUMBER

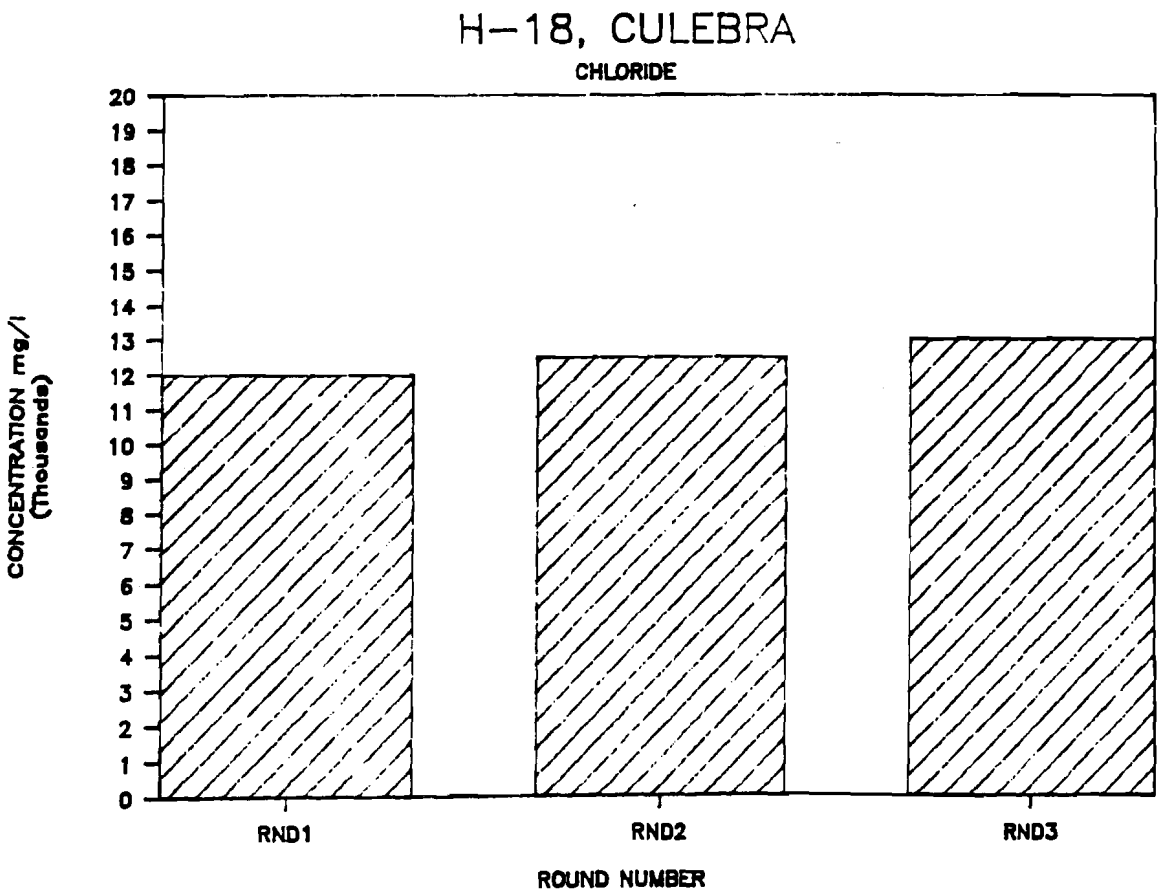

H-11b3, CULEBRA
SODIUM
CONCENTRATION mg/l (Thousands)
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RNI
ROUND NUMBER

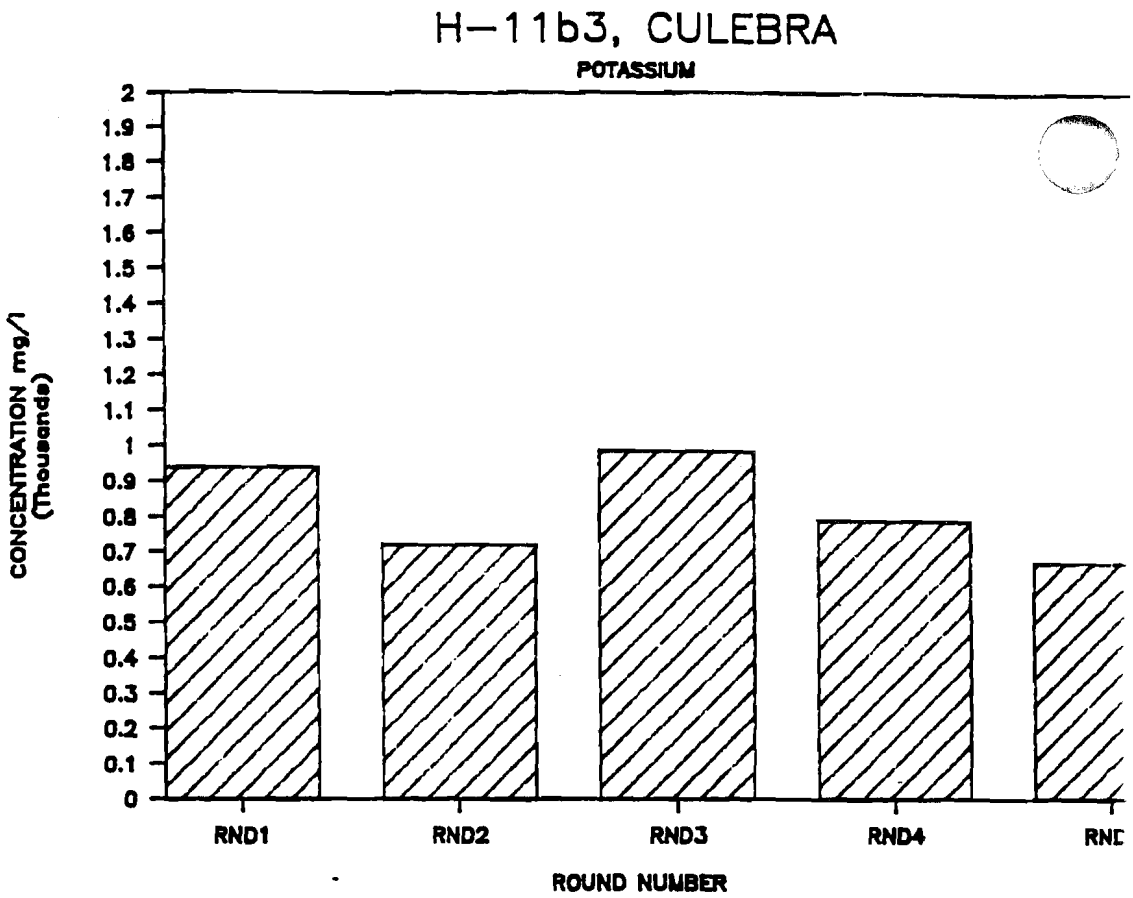

H-11b3, CULEBRA
SULFATE
CONCENTRATION mg/l
(Thousands)
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

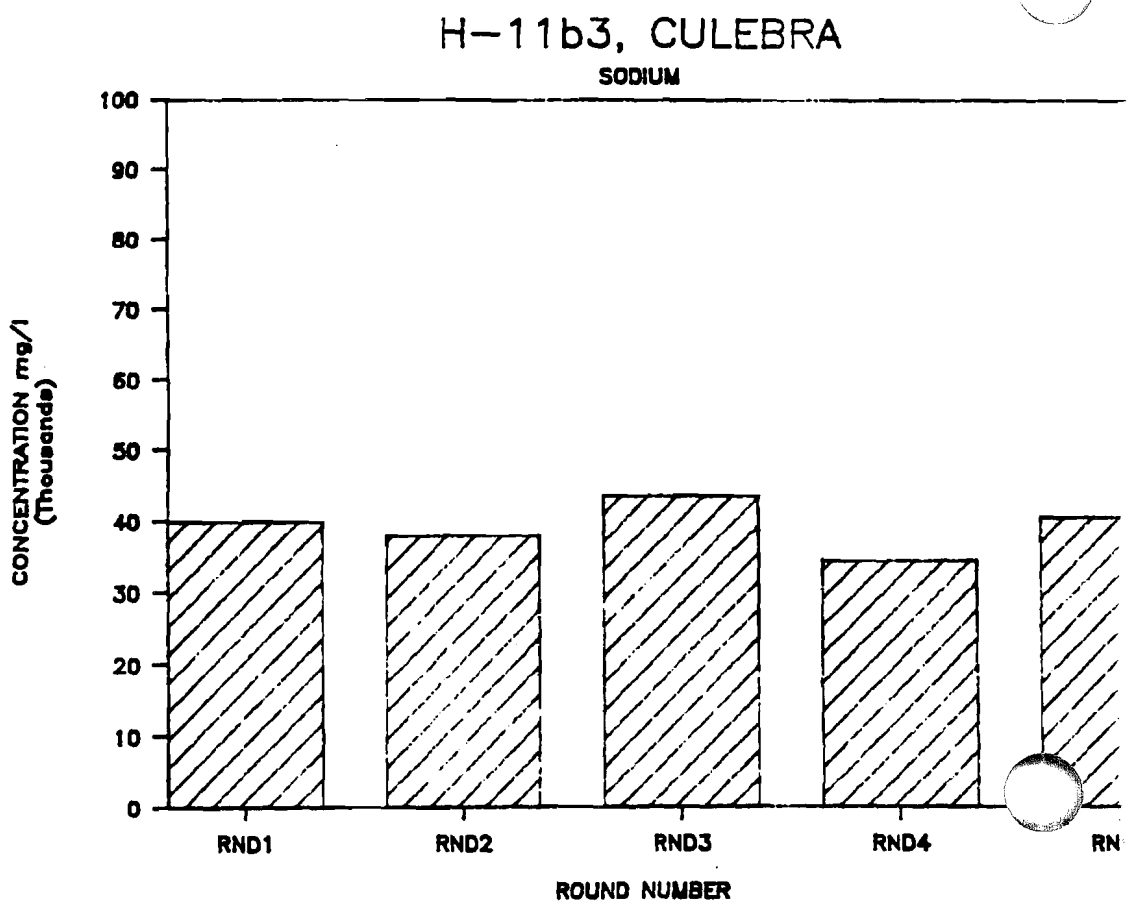

H-18, CULEBRA
ALKALINITY
CONCENTRATION mg/l
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
ROUND NUMBER

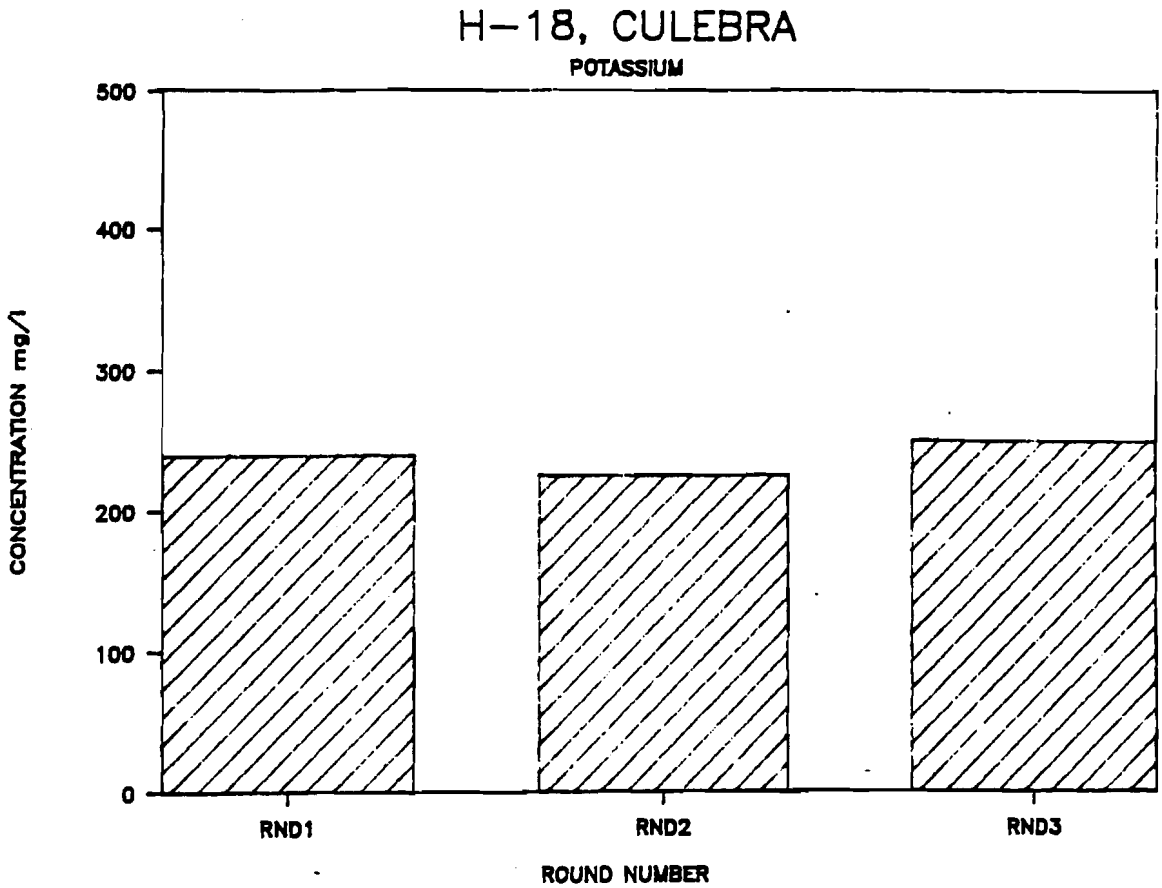

H-18, CULEBRA
BROMIDE
CONCENTRATION mg/l
26
24
22
20
18
16
14
12
10
8
6
4
2
0
RND1
RND2
RND3
ROUND NUMBER

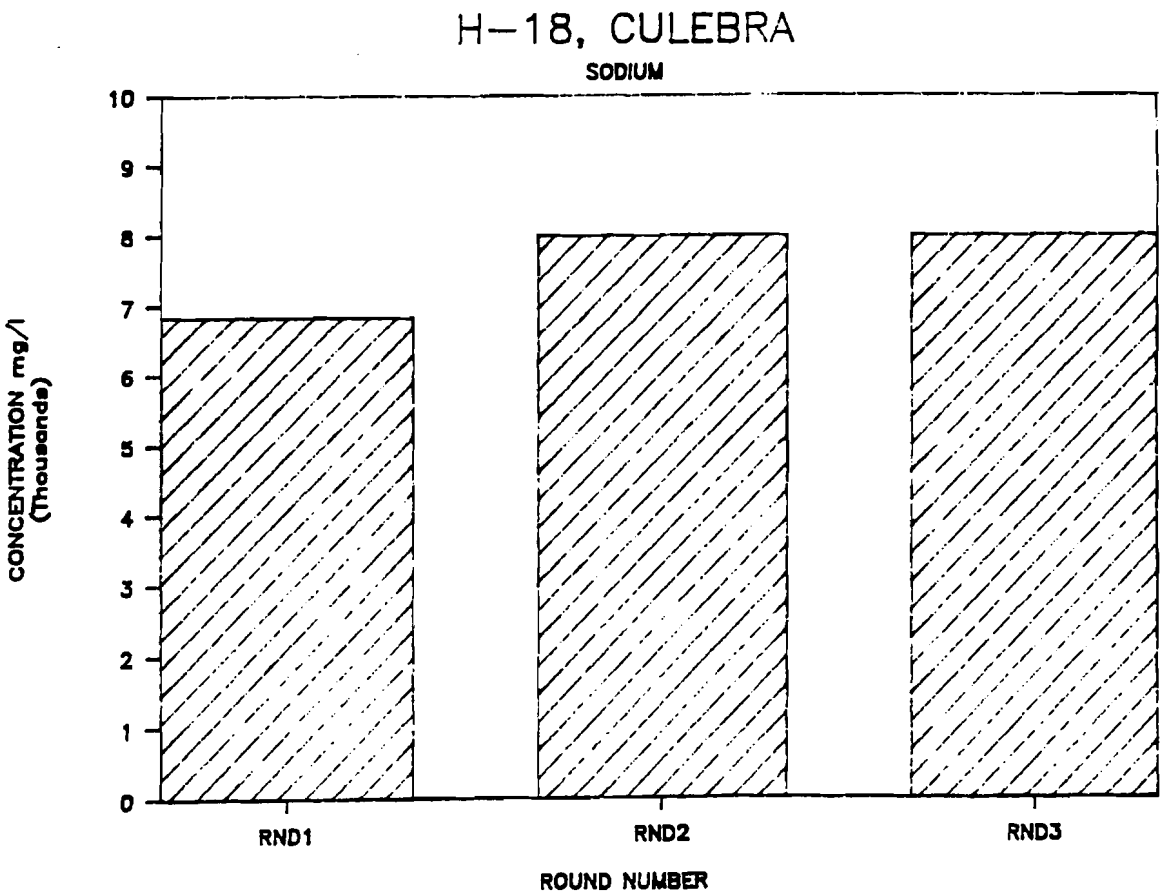

H-18, CULEBRA
CALCIUM
CONCENTRATION mg/l
(Thousands)
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
ROUND NUMBER


H-18, CULEBRA
CHLORIDE
CONCENTRATION mg/l
(Thousands)
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
ROUND NUMBER

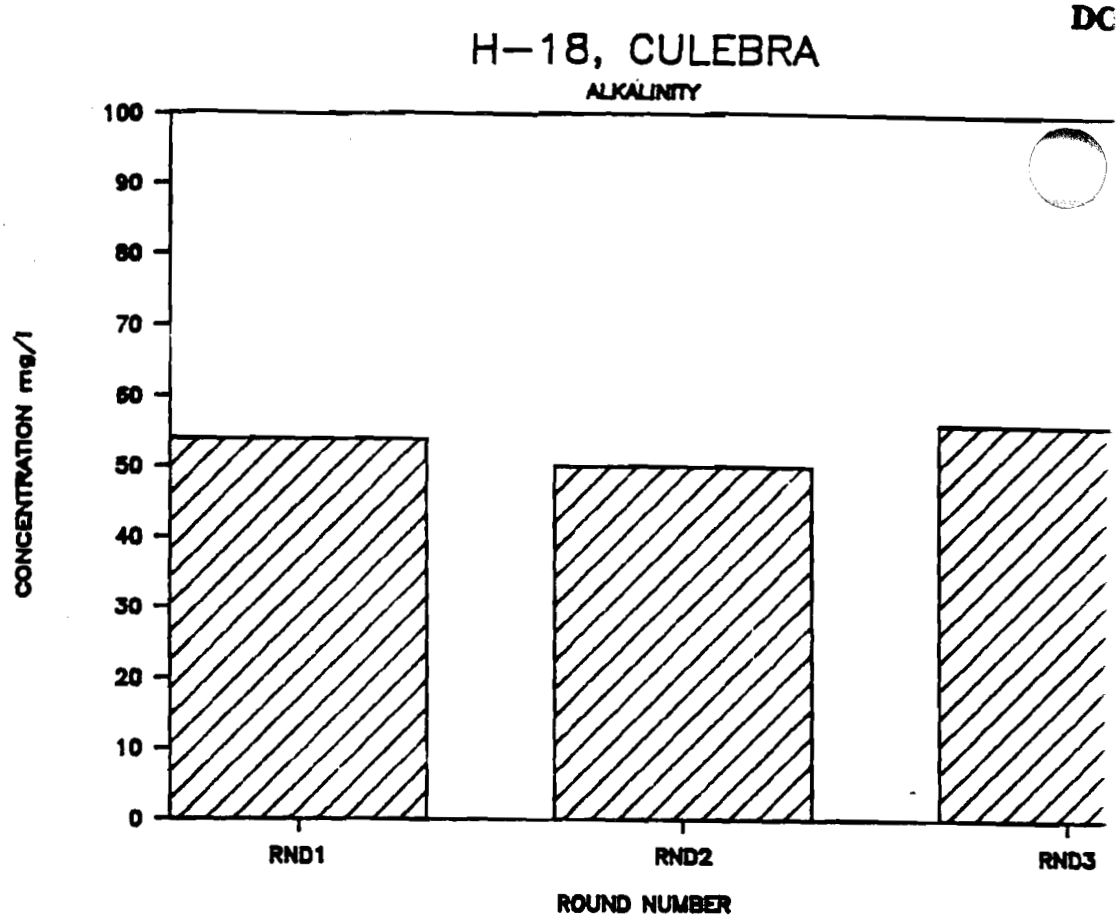

H-11b3, CULEBRA
POTASSIUM
CONCENTRATION mg/l (Thousands)
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RNI
ROUND NUMBER

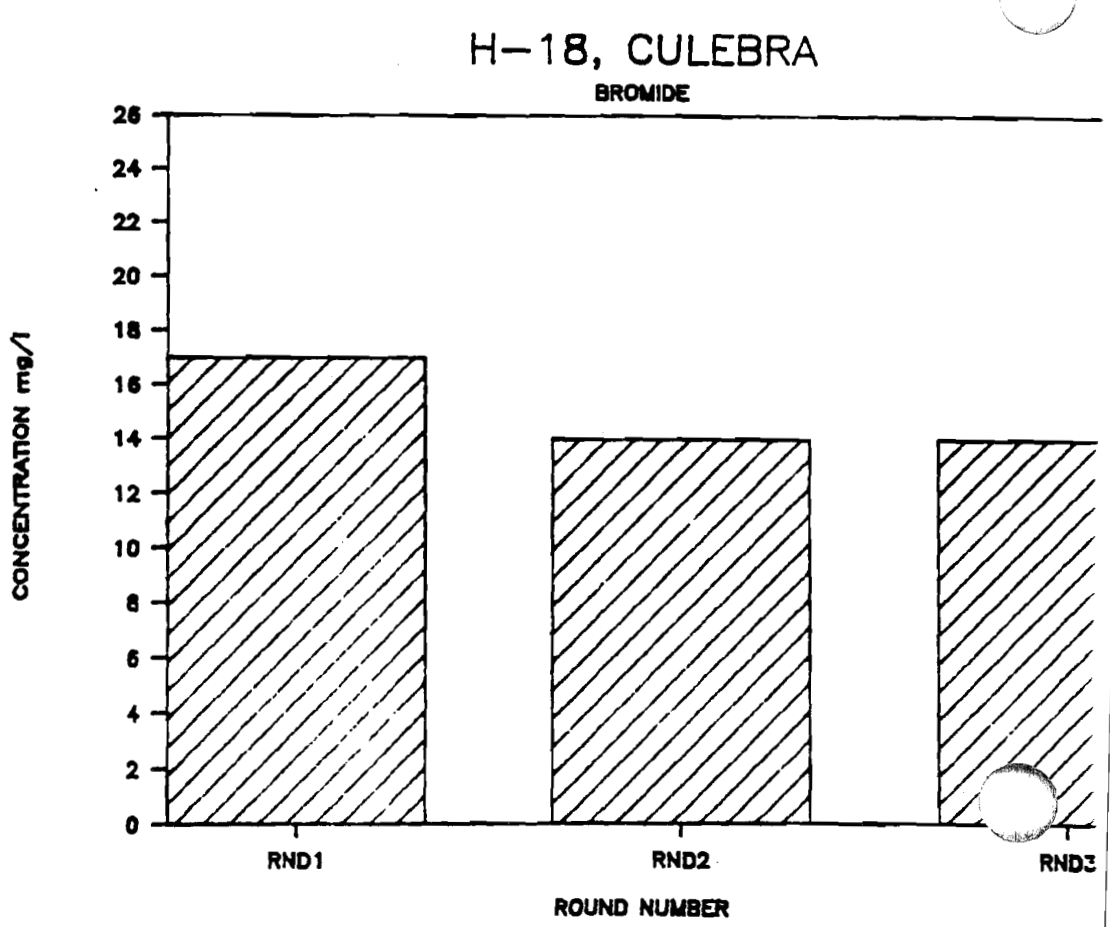

H-11b3, CULEBRA
SODIUM
CONCENTRATION mg/l (Thousands)
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RN
ROUND NUMBER

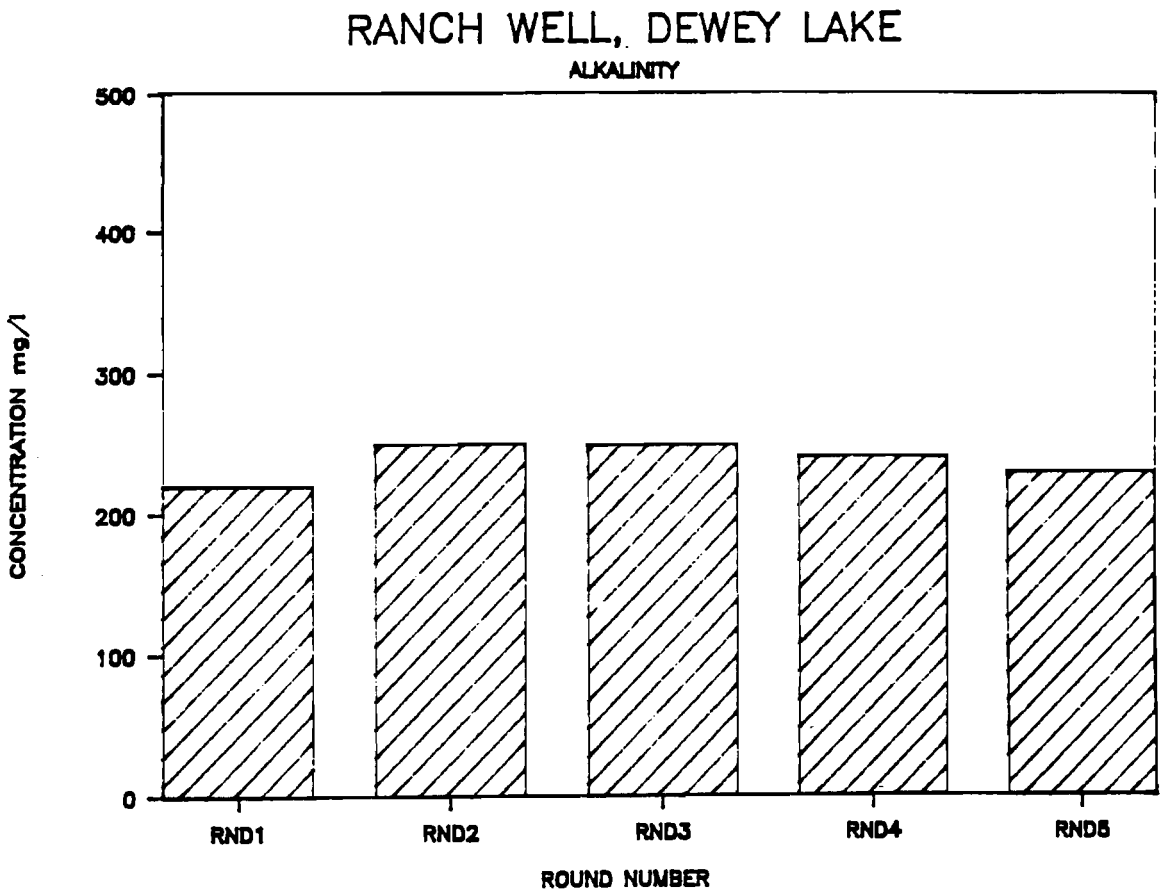

H-18, CULEBRA
POTASSIUM
CONCENTRATION mg/l
500
400
300
200
100
0
RND1
RND2
RND3
ROUND NUMBER

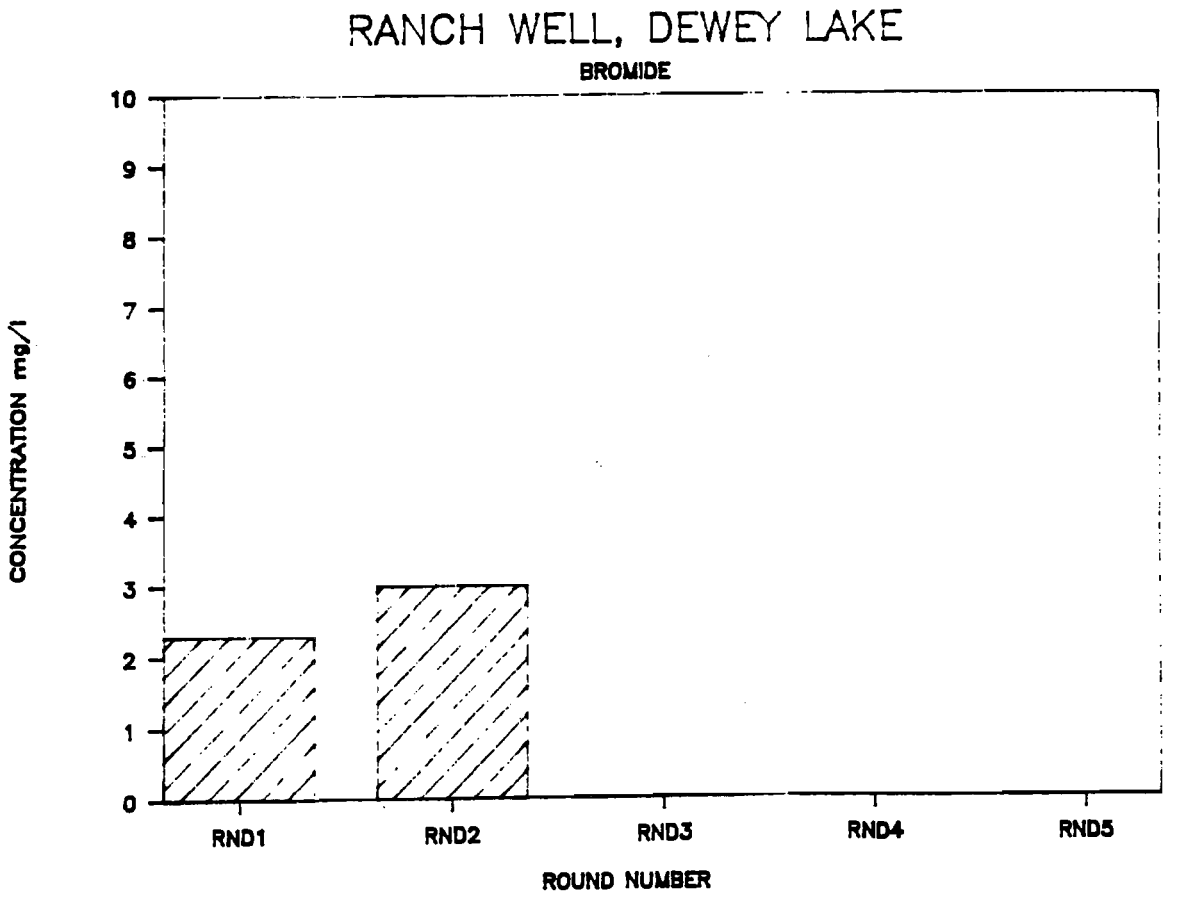

H-18, CULEBRA
SODIUM
CONCENTRATION mg/l
(Thousands)
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
ROUND NUMBER

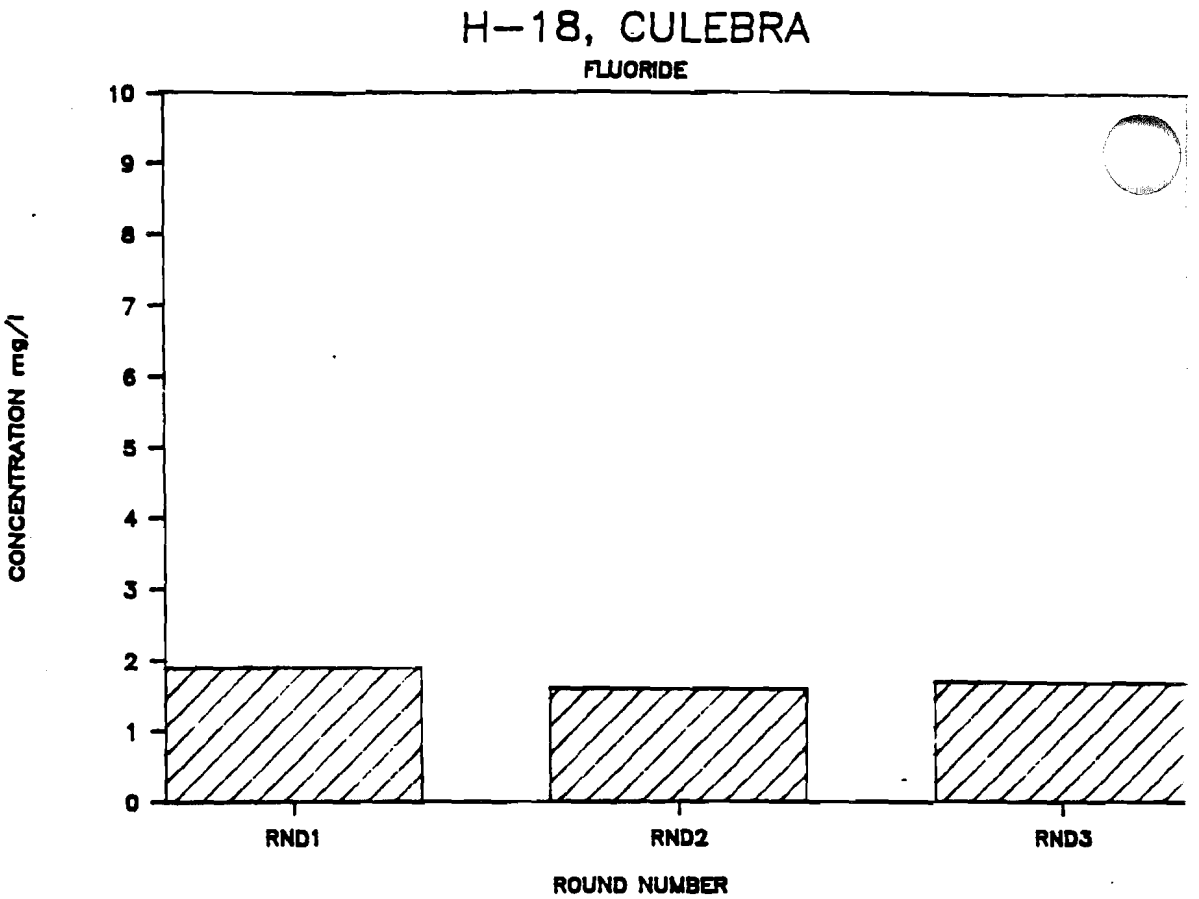
DC

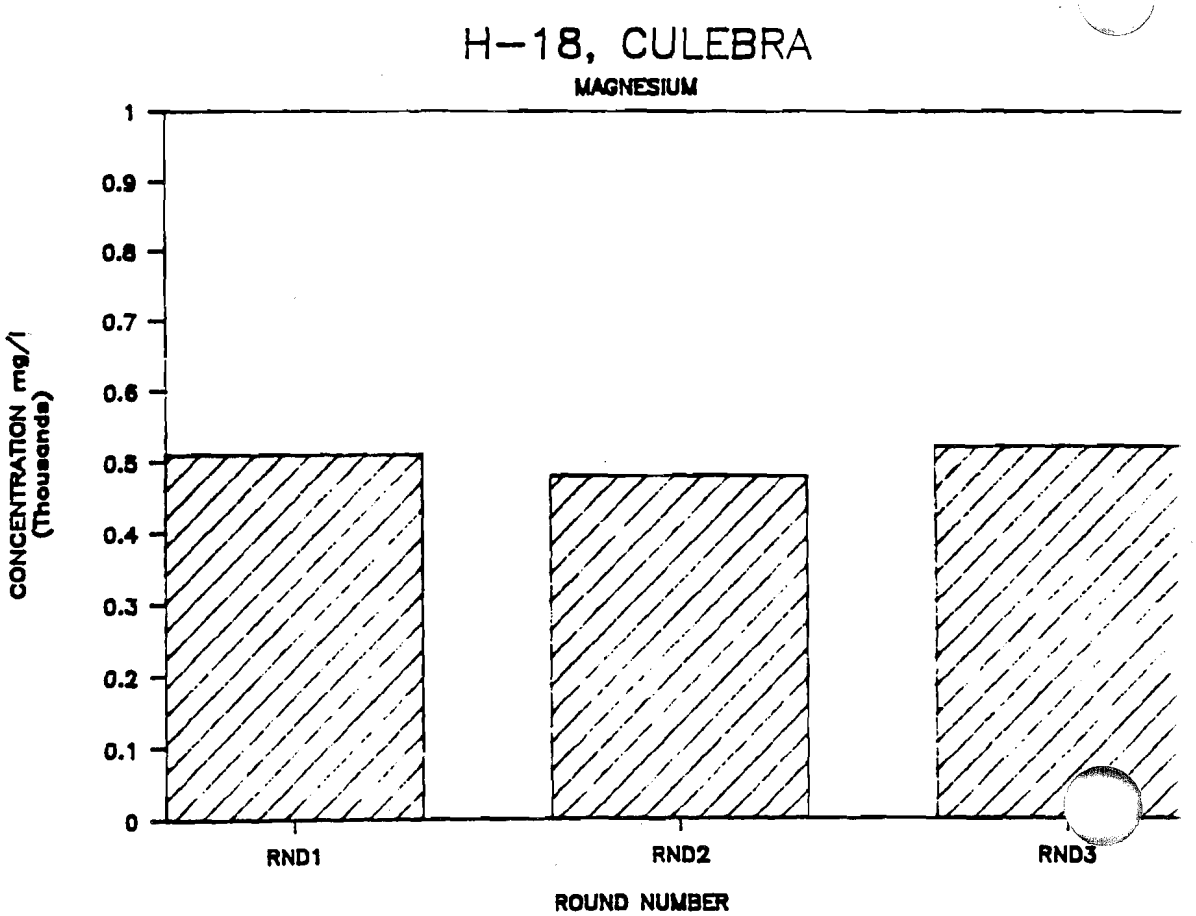

H-18, CULEBRA
ALKALINITY
CONCENTRATION mg/l
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
ROUND NUMBER

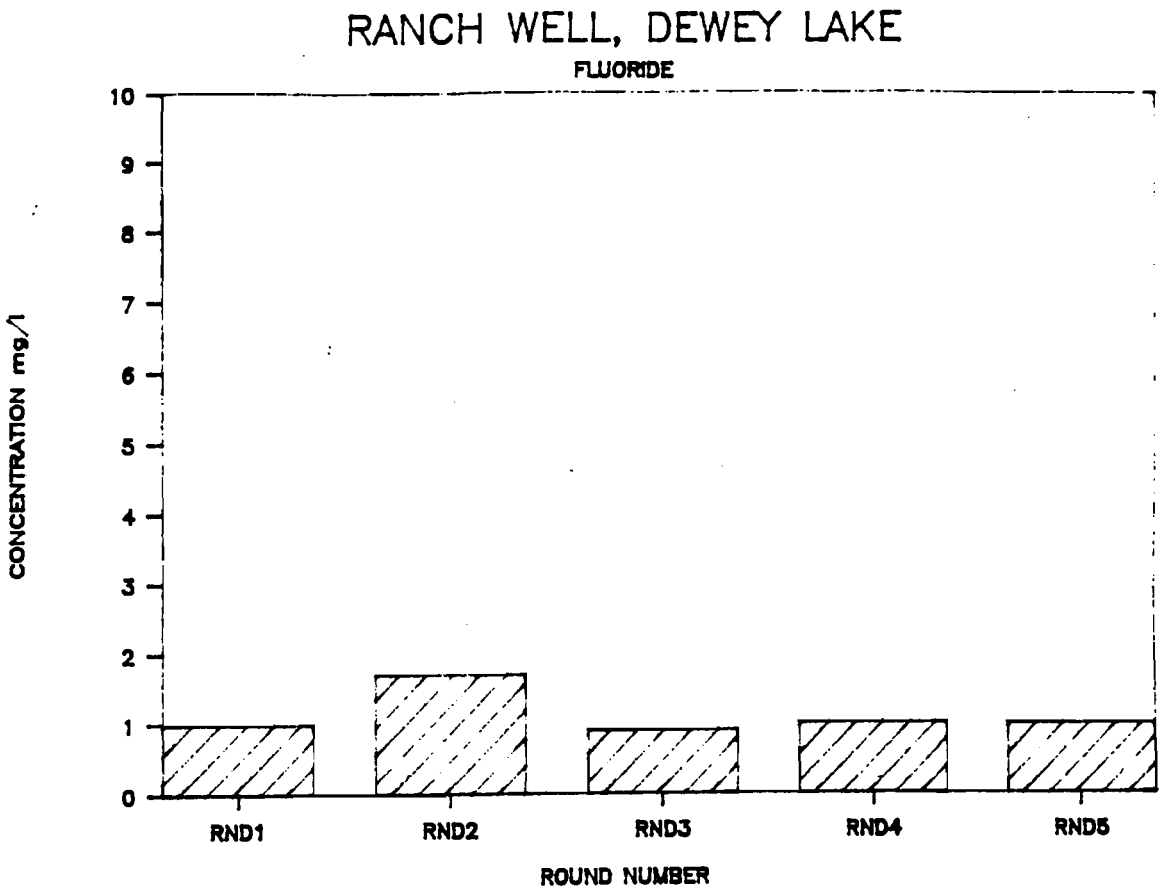

H-18, CULEBRA
BROMIDE
CONCENTRATION mg/l
26
24
22
20
18
16
14
12
10
8
6
4
2
0
RND1
RND2
RND3
ROUND NUMBER

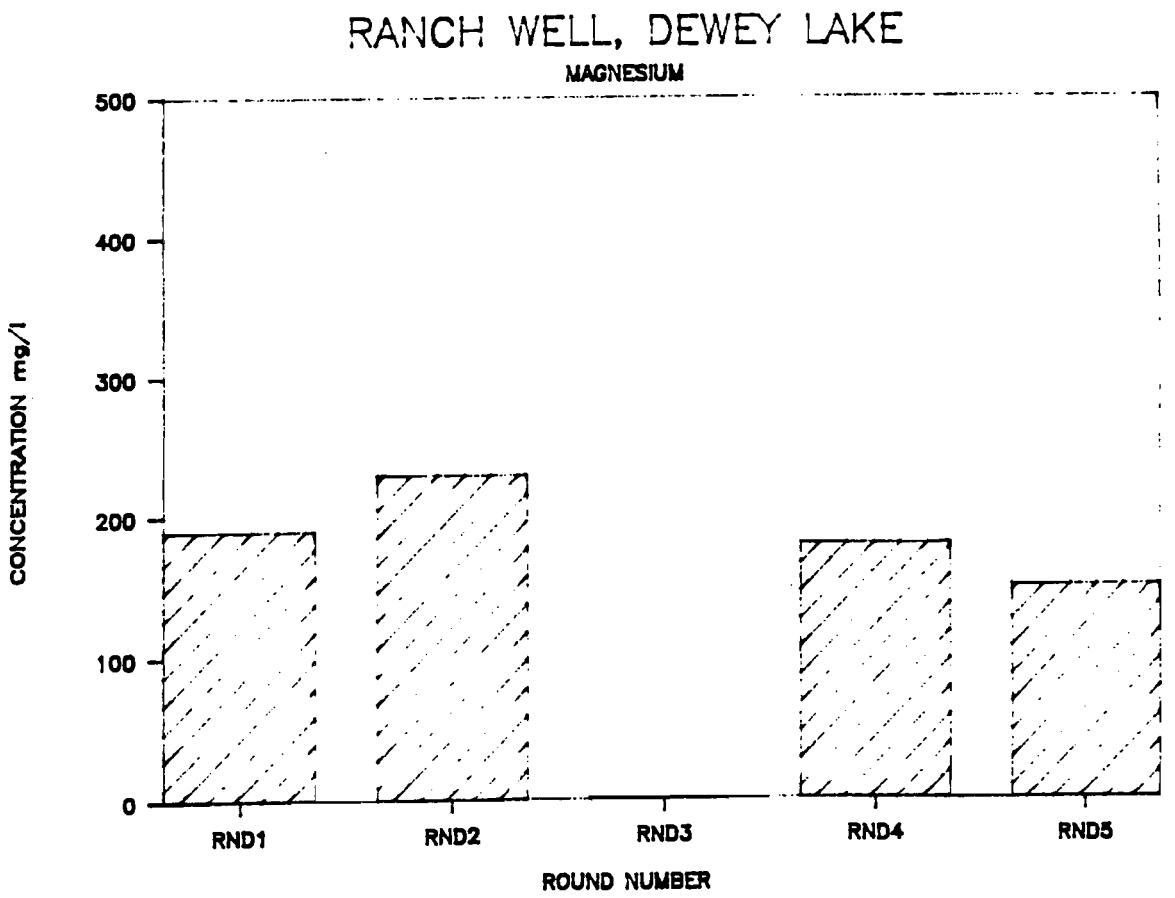

RANCH WELL, DEWEY LAKE
ALKALINITY
CONCENTRATION mg/l
500
400
300
200
100
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

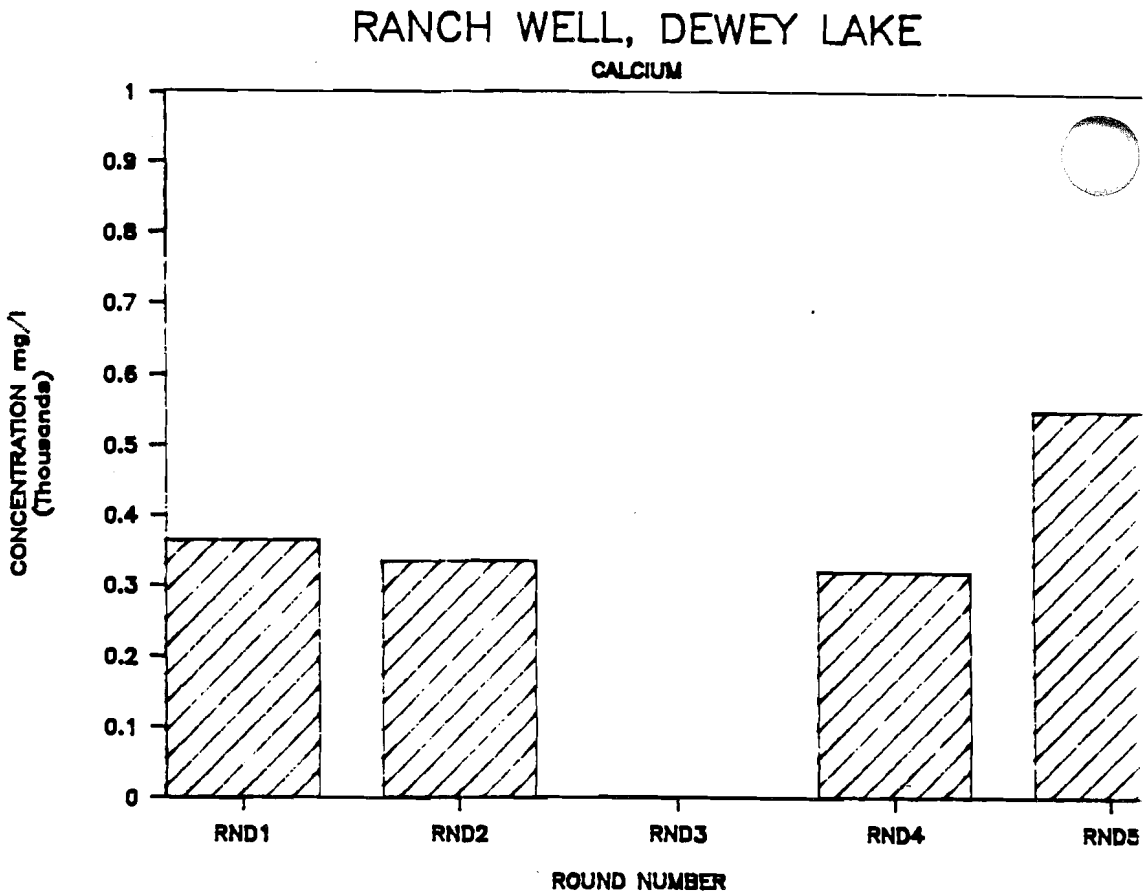

RANCH WELL, DEWEY LAKE
BROMIDE
CONCENTRATION mg/l
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

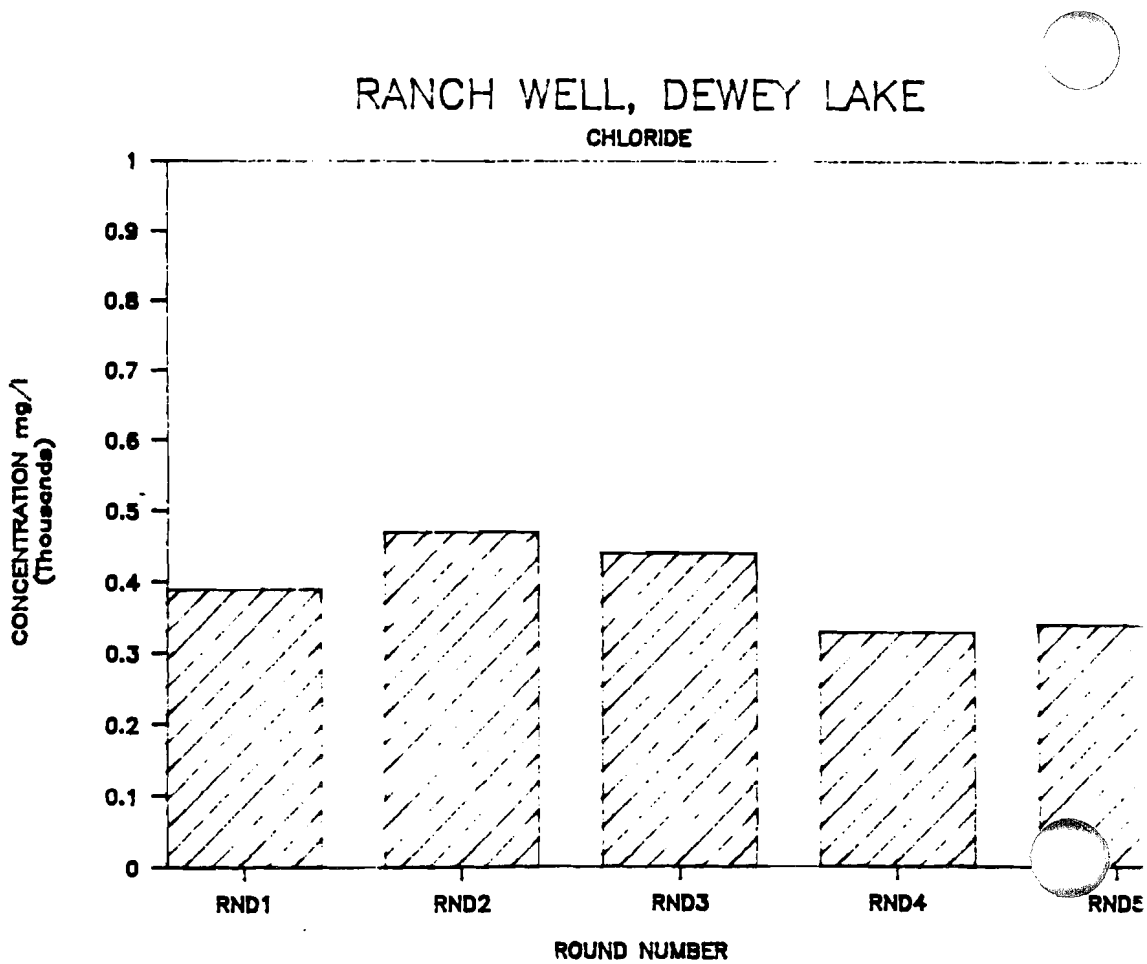

H-18, CULEBRA
FLUORIDE
CONCENTRATION mg/l
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
ROUND NUMBER

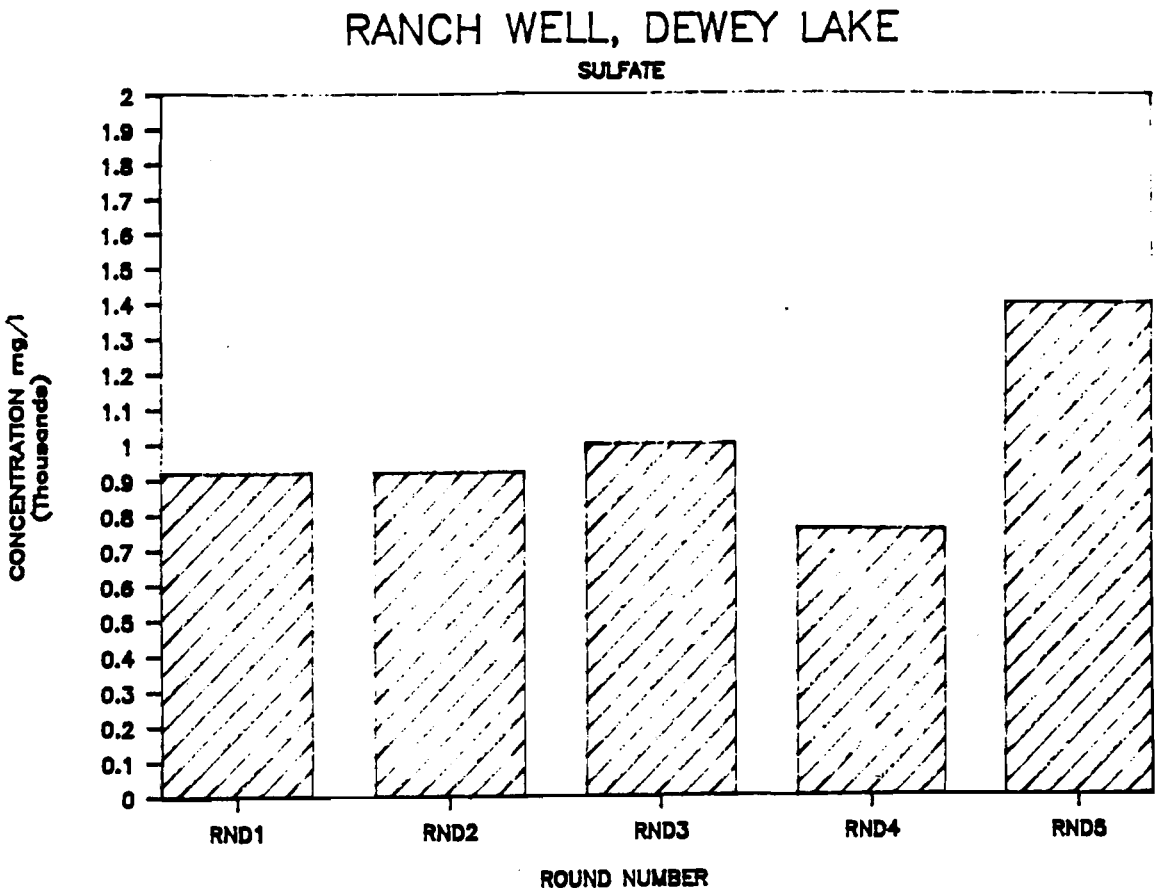

H-18, CULEBRA
MAGNESIUM
CONCENTRATION mg/l
(Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
ROUND NUMBER

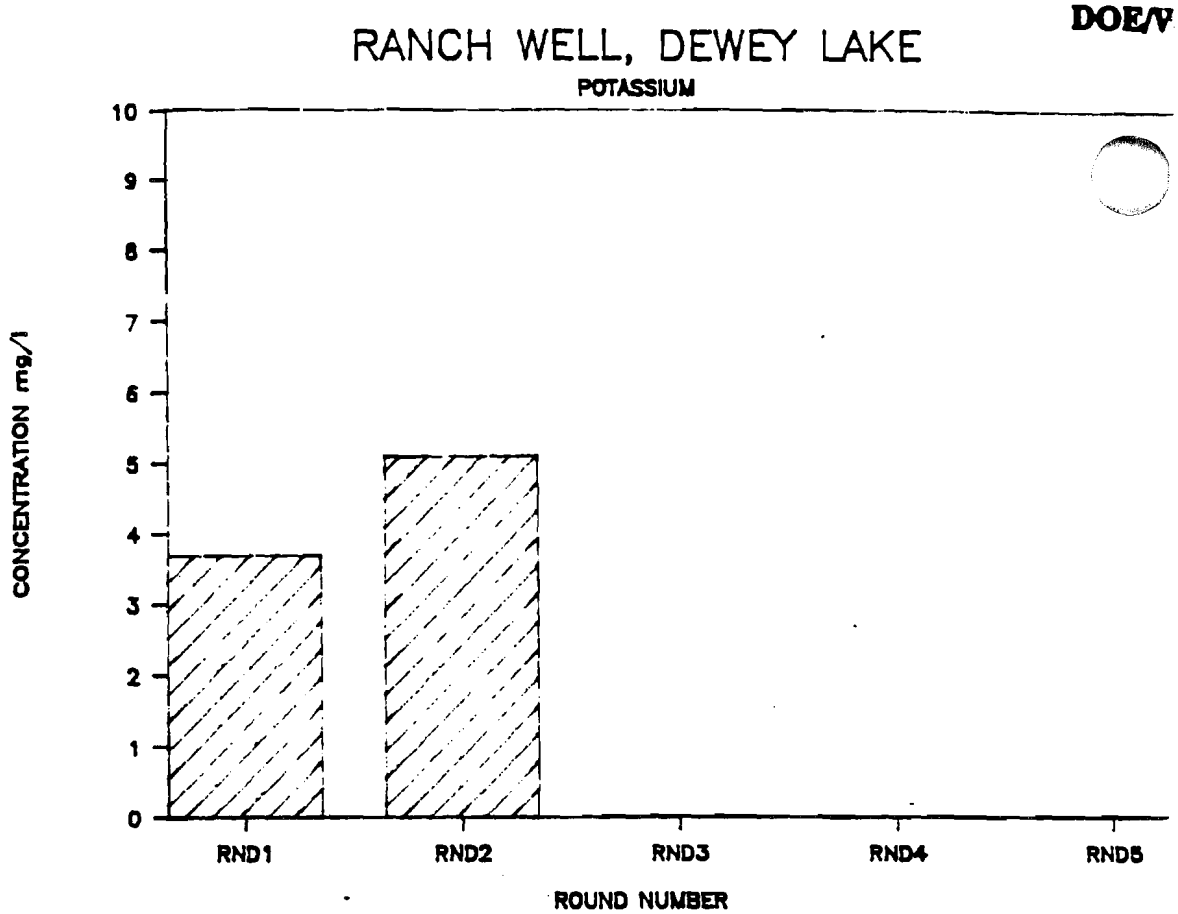

RANCH WELL, DEWEY LAKE
FLUORIDE
CONCENTRATION mg/l
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

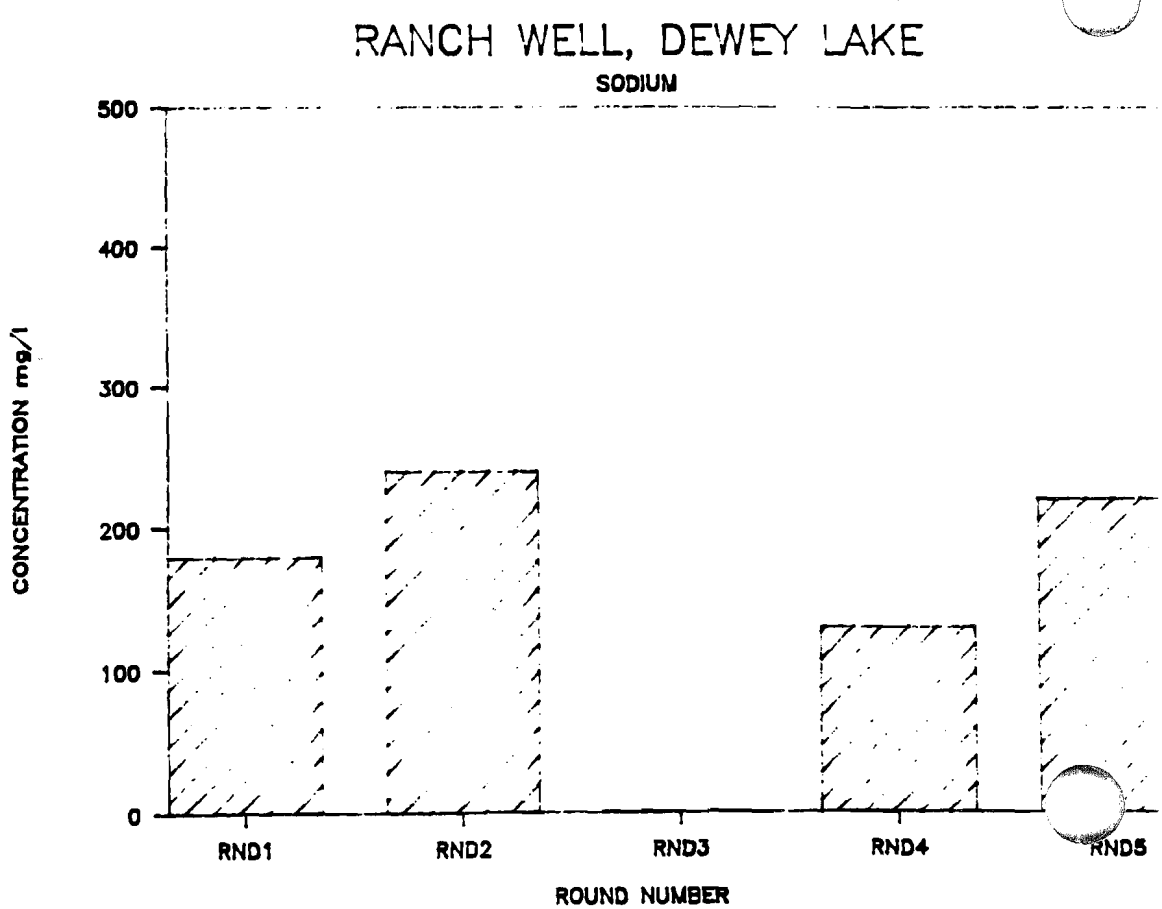

RANCH WELL, DEWEY LAKE
MAGNESIUM
CONCENTRATION mg/l
500
400
300
200
100
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

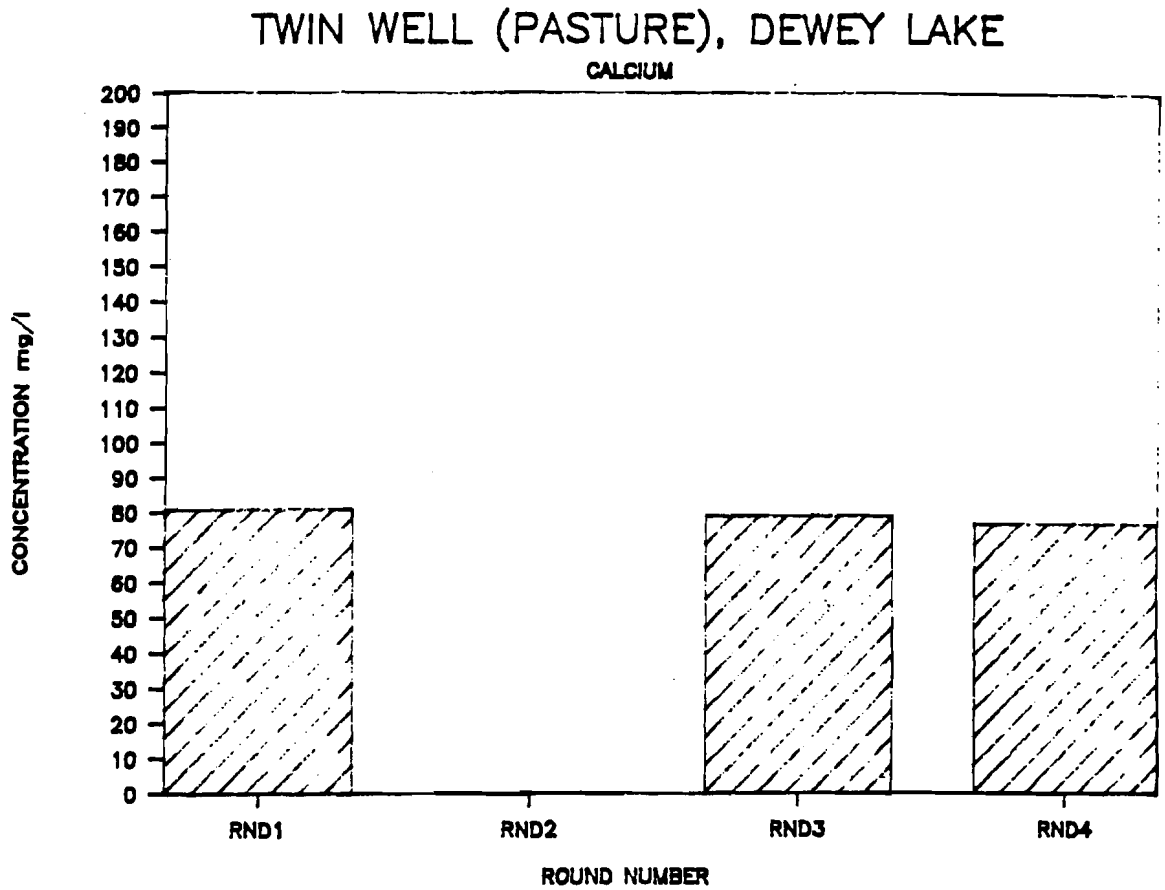

RANCH WELL, DEWEY LAKE
CALCIUM
CONCENTRATION mg/l (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

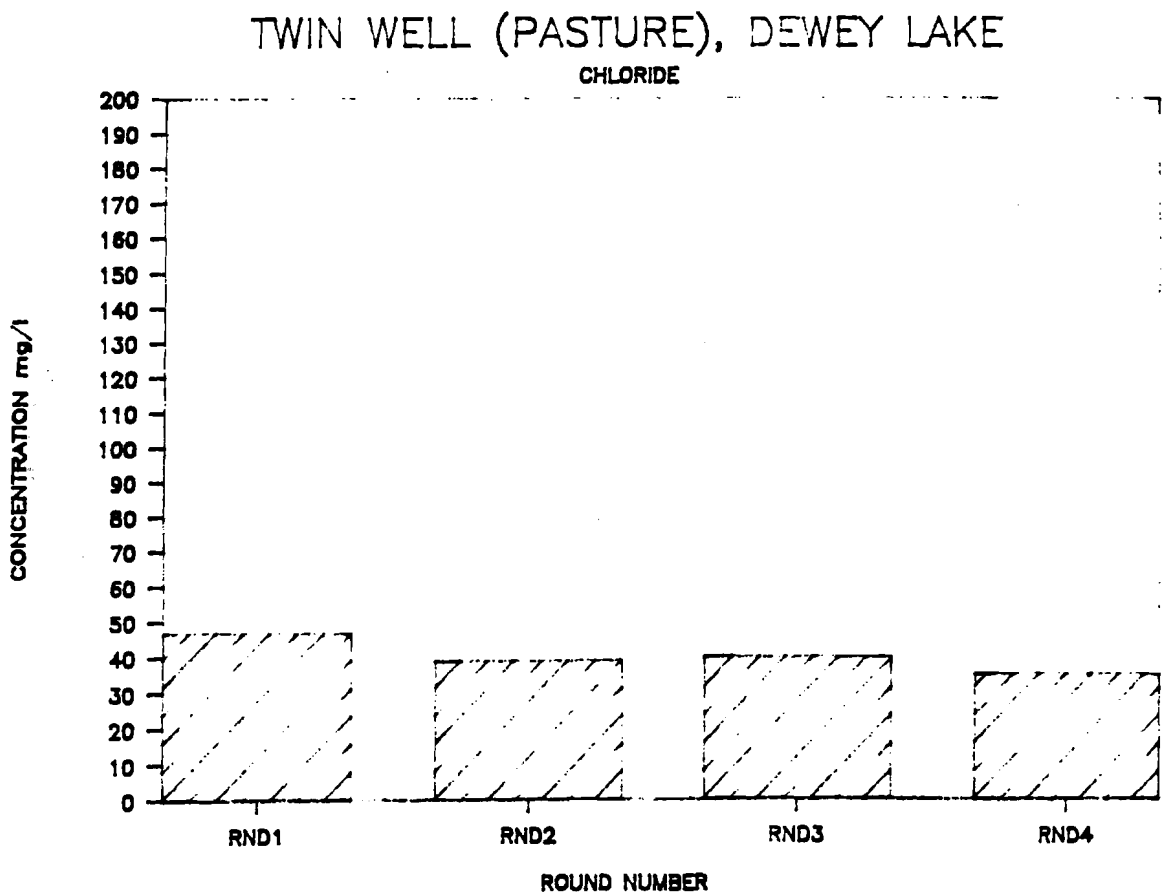

RANCH WELL, DEWEY LAKE
CHLORIDE
CONCENTRATION mg/l (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

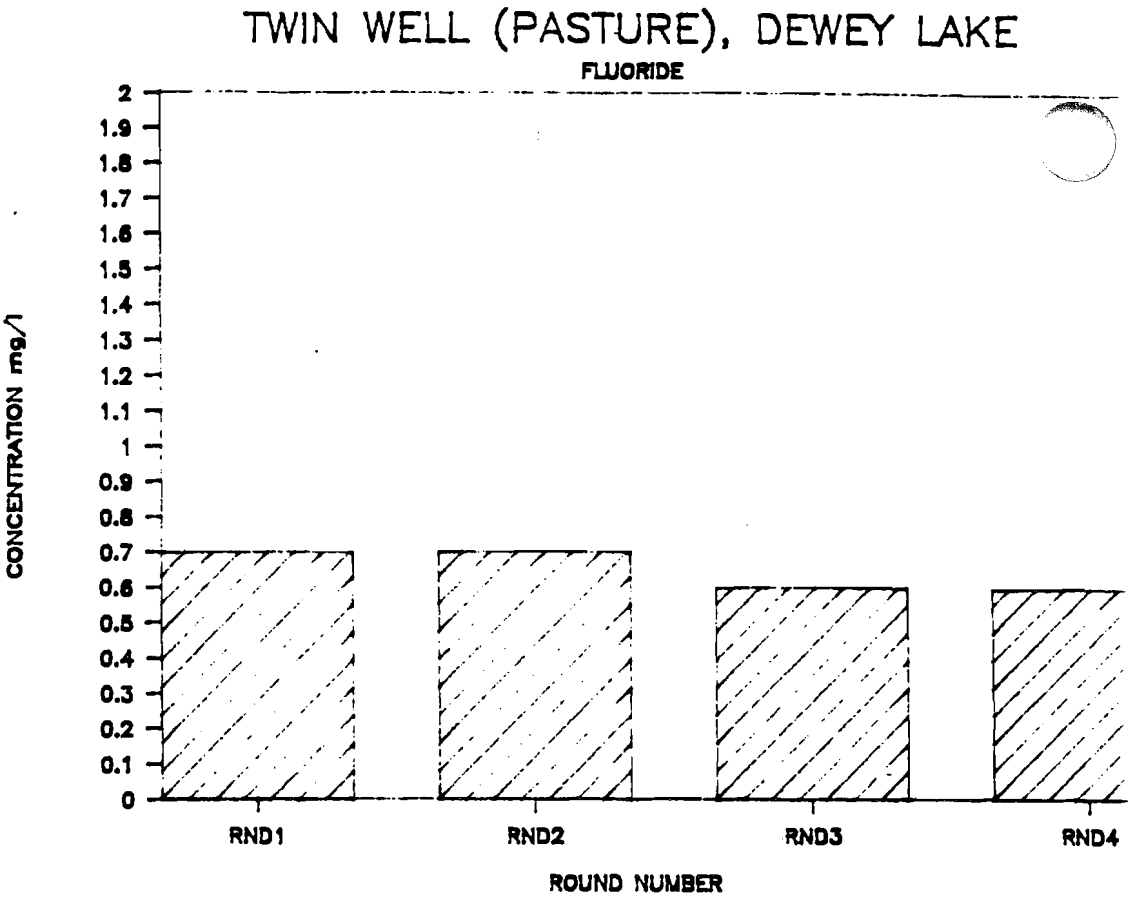

RANCH WELL, DEWEY LAKE
SULFATE
CONCENTRATION mg/l (Thousands)
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

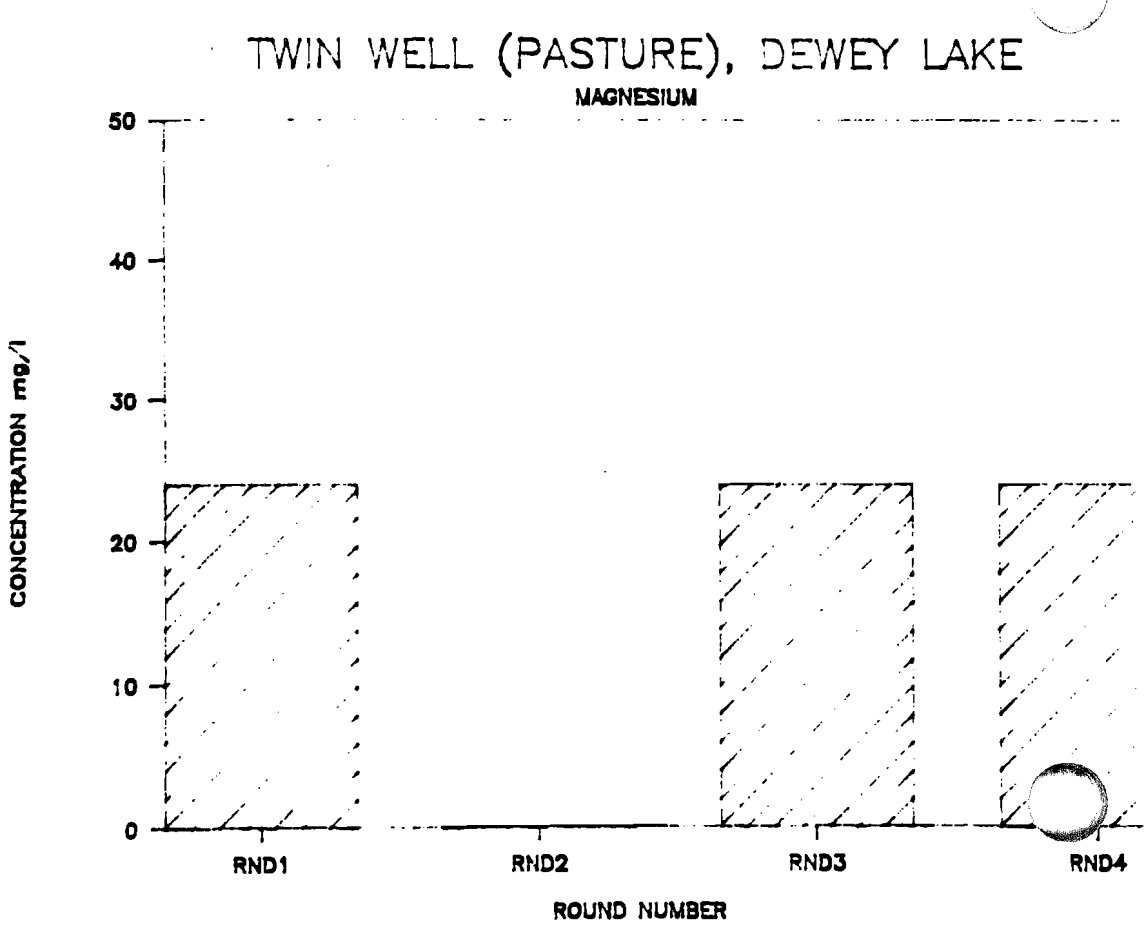

RANCH WELL, DEWEY LAKE
POTASSIUM
CONCENTRATION mg/l
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

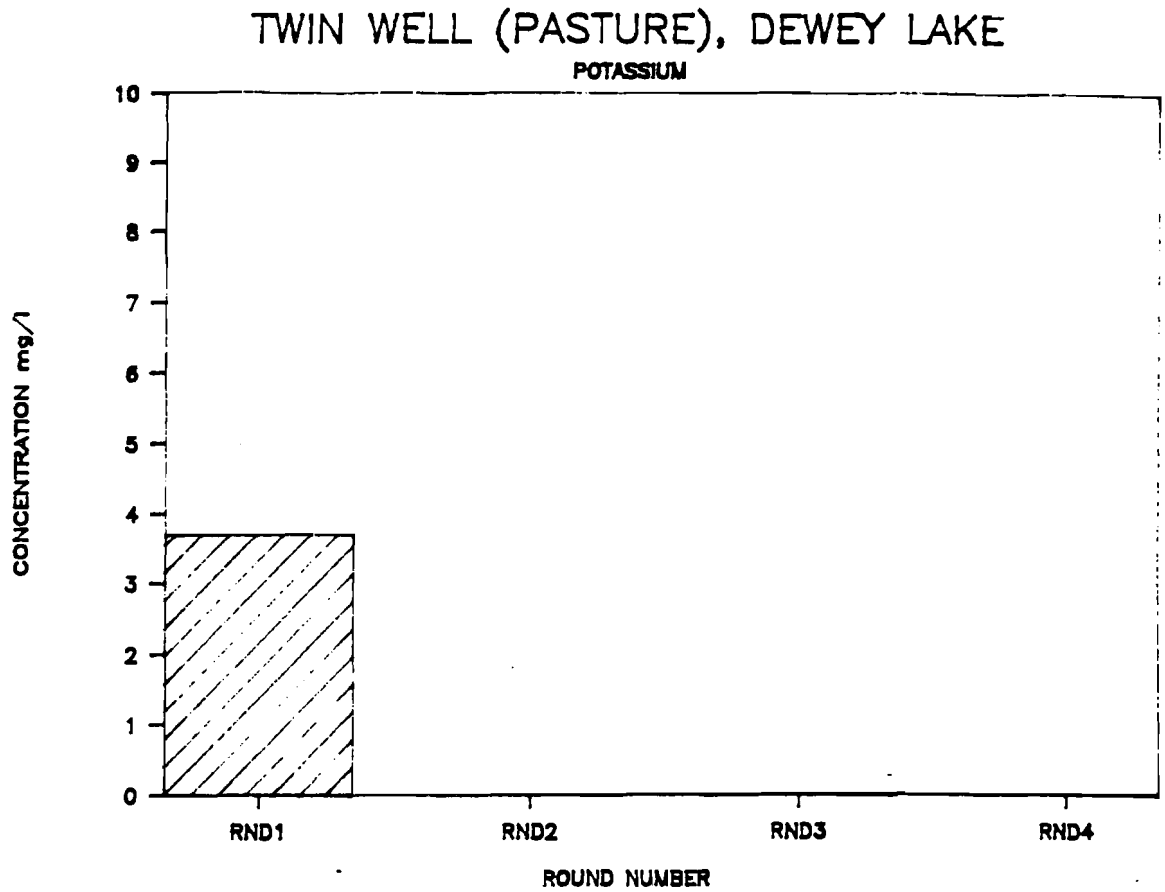

RANCH WELL, DEWEY LAKE
SODIUM
CONCENTRATION mg/l
500
400
300
200
100
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

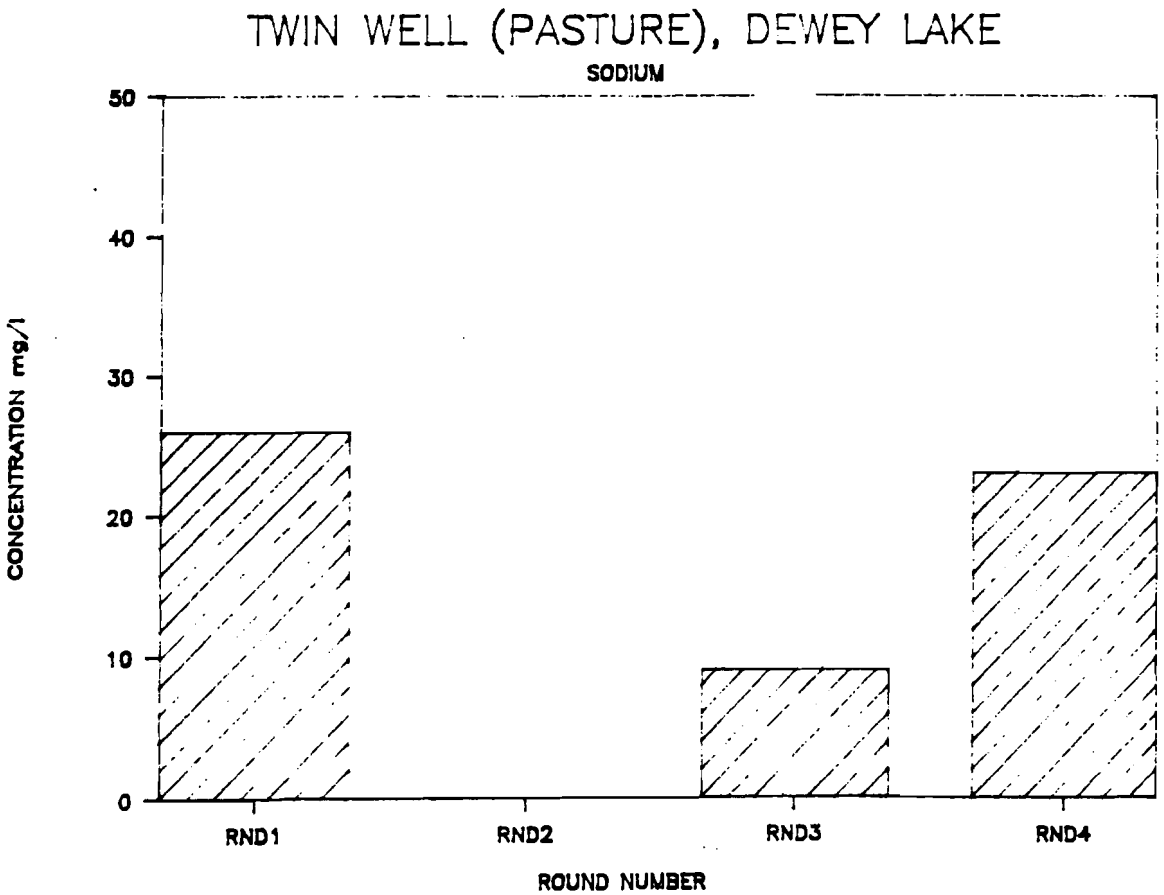

TWIN WELL (PASTURE), DEWEY LAKE
CALCIUM
CONCENTRATION mg/l
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
ROUND NUMBER

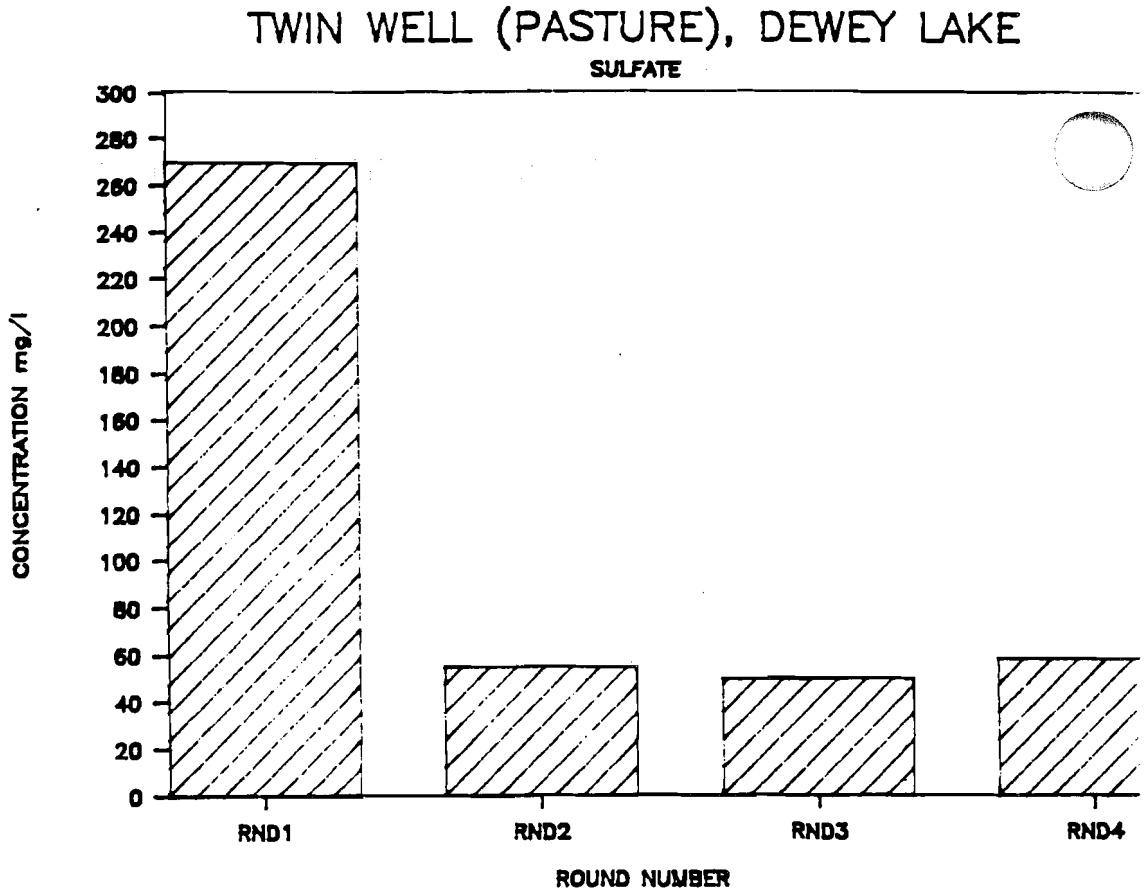

TWIN WELL (PASTURE), DEWEY LAKE
CHLORIDE
CONCENTRATION mg/l
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
ROUND NUMBER

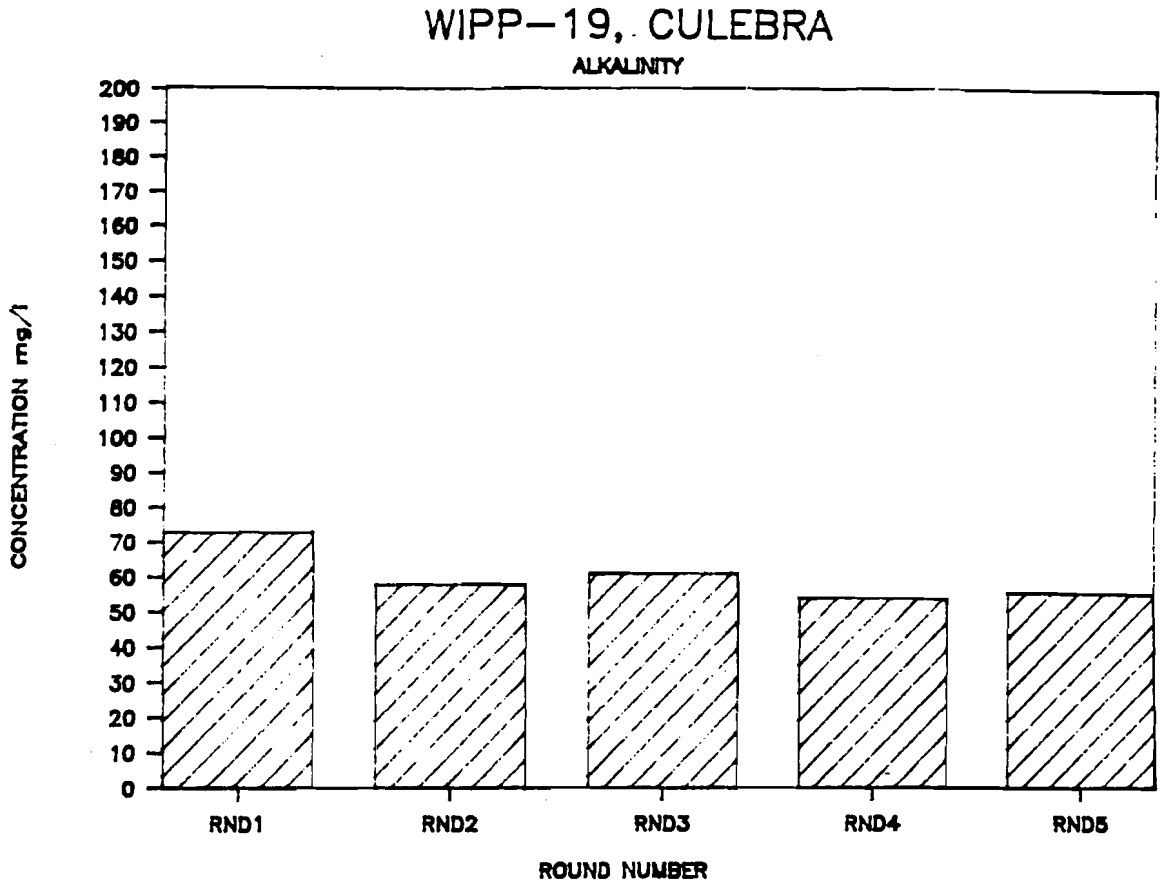

TWIN WELL (PASTURE), DEWEY LAKE
FLUORIDE
CONCENTRATION mg/l
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
ROUND NUMBER

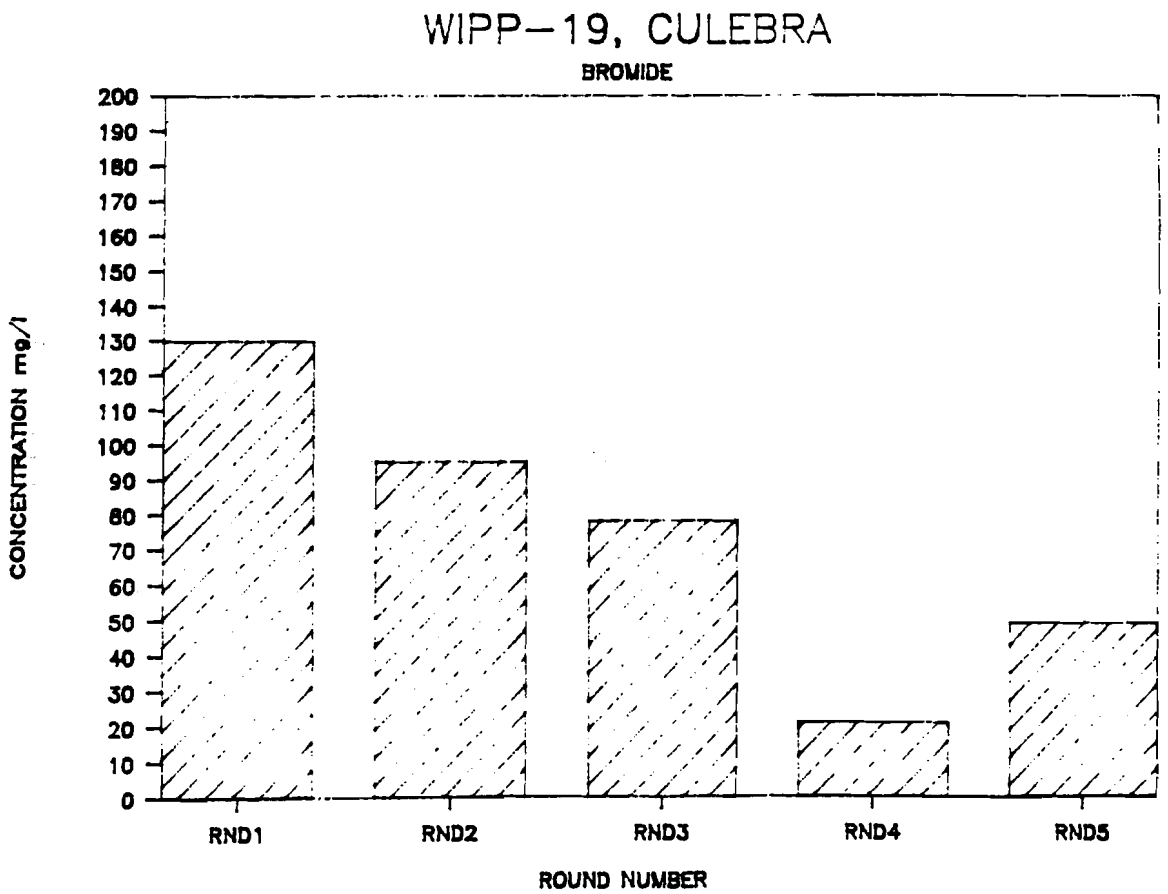

TWIN WELL (PASTURE), DEWEY LAKE
MAGNESIUM
CONCENTRATION mg/l
50
40
30
20
10
0
RND1
RND2
RND3
RND4
ROUND NUMBER

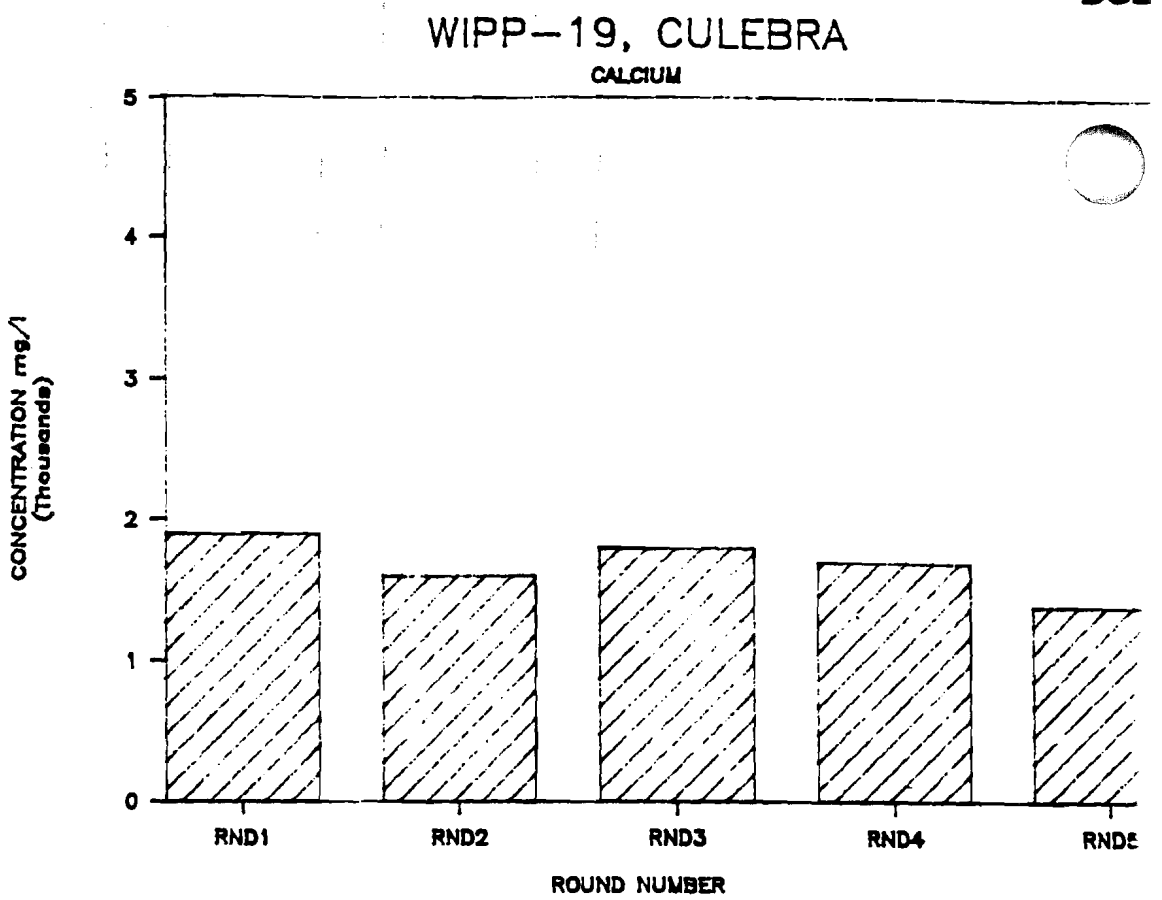

TWIN WELL (PASTURE), DEWEY LAKE
POTASSIUM
CONCENTRATION mg/l
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
ROUND NUMBER

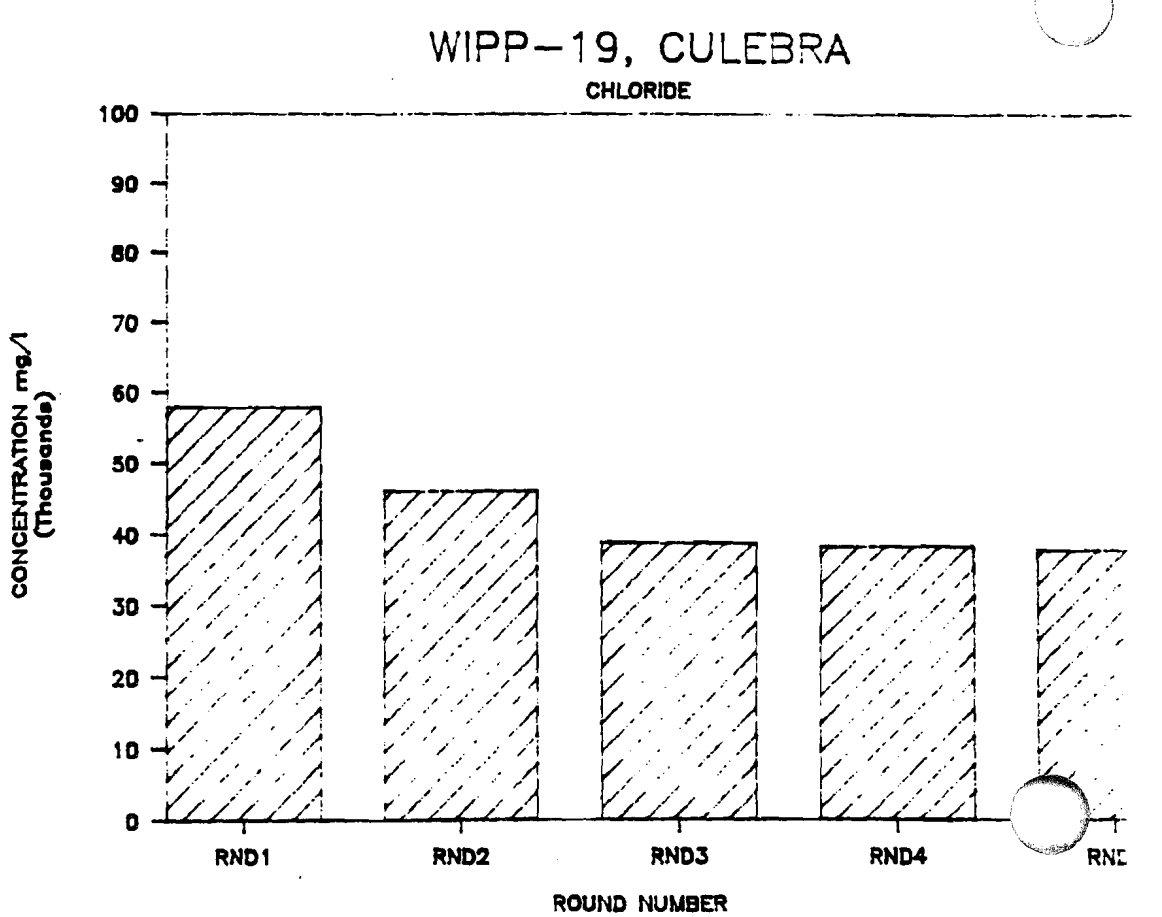

TWIN WELL (PASTURE), DEWEY LAKE
SODIUM
CONCENTRATION mg/l
50
40
30
20
10
0
RND1
RND2
RND3
RND4
ROUND NUMBER

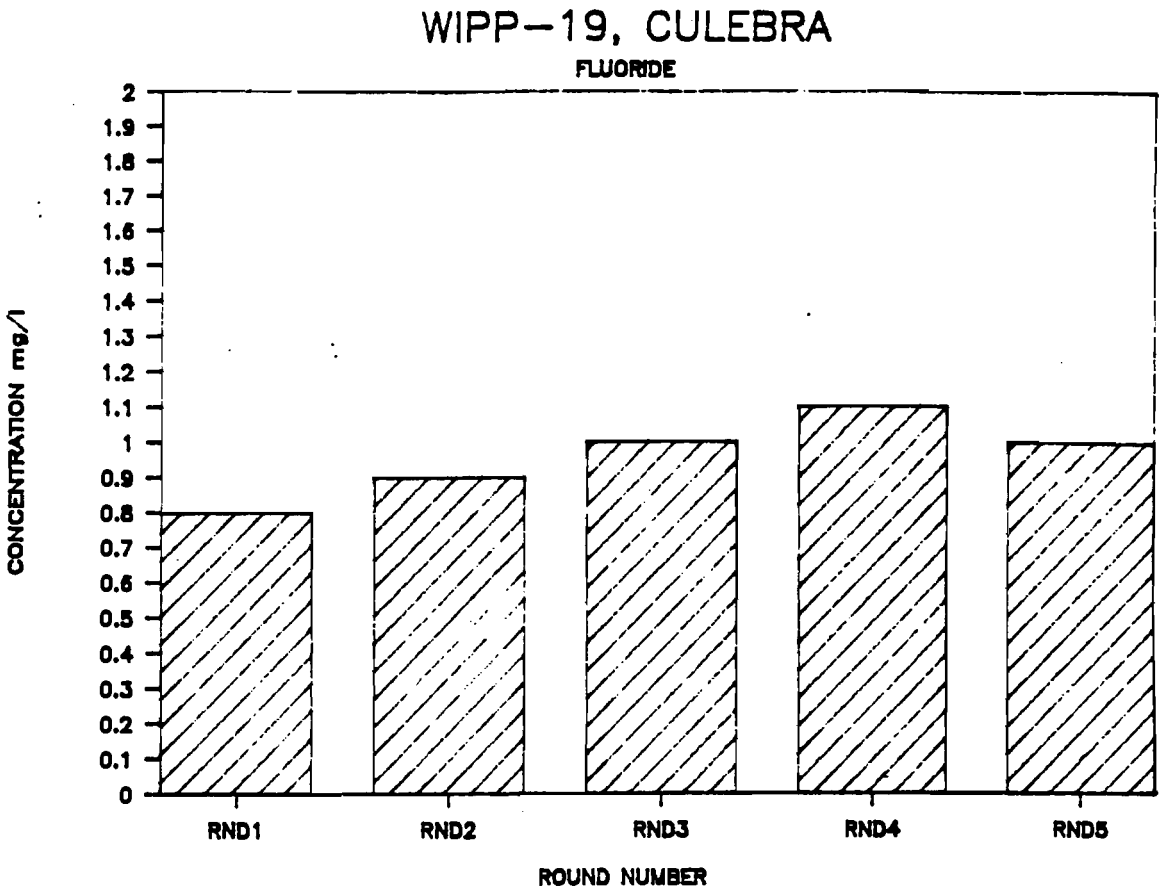

TWIN WELL (PASTURE), DEWEY LAKE
SULFATE
CONCENTRATION mg/l
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
RND1
RND2
RND3
RND4
ROUND NUMBER

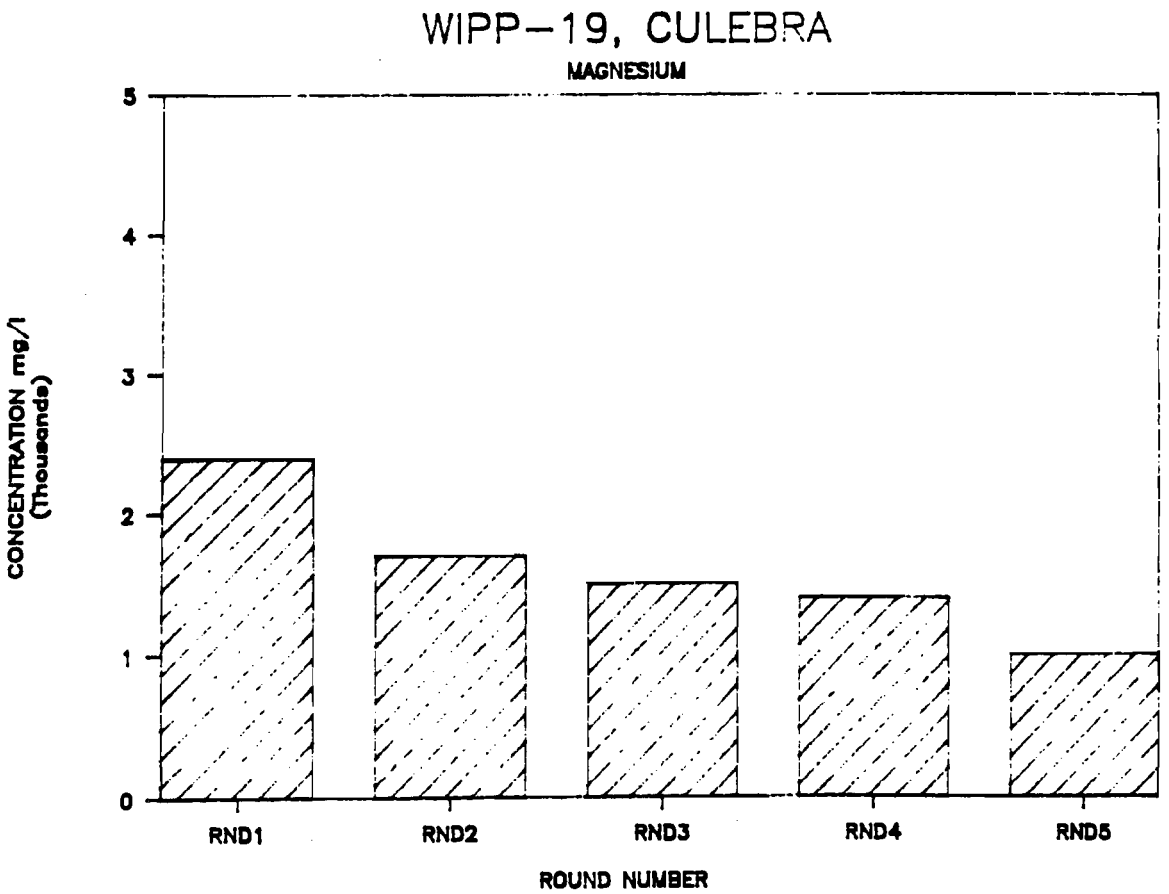

WIPP-19, CULEBRA
ALKALINITY
CONCENTRATION mg/l
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

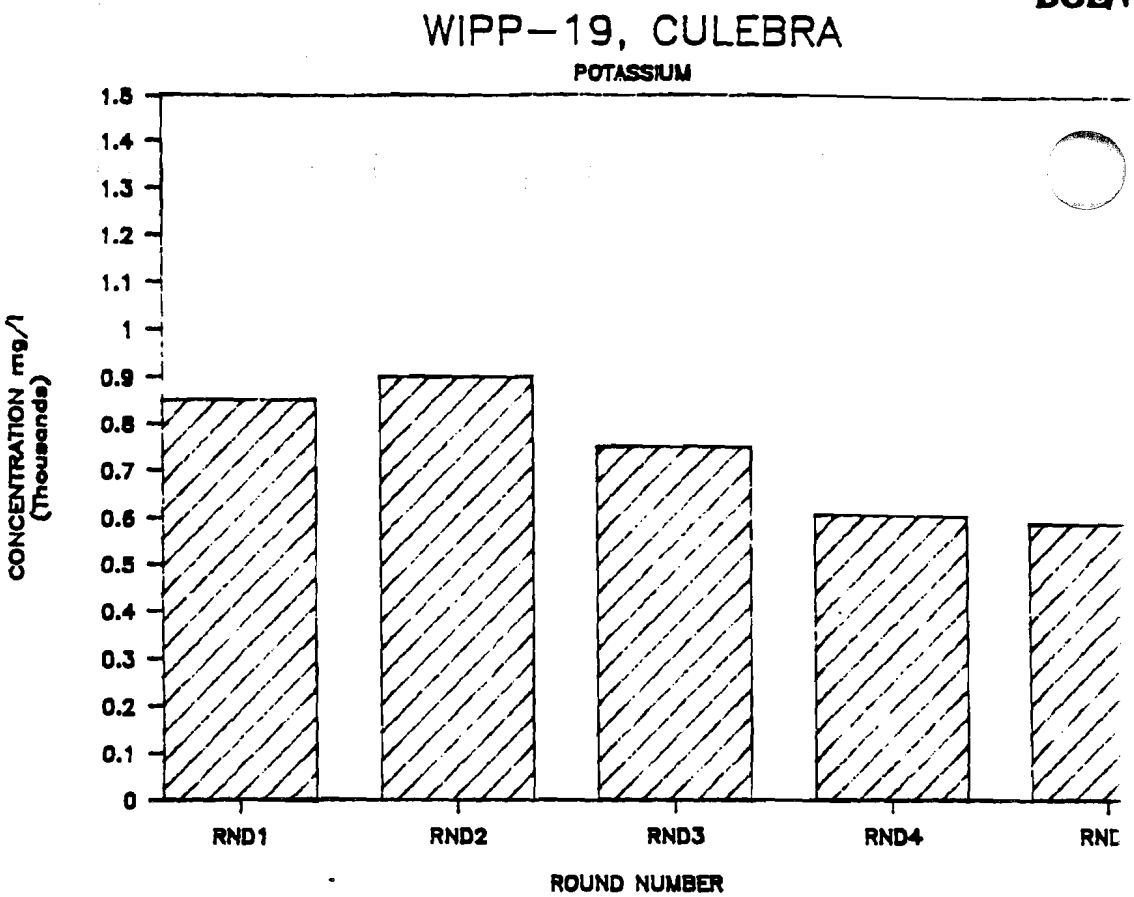

WIPP-19, CULEBRA
BROMIDE
CONCENTRATION mg/l
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

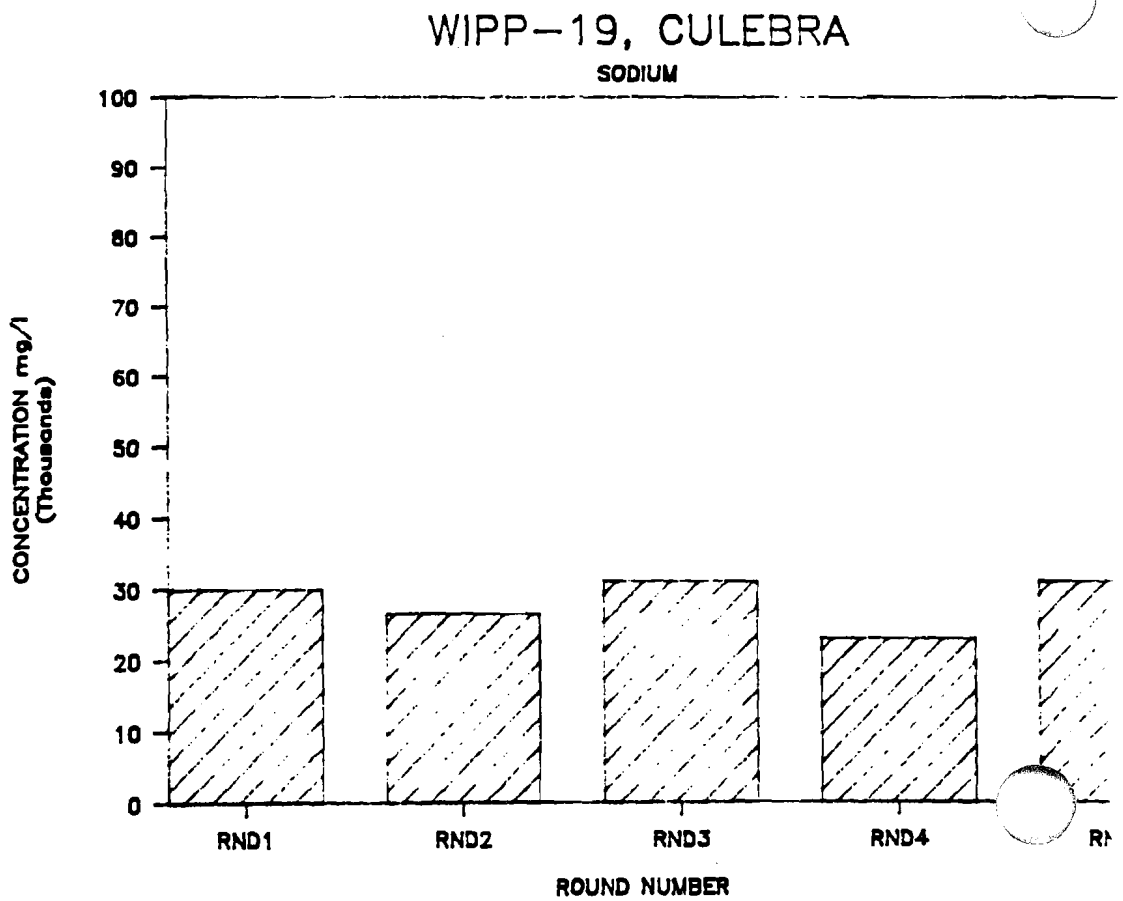

WIPP-19, CULEBRA
CALCIUM
CONCENTRATION mg/l (Thousands)
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

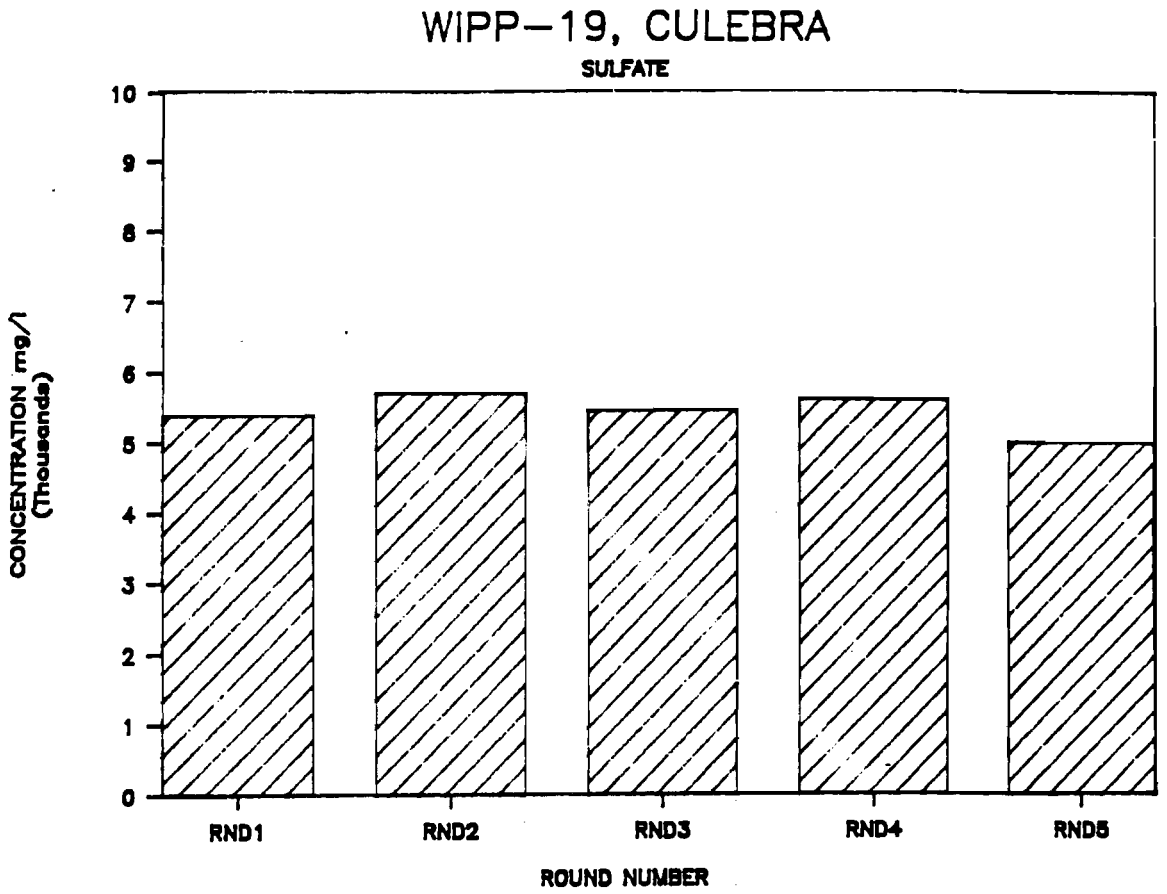

WIPP-19, CULEBRA
CHLORIDE
CONCENTRATION mg/l (Thousands)
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
ROUND NUMBER


WIPP-19, CULEBRA
FLUORIDE
CONCENTRATION mg/l
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER


WIPP-19, CULEBRA
MAGNESIUM
CONCENTRATION mg/l
(Thousands)
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER


WIPP-19, CULEBRA
POTASSIUM
CONCENTRATION mg/l (Thousands)
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
RND1
RND2
RND3
RND4
ROUND NUMBER


WIPP-19, CULEBRA
SODIUM
CONCENTRATION mg/l (Thousands)
100
90
80
70
60
50
40
30
20
10
0
RND1
RND2
RND3
RND4
ROUND NUMBER


WIPP-19, CULEBRA
SULFATE
CONCENTRATION mg/l
(Thousands)
10
9
8
7
6
5
4
3
2
1
0
RND1
RND2
RND3
RND4
RND5
ROUND NUMBER

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APPENDIX X
GROUNDWATER LEVEL DATA FOR 1990

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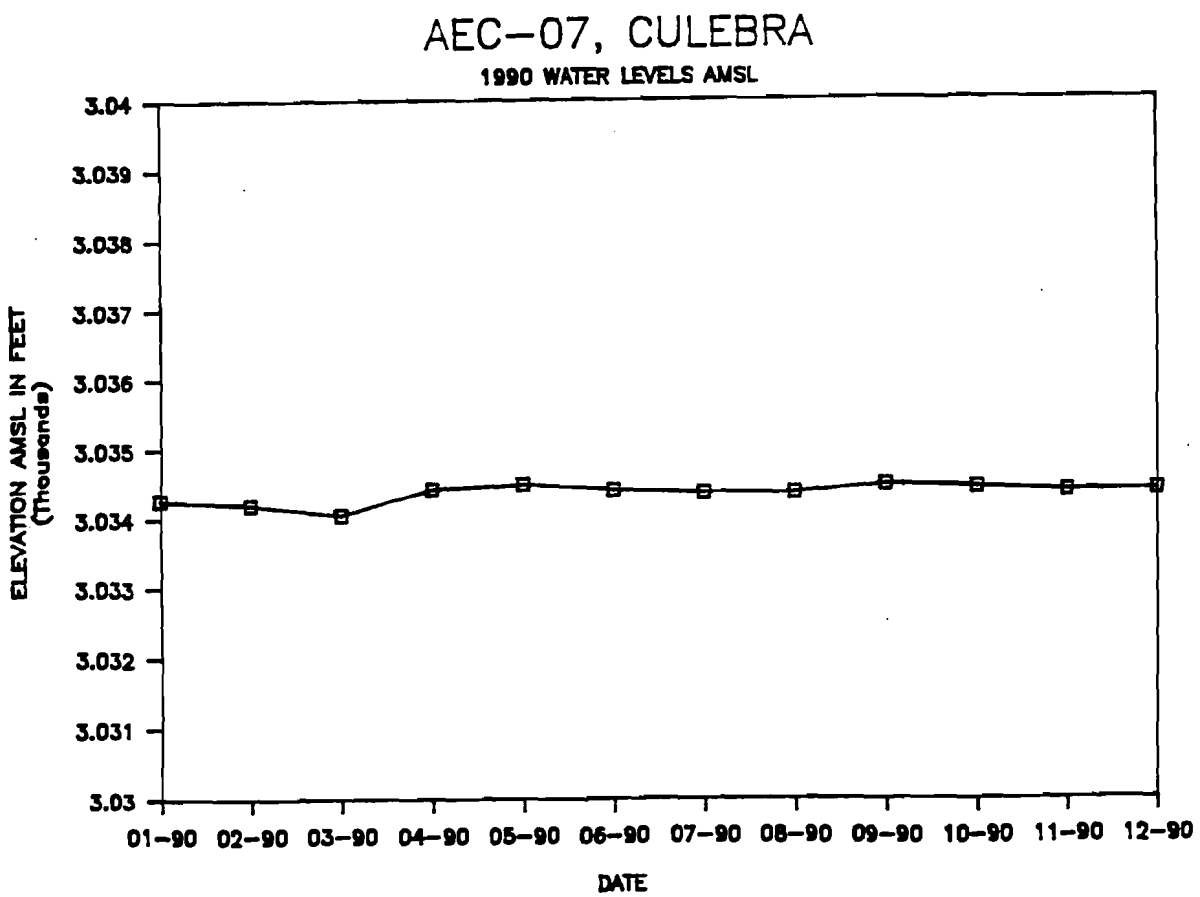
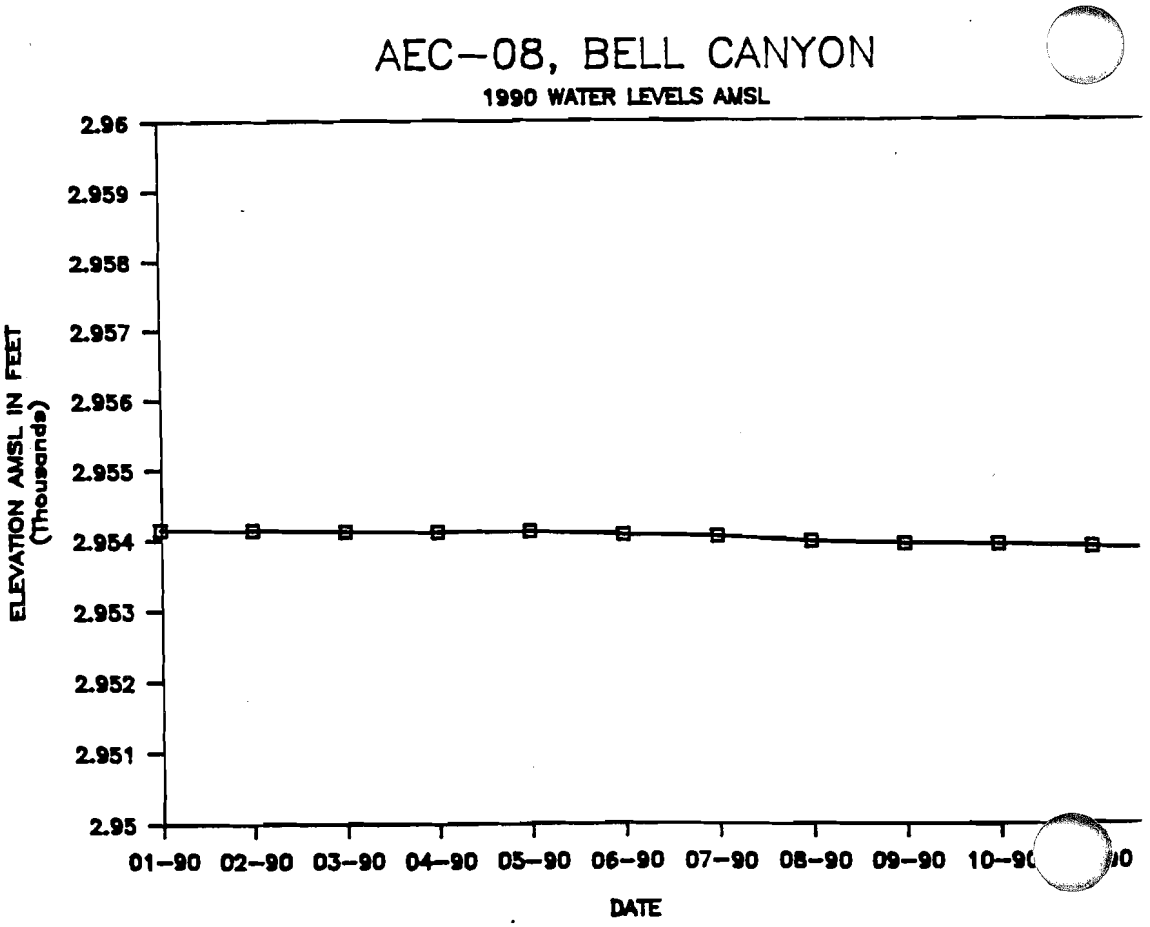
GROUND WATER-LEVELS
CALENDAR YEAR 1990
AEC-07, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL_M
AEC-7	CUL	3657.25	01-90	09:54	623.96	0.98	622.98	189.88	3034.27	924.85
AEC-7	CUL	3657.25	02-90	09:36	624.03	0.98	623.05	189.91	3034.20	924.82
AEC-7	CUL	3657.25	03-90	08:21	624.18	0.98	623.20	189.95	3034.05	924.78
AEC-7	CUL	3657.25	04-90	08:00	623.80	0.98	622.82	189.84	3034.43	924.89
AEC-7	CUL	3657.25	05-90	08:25	623.73	0.98	622.75	189.81	3034.50	924.92
AEC-7	CUL	3657.25	06-90	07:49	623.82	0.98	622.84	189.84	3034.41	924.89
AEC-7	CUL	3657.25	07-90	08:20	623.86	0.98	622.88	189.85	3034.37	924.88
AEC-7	CUL	3657.25	08-90	07:37	623.86	0.98	622.88	189.85	3034.37	924.88
AEC-7	CUL	3657.25	09-90	08:35	623.75	0.98	622.77	189.82	3034.48	924.91
AEC-7	CUL	3657.25	10-90	08:45	623.79	0.98	622.81	189.83	3034.44	924.90
AEC-7	CUL	3657.25	11-90	09:02	623.84	0.98	622.86	189.85	3034.39	924.88
AEC-7	CUL	3657.25	12-90	08:20	623.83	0.98	622.85	189.84	3034.40	924.89



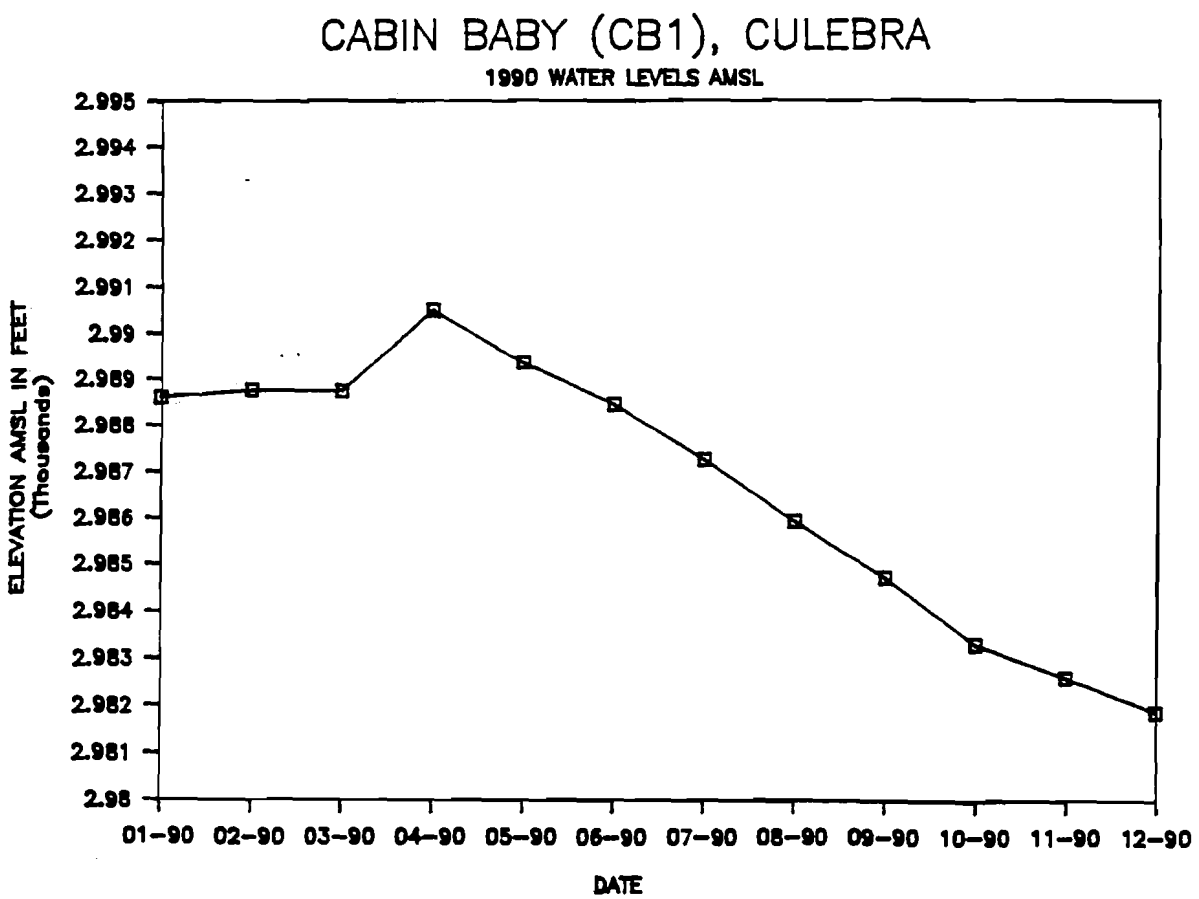
GROUN' 'TER-LEVELS
CALEN: YEAR 1990
AEC-08, BELL CANYON

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_M
AEC-8	B/C	3537.10	01-90	14:10	582.95	0.00	582.95	177.68	295
AEC-8	B/C	3537.10	02-90	12:30	582.95	0.00	582.95	177.68	295
AEC-8	B/C	3537.10	03-90	08:50	582.97	0.00	582.97	177.69	295
AEC-8	B/C	3537.10	04-90	08:31	582.98	0.00	582.98	177.69	295
AEC-8	B/C	3537.10	05-90	08:58	582.97	0.00	582.97	177.69	295
AEC-8	B/C	3537.10	06-90	08:10	583.02	0.00	583.02	177.70	295
AEC-8	B/C	3537.10	07-90	08:45	583.05	0.00	583.05	177.71	295
AEC-8	B/C	3537.10	08-90	15:20	583.13	0.00	583.13	177.74	295
AEC-8	B/C	3537.10	09-90	08:58	583.17	0.00	583.17	177.75	295
AEC-8	B/C	3537.10	10-90	09:09	583.18	0.00	583.18	177.75	295
AEC-8	B/C	3537.10	11-90	09:30	583.21	0.00	583.21	177.76	295
AEC-8	B/C	3537.10	12-90	08:45	583.25	0.00	583.25	177.77	295



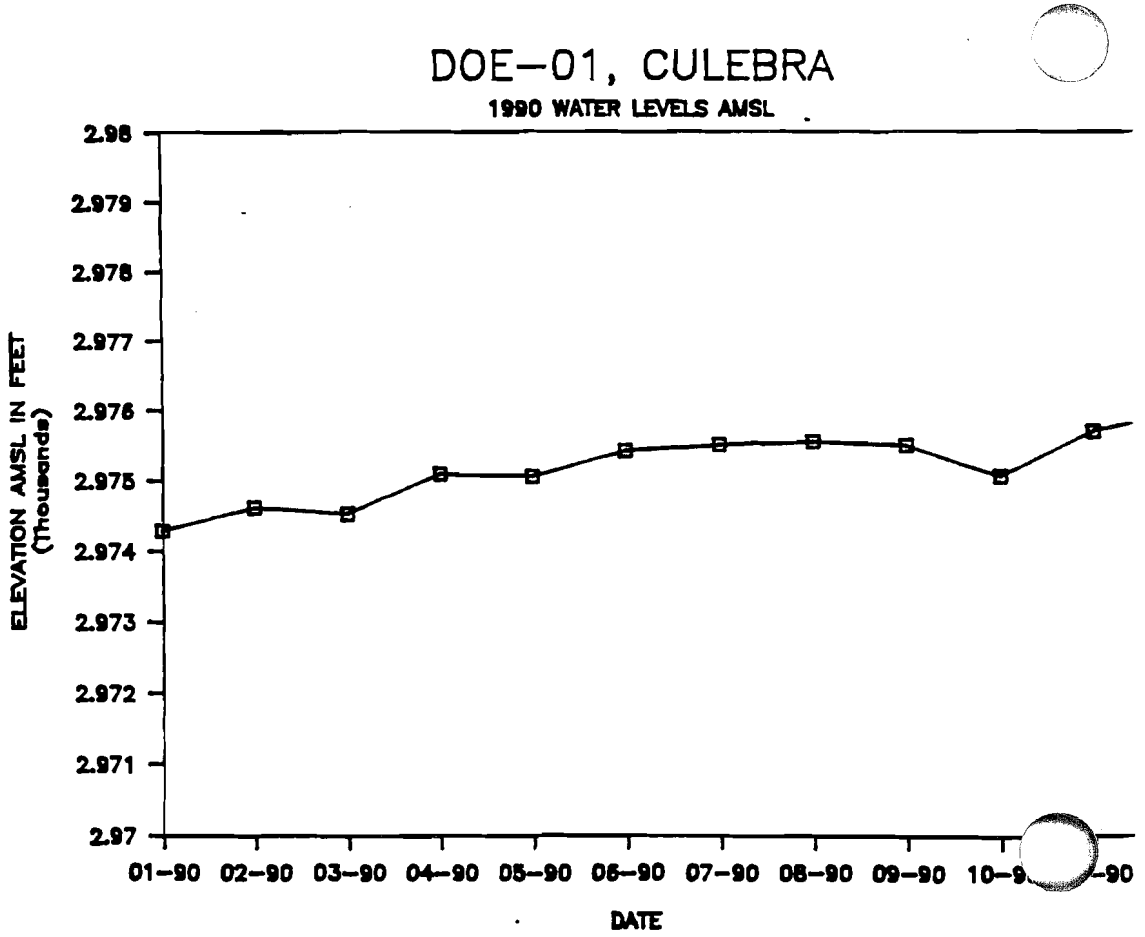
GROUND WATER-LEVELS
CALENDAR YEAR 1990
CABIN BABY, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL_M
CABIN BABY	CUL	3328.38	01-90	13:23	339.76	0.00	339.76	103.56	2988.62	910.93
CABIN BABY	CUL	3328.38	02-90	09:11	339.59	0.00	339.59	103.51	2988.79	910.98
CABIN BABY	CUL	3328.38	03-90	14:06	339.61	0.00	339.61	103.51	2988.77	910.98
CABIN BABY	CUL	3328.38	04-90	11:38	337.86	0.00	337.86	102.98	2990.52	911.51
CABIN BABY	CUL	3328.38	05-90	09:50	338.98	0.00	338.98	103.32	2989.40	911.17
CABIN BABY	CUL	3328.38	06-90	16:06	339.90	0.00	339.90	103.60	2988.48	910.89
CABIN BABY	CUL	3328.38	07-90	08:55	341.10	0.00	341.10	103.97	2987.28	910.52
CABIN BABY	CUL	3328.38	08-90	10:55	342.44	0.00	342.44	104.38	2985.94	910.11
CABIN BABY	CUL	3328.38	09-90	15:16	343.68	0.00	343.68	104.75	2984.70	909.74
CABIN BABY	CUL	3328.38	10-90	07:06	345.09	0.00	345.09	105.18	2983.29	909.31
CABIN BABY	CUL	3328.38	11-90	16:25	345.79	0.00	345.79	105.40	2982.59	909.09
CABIN BABY	CUL	3328.38	12-90	06:50	346.53	0.00	346.53	105.62	2981.85	908.87



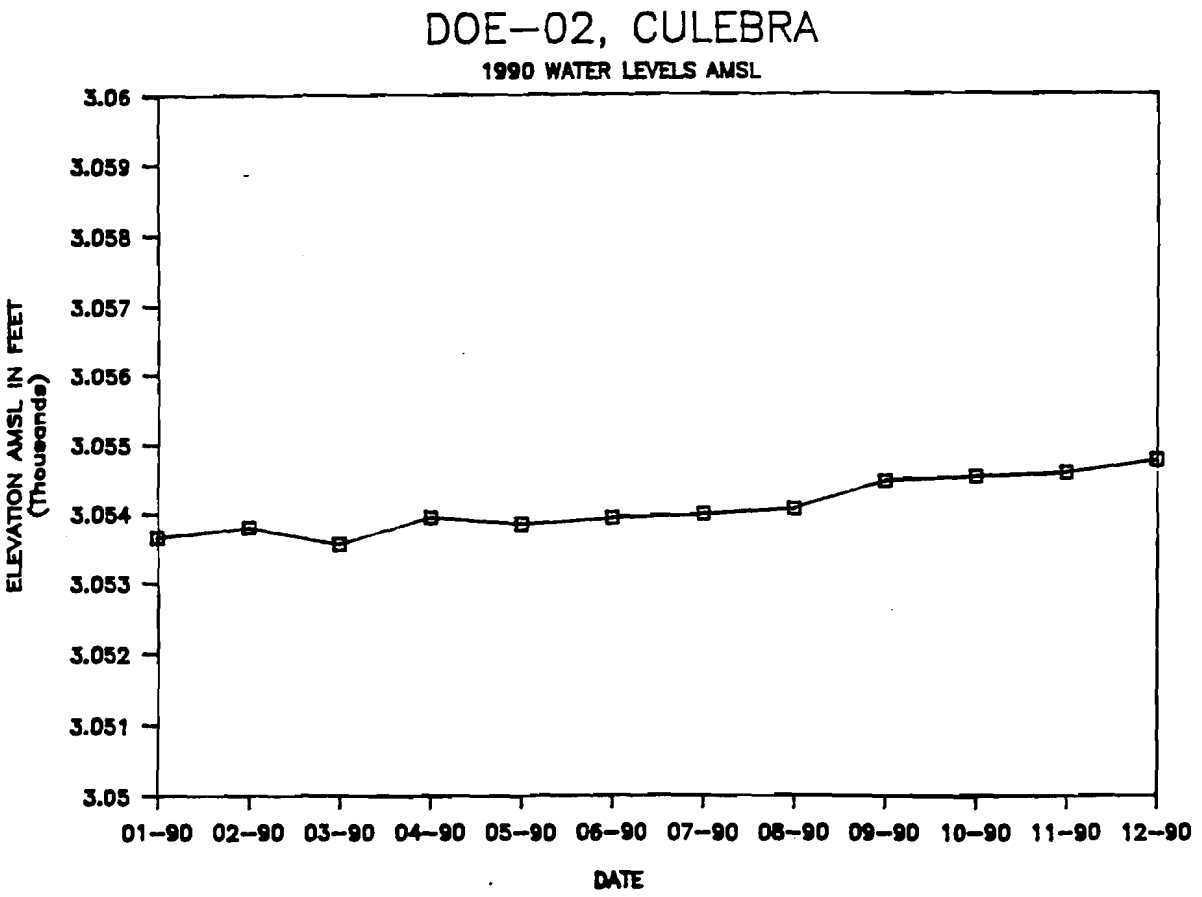
GROUND WATER-LEVELS
CALENDAR YEAR 1990
DOE-01, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_
DOE-1	CUL	3465.22	01-90	07:24	490.93	0.00	490.93	149.64	29
DOE-1	CUL	3465.22	02-90	10:50	490.59	0.00	490.59	149.53	29
DOE-1	CUL	3465.22	03-90	12:38	490.68	0.00	490.68	149.56	29
DOE-1	CUL	3465.22	04-90	17:45	490.12	0.00	490.12	149.39	29
DOE-1	CUL	3465.22	05-90	12:45	490.15	0.00	490.15	149.40	29
DOE-1	CUL	3465.22	06-90	17:20	489.78	0.00	489.78	149.28	29
DOE-1	CUL	3465.22	07-90	15:03	489.70	0.00	489.70	149.26	29
DOE-1	CUL	3465.22	08-90	14:00	489.65	0.00	489.65	149.25	29
DOE-1	CUL	3465.22	09-90	14:55	489.71	0.00	489.71	149.26	29
DOE-1	CUL	3465.22	10-90	13:41	490.15	0.00	490.15	149.40	29
DOE-1	CUL	3465.22	11-90	13:40	489.50	0.00	489.50	149.20	29
DOE-1	CUL	3465.22	12-90	12:35	489.23	0.00	489.23	149.12	29



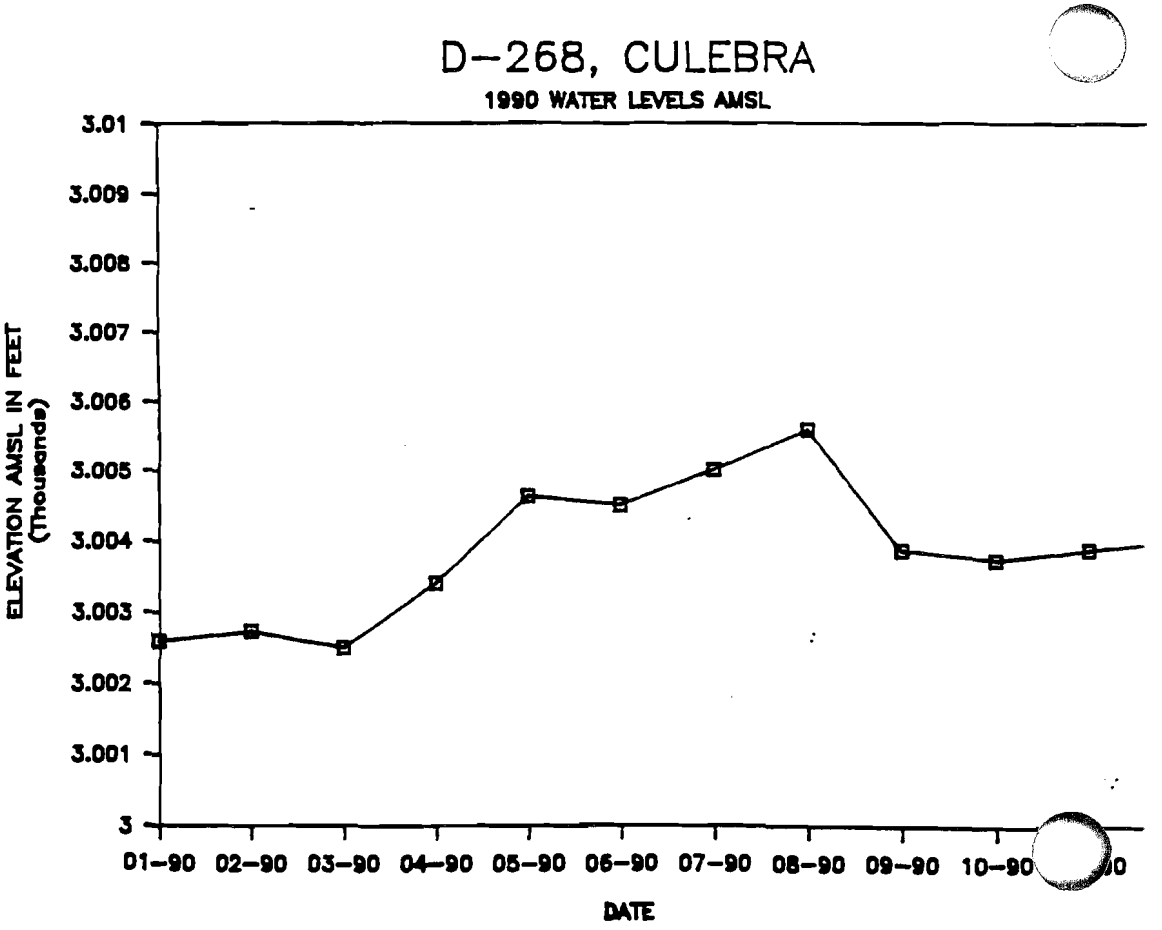
GROUND WATER-LEVELS
CALENDAR YEAR 1990
DOE-02, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL_M
DOE-2	CUL	3419.09	01-90	10:44	365.43	0.00	365.43	111.38	3053.66	930.76
DOE-2	CUL	3419.09	02-90	14:44	365.28	0.00	365.28	111.34	3053.81	930.80
DOE-2	CUL	3419.09	03-90	08:55	365.53	0.00	365.53	111.41	3053.56	930.73
DOE-2	CUL	3419.09	04-90	12:21	365.14	0.00	365.14	111.29	3053.95	930.84
DOE-2	CUL	3419.09	05-90	11:50	365.24	0.00	365.24	111.33	3053.85	930.81
DOE-2	CUL	3419.09	06-90	09:23	365.15	0.00	365.15	111.30	3053.94	930.84
DOE-2	CUL	3419.09	07-90	10:00	365.10	0.00	365.10	111.28	3053.99	930.86
DOE-2	CUL	3419.09	08-90	12:08	365.02	0.00	365.02	111.26	3054.07	930.88
DOE-2	CUL	3419.09	09-90	16:37	364.62	0.00	364.62	111.14	3054.47	931.00
DOE-2	CUL	3419.09	10-90	15:58	364.55	0.00	364.55	111.11	3054.54	931.02
DOE-2	CUL	3419.09	11-90	14:55	364.50	0.00	364.50	111.10	3054.59	931.04
DOE-2	CUL	3419.09	12-90	15:05	364.32	0.00	364.32	111.04	3054.77	931.09



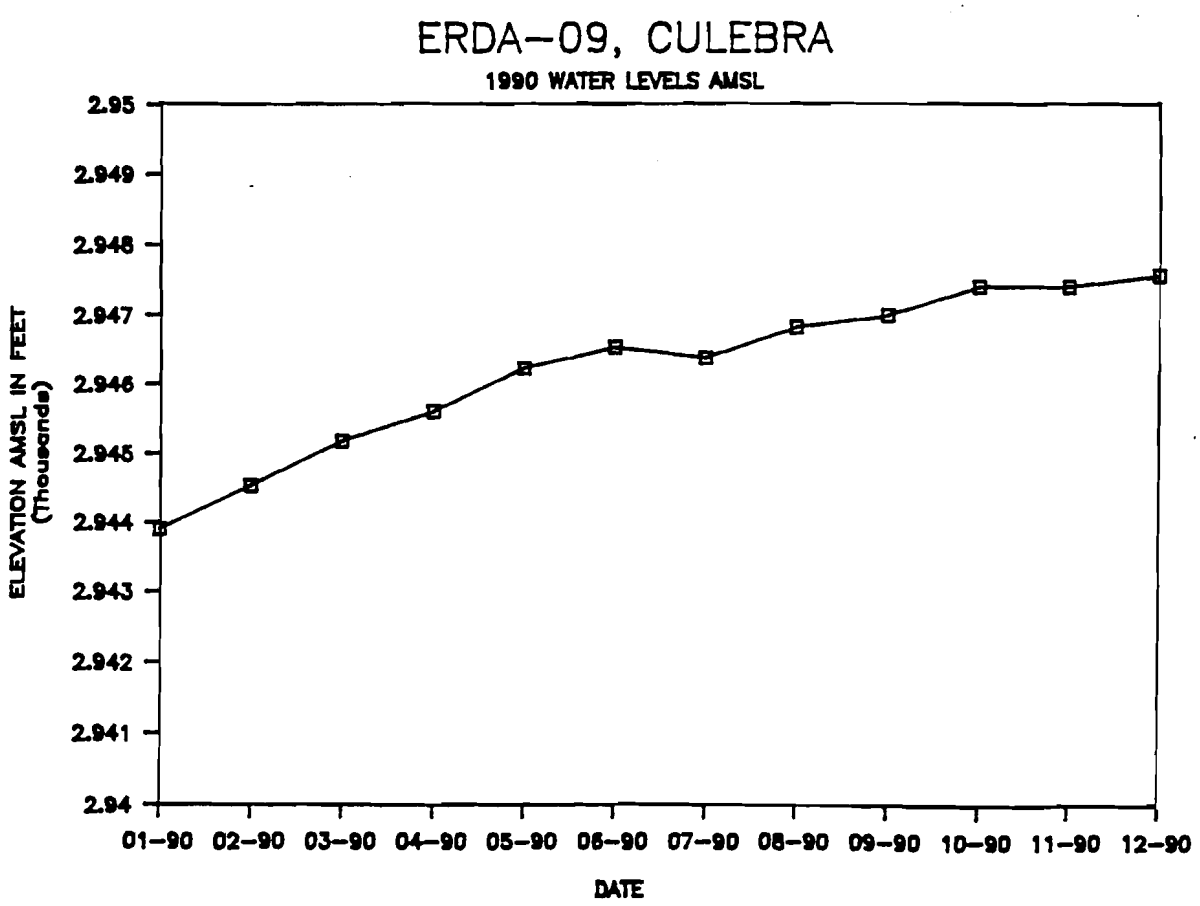
GROUND WATER-LEVELS
CALENDAR YEAR 1990
D-268, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_I
D-268	CUL	3280.70	01-90	09:16	278.85	0.75	278.10	84.76	30(
D-268	CUL	3280.70	02-90	09:41	278.70	0.75	277.95	84.72	30(
D-268	CUL	3280.70	03-90	11:10	278.94	0.75	278.19	84.79	30(
D-268	CUL	3280.70	04-90	13:49	278.03	0.75	277.28	84.51	30(
D-268	CUL	3280.70	05-90	10:50	276.79	0.75	276.04	84.14	30(
D-268	CUL	3280.70	06-90	13:06	276.93	0.75	276.18	84.18	30(
D-268	CUL	3280.70	07-90	07:40	276.42	0.75	275.67	84.02	30(
D-268	CUL	3280.70	08-90	07:25	275.84	0.75	275.09	83.85	30(
D-268	CUL	3280.70	09-90	13:50	277.57	0.75	276.82	84.37	30(
D-268	CUL	3280.70	10-90	07:38	277.70	0.75	276.95	84.41	30(
D-268	CUL	3280.70	11-90	12:35	277.55	0.75	276.80	84.37	30(
D-268	CUL	3280.70	12-90	14:20	277.41	0.75	276.66	84.33	30(



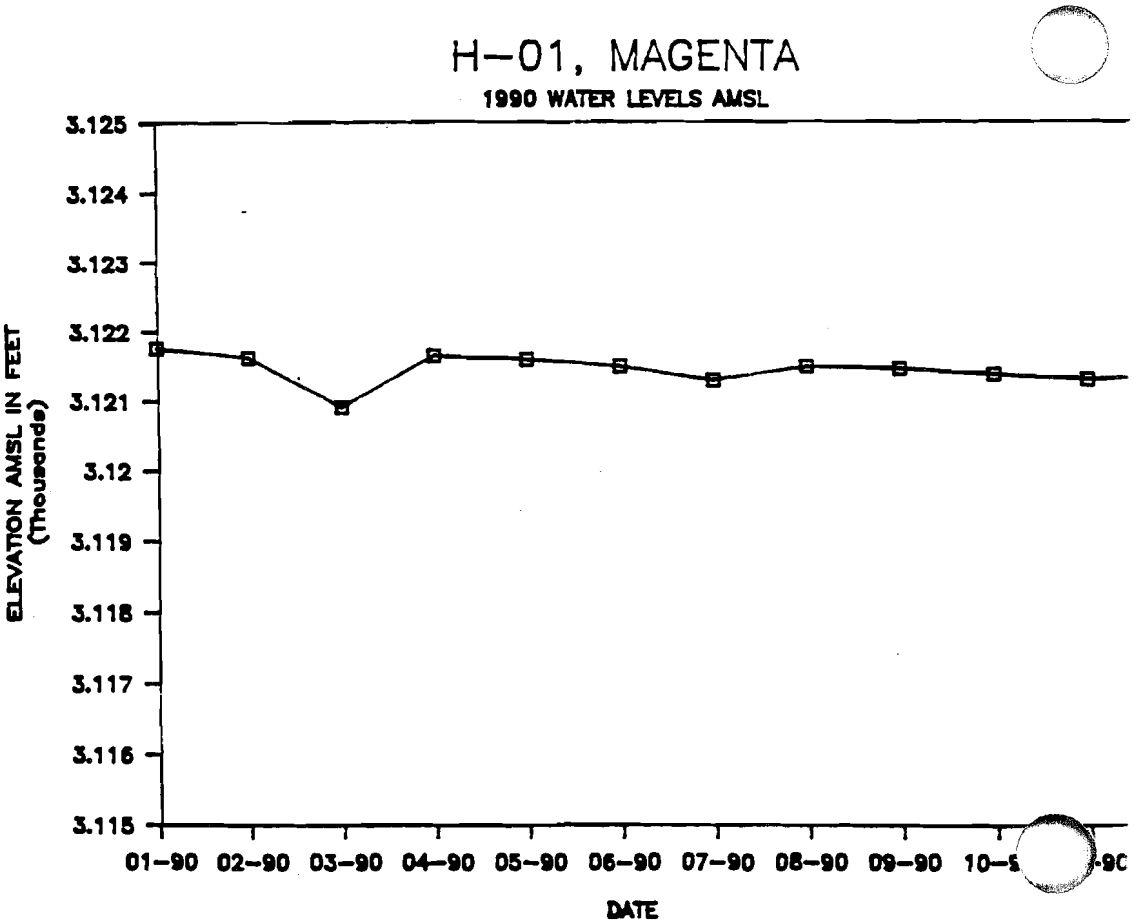
GROUND WATER-LEVELS
CALENDAR YEAR 1990
ERDA-09, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL_M
ERDA-9	CUL	3410.10	01-90	13:51	467.11	0.92	466.19	142.09	2943.91	897.30
ERDA-9	CUL	3410.10	02-90	11:38	466.47	0.92	465.55	141.90	2944.55	897.50
ERDA-9	CUL	3410.10	03-90	15:00	465.83	0.92	464.91	141.70	2945.19	897.69
ERDA-9	CUL	3410.10	04-90	16:20	465.40	0.92	464.48	141.57	2945.62	897.82
ERDA-9	CUL	3410.10	05-90	14:35	464.77	0.92	463.85	141.38	2946.25	898.02
ERDA-9	CUL	3410.10	06-90	06:51	464.47	0.92	463.55	141.29	2946.55	898.11
ERDA-9	CUL	3410.10	07-90	07:23	464.62	0.92	463.70	141.34	2946.40	898.06
ERDA-9	CUL	3410.10	08-90	13:08	464.19	0.92	463.27	141.20	2946.83	898.19
ERDA-9	CUL	3410.10	09-90	13:34	464.02	0.92	463.10	141.15	2947.00	898.25
ERDA-9	CUL	3410.10	10-90	13:08	463.61	0.92	462.69	141.03	2947.41	898.37
ERDA-9	CUL	3410.10	11-90	10:41	463.61	0.92	462.69	141.03	2947.41	898.37
ERDA-9	CUL	3410.10	12-90	10:20	463.45	0.92	462.53	140.98	2947.57	898.42



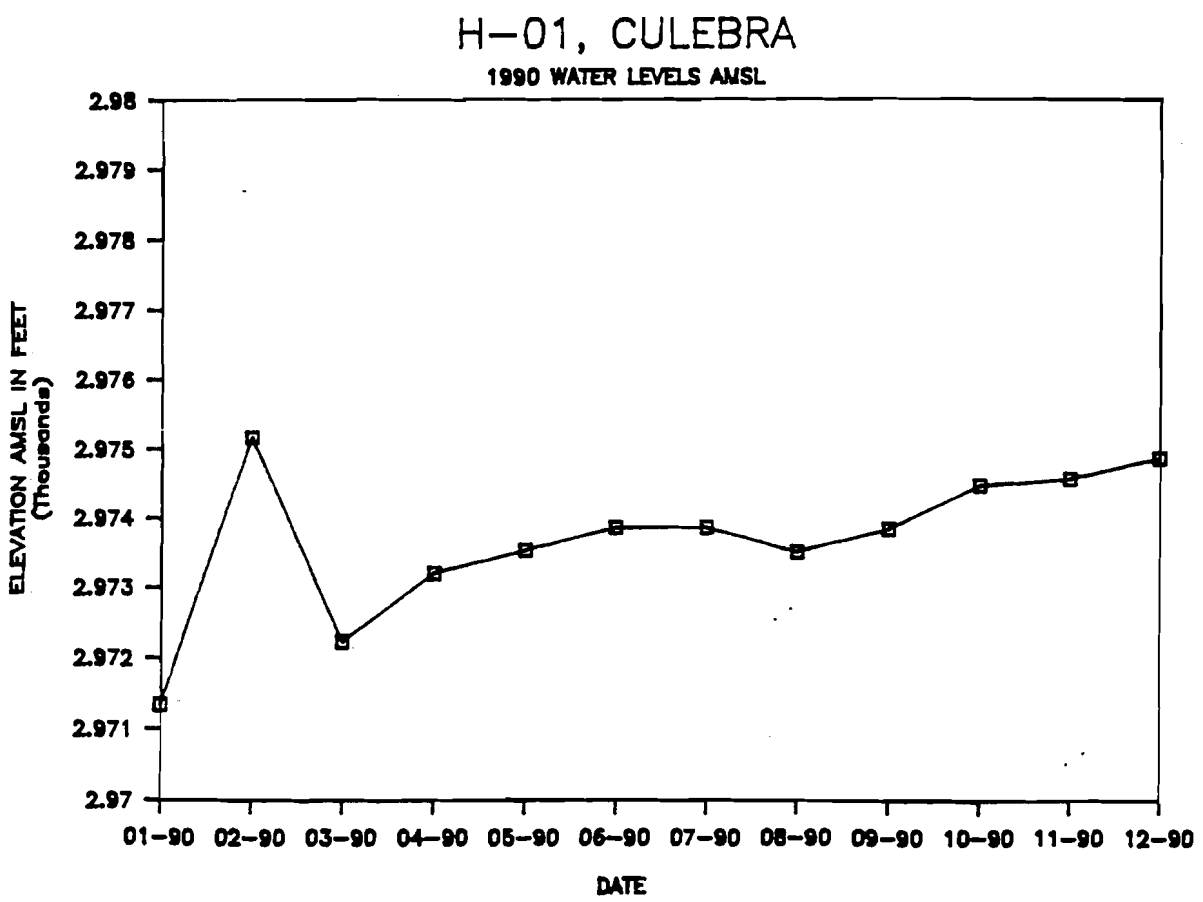
GROUND WATER-LEVELS
CALENDAR YEAR 1990
H-01, MAGENTA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_
H-01 (ANNULUS)	MAG	3399.53	01-90	14:10	278.74	0.98	277.76	84.66	31
H-01 (ANNULUS)	MAG	3399.53	02-90	12:00	278.87	0.98	277.89	84.70	31
H-01 (ANNULUS)	MAG	3399.53	03-90	14:45	279.59	0.98	278.61	84.92	31
H-01 (ANNULUS)	MAG	3399.53	04-90	16:35	278.84	0.98	277.86	84.69	31
H-01 (ANNULUS)	MAG	3399.53	05-90	14:46	278.90	0.98	277.92	84.71	31
H-01 (ANNULUS)	MAG	3399.53	06-90	06:45	279.00	0.98	278.02	84.74	31
H-01 (ANNULUS)	MAG	3399.53	07-90	07:40	279.20	0.98	278.22	84.80	31
H-01 (ANNULUS)	MAG	3399.53	08-90	13:18	279.00	0.98	278.02	84.74	31
H-01 (ANNULUS)	MAG	3399.53	09-90	13:49	279.04	0.98	278.06	84.75	31
H-01 (ANNULUS)	MAG	3399.53	10-90	13:24	279.12	0.98	278.14	84.78	31
H-01 (ANNULUS)	MAG	3399.53	11-90	10:32	279.19	0.98	278.21	84.80	31
H-01 (ANNULUS)	MAG	3399.53	12-90	10:32	279.13	0.98	278.15	84.78	31



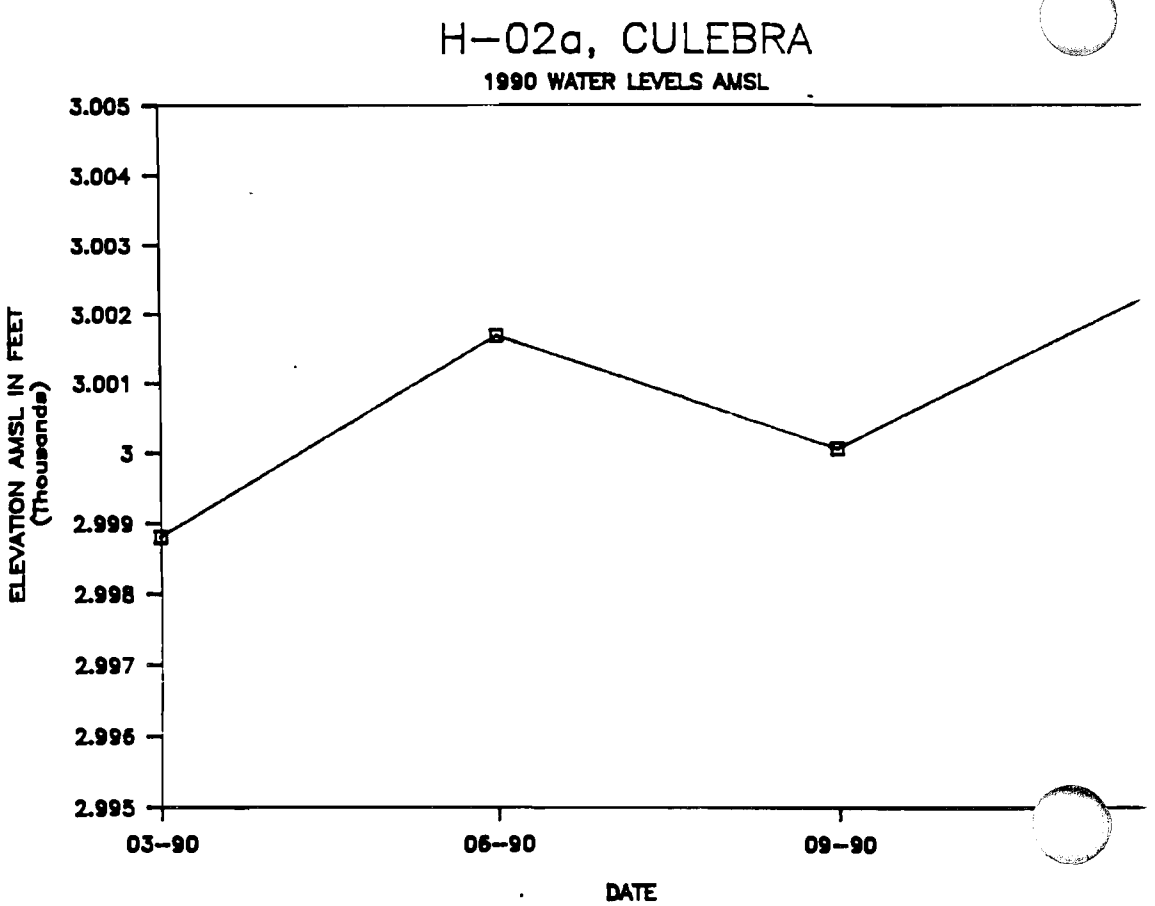
GROUND WATER-LEVELS
CALENDAR YEAR 1990
H-01, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL_
H-01 (PIP)	CUL	3399.53	01-90	14:18	429.17	0.98	428.19	130.51	2971.34	905.66
H-01 (PIP)	CUL	3399.53	02-90	11:51	425.33	0.98	424.35	129.34	2975.18	906.83
H-01 (PIP)	CUL	3399.53	03-90	14:38	428.28	0.98	427.30	130.24	2972.23	905.94
H-01 (PIP)	CUL	3399.53	04-90	16:29	427.30	0.98	426.32	129.94	2973.21	906.23
H-01 (PIP)	CUL	3399.53	05-90	14:41	426.97	0.98	425.99	129.84	2973.54	906.33
H-01 (PIP)	CUL	3399.53	06-90	06:36	426.64	0.98	425.66	129.74	2973.87	906.44
H-01 (PIP)	CUL	3399.53	07-90	07:30	426.64	0.98	425.66	129.74	2973.87	906.44
H-01 (PIP)	CUL	3399.53	08-90	13:12	427.00	0.98	426.02	129.85	2973.51	906.33
H-01 (PIP)	CUL	3399.53	09-90	13:41	426.67	0.98	425.69	129.75	2973.84	906.43
H-01 (PIP)	CUL	3399.53	10-90	13:19	426.03	0.98	425.05	129.56	2974.48	906.62
H-01 (PIP)	CUL	3399.53	11-90	10:23	425.93	0.98	424.95	129.52	2974.58	906.65
H-01 (PIP)	CUL	3399.53	12-90	10:30	425.63	0.98	424.65	129.43	2974.88	906.74



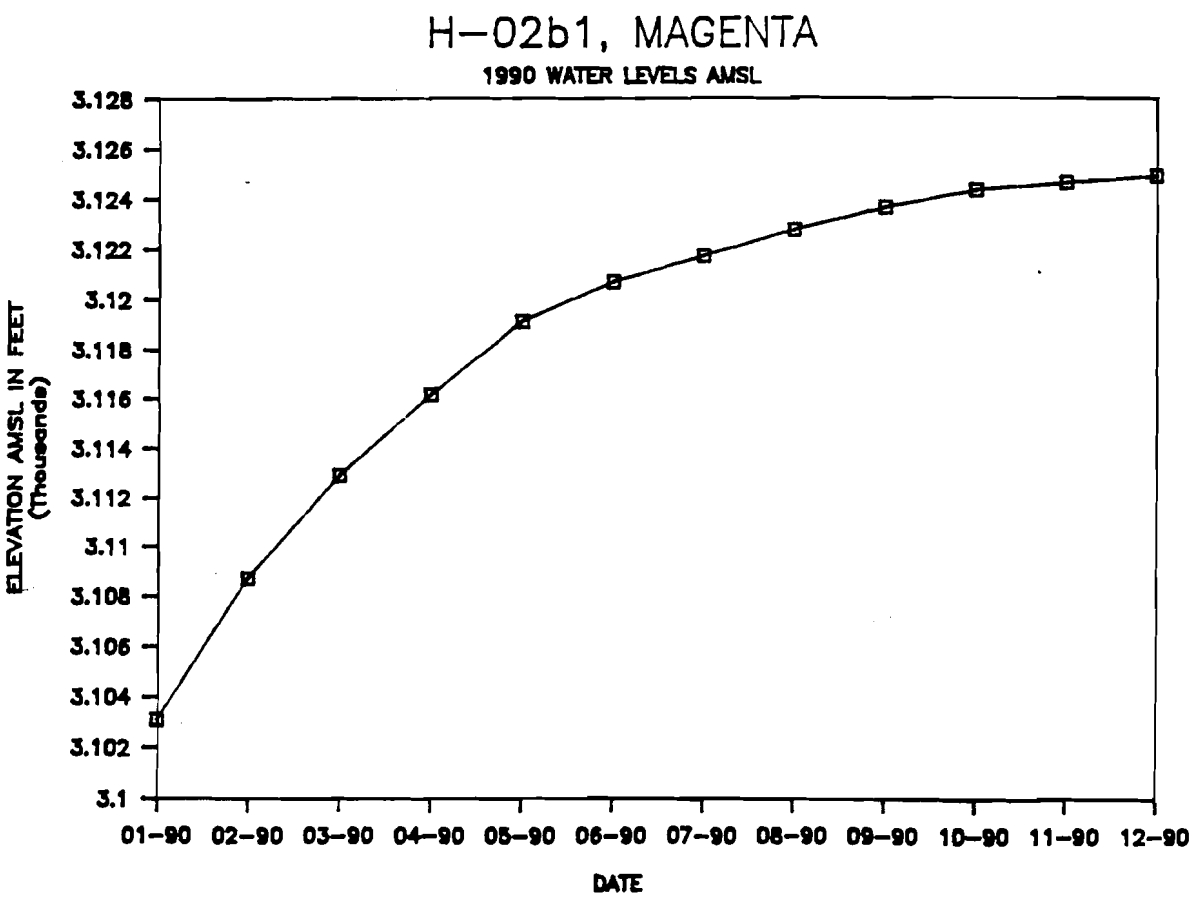
GROUND WATER-LEVELS
CALENDAR YEAR 1990
H-02a, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_
H-02a	CUL	3378.09	03-90	13:50	379.28	0.00	379.28	115.60	29
H-02a	CUL	3378.09	06-90	12:36	376.38	0.00	376.38	114.72	30
H-02a	CUL	3378.09	09-90	15:53	378.02	0.00	378.02	115.22	30
H-02a	CUL	3378.09	12-90	12:55	375.59	0.00	375.59	114.48	30



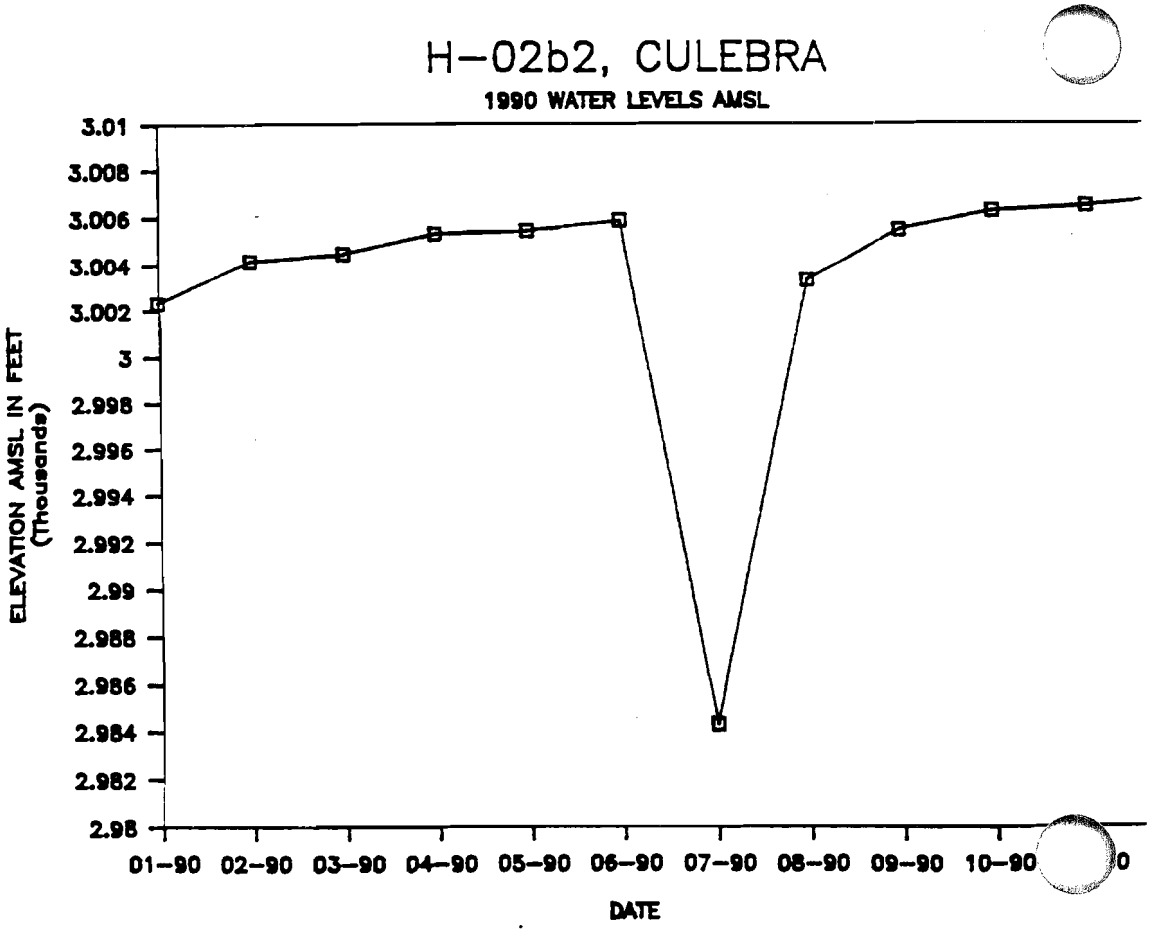
GROUND WATER-LEVELS
CALENDAR YEAR 1990
H-02b1, MAGENTA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL_
H-02b1	MAG	3378.46	01-90	14:38	275.33	0.00	275.33	83.92	3103.13	945.83
H-02b1	MAG	3378.46	02-90	12:16	269.72	0.00	269.72	82.21	3108.74	947.54
H-02b1	MAG	3378.46	03-90	14:00	265.53	0.00	265.53	80.93	3112.93	948.82
H-02b1	MAG	3378.46	04-90	17:00	262.28	0.00	262.28	79.94	3116.18	949.81
H-02b1	MAG	3378.46	05-90	13:05	259.28	0.00	259.28	79.03	3119.18	950.73
H-02b1	MAG	3378.46	06-90	12:23	257.72	0.00	257.72	78.55	3120.74	951.20
H-02b1	MAG	3378.46	07-90	07:15	256.69	0.00	256.69	78.24	3121.77	951.52
H-02b1	MAG	3378.46	08-90	13:48	255.66	0.00	255.66	77.93	3122.80	951.83
H-02b1	MAG	3378.46	09-90	14:06	254.78	0.00	254.78	77.66	3123.68	952.10
H-02b1	MAG	3378.46	10-90	15:09	254.08	0.00	254.08	77.44	3124.38	952.31
H-02b1	MAG	3378.46	11-90	11:40	253.78	0.00	253.78	77.35	3124.68	952.40
H-02b1	MAG	3378.46	12-90	13:05	253.51	0.00	253.51	77.27	3124.95	952.48



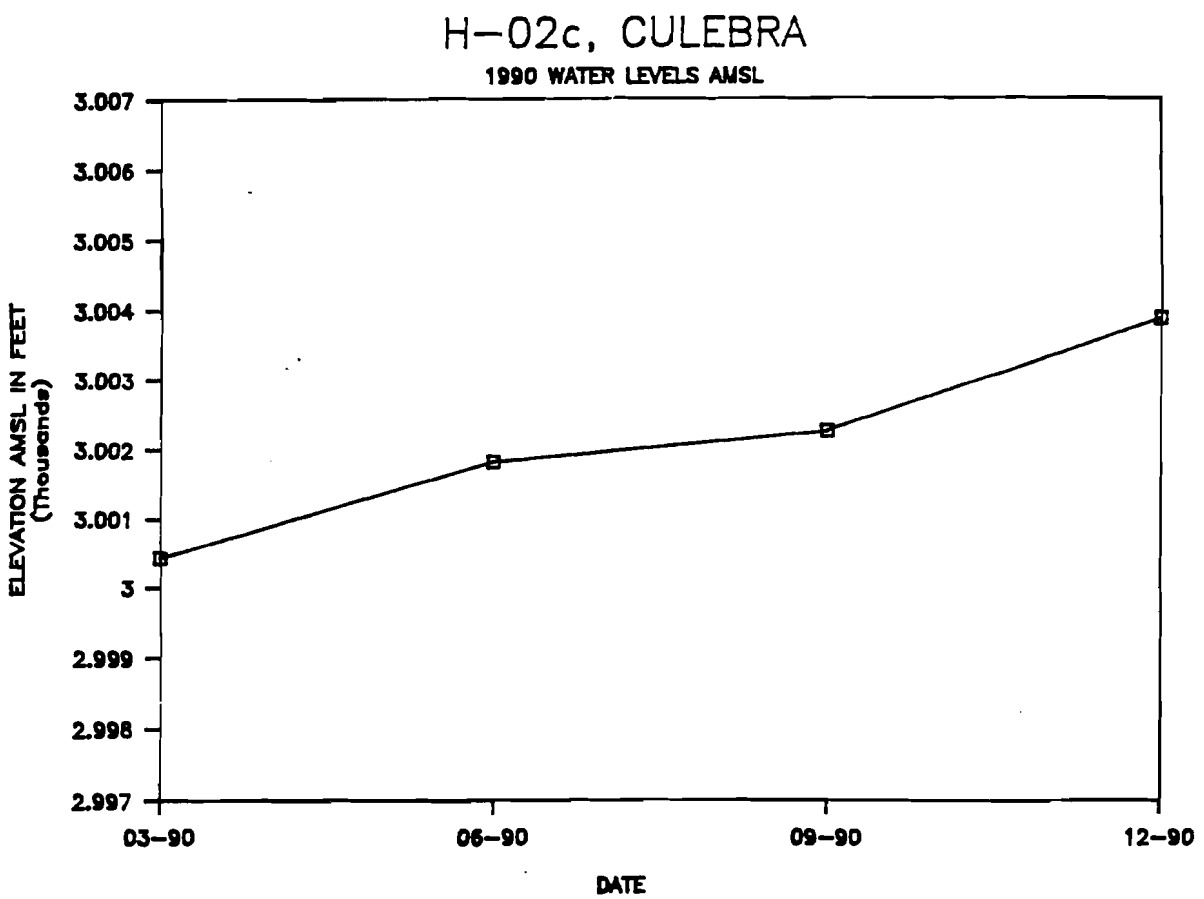
GROUND WATER-LEVELS
CALENDAR YEAR 1990
H-02b2, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL
H-02b2	CUL	3378.31	01-90	14:41	375.98	0.00	375.98	114.60	3(
H-02b2	CUL	3378.31	02-90	12:24	374.10	0.00	374.10	114.03	3(
H-02b2	CUL	3378.31	03-90	14:10	373.82	0.00	373.82	113.94	3(
H-02b2	CUL	3378.31	04-90	16:50	372.98	0.00	372.98	113.68	3(
H-02b2	CUL	3378.31	05-90	13:20	372.84	0.00	372.84	113.64	3(
H-02b2	CUL	3378.31	06-90	12:30	372.44	0.00	372.44	113.52	3(
H-02b2	CUL	3378.31	07-90	07:05	394.00	0.00	394.00	120.09	2(
H-02b2	CUL	3378.31	08-90	13:33	374.97	0.00	374.97	114.29	3(
H-02b2	CUL	3378.31	09-90	16:02	372.83	0.00	372.83	113.64	3(
H-02b2	CUL	3378.31	10-90	15:14	372.02	0.00	372.02	113.39	3(
H-02b2	CUL	3378.31	11-90	11:35	371.80	0.00	371.80	113.32	3(
H-02b2	CUL	3378.31	12-90	13:10	371.42	0.00	371.42	113.21	3(



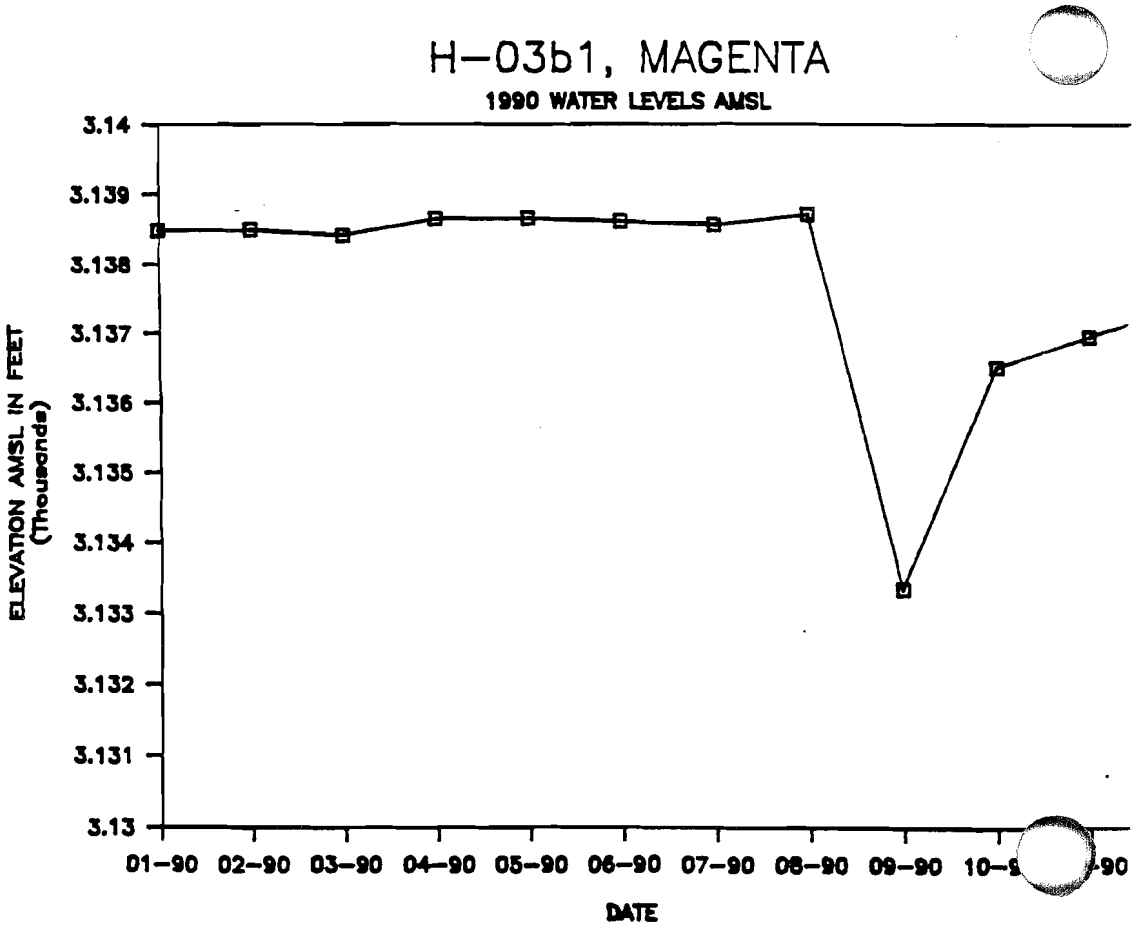
GROUND WATER-LEVELS
CALENDAR YEAR 1990
H-02c, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL_
H-02c	CUL	3378.41	03-90	14:19	377.97	0.00	377.97	115.21	3000.44	914.53
H-02c	CUL	3378.41	06-90	12:16	376.58	0.00	376.58	114.78	3001.83	914.96
H-02c	CUL	3378.41	09-90	16:14	376.14	0.00	376.14	114.65	3002.27	915.09
H-02c	CUL	3378.41	12-90	13:15	374.53	0.00	374.53	114.16	3003.88	915.58



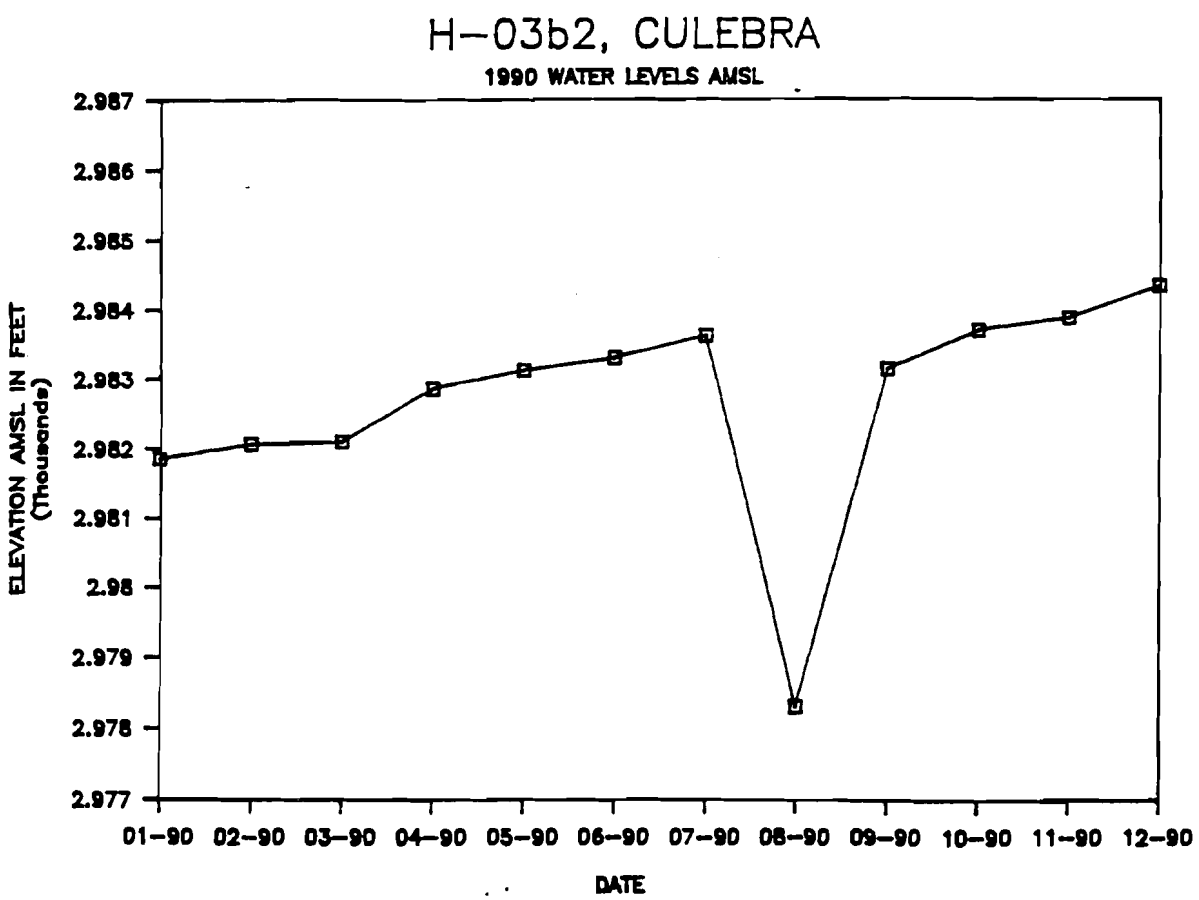
GROUND WATER-LEVELS
CALENDAR YEAR 1990
H-03b1, MAGENTA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_I
H-03b1	MAG	3390.64	01-90	14:52	252.15	0.00	252.15	76.86	31
H-03b1	MAG	3390.64	02-90	11:00	252.14	0.00	252.14	76.85	31
H-03b1	MAG	3390.64	03-90	12:53	252.22	0.00	252.22	76.88	31
H-03b1	MAG	3390.64	04-90	17:09	251.99	0.00	251.99	76.81	31
H-03b1	MAG	3390.64	05-90	15:02	251.98	0.00	251.98	76.80	31
H-03b1	MAG	3390.64	06-90	05:55	252.03	0.00	252.03	76.82	31
H-03b1	MAG	3390.64	07-90	14:17	252.07	0.00	252.07	76.83	31
H-03b1	MAG	3390.64	08-90	14:15	251.92	0.00	251.92	76.79	31
H-03b1	MAG	3390.64	09-90	14:03	257.30	0.00	257.30	78.43	31
H-03b1	MAG	3390.64	10-90	14:21	254.12	0.00	254.12	77.46	31
H-03b1	MAG	3390.64	11-90	12:52	253.68	0.00	253.68	77.32	31
H-03b1	MAG	3390.64	12-90	11:52	253.23	0.00	253.23	77.18	31



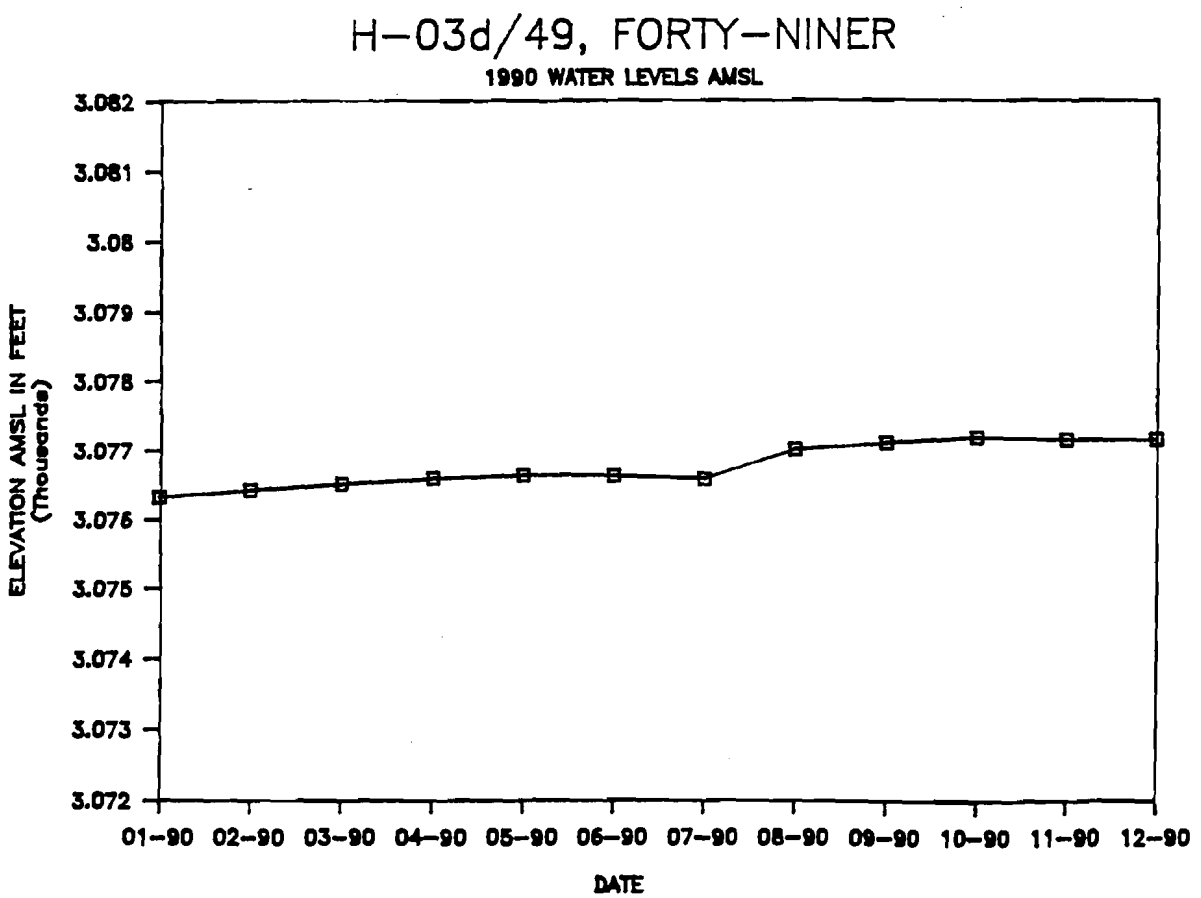
GROUND WATER-LEVELS
CALENDAR YEAR 1990
H-03b2, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL_
H-03b2	CUL	3390.03	01-90	14:58	408.17	0.00	408.17	124.41	2981.86	908.87
H-03b2	CUL	3390.03	02-90	11:10	407.95	0.00	407.95	124.34	2982.08	908.94
H-03b2	CUL	3390.03	03-90	13:00	407.91	0.00	407.91	124.33	2982.12	908.95
H-03b2	CUL	3390.03	04-90	17:25	407.15	0.00	407.15	124.10	2982.88	909.18
H-03b2	CUL	3390.03	05-90	15:25	406.88	0.00	406.88	124.02	2983.15	909.26
H-03b2	CUL	3390.03	06-90	06:21	406.70	0.00	406.70	123.96	2983.33	909.32
H-03b2	CUL	3390.03	07-90	14:25	406.38	0.00	406.38	123.86	2983.65	909.42
H-03b2	CUL	3390.03	08-90	14:30	411.72	0.00	411.72	125.49	2978.31	907.79
H-03b2	CUL	3390.03	09-90	14:38	406.86	0.00	406.86	124.01	2983.17	909.27
H-03b2	CUL	3390.03	10-90	14:12	406.31	0.00	406.31	123.84	2983.72	909.44
H-03b2	CUL	3390.03	11-90	13:00	406.13	0.00	406.13	123.79	2983.90	909.49
H-03b2	CUL	3390.03	12-90	12:20	405.67	0.00	405.67	123.65	2984.36	909.63



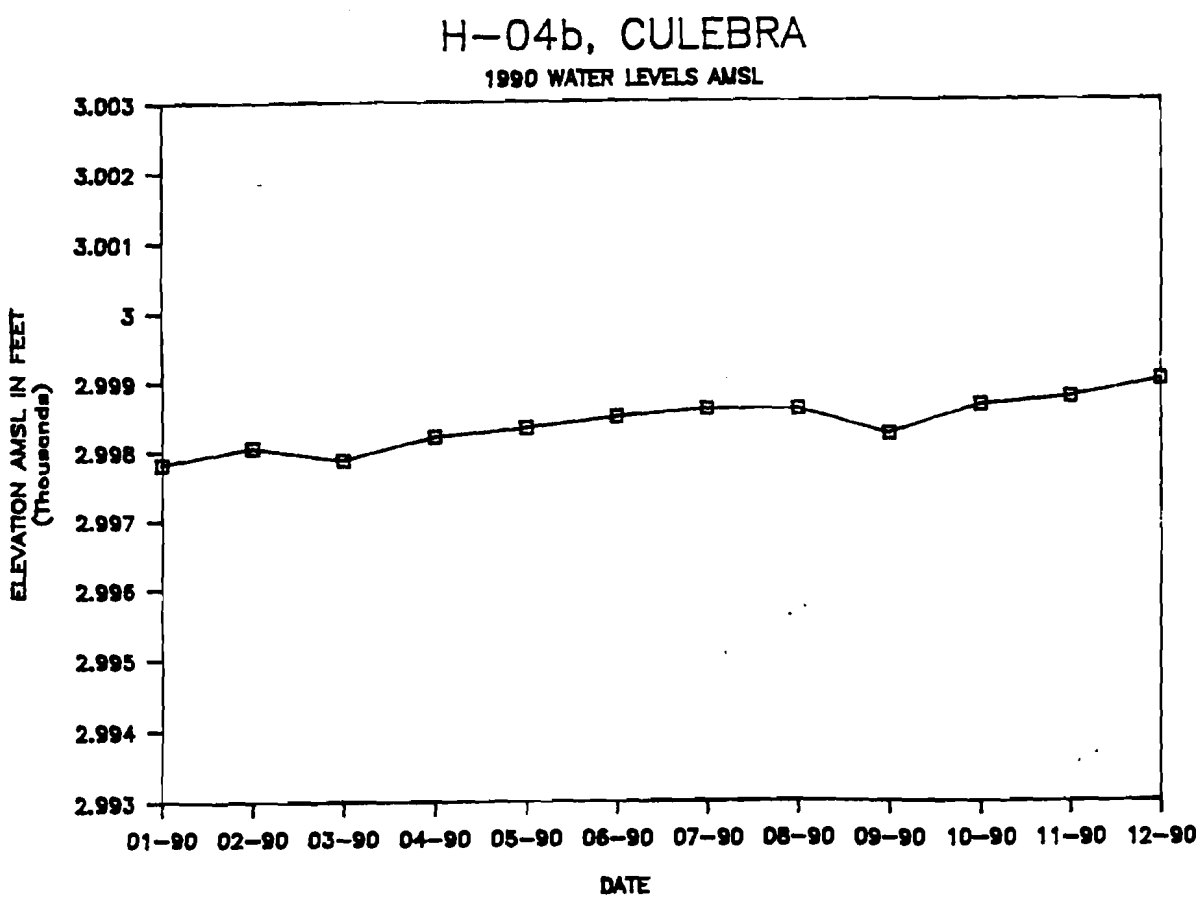
GROUND WATER-LEVELS
CALENDAR YEAR 1990
H-03d/49, FORTY-NINER

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL
H-03d/49 (PIP)	49ER	3390.01	01-90	15:09	315.90	2.22	313.68	95.61	3076.33	937.6
H-03d/49 (PIP)	49ER	3390.01	02-90	11:16	315.79	2.22	313.57	95.58	3076.44	937.7
H-03d/49 (PIP)	49ER	3390.01	03-90	13:22	315.71	2.22	313.49	95.55	3076.52	937.7
H-03d/49 (PIP)	49ER	3390.01	04-90	17:14	315.63	2.22	313.41	95.53	3076.60	937.7
H-03d/49 (PIP)	49ER	3390.01	05-90	15:08	315.58	2.22	313.36	95.51	3076.65	937.7
H-03d/49 (PIP)	49ER	3390.01	06-90	06:02	315.59	2.22	313.37	95.52	3076.64	937.7
H-03d/49 (PIP)	49ER	3390.01	07-90	14:35	315.64	2.22	313.42	95.53	3076.59	937.7
H-03d/49 (PIP)	49ER	3390.01	08-90	14:20	315.21	2.22	312.99	95.40	3077.02	937.8
H-03d/49 (PIP)	49ER	3390.01	09-90	14:10	315.12	2.22	312.90	95.37	3077.11	937.9
H-03d/49 (PIP)	49ER	3390.01	10-90	13:58	315.04	2.22	312.82	95.35	3077.19	937.9
H-03d/49 (PIP)	49ER	3390.01	11-90	12:39	315.07	2.22	312.85	95.36	3077.16	937.9
H-03d/49 (PIP)	49ER	3390.01	12-90	12:00	315.06	2.22	312.84	95.35	3077.17	937.9



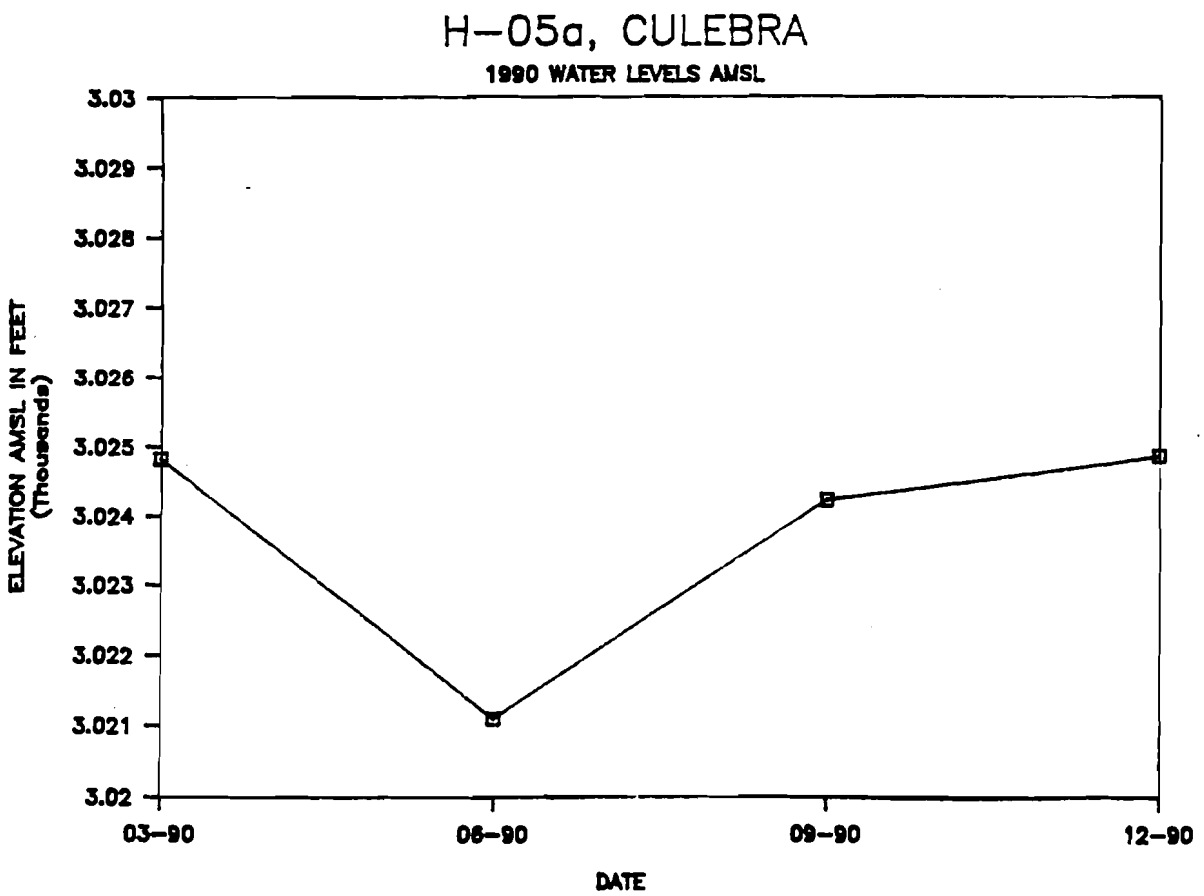
GROUND WATER-LEVELS
CALENDAR YEAR 1990
H-04b, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL
H-04b	CUL	3333.35	01-90	08:22	335.53	0.00	335.53	102.27	2997.82	913.7
H-04b	CUL	3333.35	02-90	10:10	335.29	0.00	335.29	102.20	2998.06	913.8
H-04b	CUL	3333.35	03-90	12:00	335.47	0.00	335.47	102.25	2997.88	913.7
H-04b	CUL	3333.35	04-90	12:06	335.13	0.00	335.13	102.15	2998.22	913.8
H-04b	CUL	3333.35	05-90	14:04	335.00	0.00	335.00	102.11	2998.35	913.9
H-04b	CUL	3333.35	06-90	16:40	334.85	0.00	334.85	102.06	2998.50	913.9
H-04b	CUL	3333.35	07-90	07:10	334.74	0.00	334.74	102.03	2998.61	913.9
H-04b	CUL	3333.35	08-90	08:15	334.75	0.00	334.75	102.03	2998.60	913.9
H-04b	CUL	3333.35	09-90	14:50	335.12	0.00	335.12	102.14	2998.23	913.8
H-04b	CUL	3333.35	10-90	16:28	334.70	0.00	334.70	102.02	2998.65	913.9
H-04b	CUL	3333.35	11-90	14:18	334.58	0.00	334.58	101.98	2998.77	914.0
H-04b	CUL	3333.35	12-90	13:55	334.33	0.00	334.33	101.90	2999.02	914.1



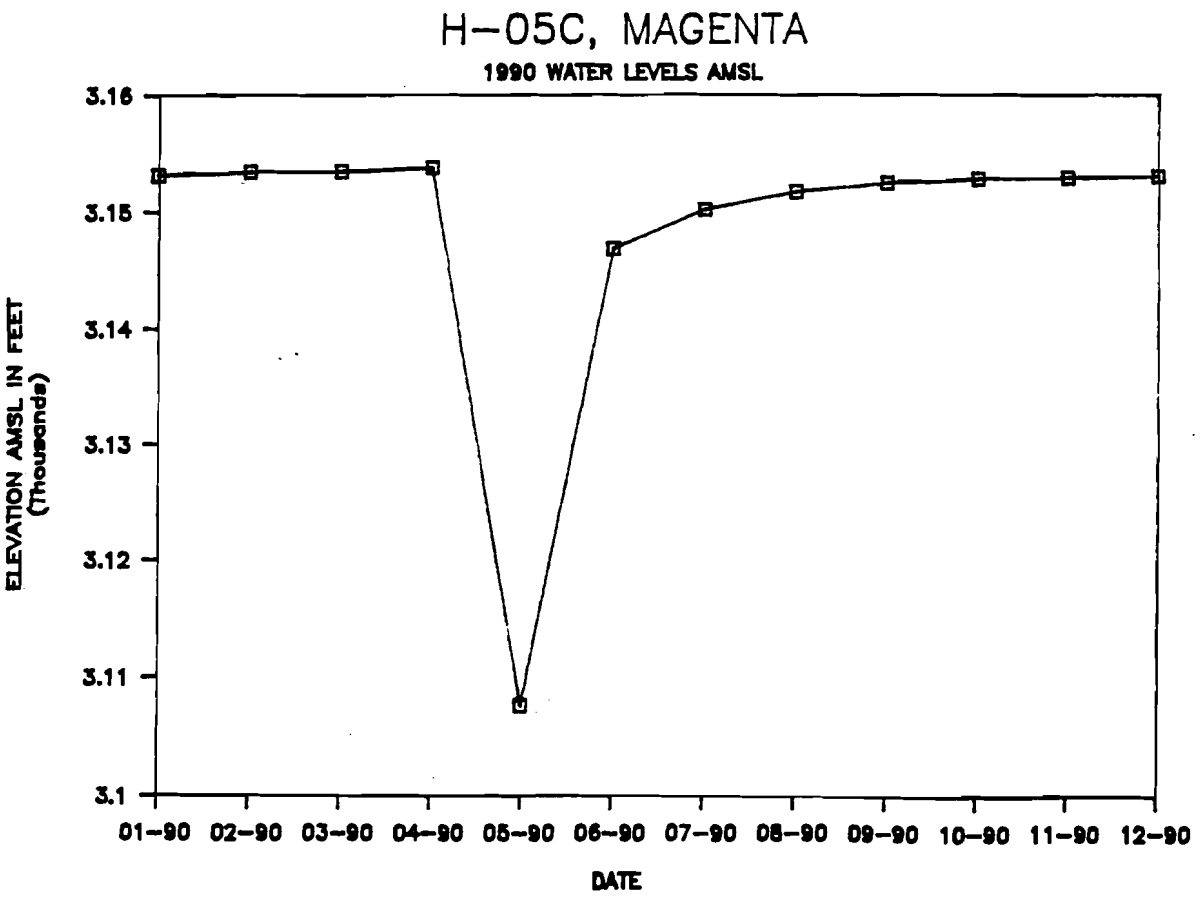
GROUND WATER-LEVELS
CALENDAR YEAR 1990
H-05a, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL
H-05a	CUL	3506.24	03-90	09:30	481.41	0.00	481.41	146.73	3024.83	921.9
H-05a	CUL	3506.24	06-90	08:38	485.14	0.00	485.14	147.87	3021.10	920.8
H-05a	CUL	3506.24	09-90	09:34	482.00	0.00	482.00	146.91	3024.24	921.7
H-05a	CUL	3506.24	12-90	12:05	481.37	0.00	481.37	146.72	3024.87	921.9



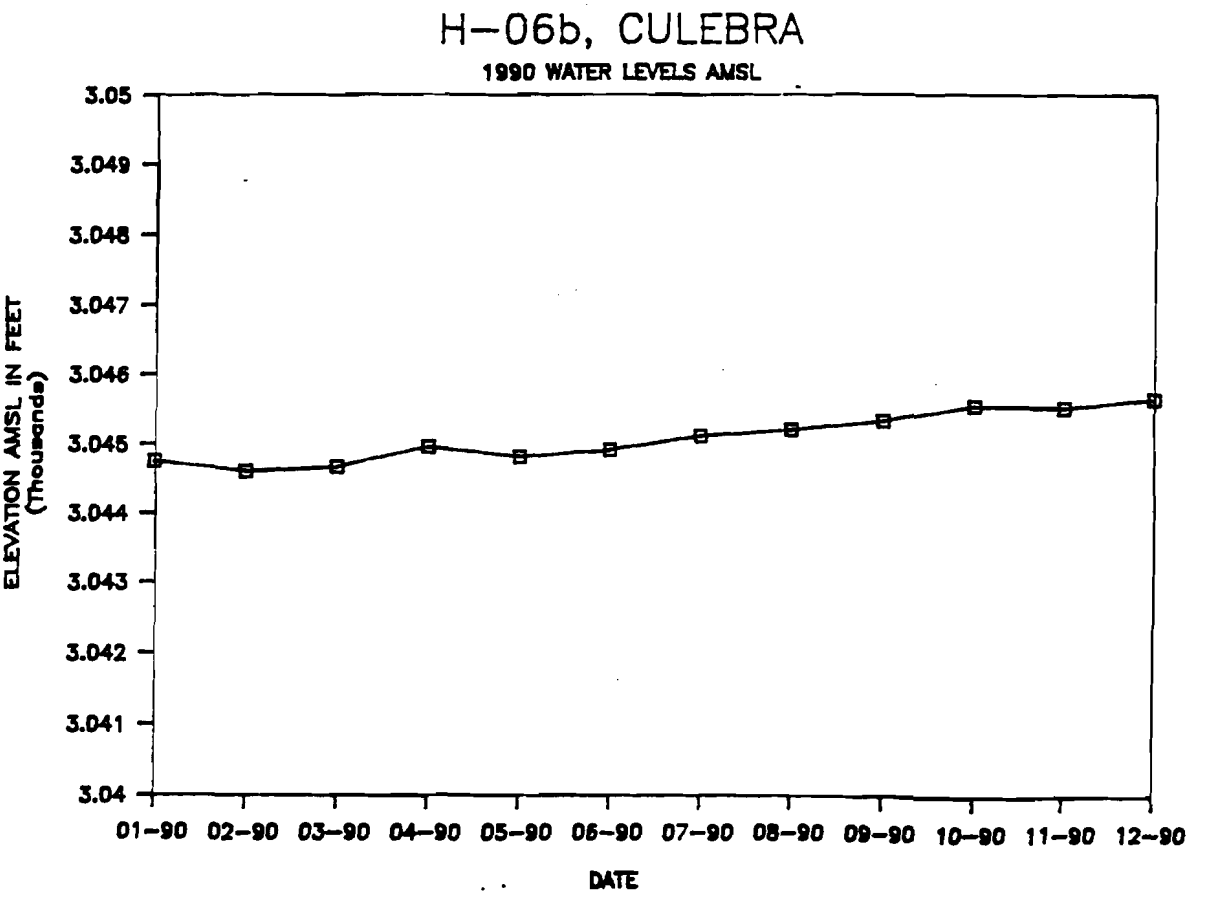
GROUND WATER-LEVELS
CALENDAR YEAR 1990
H-05c, MAGENTA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL
H-05c	MAG	3506.04	01-90	10:21	352.84	0.00	352.84	107.55	3153.20	961.1
H-05c	MAG	3506.04	02-90	14:26	352.54	0.00	352.54	107.45	3153.50	961.1
H-05c	MAG	3506.04	03-90	09:55	352.53	0.00	352.53	107.45	3153.51	961.1
H-05c	MAG	3506.04	04-90	13:03	352.18	0.00	352.18	107.34	3153.86	961.3
H-05c	MAG	3506.04	05-90	12:25	398.41	0.00	398.41	121.44	3107.63	947.2
H-05c	MAG	3506.04	06-90	08:53	359.11	0.00	359.11	109.46	3146.93	959.1
H-05c	MAG	3506.04	07-90	09:15	355.74	0.00	355.74	108.43	3150.30	960.2
H-05c	MAG	3506.04	08-90	15:04	354.24	0.00	354.24	107.97	3151.80	960.6
H-05c	MAG	3506.04	09-90	09:26	353.48	0.00	353.48	107.74	3152.56	960.9
H-05c	MAG	3506.04	10-90	09:31	353.15	0.00	353.15	107.64	3152.89	961.0
H-05c	MAG	3506.04	11-90	10:15	353.05	0.00	353.05	107.61	3152.99	961.0
H-05c	MAG	3506.04	12-90	12:20	352.91	0.00	352.91	107.57	3153.13	961.0



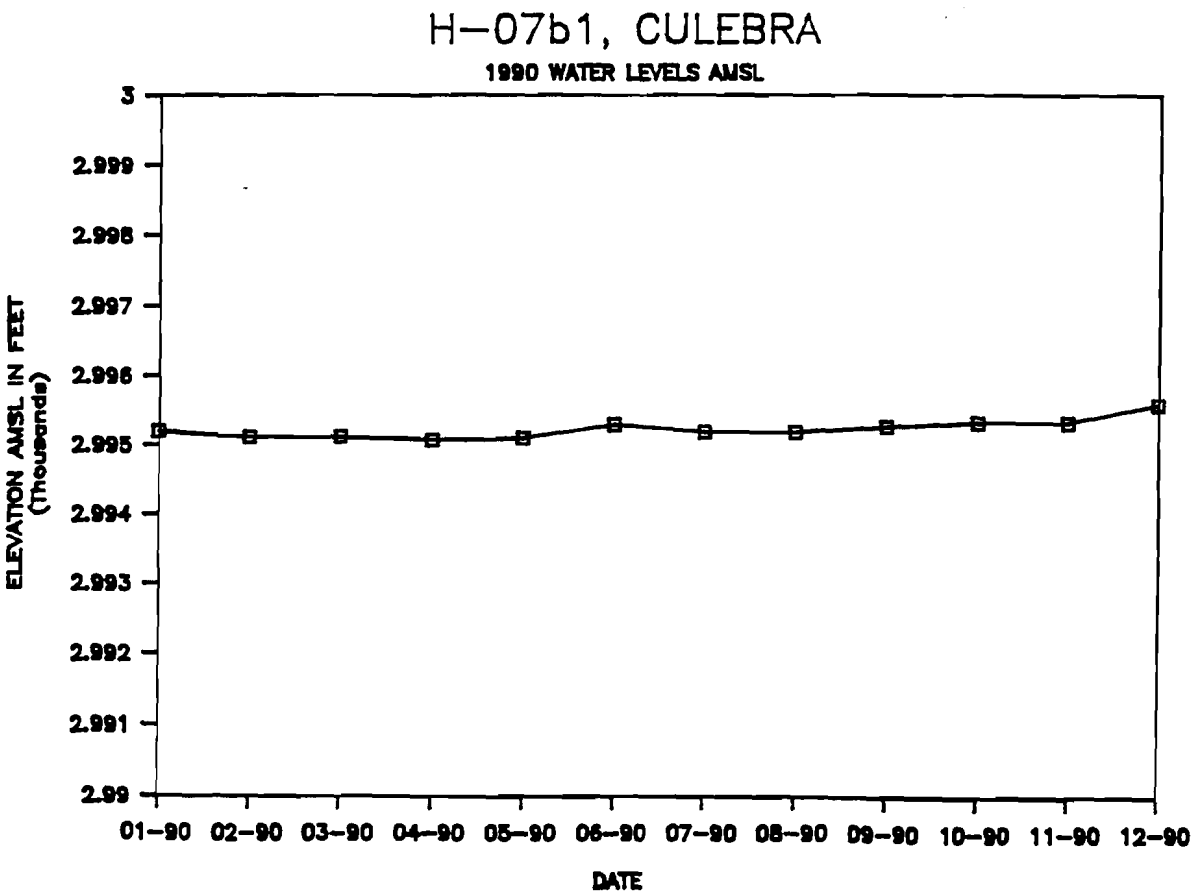
GROUND WATER-LEVELS
CALENDAR YEAR 1990
H-06b, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL_
H-06b	CUL	3348.25	01-90	14:28	303.49	0.00	303.49	92.50	3044.76	928.04
H-06b	CUL	3348.25	02-90	12:05	303.63	0.00	303.63	92.55	3044.62	928.00
H-06b	CUL	3348.25	03-90	12:54	303.57	0.00	303.57	92.53	3044.68	928.02
H-06b	CUL	3348.25	04-90	10:35	303.28	0.00	303.28	92.44	3044.97	928.11
H-06b	CUL	3348.25	05-90	10:57	303.42	0.00	303.42	92.48	3044.83	928.06
H-06b	CUL	3348.25	06-90	10:11	303.32	0.00	303.32	92.45	3044.93	928.09
H-06b	CUL	3348.25	07-90	13:30	303.12	0.00	303.12	92.39	3045.13	928.16
H-06b	CUL	3348.25	08-90	13:57	303.03	0.00	303.03	92.36	3045.22	928.18
H-06b	CUL	3348.25	09-90	12:58	302.90	0.00	302.90	92.32	3045.35	928.22
H-06b	CUL	3348.25	10-90	08:26	302.68	0.00	302.68	92.26	3045.57	928.29
H-06b	CUL	3348.25	11-90	09:10	302.71	0.00	302.71	92.27	3045.54	928.28
H-06b	CUL	3348.25	12-90	08:10	302.58	0.00	302.58	92.23	3045.67	928.32



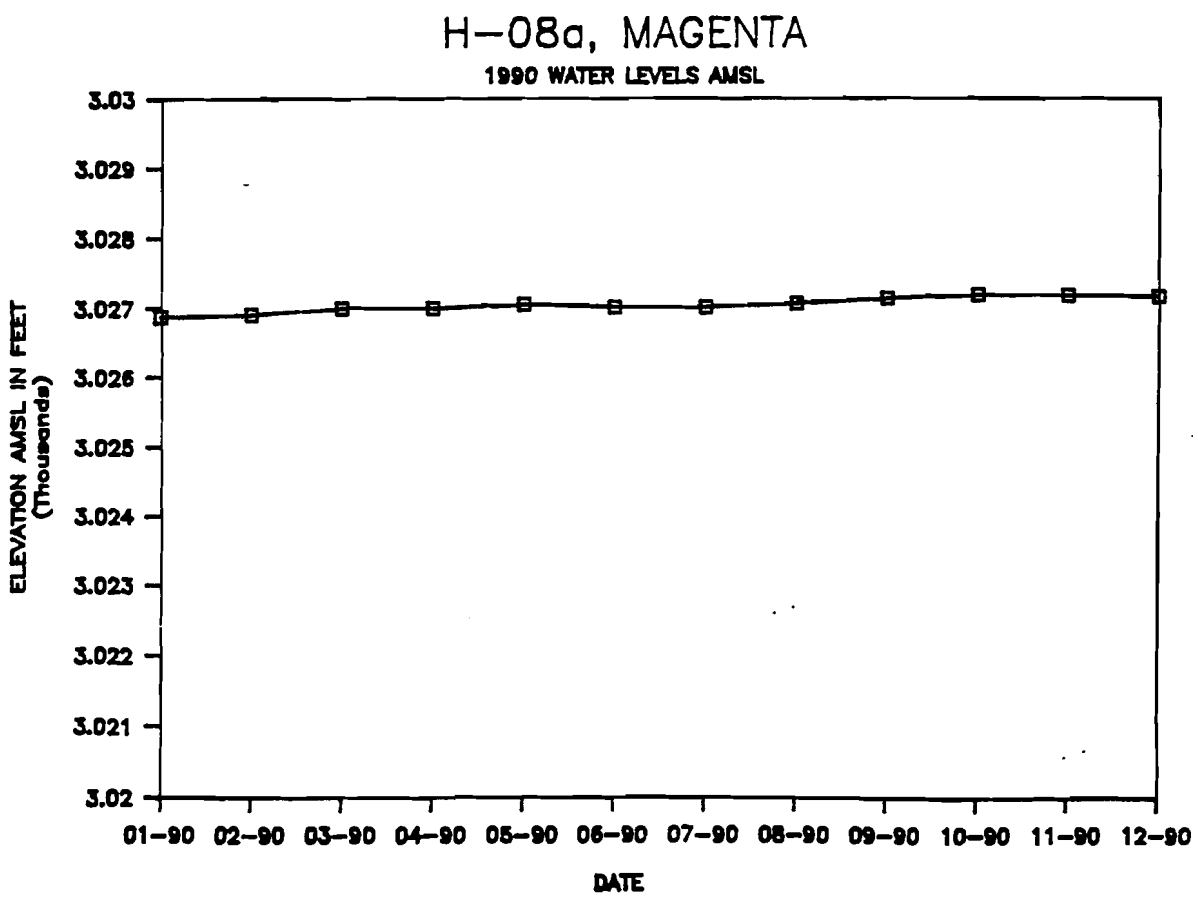
GROUND WATER-LEVELS
CALENDAR YEAR 1990
H-07b1, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL
H-07b1	CUL	3164.17	01-90	15:26	168.97	0.00	168.97	51.50	2995.20	912.9
H-07b1	CUL	3164.17	02-90	06:36	169.05	0.00	169.05	51.53	2995.12	912.9
H-07b1	CUL	3164.17	03-90	08:10	169.04	0.00	169.04	51.52	2995.13	912.9
H-07b1	CUL	3164.17	04-90	07:27	169.09	0.00	169.09	51.54	2995.08	912.9
H-07b1	CUL	3164.17	05-90	06:45	169.06	0.00	169.06	51.53	2995.11	912.9
H-07b1	CUL	3164.17	06-90	13:32	168.86	0.00	168.86	51.47	2995.31	912.9
H-07b1	CUL	3164.17	07-90	06:50	168.97	0.00	168.97	51.50	2995.20	912.9
H-07b1	CUL	3164.17	08-90	17:05	168.97	0.00	168.97	51.50	2995.20	912.9
H-07b1	CUL	3164.17	09-90	11:35	168.89	0.00	168.89	51.48	2995.28	912.9
H-07b1	CUL	3164.17	10-90	14:15	168.83	0.00	168.83	51.46	2995.34	912.9
H-07b1	CUL	3164.17	11-90	12:45	168.83	0.00	168.83	51.46	2995.34	912.9
H-07b1	CUL	3164.17	12-90	07:20	168.57	0.00	168.57	51.38	2995.60	913.0



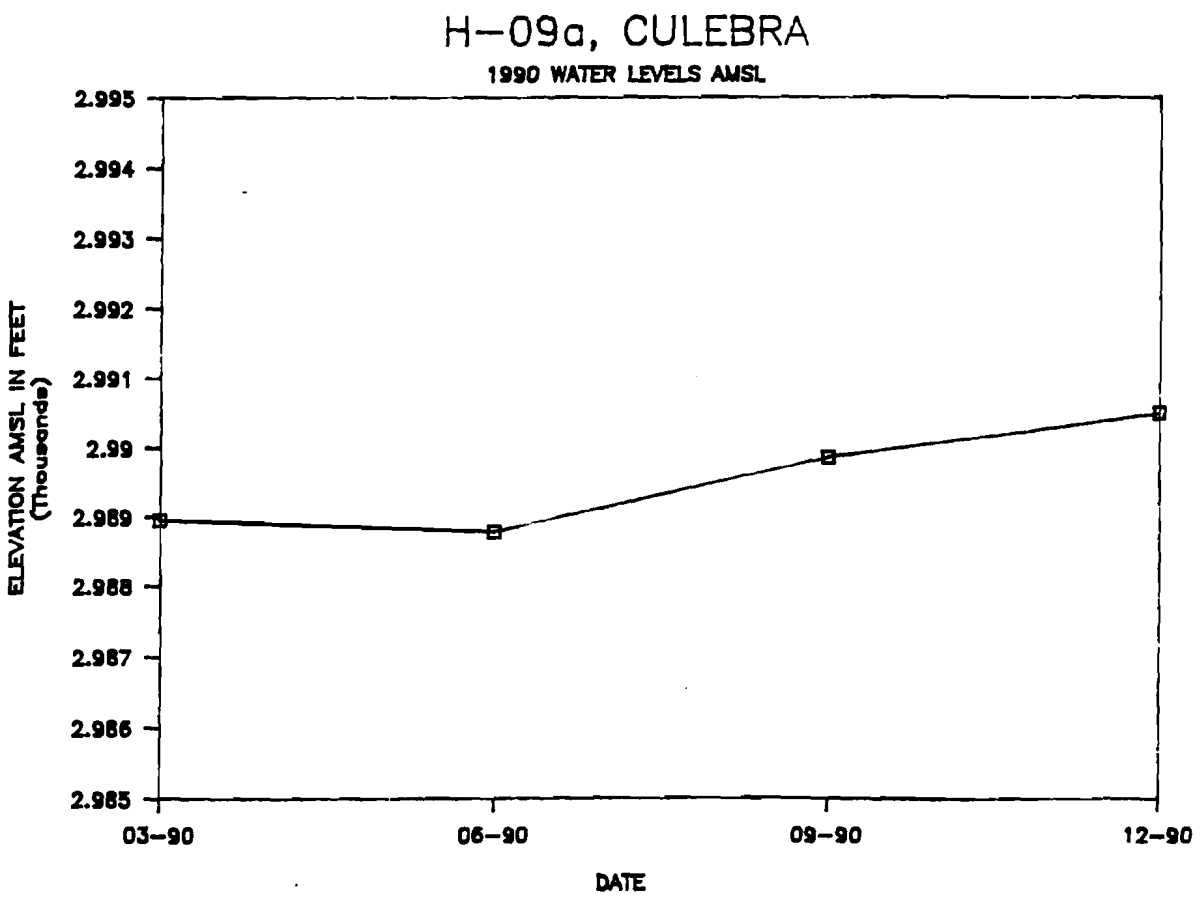
GROUND WATER-LEVELS
CALENDAR YEAR 1990
H-08a, MAGENTA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL_
H-08a	MAG	3432.99	01-90	09:15	406.11	0.00	406.11	123.78	3026.88	922.59
H-08a	MAG	3432.99	02-90	07:06	406.07	0.00	406.07	123.77	3026.92	922.61
H-08a	MAG	3432.99	03-90	17:18	405.98	0.00	405.98	123.74	3027.01	922.63
H-08a	MAG	3432.99	04-90	08:00	405.98	0.00	405.98	123.74	3027.01	922.63
H-08a	MAG	3432.99	05-90	14:42	405.92	0.00	405.92	123.72	3027.07	922.65
H-08a	MAG	3432.99	06-90	10:46	405.97	0.00	405.97	123.74	3027.02	922.64
H-08a	MAG	3432.99	07-90	11:35	405.96	0.00	405.96	123.74	3027.03	922.64
H-08a	MAG	3432.99	08-90	16:15	405.91	0.00	405.91	123.72	3027.08	922.65
H-08a	MAG	3432.99	09-90	10:20	405.83	0.00	405.83	123.70	3027.16	922.68
H-08a	MAG	3432.99	10-90	12:56	405.79	0.00	405.79	123.68	3027.20	922.69
H-08a	MAG	3432.99	11-90	11:18	405.79	0.00	405.79	123.68	3027.20	922.69
H-08a	MAG	3432.99	12-90	15:22	405.81	0.00	405.81	123.69	3027.18	922.68



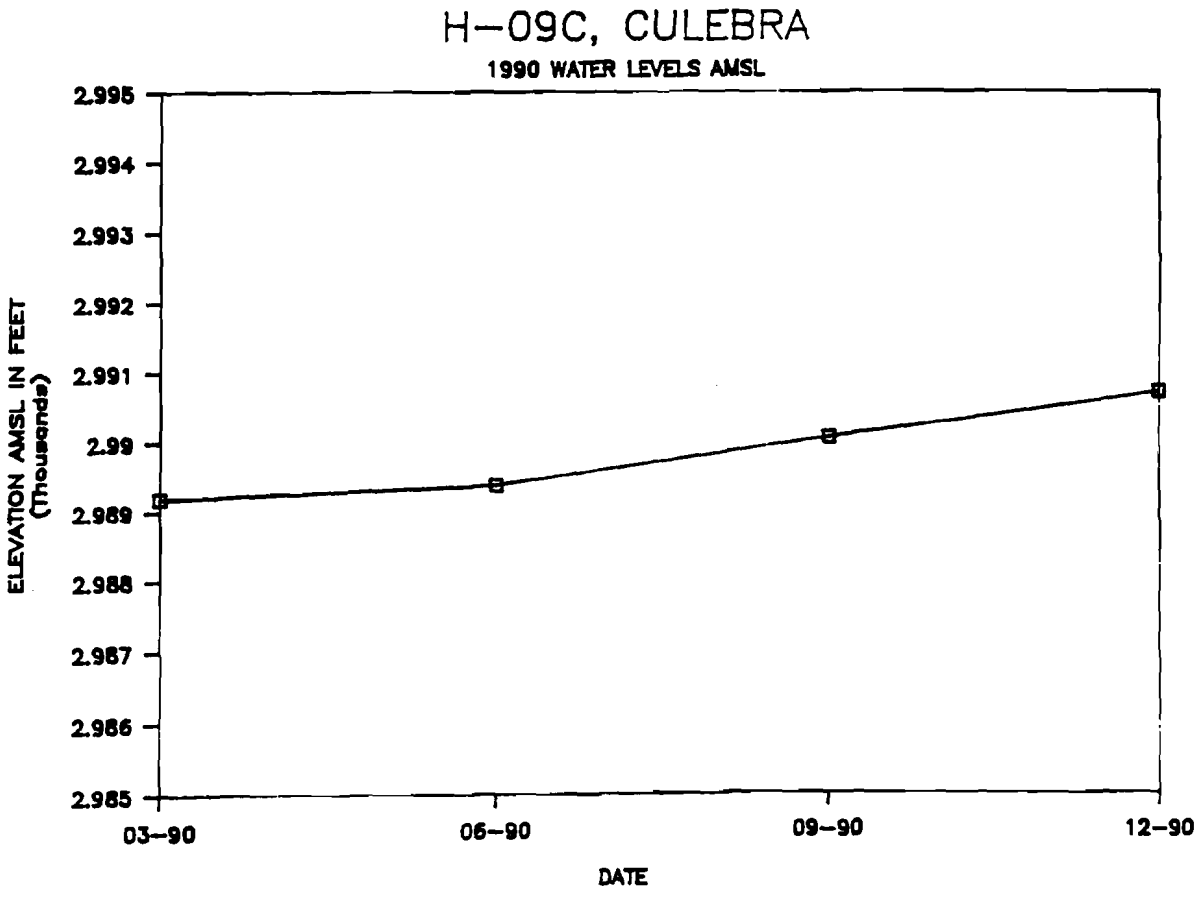
GROUND WATER-LEVELS
CALENDAR YEAR 1990
H-09a, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL
H-09a	CUL	3406.68	03-90	16:30	417.72	0.00	417.72	127.32	2988.96	911.0
H-09a	CUL	3406.68	06-90	13:02	417.89	0.00	417.89	127.37	2988.79	910.9
H-09a	CUL	3406.68	09-90	08:40	416.82	0.00	416.82	127.05	2989.86	911.3
H-09a	CUL	3406.68	12-90	14:50	416.18	0.00	416.18	126.85	2990.50	911.5



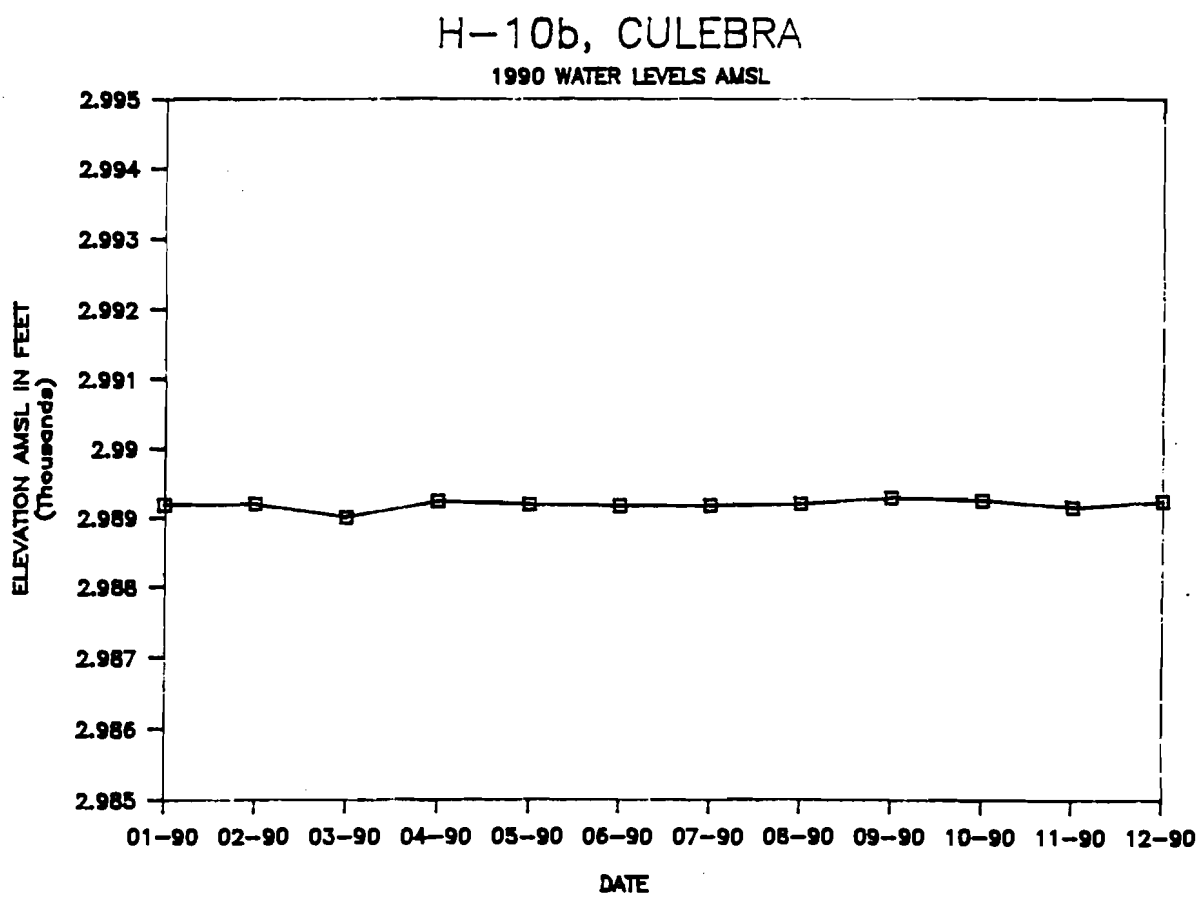
GROUND WATER-LEVELS
CALENDAR YEAR 1990
H-09c, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL
H-09c	CUL	3407.30	03-90	16:45	418.11	0.00	418.11	127.44	2989.19	911.[illegible]
H-09c	CUL	3407.30	06-90	12:55	417.92	0.00	417.92	127.38	2989.38	911.[illegible]
H-09c	CUL	3407.30	09-90	08:56	417.24	0.00	417.24	127.17	2990.06	911.[illegible]
H-09c	CUL	3407.30	12-90	15:00	416.60	0.00	416.60	126.98	2990.70	911.[illegible]



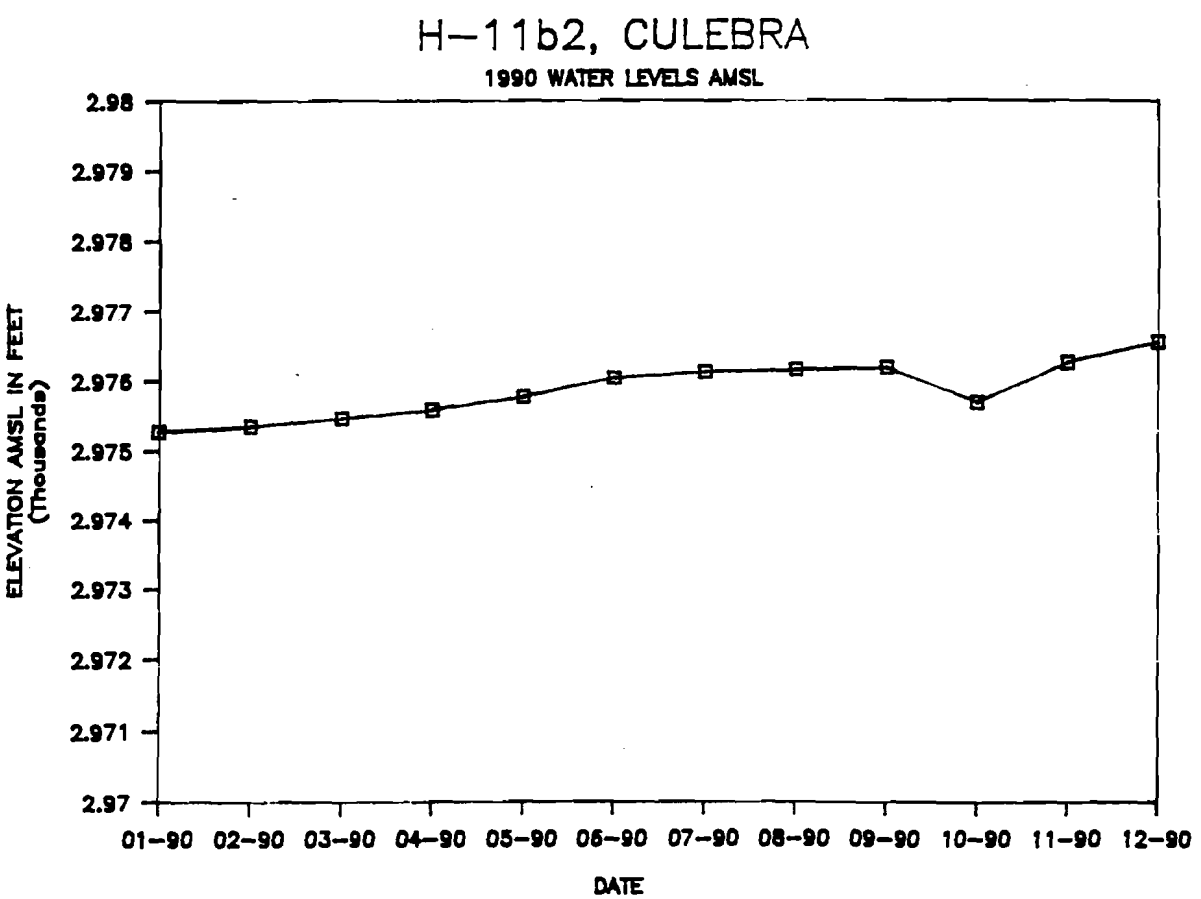
GROUND WATER-LEVELS
CALENDAR YEAR 1990
H-10b, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL
H-10b	CUL	3689.47	01-90	10:42	700.28	0.00	700.28	213.45	2989.19	911.1
H-10b	CUL	3689.47	02-90	14:24	700.26	0.00	700.26	213.44	2989.21	911.1
H-10b	CUL	3689.47	03-90	15:46	700.46	0.00	700.46	213.50	2989.01	911.0
H-10b	CUL	3689.47	04-90	09:14	700.22	0.00	700.22	213.43	2989.25	911.1
H-10b	CUL	3689.47	05-90	07:57	700.27	0.00	700.27	213.44	2989.20	911.1
H-10b	CUL	3689.47	06-90	13:57	700.29	0.00	700.29	213.45	2989.18	911.1
H-10b	CUL	3689.47	07-90	10:34	700.29	0.00	700.29	213.45	2989.18	911.1
H-10b	CUL	3689.47	08-90	08:17	700.26	0.00	700.26	213.44	2989.21	911.1
H-10b	CUL	3689.47	09-90	07:59	700.17	0.00	700.17	213.41	2989.30	911.1
H-10b	CUL	3689.47	10-90	11:16	700.21	0.00	700.21	213.42	2989.26	911.1
H-10b	CUL	3689.47	11-90	09:06	700.31	0.00	700.31	213.45	2989.16	911.1
H-10b	CUL	3689.47	12-90	14:15	700.22	0.00	700.22	213.43	2989.25	911.1



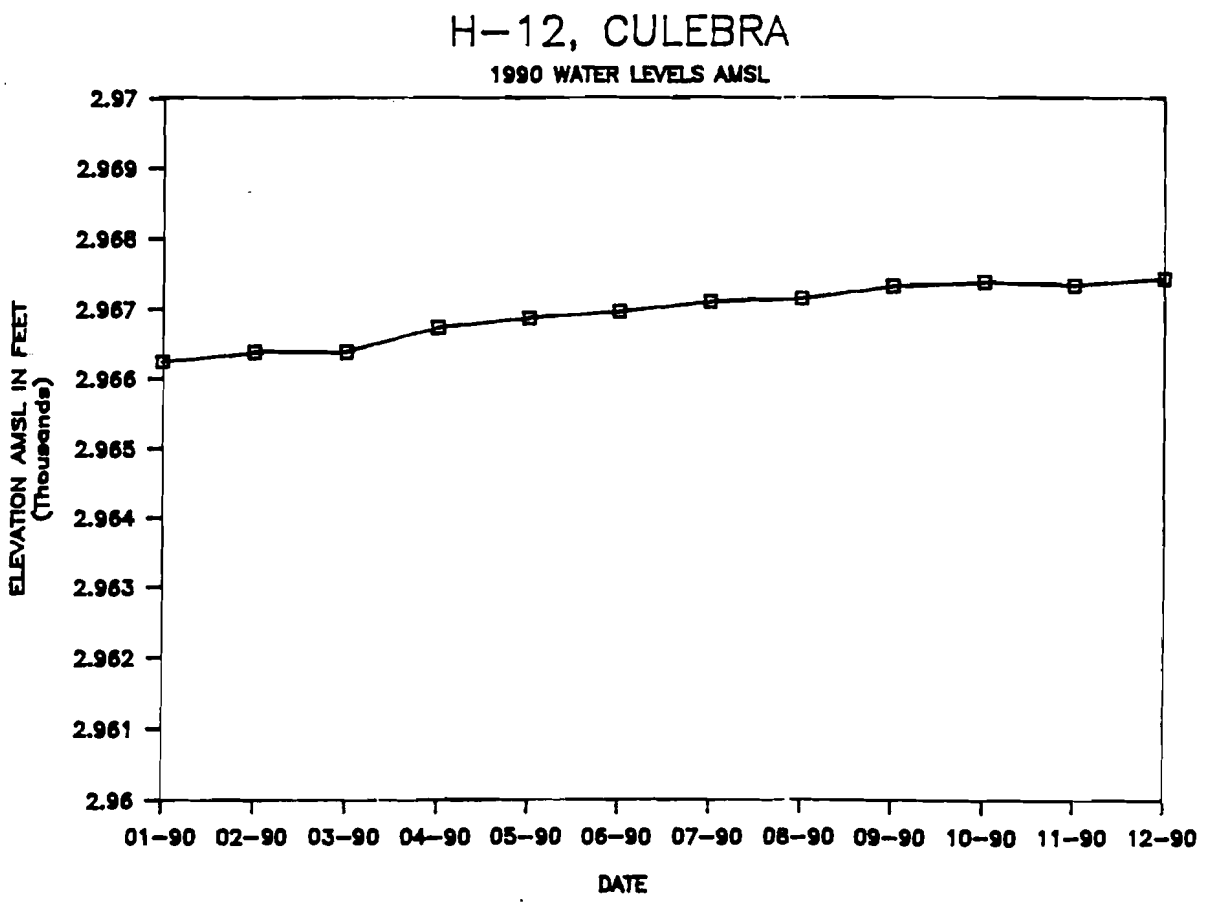
GROUND WATER-LEVELS
CALENDAR YEAR 1990
H-11b2, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL
H-11b2	CUL	3411.64	01-90	13:11	436.36	0.00	436.36	133.00	2975.28	906.8
H-11b2	CUL	3411.64	02-90	08:42	436.28	0.00	436.28	132.98	2975.36	906.8
H-11b2	CUL	3411.64	03-90	14:42	436.16	0.00	436.16	132.94	2975.48	906.9
H-11b2	CUL	3411.64	04-90	11:09	436.04	0.00	436.04	132.90	2975.60	906.9
H-11b2	CUL	3411.64	05-90	09:15	435.85	0.00	435.85	132.85	2975.79	907.0
H-11b2	CUL	3411.64	06-90	15:40	435.58	0.00	435.58	132.76	2976.06	907.1
H-11b2	CUL	3411.64	07-90	09:35	435.49	0.00	435.49	132.74	2976.15	907.1
H-11b2	CUL	3411.64	08-90	11:35	435.46	0.00	435.46	132.73	2976.18	907.1
H-11b2	CUL	3411.64	09-90	11:53	435.43	0.00	435.43	132.72	2976.21	907.1
H-11b2	CUL	3411.64	10-90	07:45	435.95	0.00	435.95	132.88	2975.69	906.9
H-11b2	CUL	3411.64	11-90	16:58	435.36	0.00	435.36	132.70	2976.28	907.1
H-11b2	CUL	3411.64	12-90	07:25	435.08	0.00	435.08	132.61	2976.56	907.2



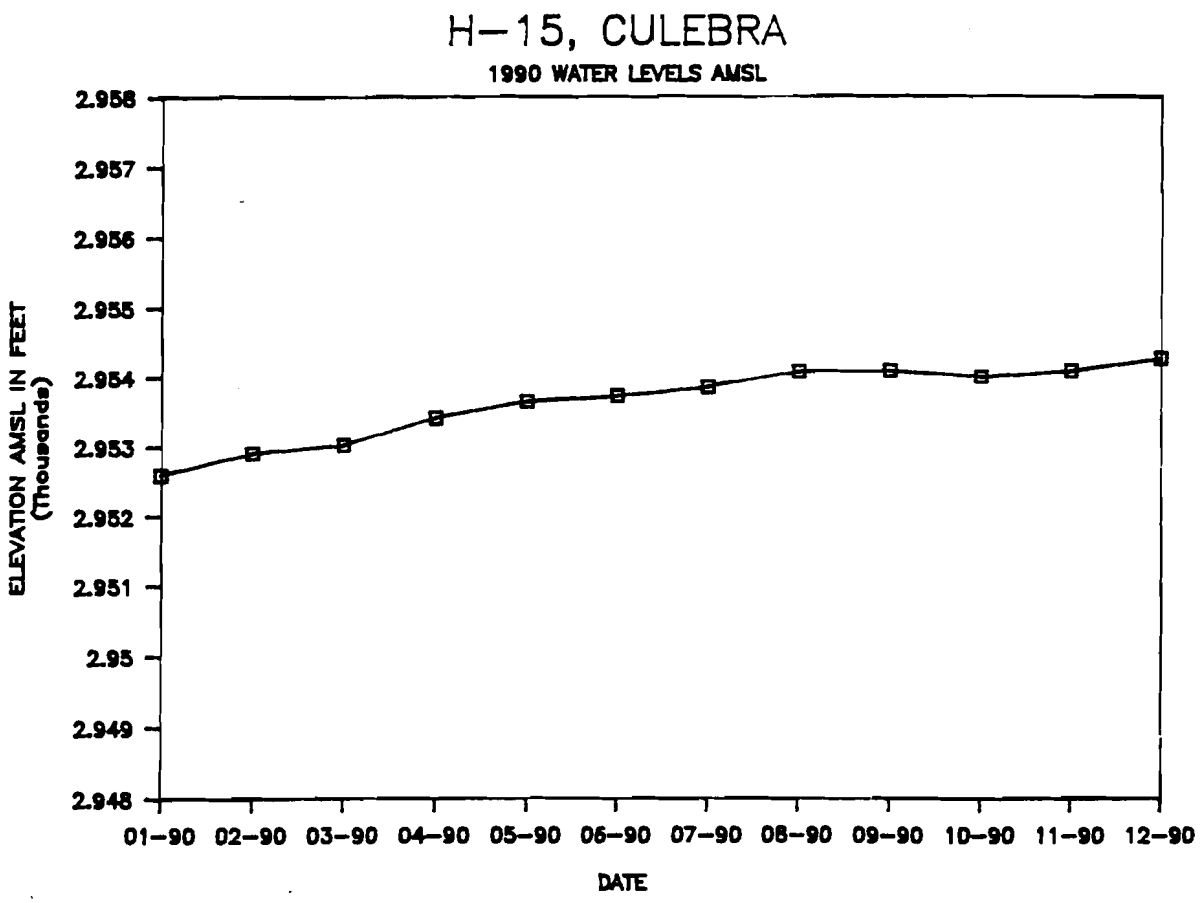
GROUND WATER-LEVELS
CALENDAR YEAR 1990
H-12, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL
H-12	CUL	3427.19	01-90	11:44	460.93	0.00	460.93	140.49	2966.26	904.1
H-12	CUL	3427.19	02-90	08:13	460.79	0.00	460.79	140.45	2966.40	904.1
H-12	CUL	3427.19	03-90	15:20	460.79	0.00	460.79	140.45	2966.40	904.1
H-12	CUL	3427.19	04-90	09:45	460.44	0.00	460.44	140.34	2966.75	904.2
H-12	CUL	3427.19	05-90	08:35	460.31	0.00	460.31	140.30	2966.88	904.3
H-12	CUL	3427.19	06-90	14:45	460.22	0.00	460.22	140.28	2966.97	904.3
H-12	CUL	3427.19	07-90	09:50	460.08	0.00	460.08	140.23	2967.11	904.3
H-12	CUL	3427.19	08-90	09:25	460.03	0.00	460.03	140.22	2967.16	904.3
H-12	CUL	3427.19	09-90	07:05	459.86	0.00	459.86	140.17	2967.33	904.4
H-12	CUL	3427.19	10-90	10:10	459.80	0.00	459.80	140.15	2967.39	904.4
H-12	CUL	3427.19	11-90	15:20	459.85	0.00	459.85	140.16	2967.34	904.4
H-12	CUL	3427.19	12-90	13:25	459.75	0.00	459.75	140.13	2967.44	904.4



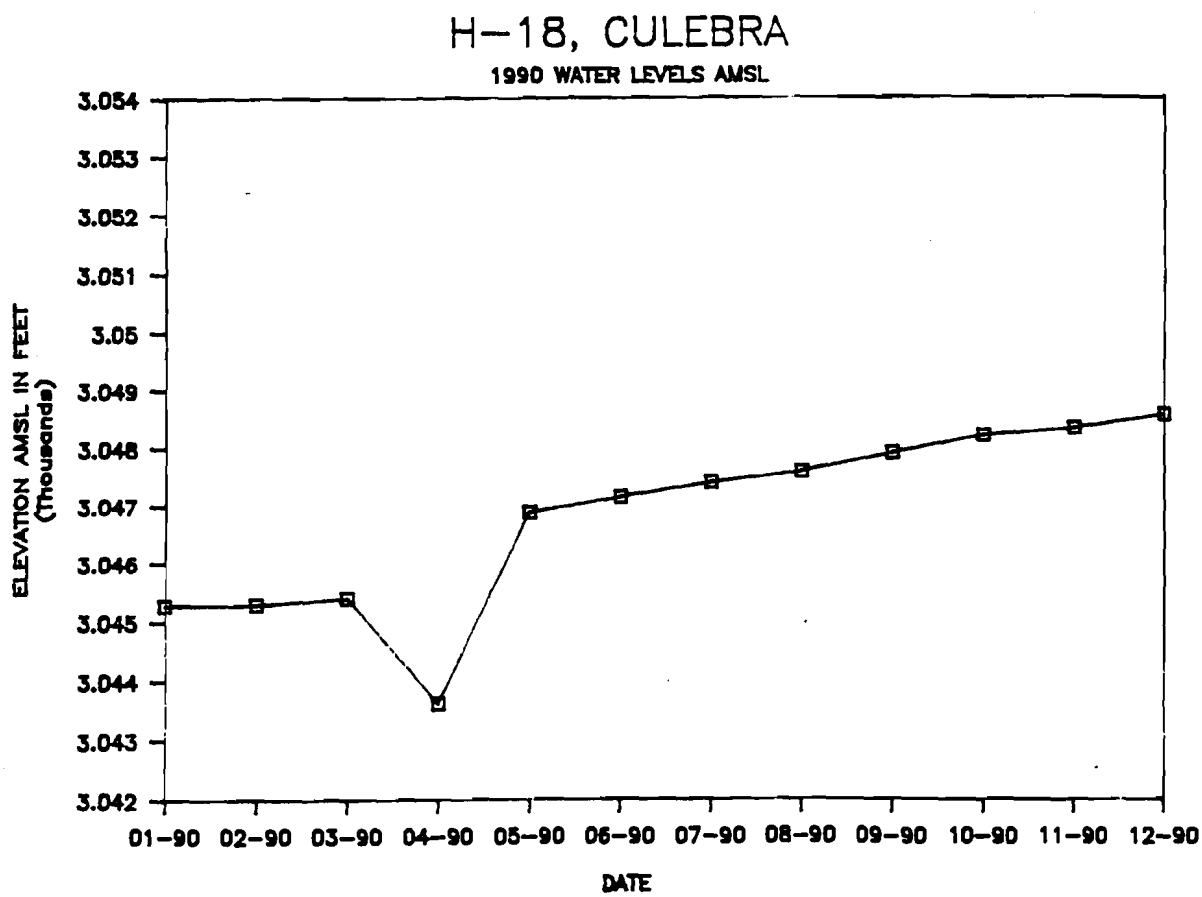
GROUND WATER-LEVELS
CALENDAR YEAR 1990
H-15, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL
H-15	CUL	3481.63	01-90	09:44	529.03	0.00	529.03	161.25	2952.60	899.9
H-15	CUL	3481.63	02-90	13:56	528.71	0.00	528.71	161.15	2952.92	900.0
H-15	CUL	3481.63	03-90	10:20	528.59	0.00	528.59	161.11	2953.04	900.0
H-15	CUL	3481.63	04-90	13:25	528.20	0.00	528.20	161.00	2953.43	900.2
H-15	CUL	3481.63	05-90	12:44	527.96	0.00	527.96	160.92	2953.67	900.2
H-15	CUL	3481.63	06-90	08:12	527.89	0.00	527.89	160.90	2953.74	900.3
H-15	CUL	3481.63	07-90	07:55	527.76	0.00	527.76	160.86	2953.87	900.3
H-15	CUL	3481.63	08-90	15:41	527.53	0.00	527.53	160.79	2954.10	900.4
H-15	CUL	3481.63	09-90	09:52	527.52	0.00	527.52	160.79	2954.11	900.4
H-15	CUL	3481.63	10-90	10:35	527.61	0.00	527.61	160.82	2954.02	900.3
H-15	CUL	3481.63	11-90	10:40	527.52	0.00	527.52	160.79	2954.11	900.4
H-15	CUL	3481.63	12-90	09:20	527.35	0.00	527.35	160.74	2954.28	900.4



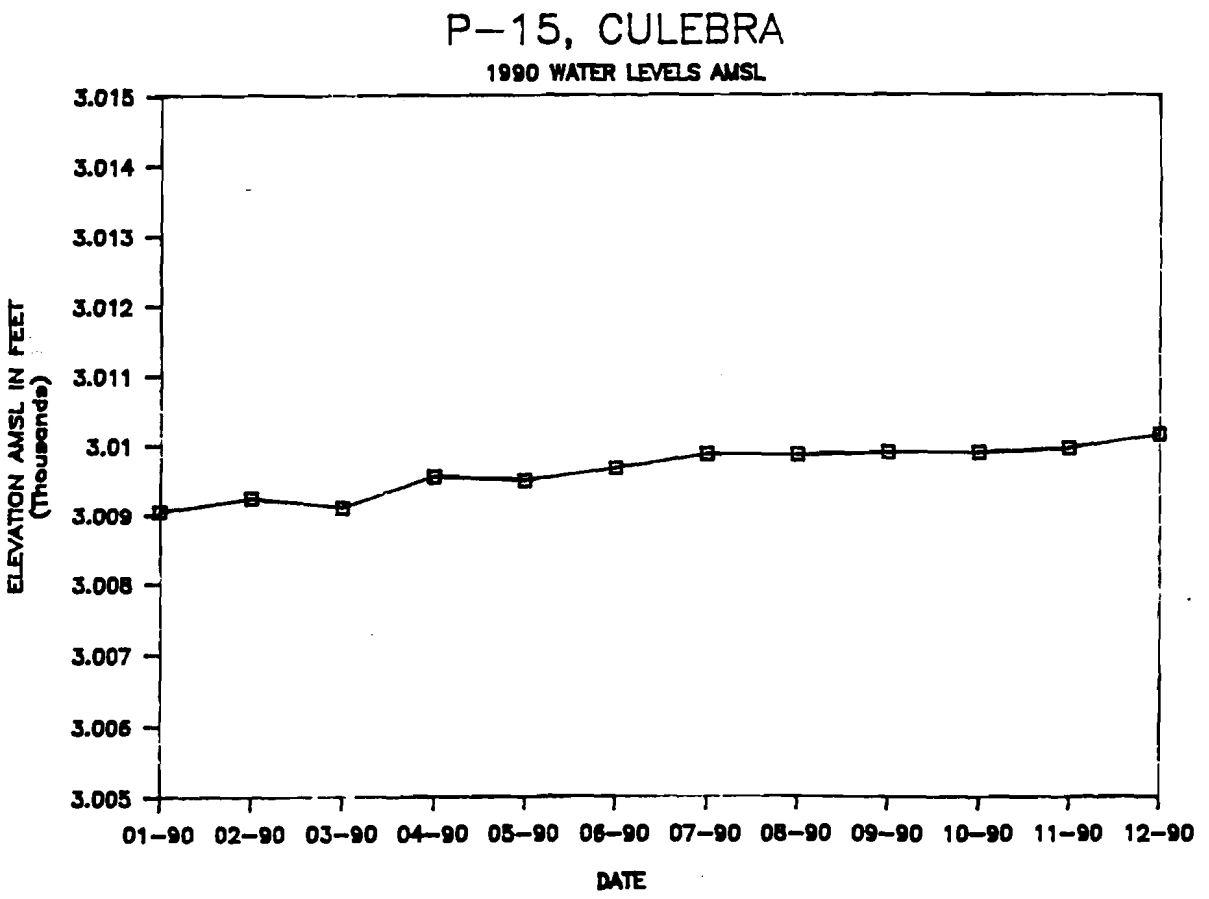
GROUND WATER-LEVELS
CALENDAR YEAR 1990
H-18, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL
H-18	CUL	3414.21	01-90	14:02	368.92	0.00	368.92	112.45	3045.29	928.2
H-18	CUL	3414.21	02-90	12:36	368.90	0.00	368.90	112.44	3045.31	928.2
H-18	CUL	3414.21	03-90	13:30	368.79	0.00	368.79	112.41	3045.42	928.2
H-18	CUL	3414.21	04-90	11:05	370.58	0.00	370.58	112.95	3043.63	927.7
H-18	CUL	3414.21	05-90	11:17	367.31	0.00	367.31	111.96	3046.90	928.7
H-18	CUL	3414.21	06-90	10:44	367.05	0.00	367.05	111.88	3047.16	928.7
H-18	CUL	3414.21	07-90	13:50	366.80	0.00	366.80	111.80	3047.41	928.8
H-18	CUL	3414.21	08-90	14:20	366.61	0.00	366.61	111.74	3047.60	928.9
H-18	CUL	3414.21	09-90	12:25	366.30	0.00	366.30	111.65	3047.91	929.0
H-18	CUL	3414.21	10-90	08:50	365.99	0.00	365.99	111.55	3048.22	929.1
H-18	CUL	3414.21	11-90	09:56	365.86	0.00	365.86	111.51	3048.35	929.1
H-18	CUL	3414.21	12-90	08:50	365.63	0.00	365.63	111.44	3048.58	929.2



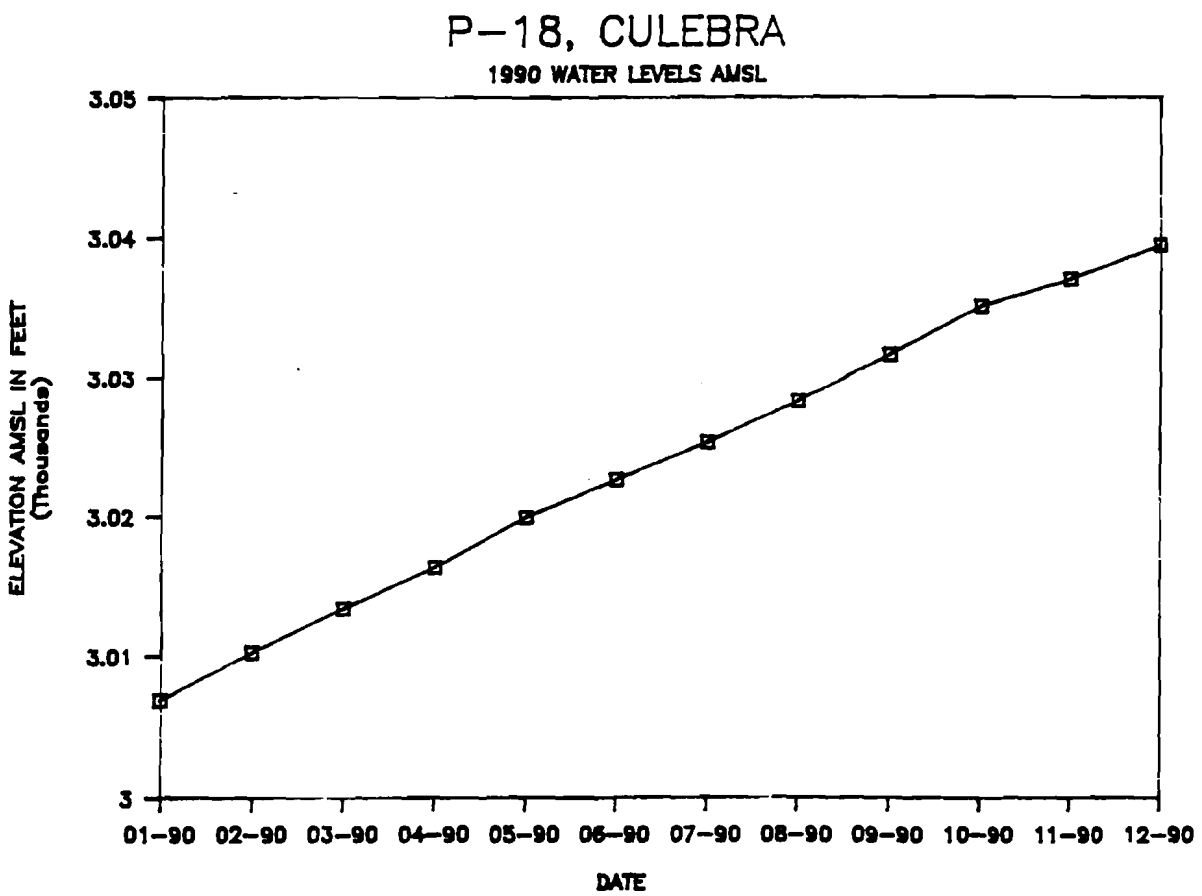
GROUND WATER-LEVELS
CALENDAR YEAR 1990
P-15, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL
P-15	CUL	3311.38	01-90	08:55	302.33	0.00	302.33	92.15	3009.05	917.1
P-15	CUL	3311.38	02-90	09:56	302.13	0.00	302.13	92.09	3009.25	917.2
P-15	CUL	3311.38	03-90	11:17	302.27	0.00	302.27	92.13	3009.11	917.1
P-15	CUL	3311.38	04-90	14:06	301.82	0.00	301.82	91.99	3009.56	917.3
P-15	CUL	3311.38	05-90	11:07	301.88	0.00	301.88	92.01	3009.50	917.3
P-15	CUL	3311.38	06-90	12:50	301.70	0.00	301.70	91.96	3009.68	917.3
P-15	CUL	3311.38	07-90	07:28	301.50	0.00	301.50	91.90	3009.88	917.4
P-15	CUL	3311.38	08-90	07:47	301.51	0.00	301.51	91.90	3009.87	917.4
P-15	CUL	3311.38	09-90	14:15	301.47	0.00	301.47	91.89	3009.91	917.4
P-15	CUL	3311.38	10-90	07:57	301.48	0.00	301.48	91.89	3009.90	917.4
P-15	CUL	3311.38	11-90	11:58	301.42	0.00	301.42	91.87	3009.96	917.4
P-15	CUL	3311.38	12-90	14:05	301.23	0.00	301.23	91.81	3010.15	917.4



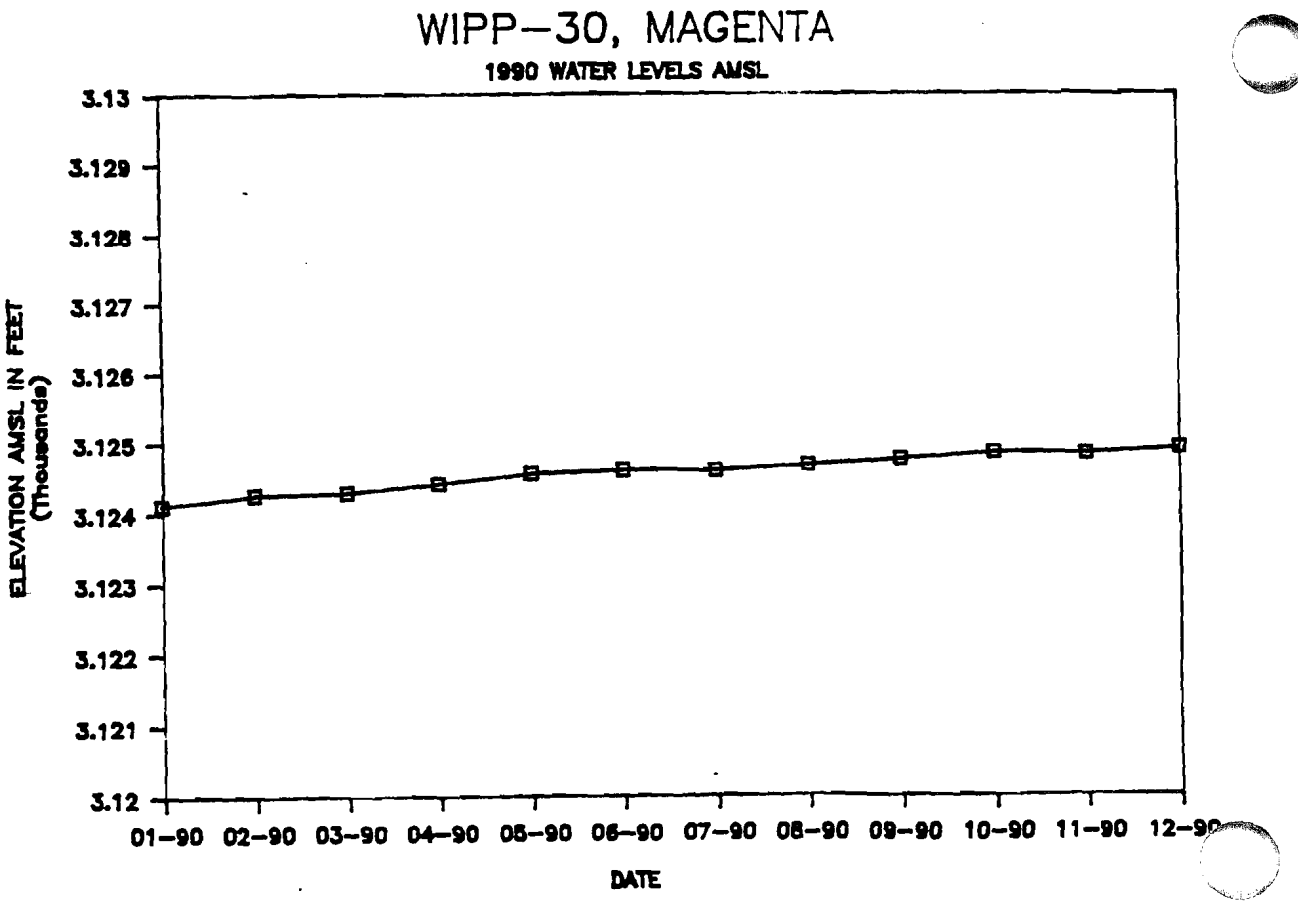
GROUND WATER-LEVELS
CALENDAR YEAR 1990
P-18, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL
P-18	CUL	3478.42	01-90	12:15	472.18	0.68	471.50	143.71	3006.92	916.5
P-18	CUL	3478.42	02-90	08:29	468.82	0.68	468.14	142.69	3010.28	917.5
P-18	CUL	3478.42	03-90	15:04	465.71	0.68	465.03	141.74	3013.39	918.4
P-18	CUL	3478.42	04-90	10:01	462.75	0.68	462.07	140.84	3016.35	919.3
P-18	CUL	3478.42	05-90	09:00	459.13	0.68	458.45	139.74	3019.97	920.4
P-18	CUL	3478.42	06-90	15:07	456.42	0.68	455.74	138.91	3022.68	921.3
P-18	CUL	3478.42	07-90	09:35	453.74	0.68	453.06	138.09	3025.36	922.1
P-18	CUL	3478.42	08-90	09:42	450.77	0.68	450.09	137.19	3028.33	923.0
P-18	CUL	3478.42	09-90	16:30	447.42	0.68	446.74	136.17	3031.68	924.0
P-18	CUL	3478.42	10-90	10:32	444.00	0.68	443.32	135.12	3035.10	925.1
P-18	CUL	3478.42	11-90	15:45	442.07	0.68	441.39	134.54	3037.03	925.6
P-18	CUL	3478.42	12-90	12:50	439.67	0.68	438.99	133.80	3039.43	926.4



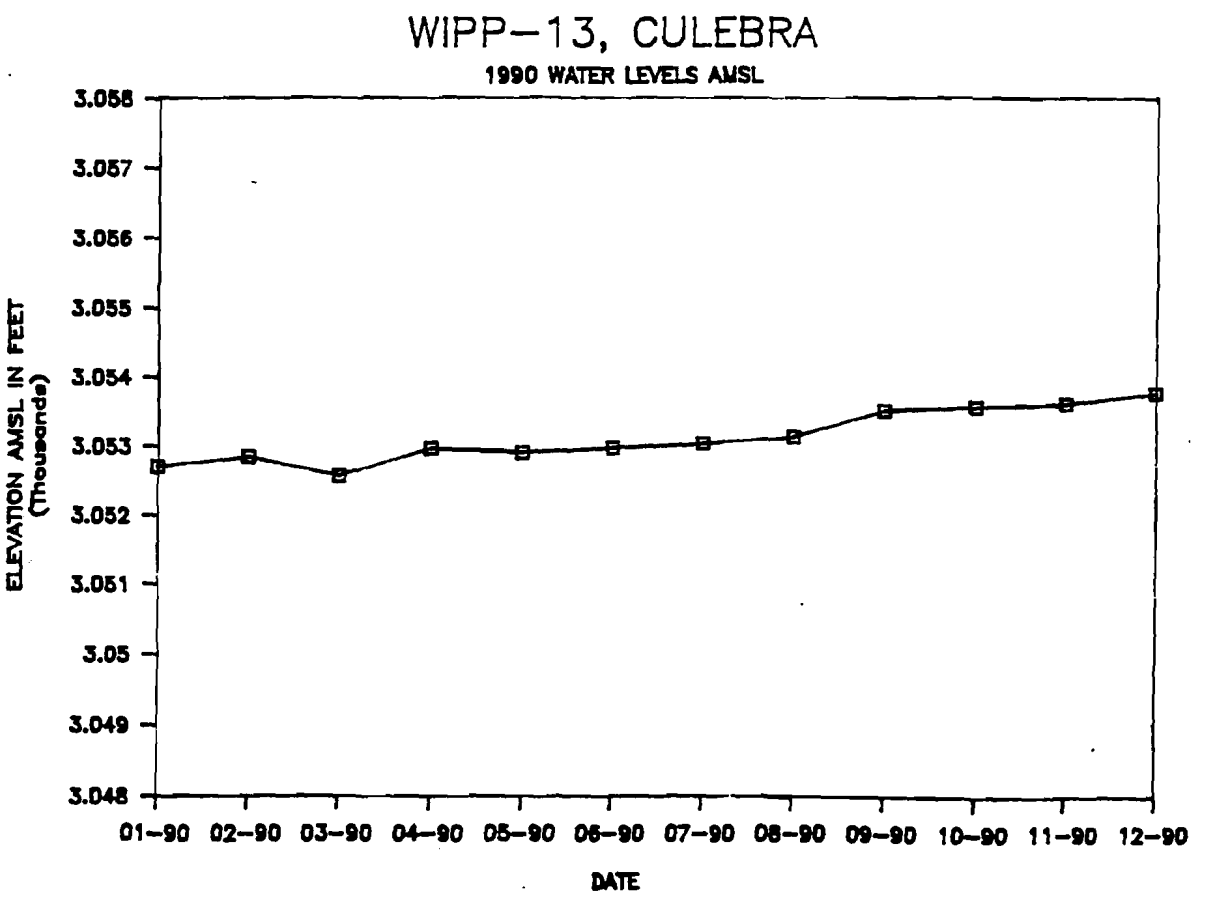
GROUND WATER-LEVELS
CALENDAR YEAR 1990
WIPP-30, MAGENTA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL_
WIPP-30 (ANNULUS)	MAG	3429.05	01-90	11:52	304.93	0.00	304.93	92.94	3124.12	952.23
WIPP-30 (ANNULUS)	MAG	3429.05	02-90	11:26	304.78	0.00	304.78	92.90	3124.27	952.28
WIPP-30 (ANNULUS)	MAG	3429.05	03-90	09:36	304.75	0.00	304.75	92.89	3124.30	952.29
WIPP-30 (ANNULUS)	MAG	3429.05	04-90	09:14	304.63	0.00	304.63	92.85	3124.42	952.32
WIPP-30 (ANNULUS)	MAG	3429.05	05-90	09:36	304.48	0.00	304.48	92.81	3124.57	952.37
WIPP-30 (ANNULUS)	MAG	3429.05	06-90	09:43	304.44	0.00	304.44	92.79	3124.61	952.38
WIPP-30 (ANNULUS)	MAG	3429.05	07-90	10:30	304.45	0.00	304.45	92.80	3124.60	952.38
WIPP-30 (ANNULUS)	MAG	3429.05	08-90	12:32	304.37	0.00	304.37	92.77	3124.68	952.40
WIPP-30 (ANNULUS)	MAG	3429.05	09-90	17:06	304.29	0.00	304.29	92.75	3124.76	952.43
WIPP-30 (ANNULUS)	MAG	3429.05	10-90	16:25	304.20	0.00	304.20	92.72	3124.85	952.45
WIPP-30 (ANNULUS)	MAG	3429.05	11-90	15:18	304.22	0.00	304.22	92.73	3124.83	952.45
WIPP-30 (ANNULUS)	MAG	3429.05	12-90	15:35	304.14	0.00	304.14	92.70	3124.91	952.47



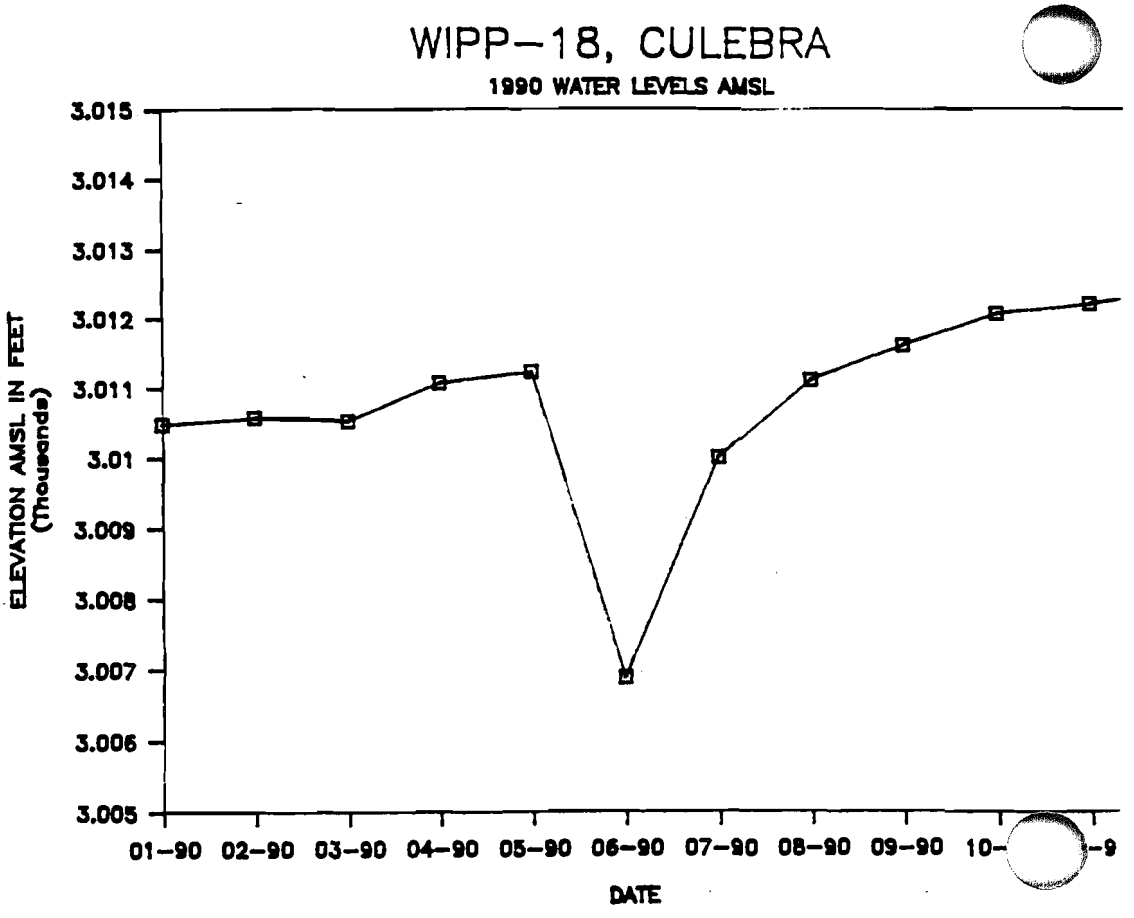
GROUND WATER-LEVELS
CALANDER YEAR 1990
WIPP-13, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL_
WIPP-13	CUL	3405.71	01-90	10:58	353.00	0.00	353.00	107.59	3052.71	930.47
WIPP-13	CUL	3405.71	02-90	14:56	352.85	0.00	352.85	107.55	3052.86	930.51
WIPP-13	CUL	3405.71	03-90	08:40	353.13	0.00	353.13	107.63	3052.58	930.43
WIPP-13	CUL	3405.71	04-90	12:33	352.73	0.00	352.73	107.51	3052.98	930.55
WIPP-13	CUL	3405.71	05-90	11:38	352.79	0.00	352.79	107.53	3052.92	930.53
WIPP-13	CUL	3405.71	06-90	09:36	352.72	0.00	352.72	107.51	3052.99	930.55
WIPP-13	CUL	3405.71	07-90	09:45	352.66	0.00	352.66	107.49	3053.05	930.57
WIPP-13	CUL	3405.71	08-90	11:57	352.56	0.00	352.56	107.46	3053.15	930.60
WIPP-13	CUL	3405.71	09-90	16:25	352.18	0.00	352.18	107.34	3053.53	930.72
WIPP-13	CUL	3405.71	10-90	15:30	352.12	0.00	352.12	107.33	3053.59	930.73
WIPP-13	CUL	3405.71	11-90	16:10	352.07	0.00	352.07	107.31	3053.64	930.75
WIPP-13	CUL	3405.71	12-90	14:43	351.92	0.00	351.92	107.27	3053.79	930.80



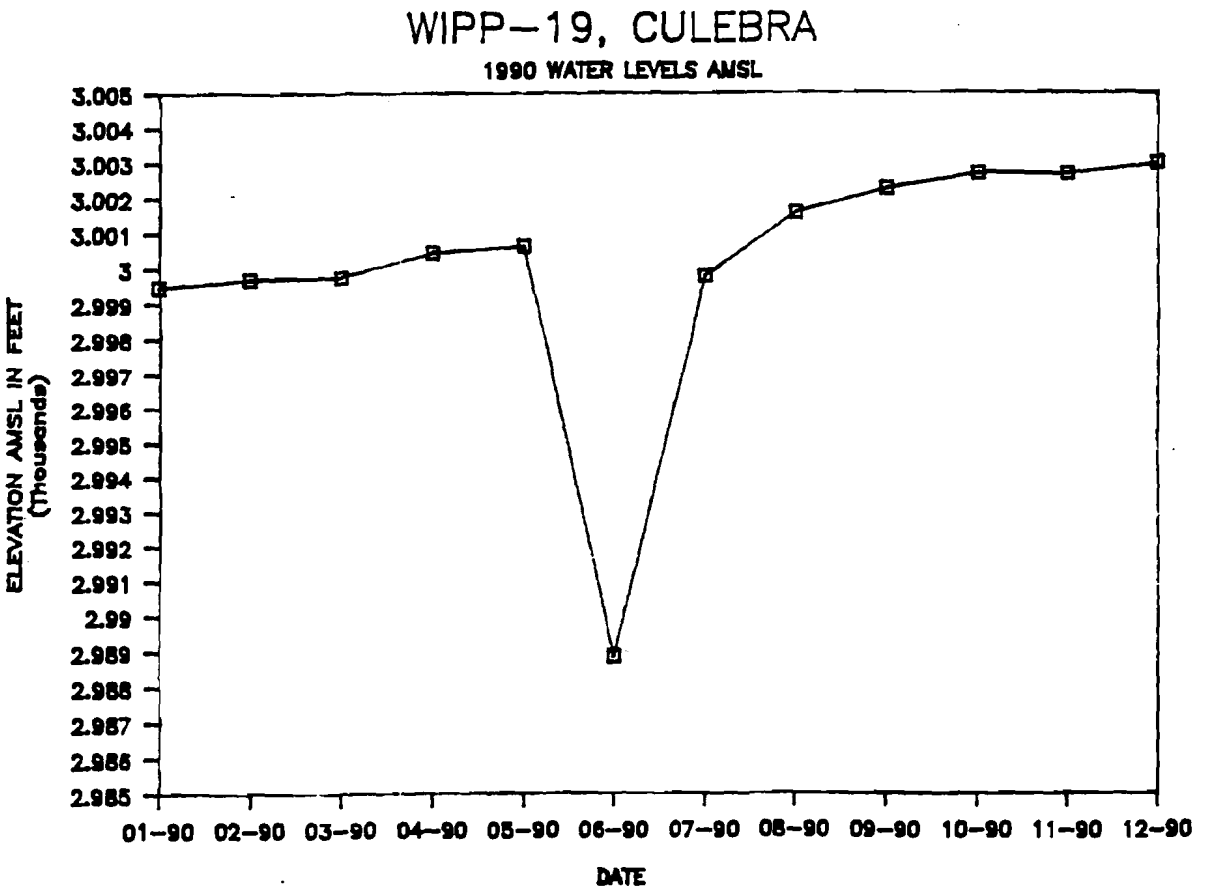
GROUND WATER-LEVELS
CALENDAR YEAR 1990
WIPP-18, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_
WIPP-18	CUL	3458.76	01-90	13:22	448.27	0.00	448.27	136.63	3C
WIPP-18	CUL	3458.76	02-90	13:20	448.17	0.00	448.17	136.60	3C
WIPP-18	CUL	3458.76	03-90	15:30	448.22	0.00	448.22	136.62	3C
WIPP-18	CUL	3458.76	04-90	16:00	447.67	0.00	447.67	136.45	3C
WIPP-18	CUL	3458.76	05-90	14:06	447.51	0.00	447.51	136.40	3C
WIPP-18	CUL	3458.76	06-90	07:41	451.88	0.00	451.88	137.73	3C
WIPP-18	CUL	3458.76	07-90	14:00	448.75	0.00	448.75	136.78	3C
WIPP-18	CUL	3458.76	08-90	12:45	447.63	0.00	447.63	136.44	3C
WIPP-18	CUL	3458.76	09-90	13:08	447.14	0.00	447.14	136.29	3C
WIPP-18	CUL	3458.76	10-90	11:15	446.69	0.00	446.69	136.15	3C
WIPP-18	CUL	3458.76	11-90	11:11	446.56	0.00	446.56	136.11	3C
WIPP-18	CUL	3458.76	12-90	10:00	446.35	0.00	446.35	136.05	3C



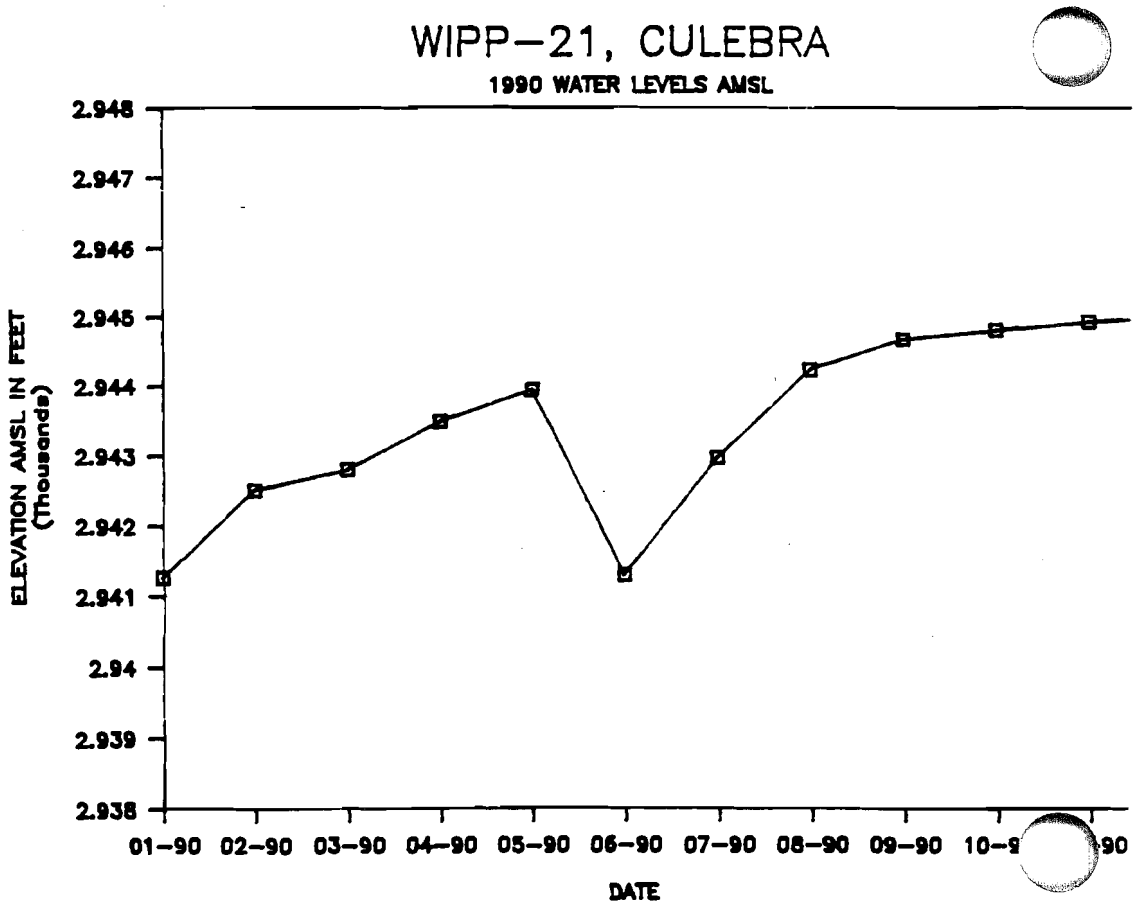
GROUND WATER-LEVELS
CALENDAR YEAR 1990
WIPP-19, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL_
WIPP-19	CUL	3435.14	01-90	13:12	435.65	0.00	435.65	132.79	2999.49	914.24
WIPP-19	CUL	3435.14	02-90	13:12	435.42	0.00	435.42	132.72	2999.72	914.31
WIPP-19	CUL	3435.14	03-90	15:22	435.37	0.00	435.37	132.70	2999.77	914.33
WIPP-19	CUL	3435.14	04-90	15:51	434.67	0.00	434.67	132.49	3000.47	914.54
WIPP-19	CUL	3435.14	05-90	13:53	434.48	0.00	434.48	132.43	3000.66	914.60
WIPP-19	CUL	3435.14	06-90	07:25	446.28	0.00	446.28	136.03	2988.86	911.00
WIPP-19	CUL	3435.14	07-90	13:50	435.33	0.00	435.33	132.69	2999.81	914.34
WIPP-19	CUL	3435.14	08-90	12:34	433.54	0.00	433.54	132.14	3001.60	914.89
WIPP-19	CUL	3435.14	09-90	13:01	432.86	0.00	432.86	131.94	3002.28	915.09
WIPP-19	CUL	3435.14	10-90	11:04	432.44	0.00	432.44	131.81	3002.70	915.22
WIPP-19	CUL	3435.14	11-90	11:05	432.44	0.00	432.44	131.81	3002.70	915.22
WIPP-19	CUL	3435.14	12-90	09:45	432.14	0.00	432.14	131.72	3003.00	915.31



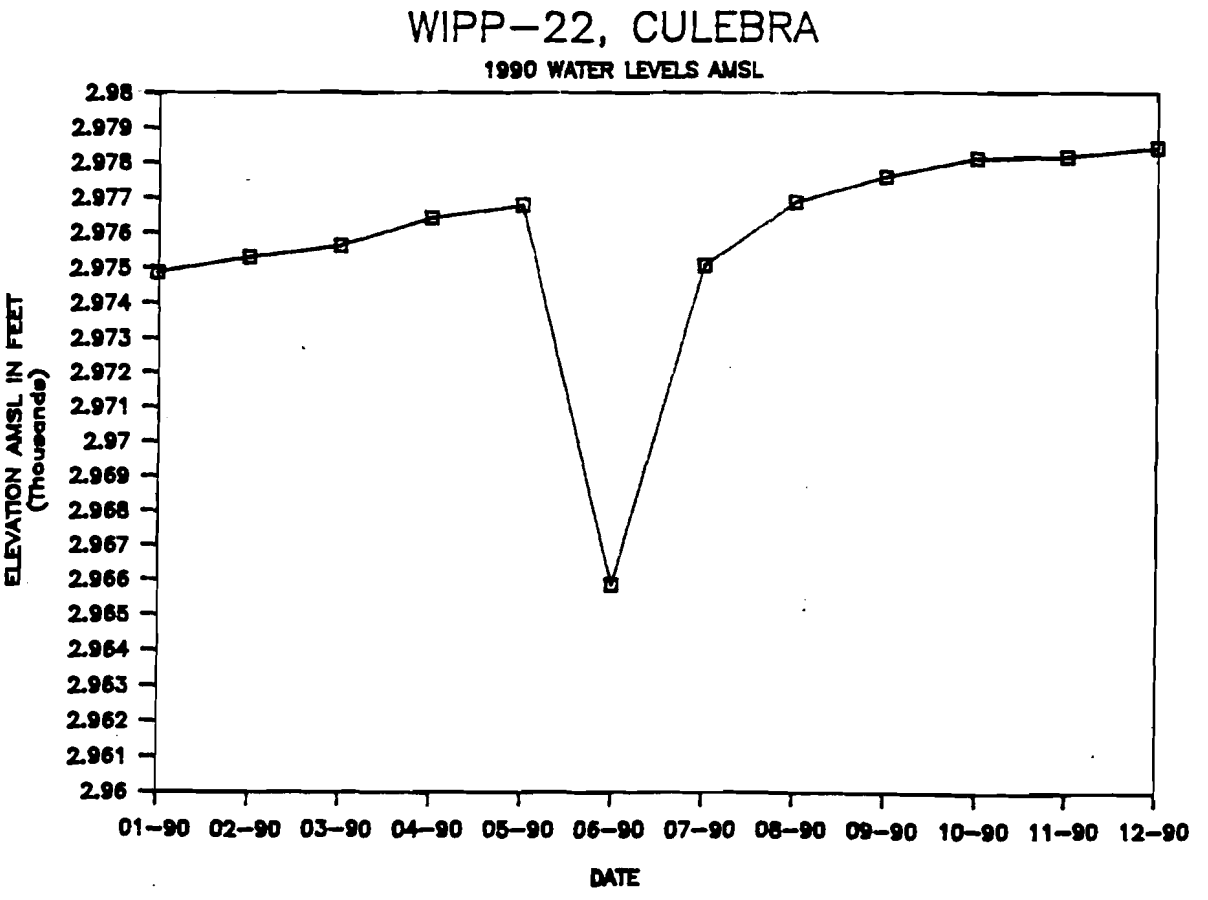
GROUND WATER-LEVELS
CALENDAR YEAR 1990
WIPP-21, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_
WIPP-21	CUL	3418.96	01-90	12:50	478.31	0.62	477.69	145.60	29
WIPP-21	CUL	3418.96	02-90	12:50	477.07	0.62	476.45	145.22	29
WIPP-21	CUL	3418.96	03-90	15:08	476.77	0.62	476.15	145.13	29
WIPP-21	CUL	3418.96	04-90	15:34	476.08	0.62	475.46	144.92	29
WIPP-21	CUL	3418.96	05-90	13:32	475.62	0.62	475.00	144.78	29
WIPP-21	CUL	3418.96	06-90	06:58	478.28	0.62	477.66	145.59	29
WIPP-21	CUL	3418.96	07-90	13:00	476.61	0.62	475.99	145.08	29
WIPP-21	CUL	3418.96	08-90	12:12	475.33	0.62	474.71	144.69	29
WIPP-21	CUL	3418.96	09-90	12:35	474.90	0.62	474.28	144.56	29
WIPP-21	CUL	3418.96	10-90	10:44	474.77	0.62	474.15	144.52	29
WIPP-21	CUL	3418.96	11-90	10:51	474.65	0.62	474.03	144.48	29
WIPP-21	CUL	3418.96	12-90	09:00	474.58	0.62	473.96	144.46	29



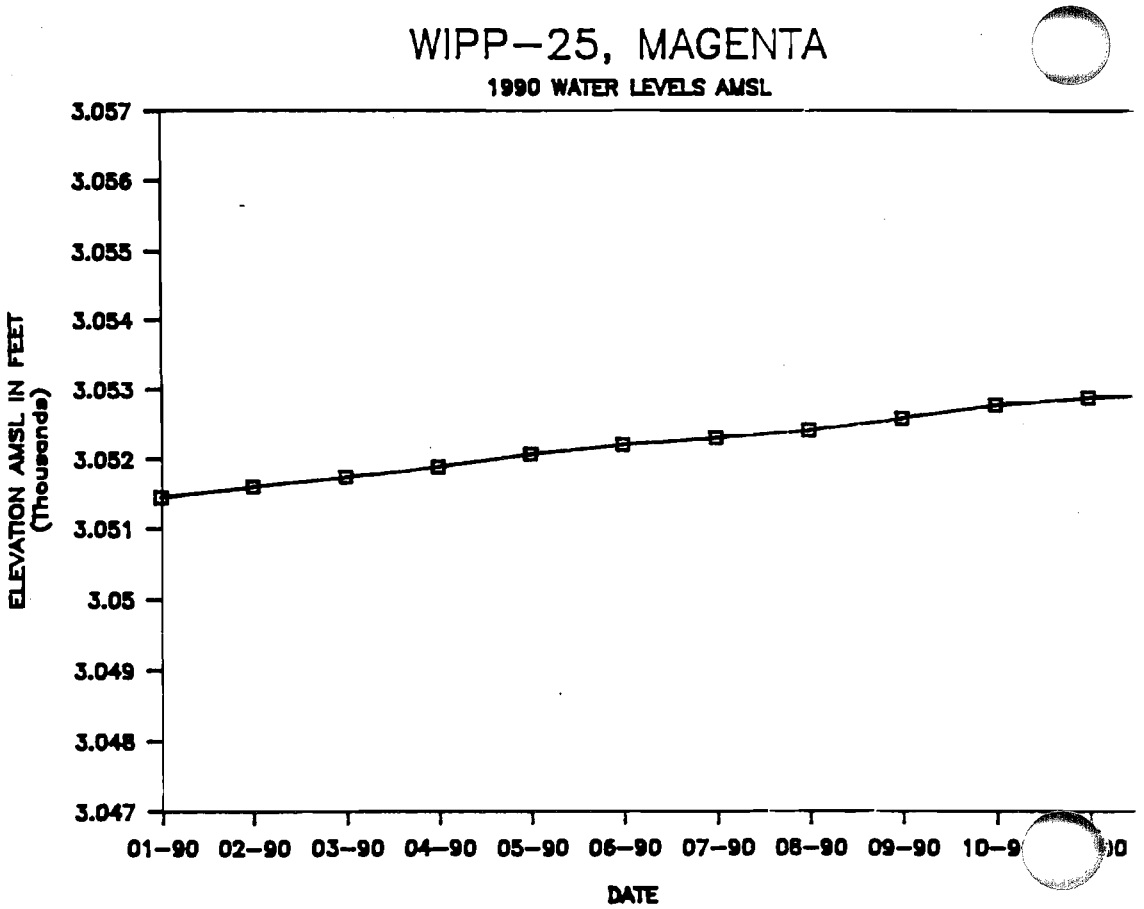
GROUND WATER-LEVELS
CALENDAR YEAR 1990
WIPP-22, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL_
WIPP-22	CUL	3428.12	01-90	12:25	453.23	0.00	453.23	138.14	2974.89	906.75
WIPP-22	CUL	3428.12	02-90	13:03	452.79	0.00	452.79	138.01	2975.33	906.88
WIPP-22	CUL	3428.12	03-90	15:15	452.48	0.00	452.48	137.92	2975.64	906.98
WIPP-22	CUL	3428.12	04-90	15:41	451.68	0.00	451.68	137.67	2976.44	907.22
WIPP-22	CUL	3428.12	05-90	13:44	451.33	0.00	451.33	137.57	2976.79	907.33
WIPP-22	CUL	3428.12	06-90	07:15	462.27	0.00	462.27	140.90	2965.85	903.99
WIPP-22	CUL	3428.12	07-90	13:20	453.04	0.00	453.04	138.09	2975.08	906.80
WIPP-22	CUL	3428.12	08-90	12:20	451.24	0.00	451.24	137.54	2976.88	907.35
WIPP-22	CUL	3428.12	09-90	12:45	450.53	0.00	450.53	137.32	2977.59	907.57
WIPP-22	CUL	3428.12	10-90	10:55	450.00	0.00	450.00	137.16	2978.12	907.73
WIPP-22	CUL	3428.12	11-90	10:59	449.93	0.00	449.93	137.14	2978.19	907.75
WIPP-22	CUL	3428.12	12-90	09:17	449.67	0.00	449.67	137.06	2978.45	907.83



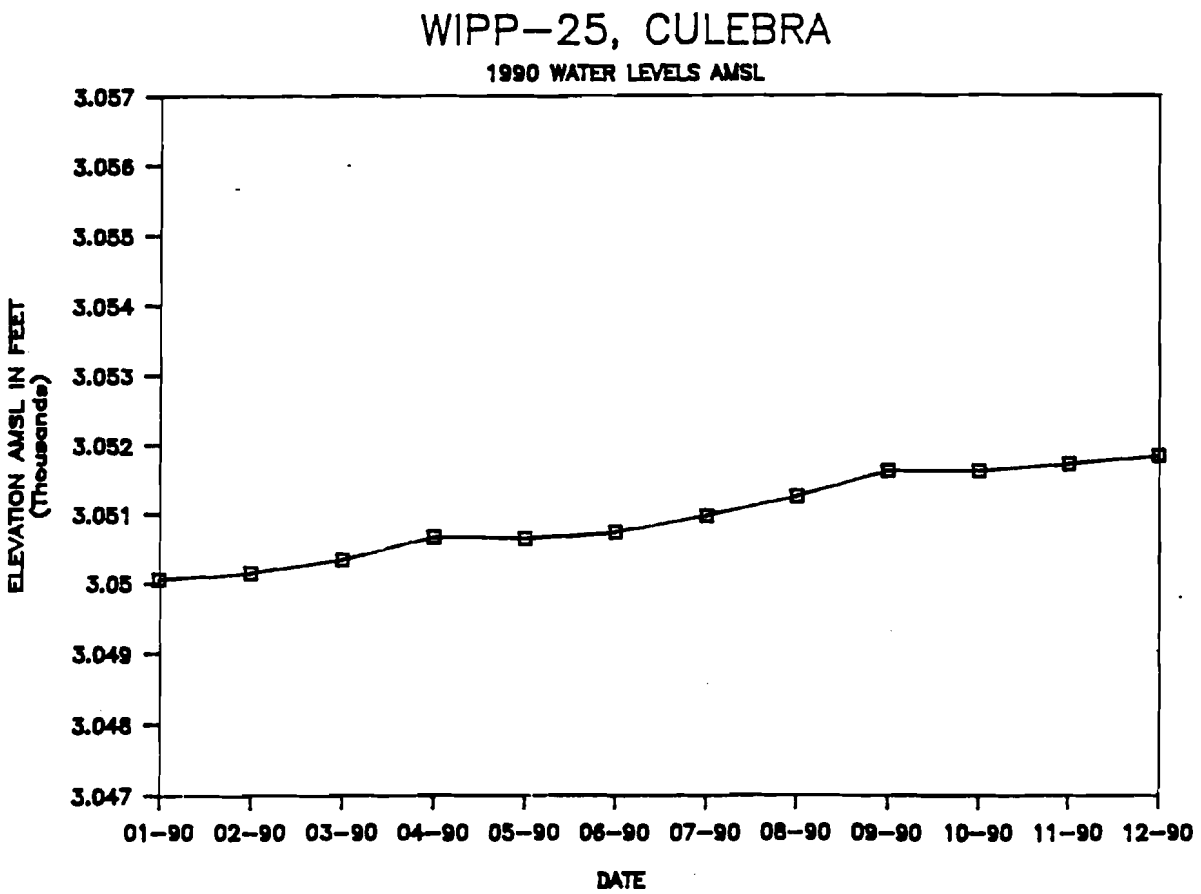
GROUND WATER-LEVELS
CALENDAR YEAR 1990
WIPP-25, MAGENTA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_
WIPP-25 (ANNULUS)	MAG	3214.39	01-90	13:15	162.94	0.00	162.94	49.66	3C
WIPP-25 (ANNULUS)	MAG	3214.39	02-90	11:13	162.79	0.00	162.79	49.62	3C
WIPP-25 (ANNULUS)	MAG	3214.39	03-90	12:10	162.65	0.00	162.65	49.58	3C
WIPP-25 (ANNULUS)	MAG	3214.39	04-90	09:55	162.51	0.00	162.51	49.53	3C
WIPP-25 (ANNULUS)	MAG	3214.39	05-90	10:06	162.32	0.00	162.32	49.48	3C
WIPP-25 (ANNULUS)	MAG	3214.39	06-90	09:14	162.18	0.00	162.18	49.43	3C
WIPP-25 (ANNULUS)	MAG	3214.39	07-90	12:55	162.08	0.00	162.08	49.40	30
WIPP-25 (ANNULUS)	MAG	3214.39	08-90	13:20	161.97	0.00	161.97	49.37	30
WIPP-25 (ANNULUS)	MAG	3214.39	09-90	17:48	161.80	0.00	161.80	49.32	30
WIPP-25 (ANNULUS)	MAG	3214.39	10-90	07:06	161.61	0.00	161.61	49.26	30
WIPP-25 (ANNULUS)	MAG	3214.39	11-90	16:50	161.50	0.00	161.50	49.23	30
WIPP-25 (ANNULUS)	MAG	3214.39	12-90	16:05	161.43	0.00	161.43	49.20	3C



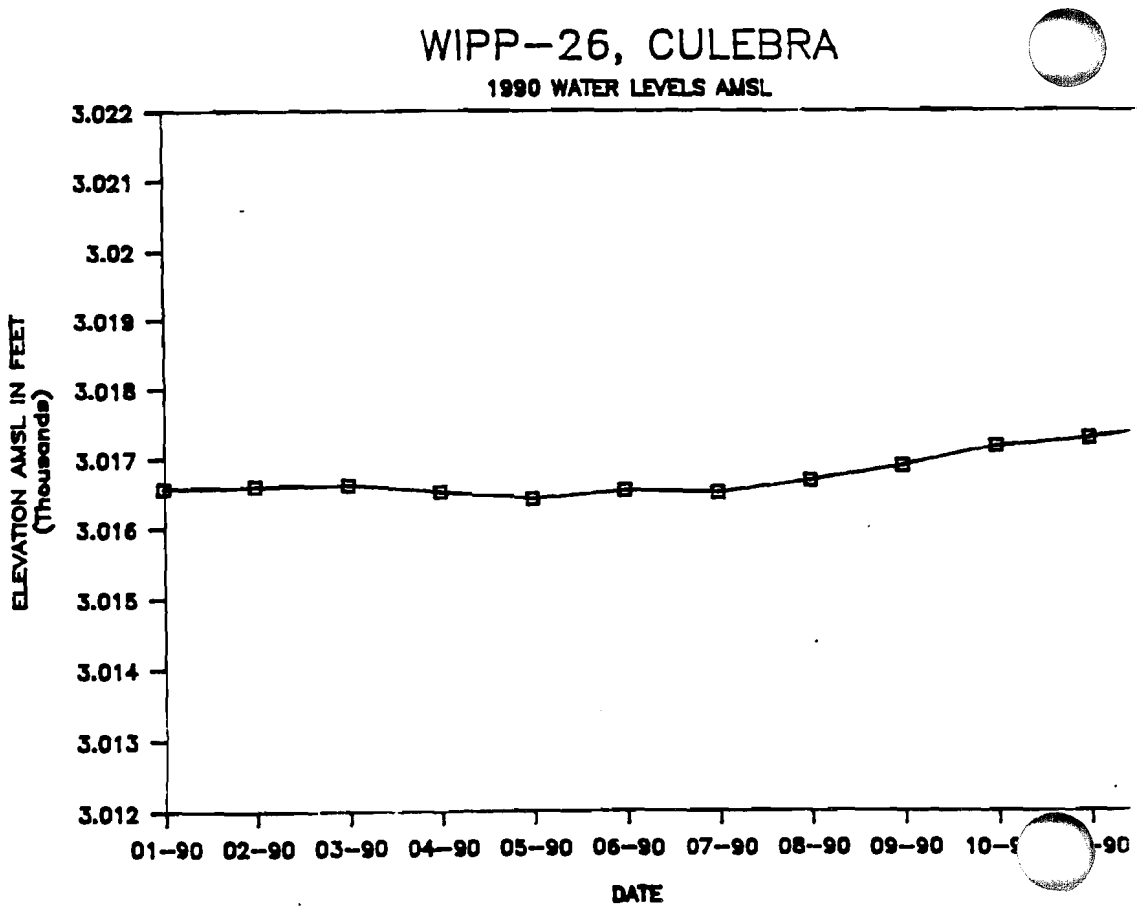
GROUND WATER-LEVELS
CALENDAR YEAR 1990
WIPP-25, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL_M
WIPP-25 (PIP)	CUL	3214.39	01-90	13:10	164.75	0.42	164.33	50.09	3050.06	929.66
WIPP-25 (PIP)	CUL	3214.39	02-90	11:05	164.65	0.42	164.23	50.06	3050.16	929.69
WIPP-25 (PIP)	CUL	3214.39	03-90	12:05	164.46	0.42	164.04	50.00	3050.35	929.75
WIPP-25 (PIP)	CUL	3214.39	04-90	09:51	164.13	0.42	163.71	49.90	3050.68	929.85
WIPP-25 (PIP)	CUL	3214.39	05-90	10:03	164.15	0.42	163.73	49.90	3050.66	929.84
WIPP-25 (PIP)	CUL	3214.39	06-90	09:11	164.07	0.42	163.65	49.88	3050.74	929.87
WIPP-25 (PIP)	CUL	3214.39	07-90	12:50	163.83	0.42	163.41	49.81	3050.98	929.94
WIPP-25 (PIP)	CUL	3214.39	08-90	13:18	163.55	0.42	163.13	49.72	3051.26	930.02
WIPP-25 (PIP)	CUL	3214.39	09-90	17:45	163.18	0.42	162.76	49.61	3051.63	930.14
WIPP-25 (PIP)	CUL	3214.39	10-90	07:00	163.18	0.42	162.76	49.61	3051.63	930.14
WIPP-25 (PIP)	CUL	3214.39	11-90	16:45	163.08	0.42	162.66	49.58	3051.73	930.17
WIPP-25 (PIP)	CUL	3214.39	12-90	16:00	162.97	0.42	162.55	49.55	3051.84	930.20



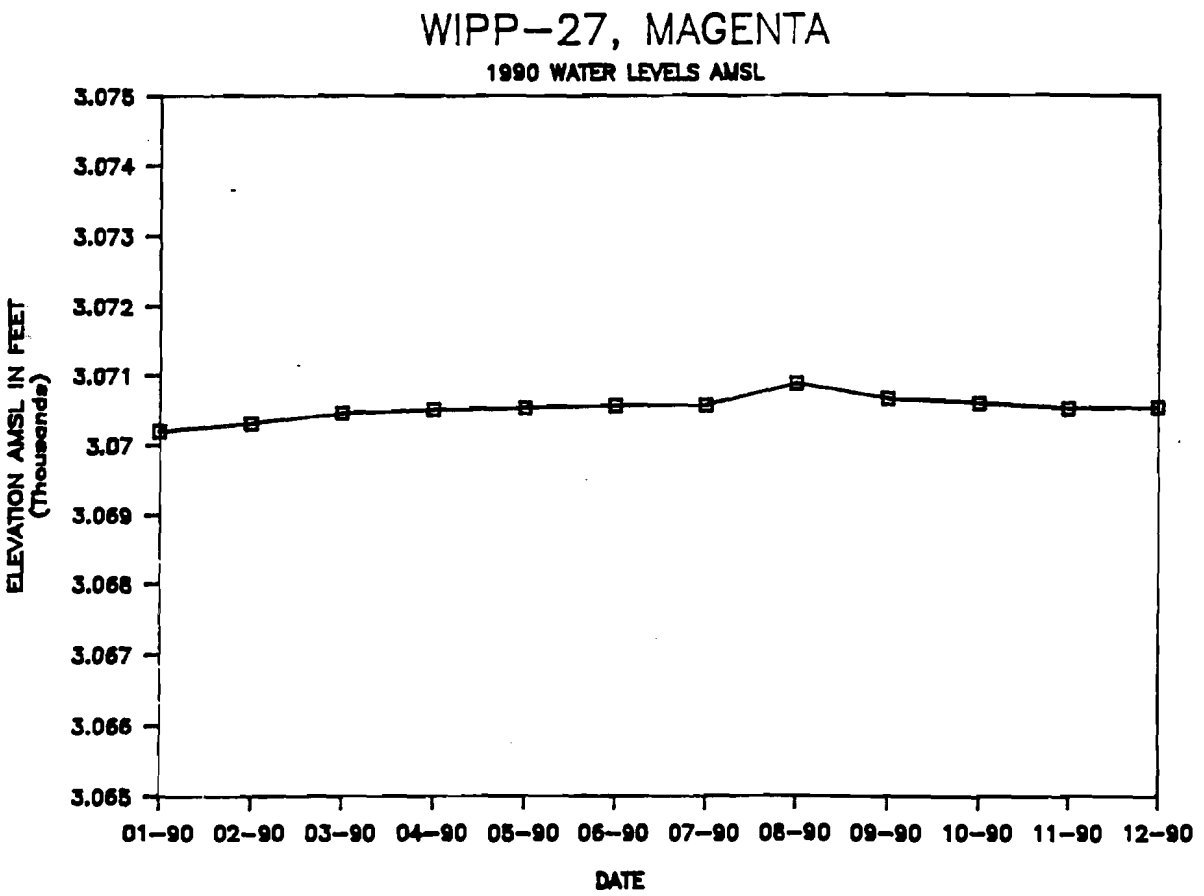
GROUND WATER-LEVELS
CALENDAR YEAR 1990
WIPP-26, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_
WIPP-26	CUL	3153.20	01-90	08:04	136.63	0.00	136.63	41.64	30
WIPP-26	CUL	3153.20	02-90	15:15	136.60	0.00	136.60	41.64	30
WIPP-26	CUL	3153.20	03-90	07:15	136.57	0.00	136.57	41.63	30
WIPP-26	CUL	3153.20	04-90	06:48	136.68	0.00	136.68	41.66	30
WIPP-26	CUL	3153.20	05-90	06:22	136.78	0.00	136.78	41.69	30
WIPP-26	CUL	3153.20	06-90	14:32	136.65	0.00	136.65	41.65	30
WIPP-26	CUL	3153.20	07-90	06:30	136.69	0.00	136.69	41.66	30
WIPP-26	CUL	3153.20	08-90	06:40	136.51	0.00	136.51	41.61	30
WIPP-26	CUL	3153.20	09-90	11:05	136.30	0.00	136.30	41.54	30
WIPP-26	CUL	3153.20	10-90	07:34	136.02	0.00	136.02	41.46	30
WIPP-26	CUL	3153.20	11-90	07:36	135.90	0.00	135.90	41.42	30
WIPP-26	CUL	3153.20	12-90	06:52	135.72	0.00	135.72	41.37	30



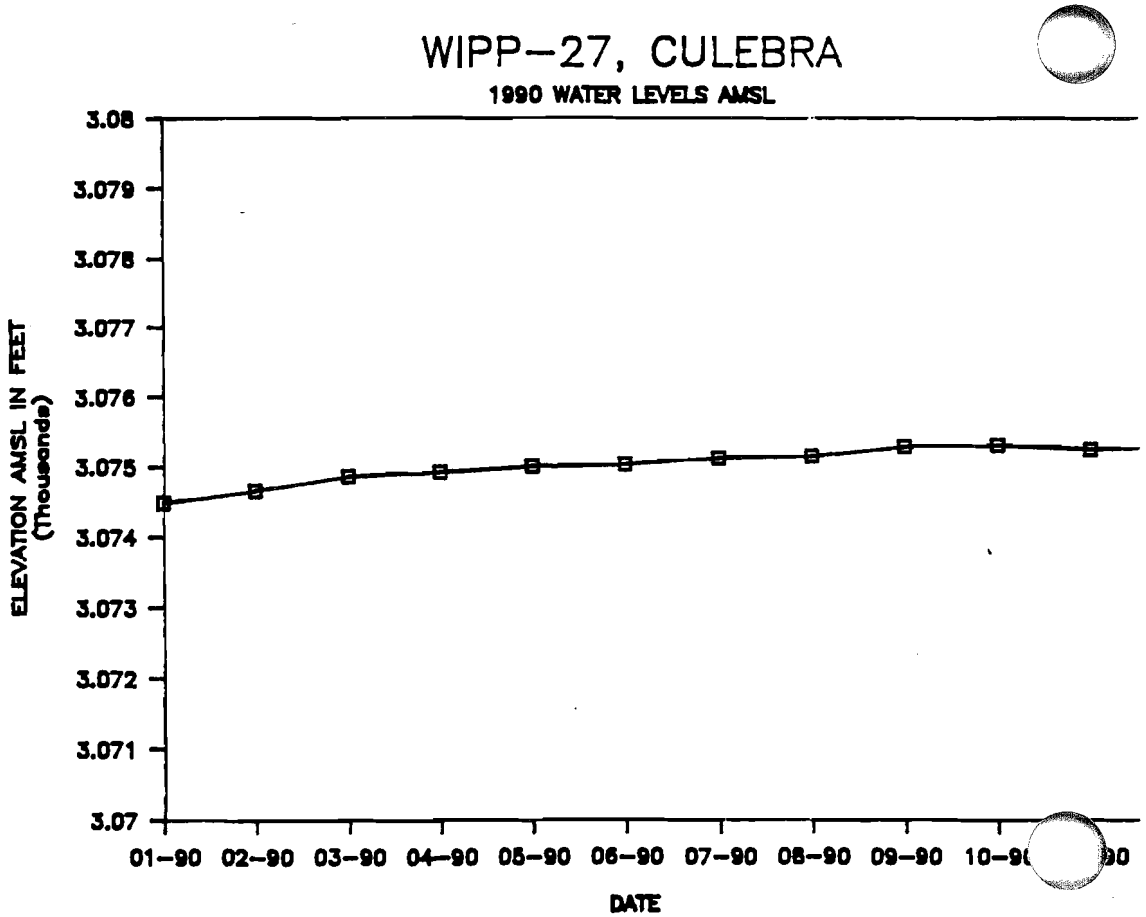
GROUND WATER-LEVELS
CALENDAR YEAR 1990
WIPP-27, MAGENTA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL_
WIPP-27 (ANNULUS)	MAG	3178.98	01-90	07:50	108.78	0.00	108.78	33.16	3070.20	935.80
WIPP-27 (ANNULUS)	MAG	3178.98	02-90	07:26	108.66	0.00	108.66	33.12	3070.32	935.83
WIPP-27 (ANNULUS)	MAG	3178.98	03-90	06:40	108.51	0.00	108.51	33.07	3070.47	935.88
WIPP-27 (ANNULUS)	MAG	3178.98	04-90	06:26	108.46	0.00	108.46	33.06	3070.52	935.89
WIPP-27 (ANNULUS)	MAG	3178.98	05-90	05:55	108.43	0.00	108.43	33.05	3070.55	935.90
WIPP-27 (ANNULUS)	MAG	3178.98	06-90	06:16	108.40	0.00	108.40	33.04	3070.58	935.91
WIPP-27 (ANNULUS)	MAG	3178.98	07-90	12:05	108.40	0.00	108.40	33.04	3070.58	935.91
WIPP-27 (ANNULUS)	MAG	3178.98	08-90	06:13	108.09	0.00	108.09	32.95	3070.89	936.01
WIPP-27 (ANNULUS)	MAG	3178.98	09-90	06:36	108.31	0.00	108.31	33.01	3070.67	935.94
WIPP-27 (ANNULUS)	MAG	3178.98	10-90	06:55	108.38	0.00	108.38	33.03	3070.60	935.92
WIPP-27 (ANNULUS)	MAG	3178.98	11-90	06:54	108.45	0.00	108.45	33.06	3070.53	935.90
WIPP-27 (ANNULUS)	MAG	3178.98	12-90	06:40	108.44	0.00	108.44	33.05	3070.54	935.90



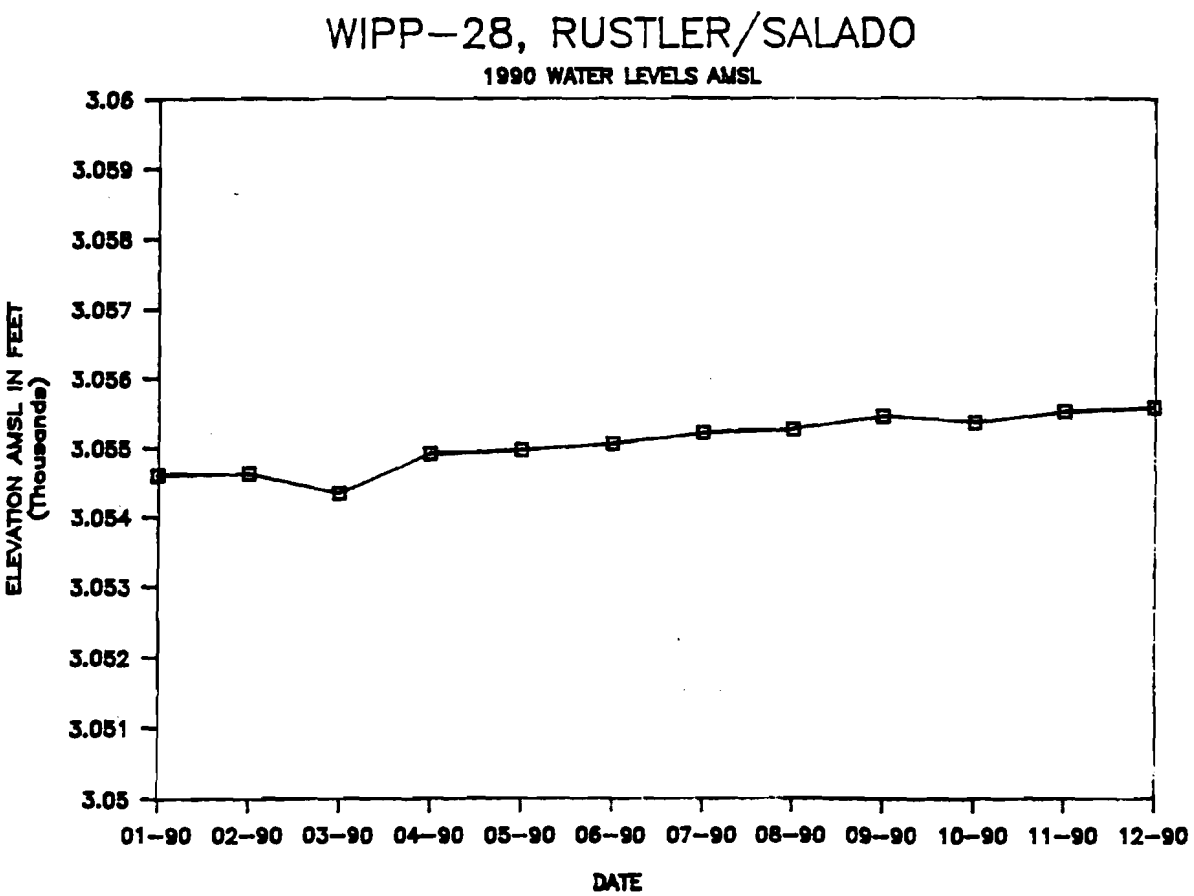
GROUND WATER-LEVELS
CALENDAR YEAR 1990
WIPP-27, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_
WIPP-27 (PIP)	CUL	3178.98	01-90	07:40	104.91	0.42	104.49	31.85	30
WIPP-27 (PIP)	CUL	3178.98	02-90	07:16	104.74	0.42	104.32	31.80	30
WIPP-27 (PIP)	CUL	3178.98	03-90	06:35	104.53	0.42	104.11	31.73	30
WIPP-27 (PIP)	CUL	3178.98	04-90	06:20	104.47	0.42	104.05	31.71	30
WIPP-27 (PIP)	CUL	3178.98	05-90	05:53	104.39	0.42	103.97	31.69	30
WIPP-27 (PIP)	CUL	3178.98	06-90	06:00	104.36	0.42	103.94	31.68	30
WIPP-27 (PIP)	CUL	3178.98	07-90	12:00	104.27	0.42	103.85	31.65	30
WIPP-27 (PIP)	CUL	3178.98	08-90	06:10	104.24	0.42	103.82	31.64	30
WIPP-27 (PIP)	CUL	3178.98	09-90	06:30	104.10	0.42	103.68	31.60	30
WIPP-27 (PIP)	CUL	3178.98	10-90	06:50	104.08	0.42	103.66	31.60	30
WIPP-27 (PIP)	CUL	3178.98	11-90	06:50	104.14	0.42	103.72	31.61	30
WIPP-27 (PIP)	CUL	3178.98	12-90	06:35	104.11	0.42	103.69	31.60	30



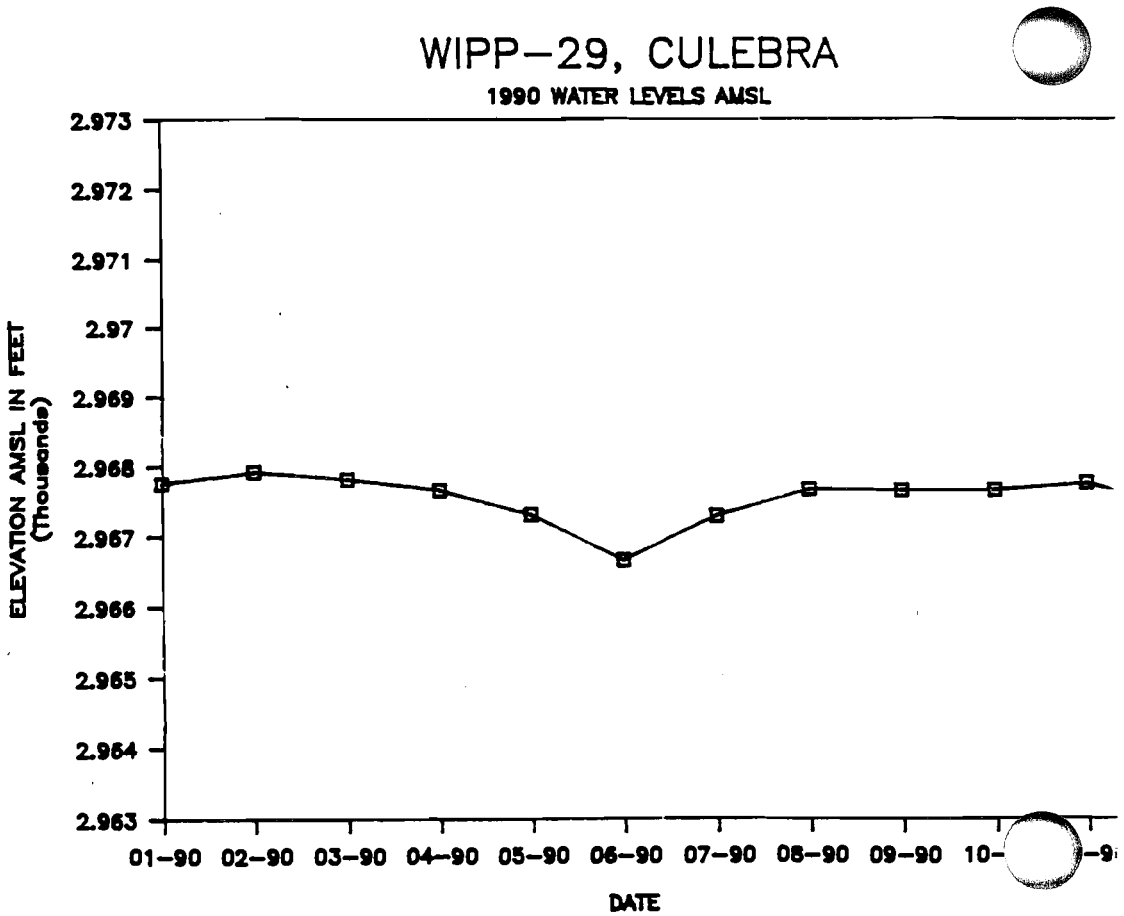
GROUND WATER-LEVELS
CALENDAR YEAR 1990
WIPP-28 RUSTLER/SALADO

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL_
WIPP-28 (PIP)	RUS/SAL	3349.21	01-90	08:57	295.02	0.42	294.60	89.79	3054.61	931.05
WIPP-28 (PIP)	RUS/SAL	3349.21	02-90	08:36	294.99	0.42	294.57	89.78	3054.64	931.05
WIPP-28 (PIP)	RUS/SAL	3349.21	03-90	07:35	295.28	0.42	294.86	89.87	3054.35	930.97
WIPP-28 (PIP)	RUS/SAL	3349.21	04-90	07:20	294.71	0.42	294.29	89.70	3054.92	931.14
WIPP-28 (PIP)	RUS/SAL	3349.21	05-90	06:42	294.65	0.42	294.23	89.68	3054.98	931.16
WIPP-28 (PIP)	RUS/SAL	3349.21	06-90	07:09	294.56	0.42	294.14	89.65	3055.07	931.19
WIPP-28 (PIP)	RUS/SAL	3349.21	07-90	11:10	294.40	0.42	293.98	89.61	3055.23	931.23
WIPP-28 (PIP)	RUS/SAL	3349.21	08-90	07:00	294.35	0.42	293.93	89.59	3055.28	931.25
WIPP-28 (PIP)	RUS/SAL	3349.21	09-90	07:45	294.17	0.42	293.75	89.54	3055.46	931.30
WIPP-28 (PIP)	RUS/SAL	3349.21	10-90	08:00	294.26	0.42	293.84	89.56	3055.37	931.28
WIPP-28 (PIP)	RUS/SAL	3349.21	11-90	08:20	294.10	0.42	293.68	89.51	3055.53	931.33
WIPP-28 (PIP)	RUS/SAL	3349.21	12-90	07:35	294.05	0.42	293.63	89.50	3055.58	931.34



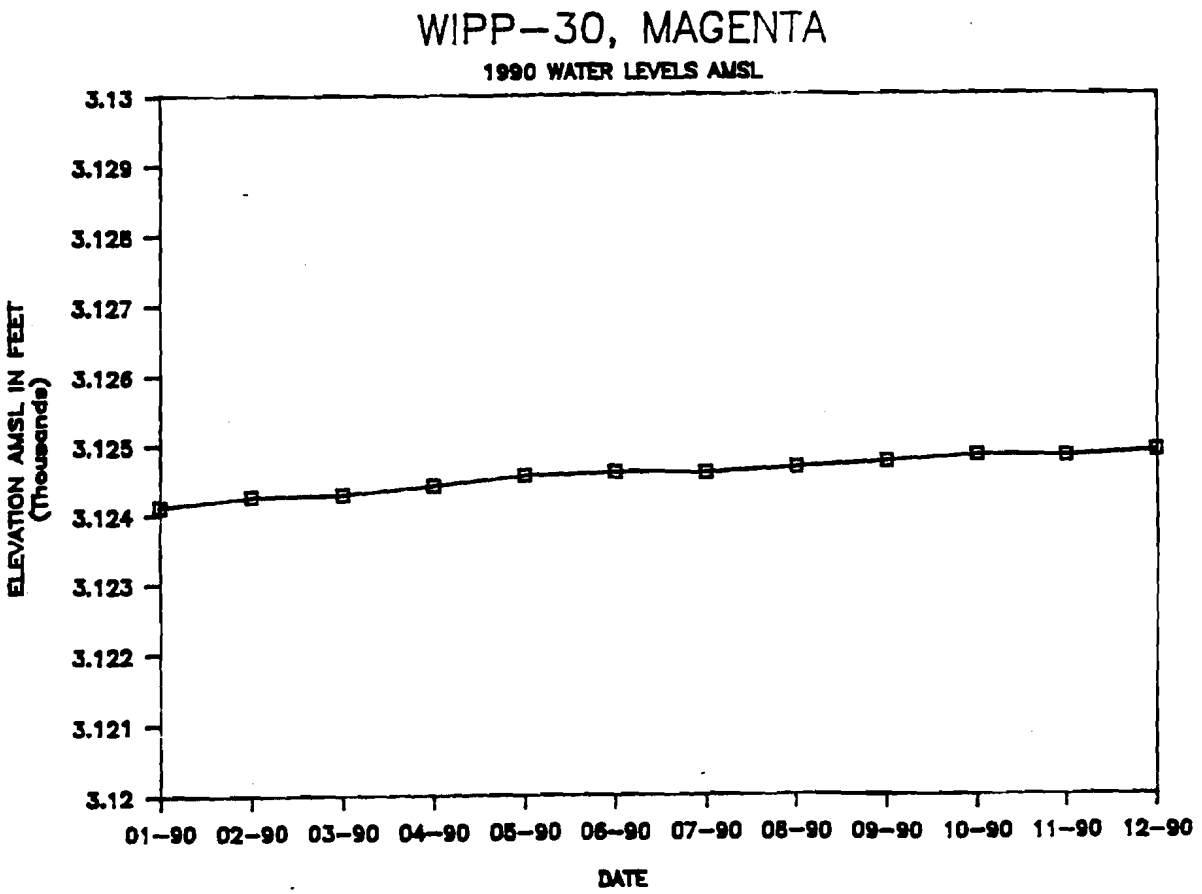
GROUND WATER-LEVELS
CALENDAR YEAR 1990
WIPP-29, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_
WIPP-29	CUL	2978.26	01-90	15:47	10.50	0.00	10.50	3.20	29
WIPP-29	CUL	2978.26	02-90	06:55	10.33	0.00	10.33	3.15	29
WIPP-29	CUL	2978.26	03-90	06:36	10.44	0.00	10.44	3.18	29
WIPP-29	CUL	2978.26	04-90	06:03	10.60	0.00	10.60	3.23	29
WIPP-29	CUL	2978.26	05-90	05:45	10.95	0.00	10.95	3.34	29
WIPP-29	CUL	2978.26	06-90	14:00	11.59	0.00	11.59	3.53	29
WIPP-29	CUL	2978.26	07-90	06:15	10.96	0.00	10.96	3.34	29
WIPP-29	CUL	2978.26	08-90	06:04	10.59	0.00	10.59	3.23	29
WIPP-29	CUL	2978.26	09-90	10:17	10.60	0.00	10.60	3.23	29
WIPP-29	CUL	2978.26	10-90	06:33	10.60	0.00	10.60	3.23	29
WIPP-29	CUL	2978.26	11-90	06:45	10.50	0.00	10.50	3.20	29
WIPP-29	CUL	2978.26	12-90	06:20	10.86	0.00	10.86	3.31	29



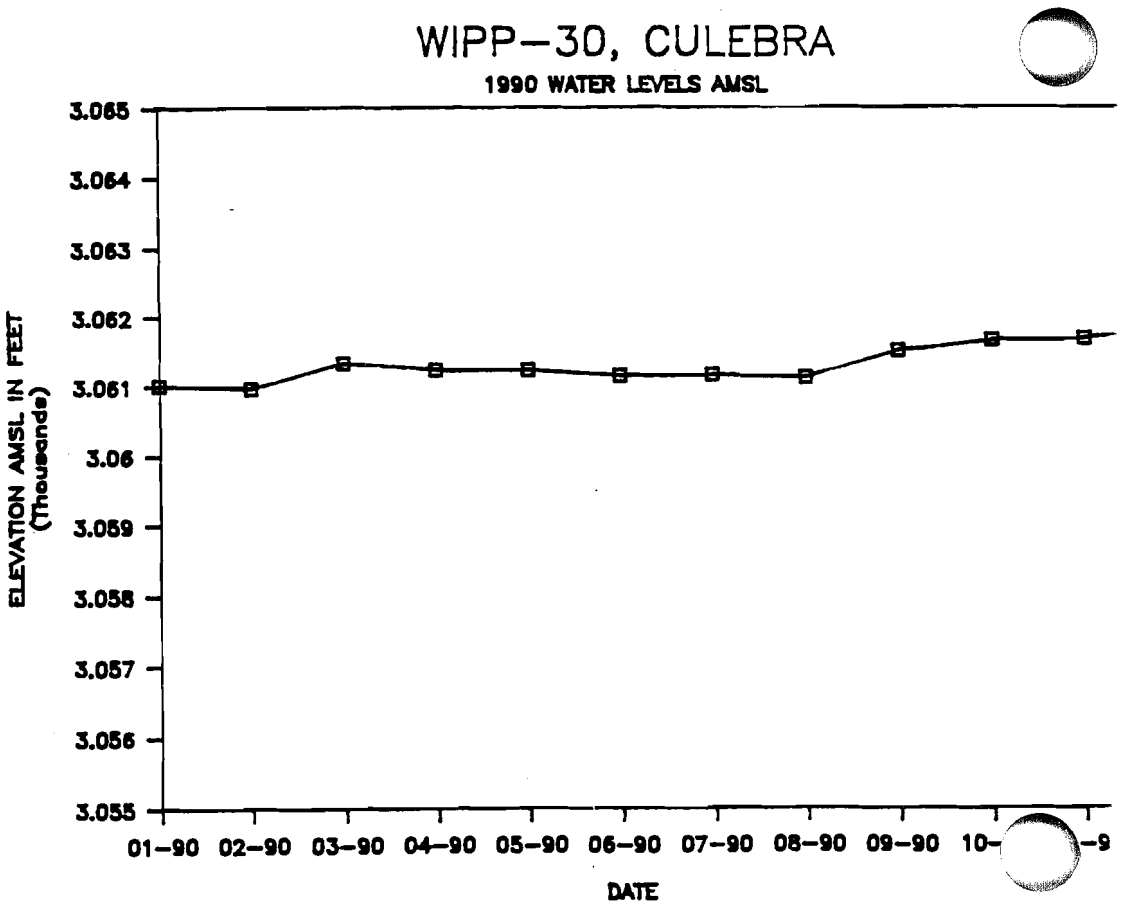
GROUND WATER-LEVELS
CALENDAR YEAR 1990
WIPP-30, MAGENTA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_MSL_FT	WL_MSL_
WIPP-30 (ANNULUS)	MAG	3429.05	01-90	11:52	304.93	0.00	304.93	92.94	3124.12	952.2
WIPP-30 (ANNULUS)	MAG	3429.05	02-90	11:26	304.78	0.00	304.78	92.90	3124.27	952.2
WIPP-30 (ANNULUS)	MAG	3429.05	03-90	09:36	304.75	0.00	304.75	92.89	3124.30	952.2
WIPP-30 (ANNULUS)	MAG	3429.05	04-90	09:14	304.63	0.00	304.63	92.85	3124.42	952.3
WIPP-30 (ANNULUS)	MAG	3429.05	05-90	09:36	304.48	0.00	304.48	92.81	3124.57	952.3
WIPP-30 (ANNULUS)	MAG	3429.05	06-90	09:43	304.44	0.00	304.44	92.79	3124.61	952.3
WIPP-30 (ANNULUS)	MAG	3429.05	07-90	10:30	304.45	0.00	304.45	92.80	3124.60	952.3
WIPP-30 (ANNULUS)	MAG	3429.05	08-90	12:32	304.37	0.00	304.37	92.77	3124.68	952.4
WIPP-30 (ANNULUS)	MAG	3429.05	09-90	17:06	304.29	0.00	304.29	92.75	3124.76	952.4
WIPP-30 (ANNULUS)	MAG	3429.05	10-90	16:25	304.20	0.00	304.20	92.72	3124.85	952.4
WIPP-30 (ANNULUS)	MAG	3429.05	11-90	15:18	304.22	0.00	304.22	92.73	3124.83	952.4
WIPP-30 (ANNULUS)	MAG	3429.05	12-90	15:35	304.14	0.00	304.14	92.70	3124.91	952.4



GROUND WATER-LEVELS
CALENDAR YEAR 1990
WIPP-30, CULEBRA

WELL_NO	ZONE	TOC_AMSL	DATE	TIME	TP_FT_TOC	ADJ_FT	WL_FT	WL_METERS	WL_
WIPP-30 (PIP)	CUL	3429.05	01-90	11:47	369.23	1.20	368.03	112.18	30
WIPP-30 (PIP)	CUL	3429.05	02-90	10:20	369.27	1.20	368.07	112.19	30
WIPP-30 (PIP)	CUL	3429.05	03-90	11:18	368.91	1.20	367.71	112.08	30
WIPP-30 (PIP)	CUL	3429.05	04-90	09:04	369.01	1.20	367.81	112.11	30
WIPP-30 (PIP)	CUL	3429.05	05-90	09:33	369.01	1.20	367.81	112.11	30
WIPP-30 (PIP)	CUL	3429.05	06-90	08:34	369.10	1.20	367.90	112.14	30
WIPP-30 (PIP)	CUL	3429.05	07-90	10:25	369.08	1.20	367.88	112.13	30
WIPP-30 (PIP)	CUL	3429.05	08-90	12:27	369.12	1.20	367.92	112.14	30
WIPP-30 (PIP)	CUL	3429.05	09-90	16:56	368.74	1.20	367.54	112.03	30
WIPP-30 (PIP)	CUL	3429.05	10-90	16:20	368.59	1.20	367.39	111.98	30
WIPP-30 (PIP)	CUL	3429.05	11-90	15:21	368.57	1.20	367.37	111.97	30
WIPP-30 (PIP)	CUL	3429.05	12-90	15:20	368.38	1.20	367.18	111.92	30



APPENDIX XI
HISTORICAL GROUNDWATER LEVEL DATA

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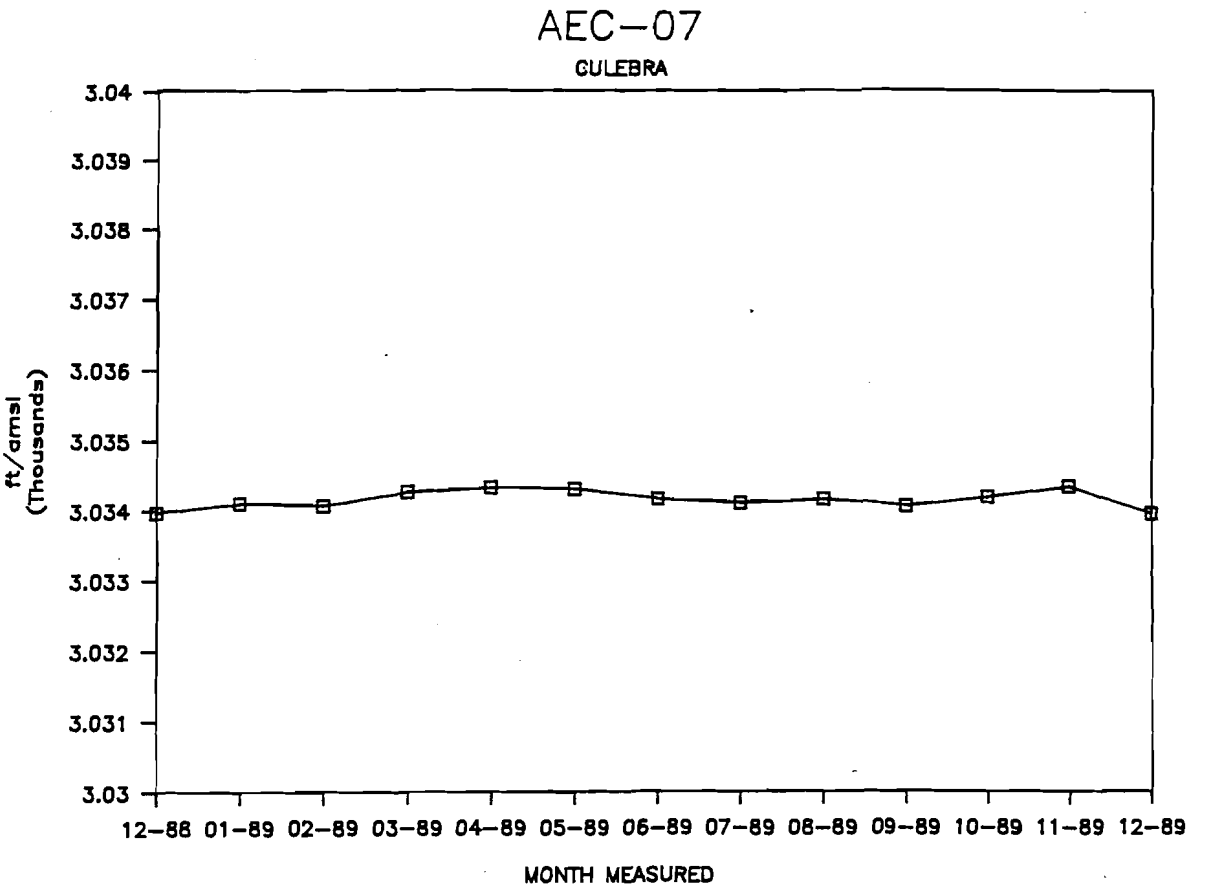
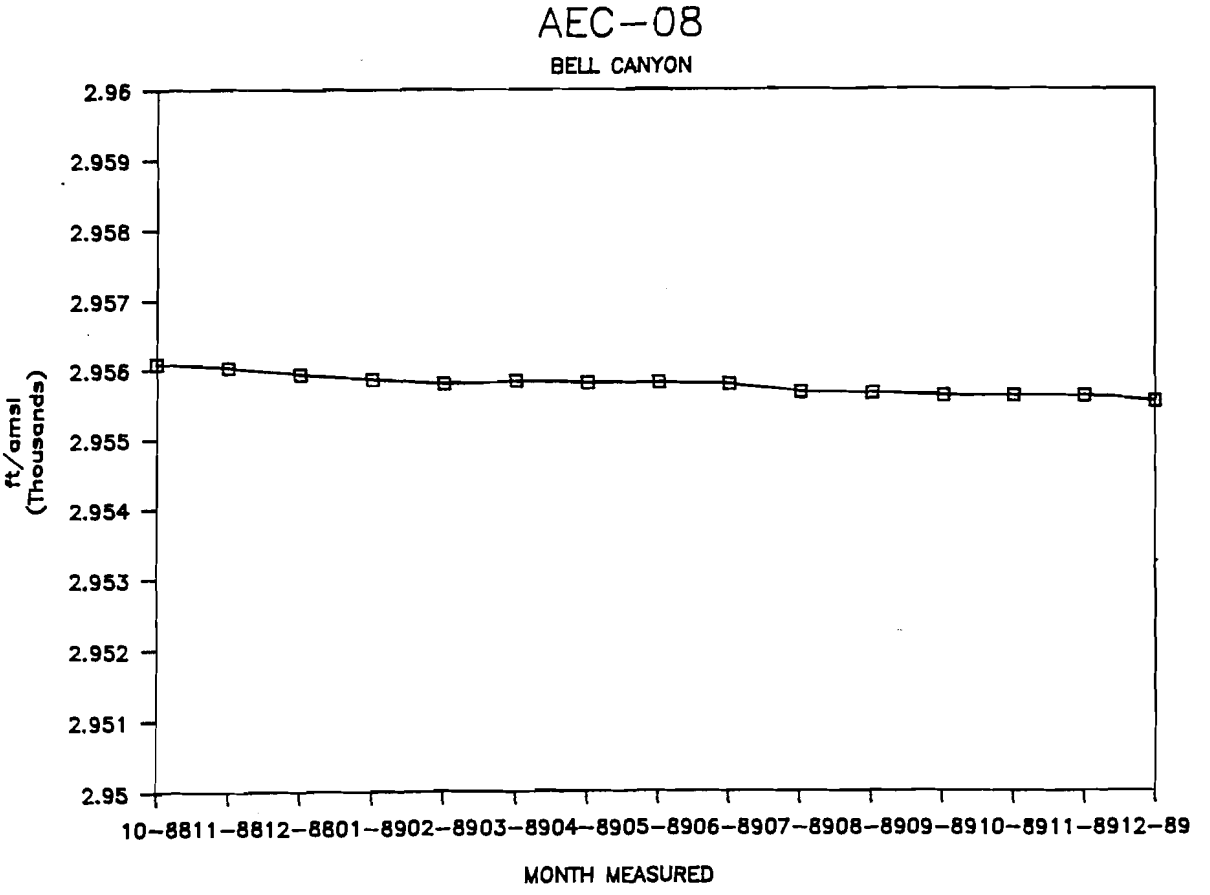
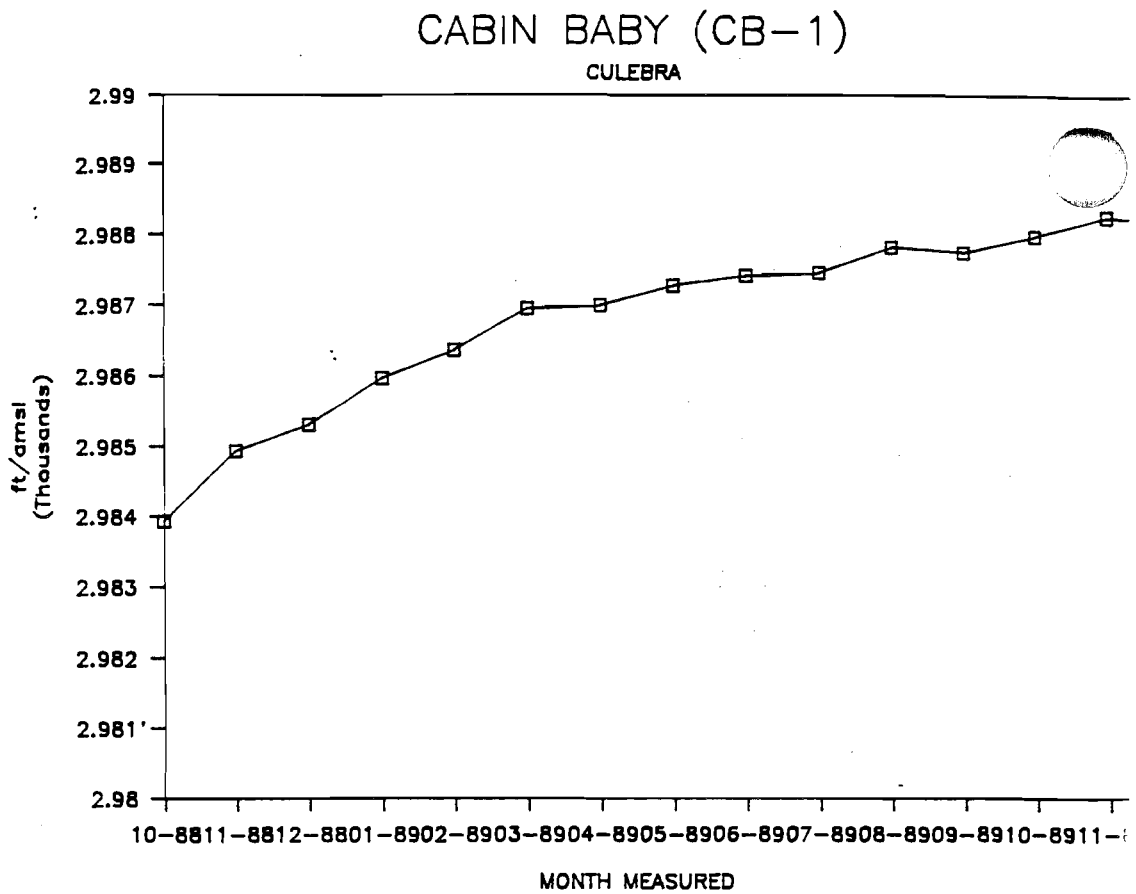
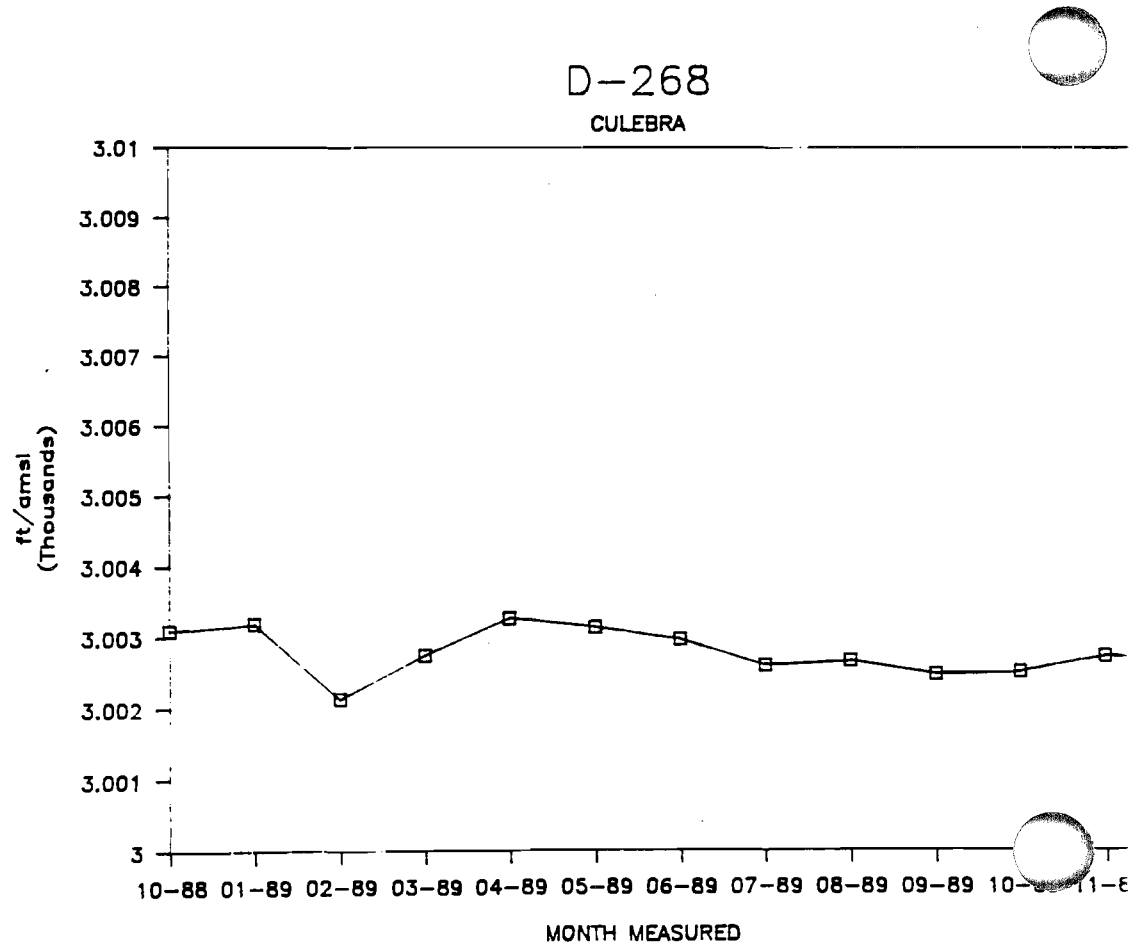
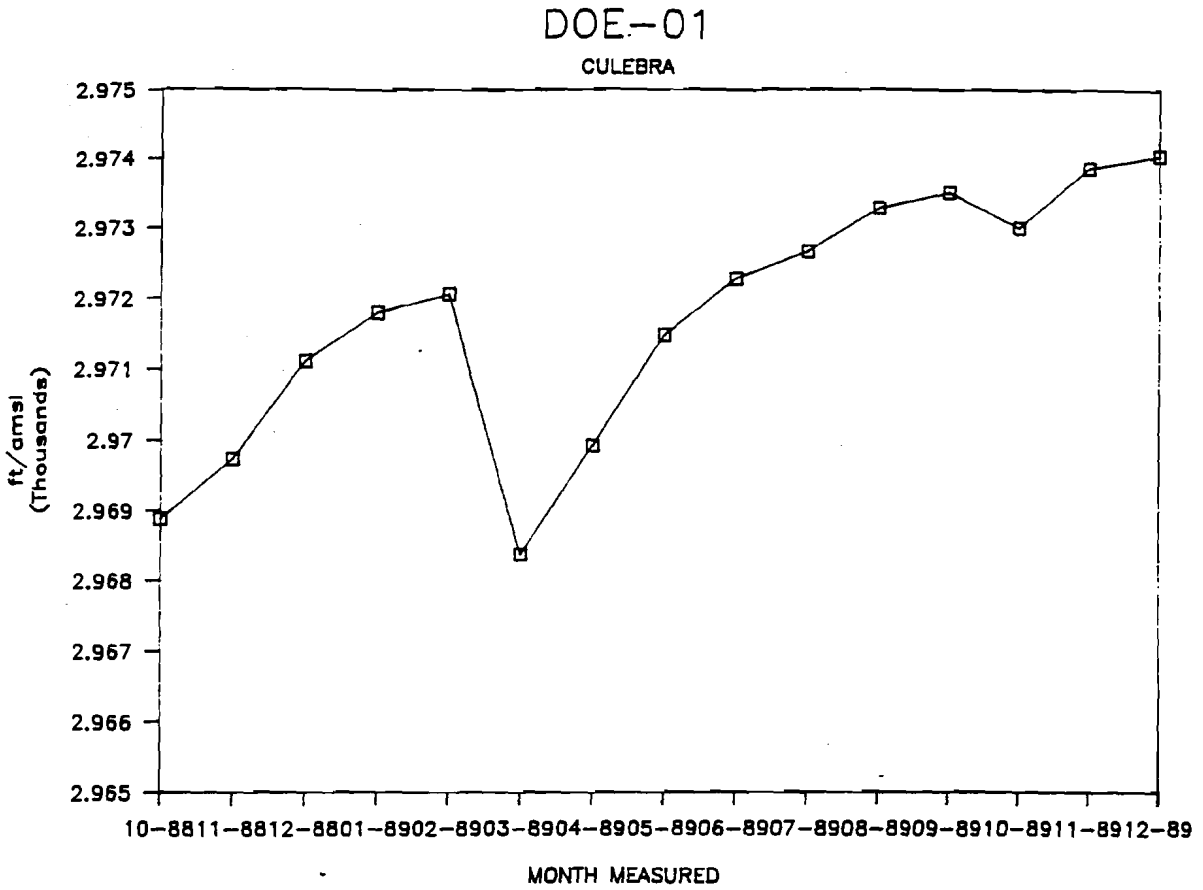
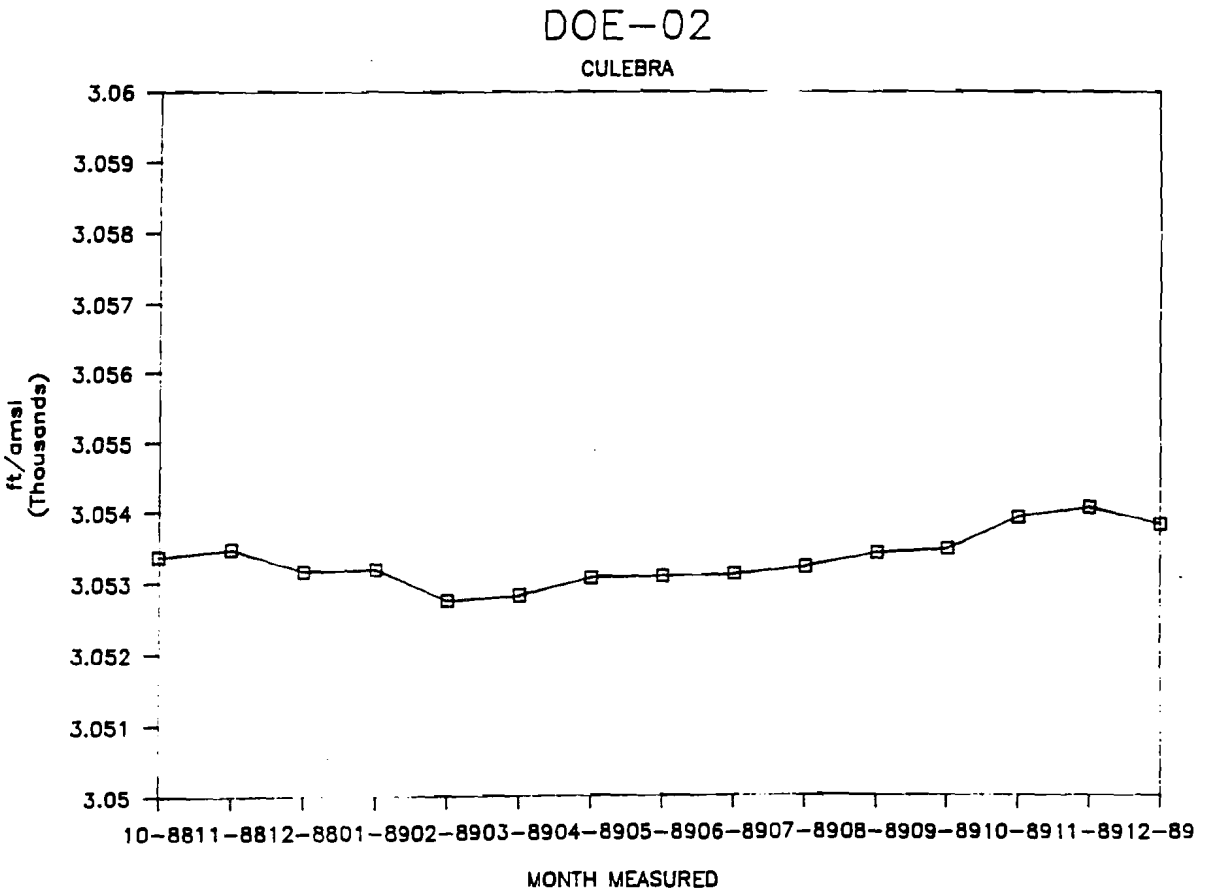

AEC-07
GULEBRA
3.04
3.039
3.038
3.037
3.036
3.035
3.034
3.033
3.032
3.031
3.03
ft/amsl
(Thousands)
12-88 01-89 02-89 03-89 04-89 05-89 06-89 07-89 08-89 09-89 10-89 11-89 12-89
MONTH MEASURED

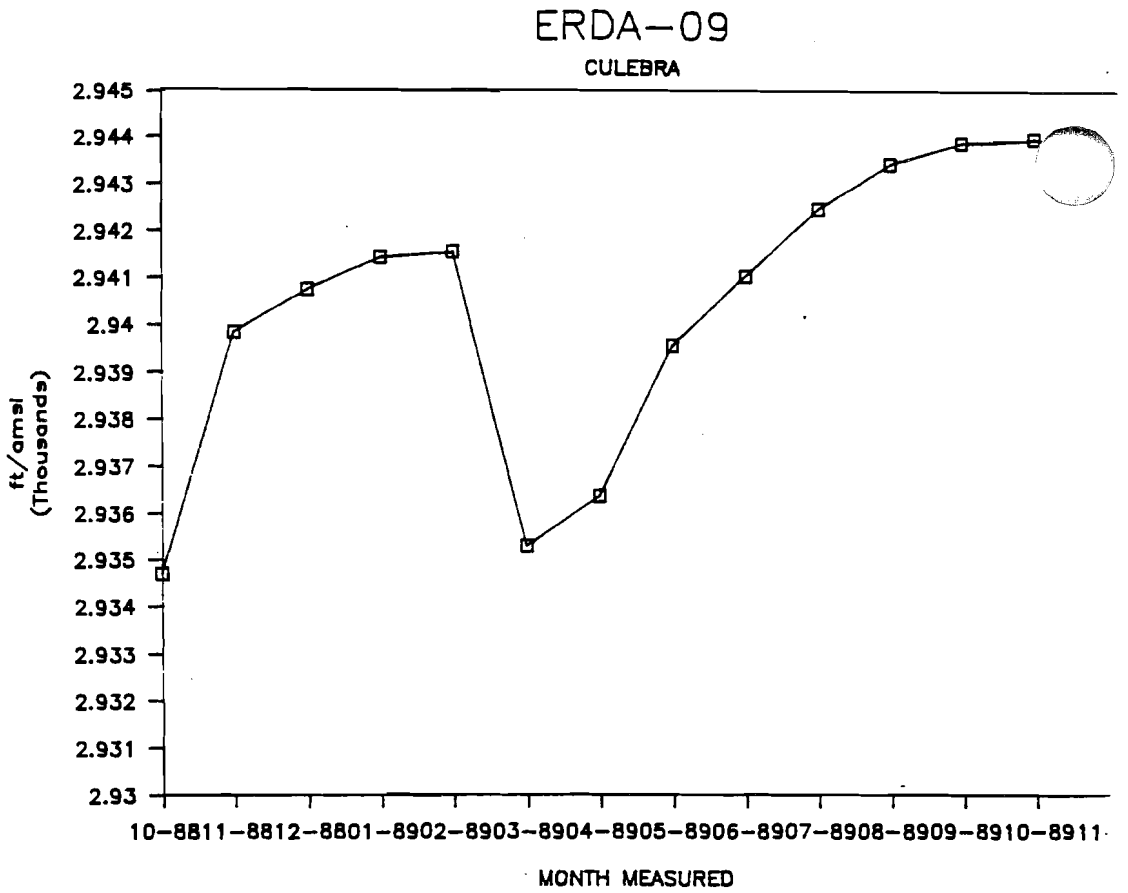

AEC-08
BELL CANYON
2.96
2.959
2.958
2.957
2.956
2.955
2.954
2.953
2.952
2.951
2.95
ft/amsl
(Thousands)
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-8912-89
MONTH MEASURED

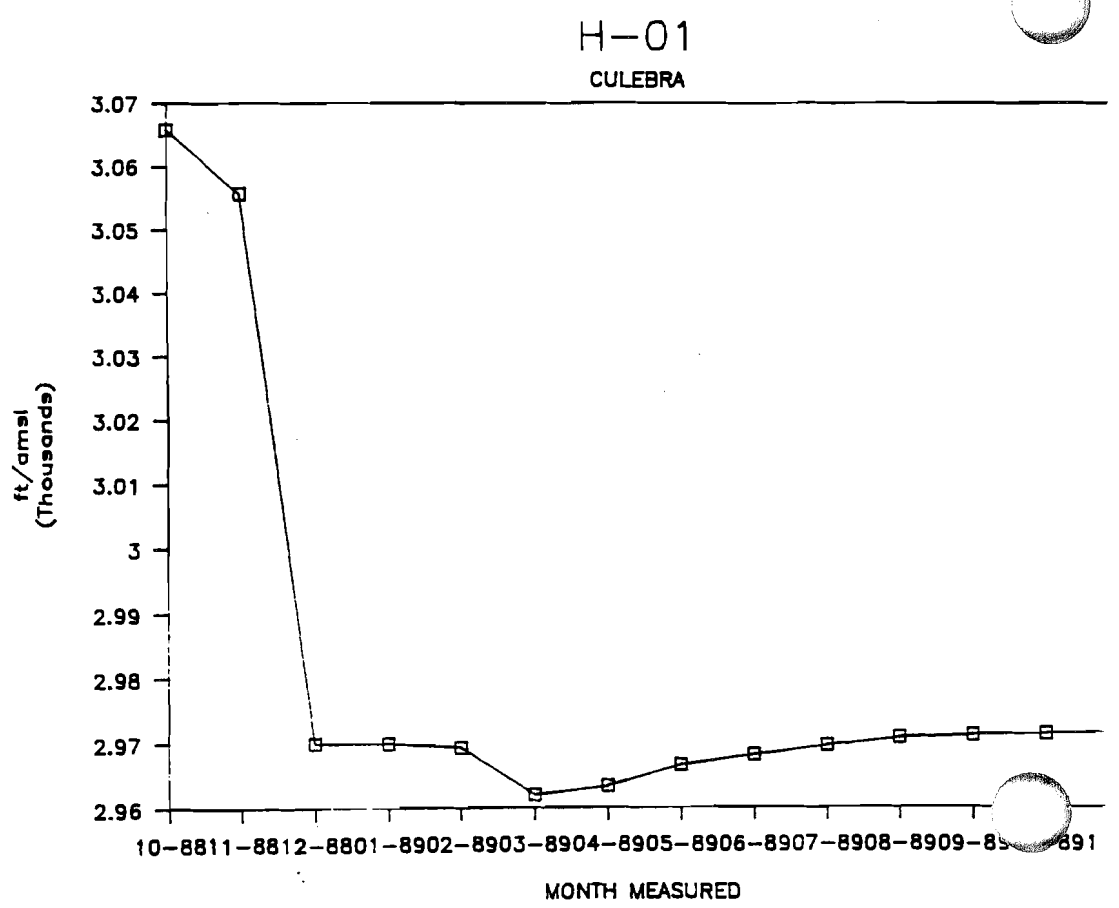

CABIN BABY (CB-1)
CULEBRA
ft/amsl (Thousands)
2.99
2.989
2.988
2.987
2.986
2.985
2.984
2.983
2.982
2.981
2.98
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-
MONTH MEASURED

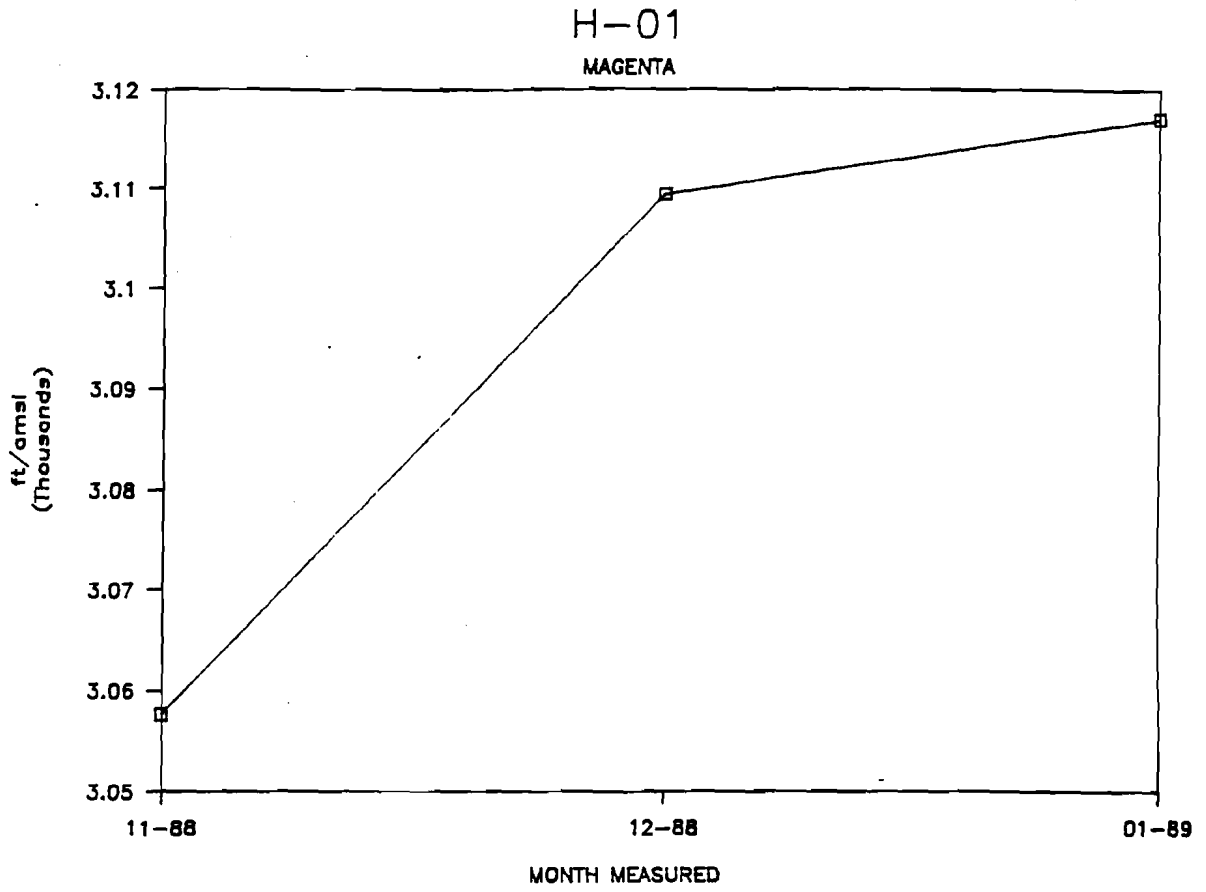

D-268
CULEBRA
ft/amsl (Thousands)
3.01
3.009
3.008
3.007
3.006
3.005
3.004
3.003
3.002
3.001
3
10-88 01-89 02-89 03-89 04-89 05-89 06-89 07-89 08-89 09-89
MONTH MEASURED

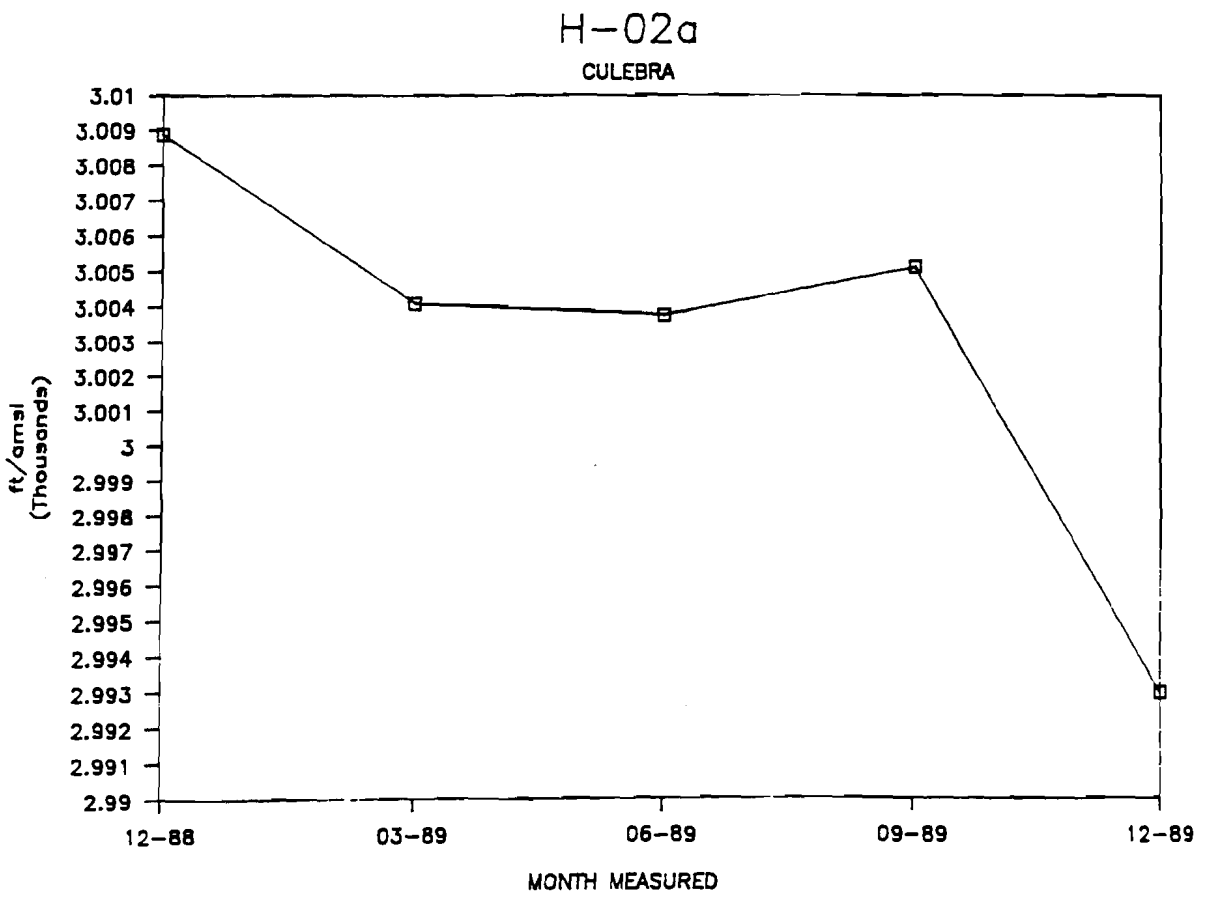

DOE-01
CULEBRA
2.975
2.974
2.973
2.972
2.971
2.97
2.969
2.968
2.967
2.966
2.965
ft/amsl
(Thousands)
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-8912-89
MONTH MEASURED

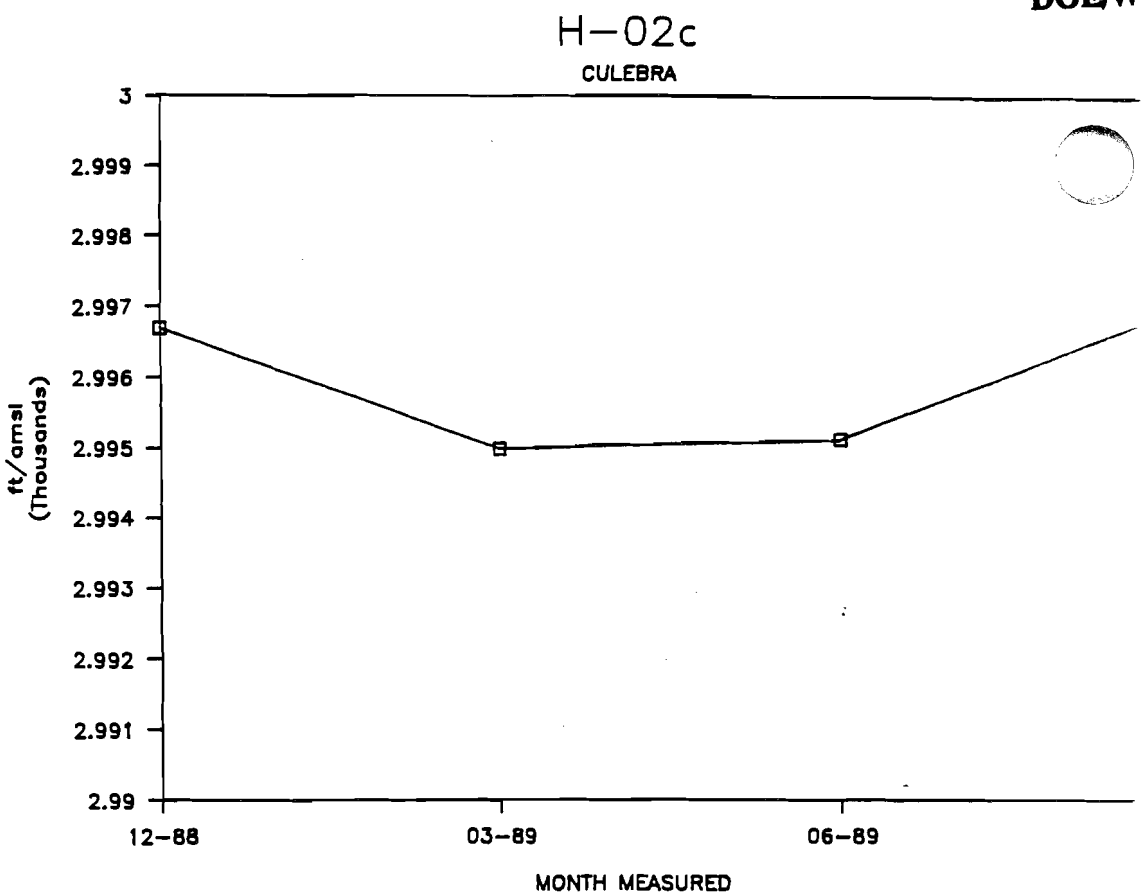

DOE-02
CULEBRA
3.06
3.059
3.058
3.057
3.056
3.055
3.054
3.053
3.052
3.051
3.05
ft/amsl
(Thousands)
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-8912-89
MONTH MEASURED

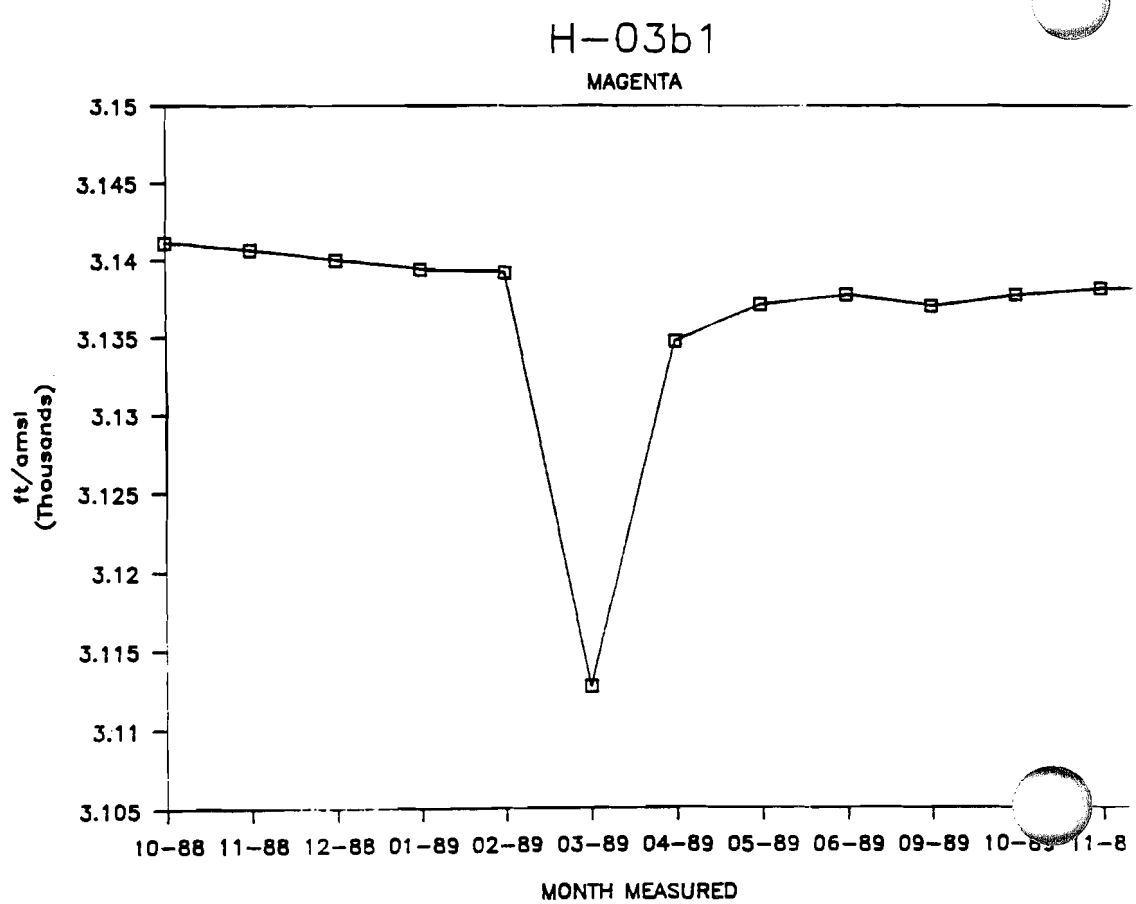

ERDA-09
CULEBRA
ft/amsl (Thousands)
2.945
2.944
2.943
2.942
2.941
2.94
2.939
2.938
2.937
2.936
2.935
2.934
2.933
2.932
2.931
2.93
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911
MONTH MEASURED

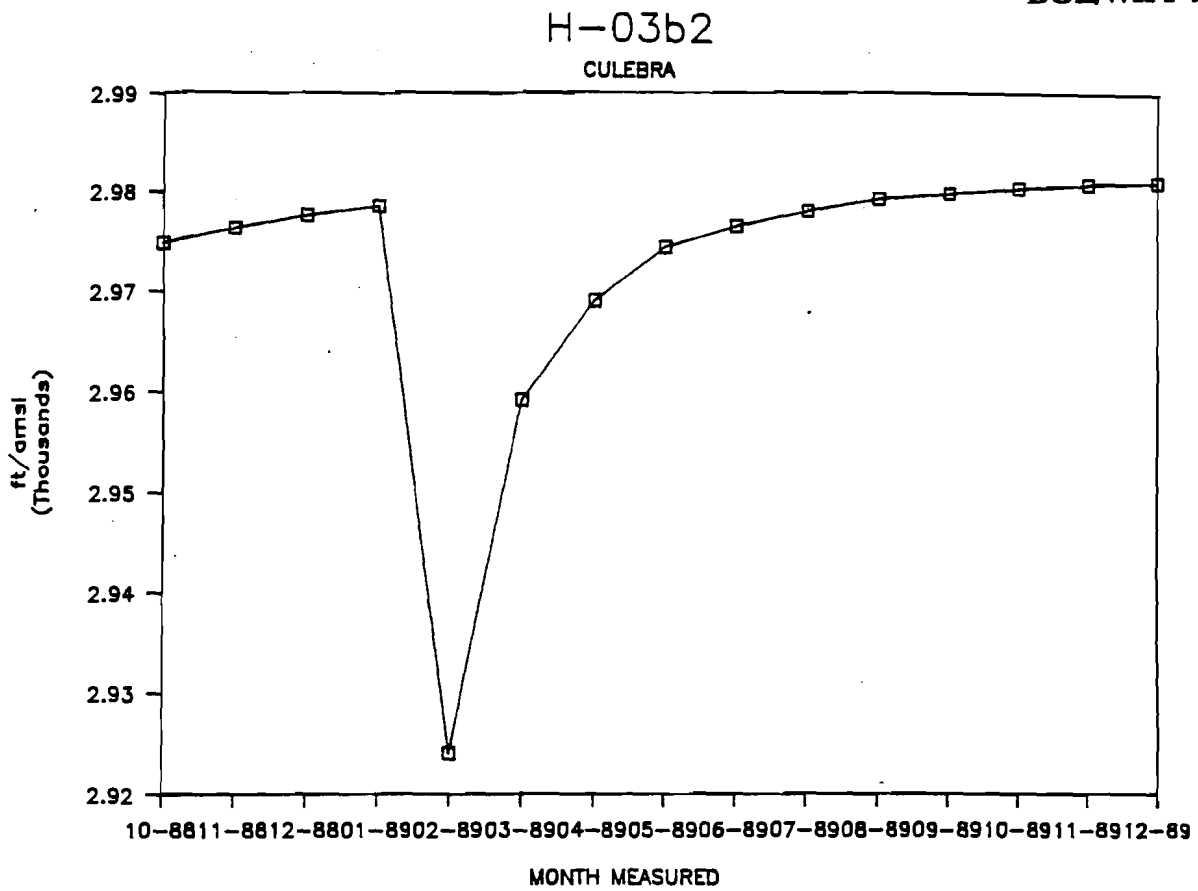

H-01
CULEBRA
ft/amsl (Thousands)
3.07
3.06
3.05
3.04
3.03
3.02
3.01
3
2.99
2.98
2.97
2.96
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8
891
MONTH MEASURED

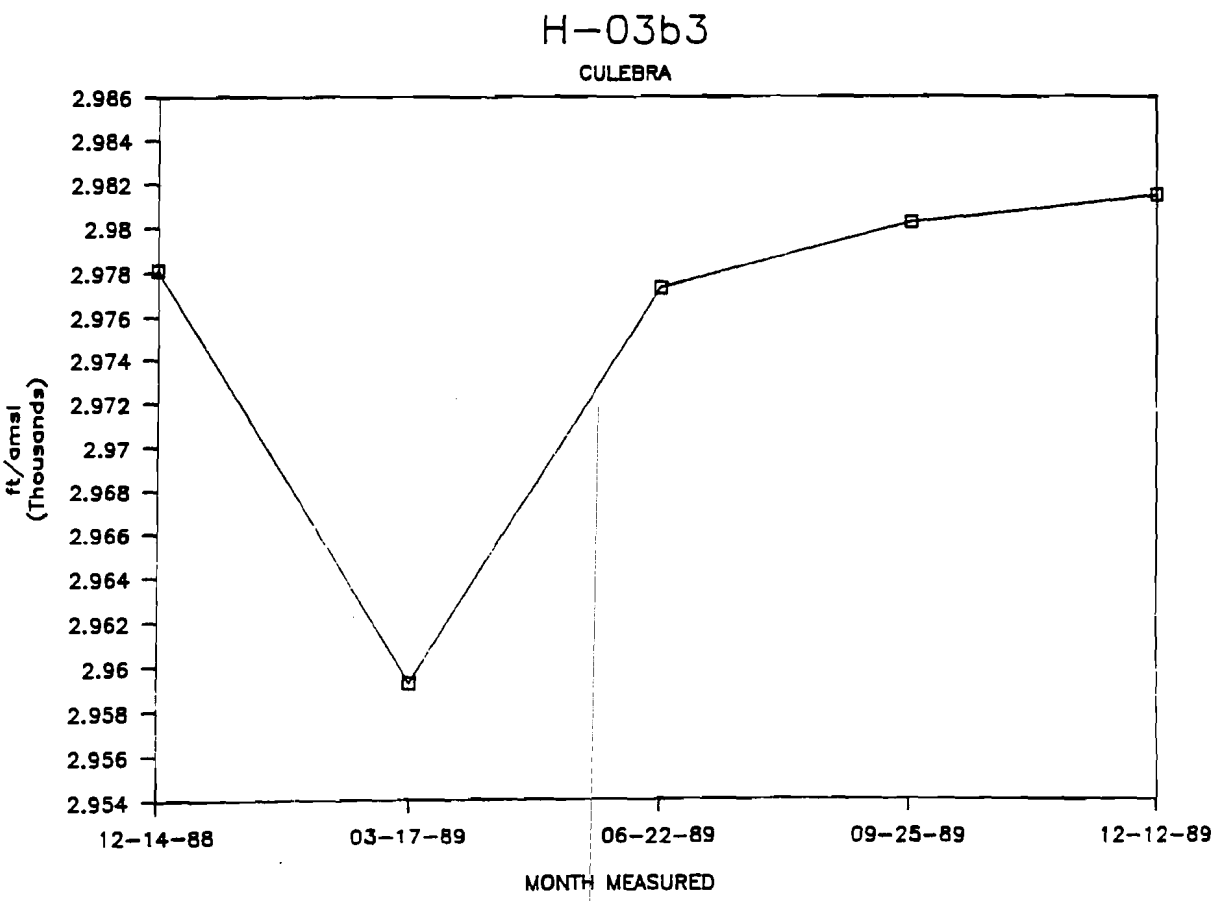

H-01
MAGENTA
3.12
3.11
3.1
3.09
3.08
3.07
3.06
3.05
ft/amsl
(Thousands)
11-88
12-88
01-89
MONTH MEASURED

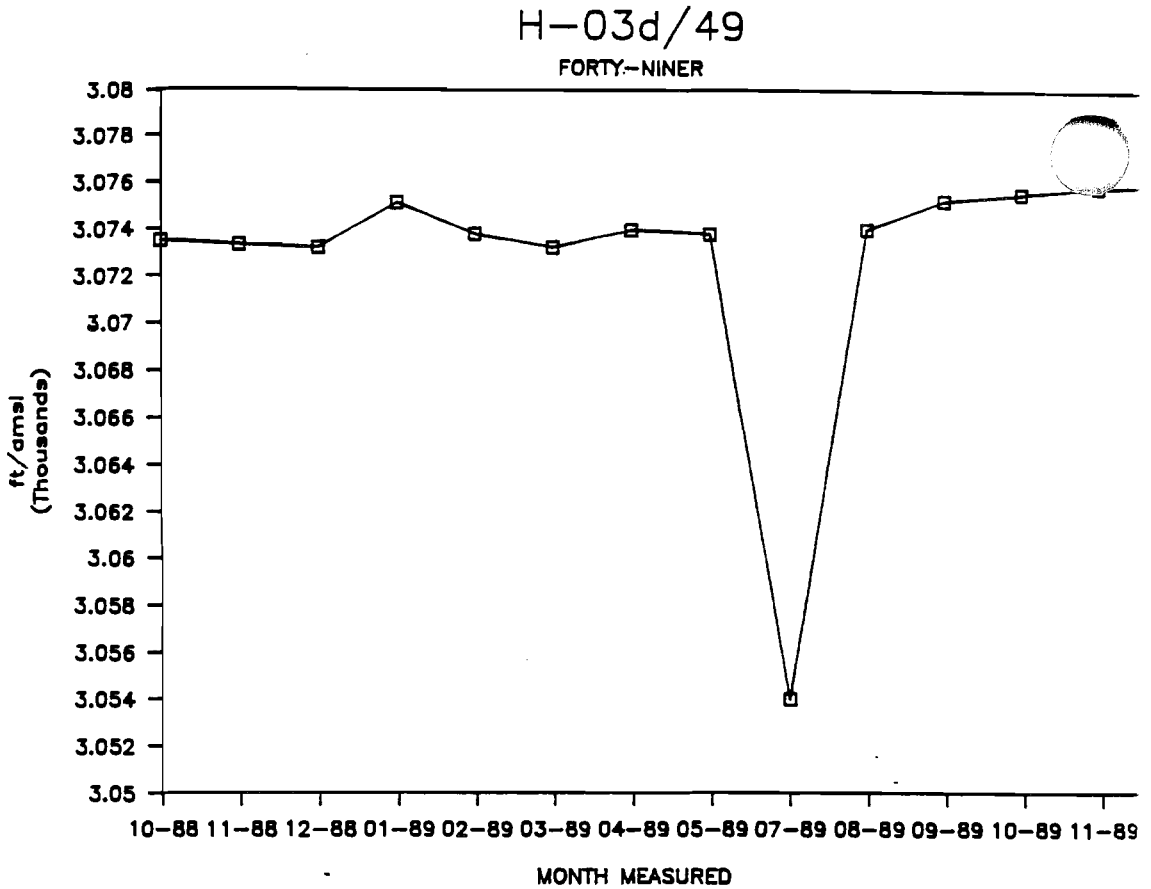

H-02a
CULEBRA
3.01
3.009
3.008
3.007
3.006
3.005
3.004
3.003
3.002
3.001
3
2.999
2.998
2.997
2.996
2.995
2.994
2.993
2.992
2.991
2.99
ft/amsl
(Thousands)
12-88
03-89
06-89
09-89
12-89
MONTH MEASURED

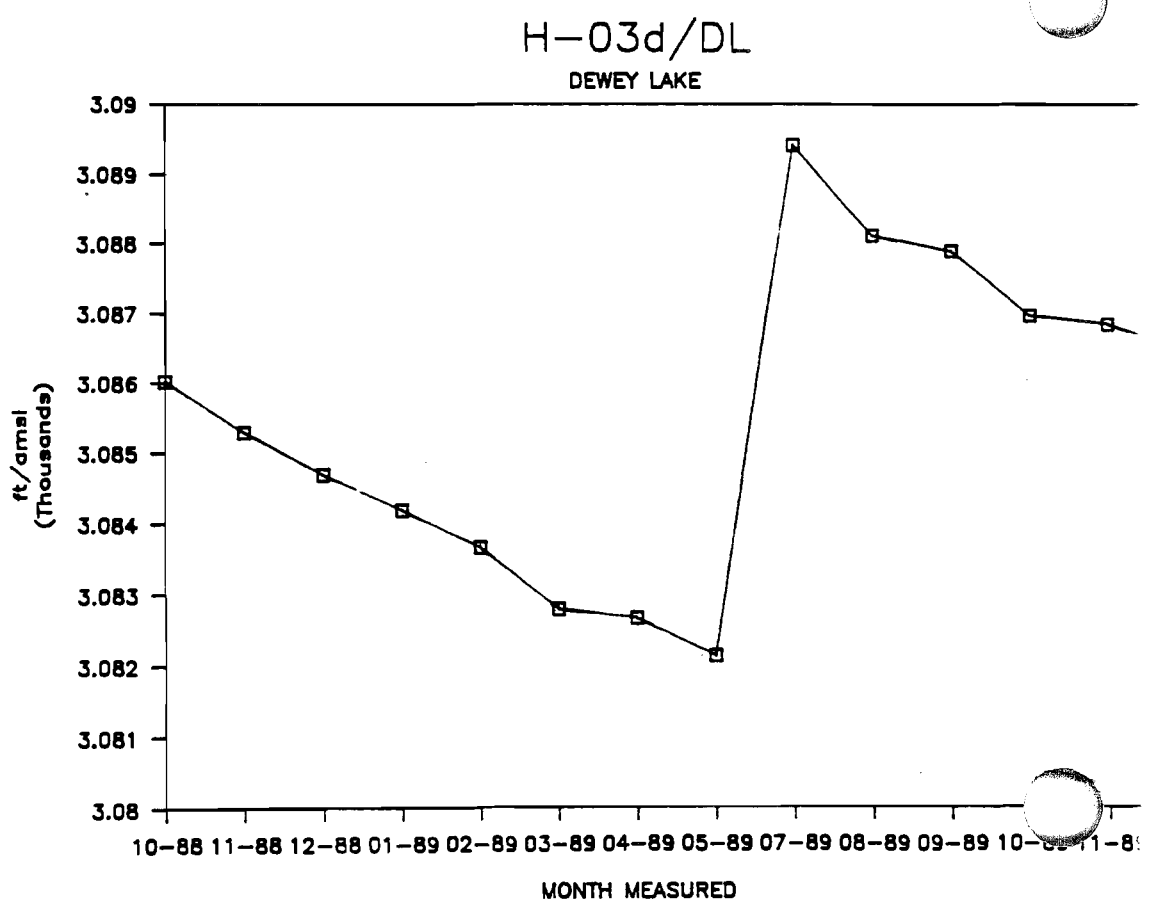

H-02c
CULEBRA
3
2.999
2.998
2.997
2.996
2.995
2.994
2.993
2.992
2.991
2.99
ft/amsl
(Thousands)
12-88
03-89
06-89
MONTH MEASURED

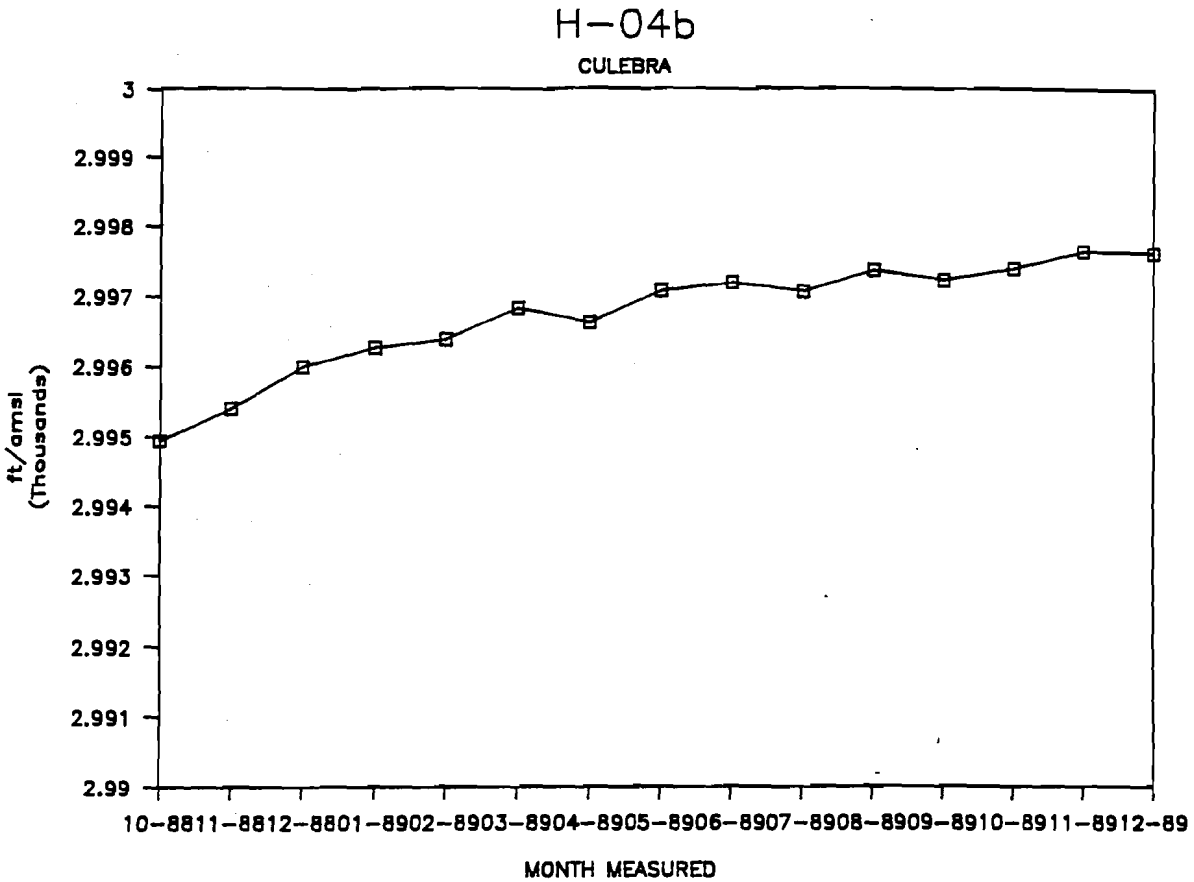

H-03b1
MAGENTA
3.15
3.145
3.14
3.135
3.13
3.125
3.12
3.115
3.11
3.105
ft/amsl
(Thousands)
10-88
11-88
12-88
01-89
02-89
03-89
04-89
05-89
06-89
09-89
MONTH MEASURED

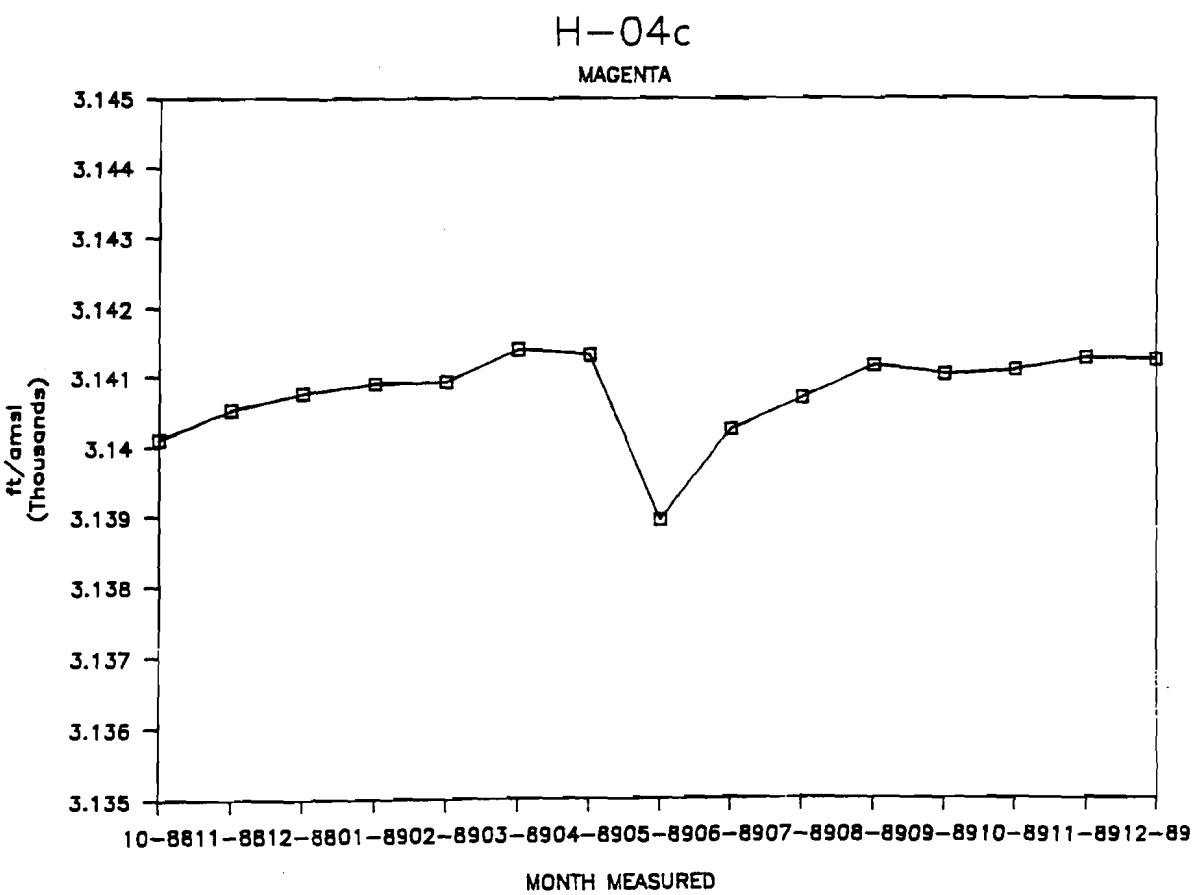

H-03b2
CULEBRA
2.99
2.98
2.97
2.96
2.95
2.94
2.93
2.92
ft/amsl
(Thousands)
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-8912-89
MONTH MEASURED

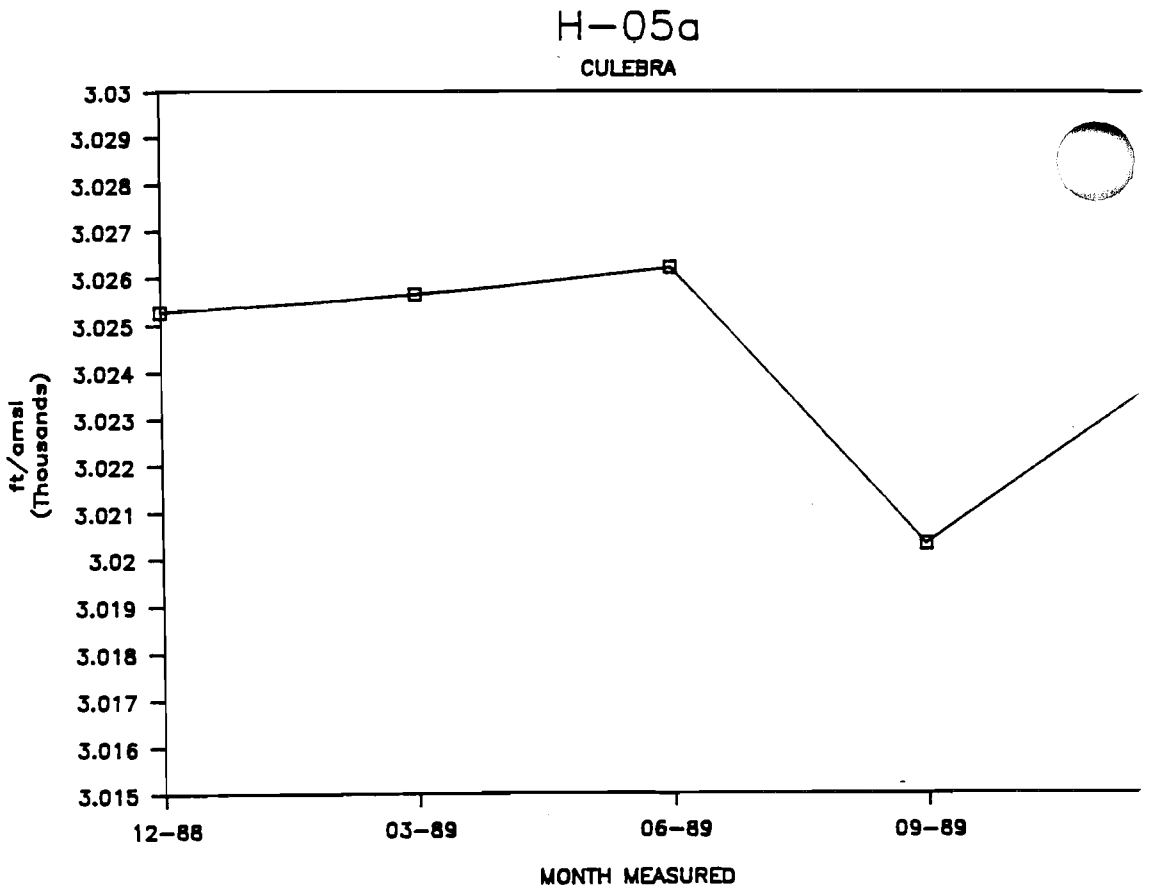

H-03b3
CULEBRA
2.986
2.984
2.982
2.98
2.978
2.976
2.974
2.972
2.97
2.968
2.966
2.964
2.962
2.96
2.958
2.956
2.954
ft/amsl
(Thousands)
12-14-88
03-17-89
06-22-89
09-25-89
12-12-89
MONTH MEASURED

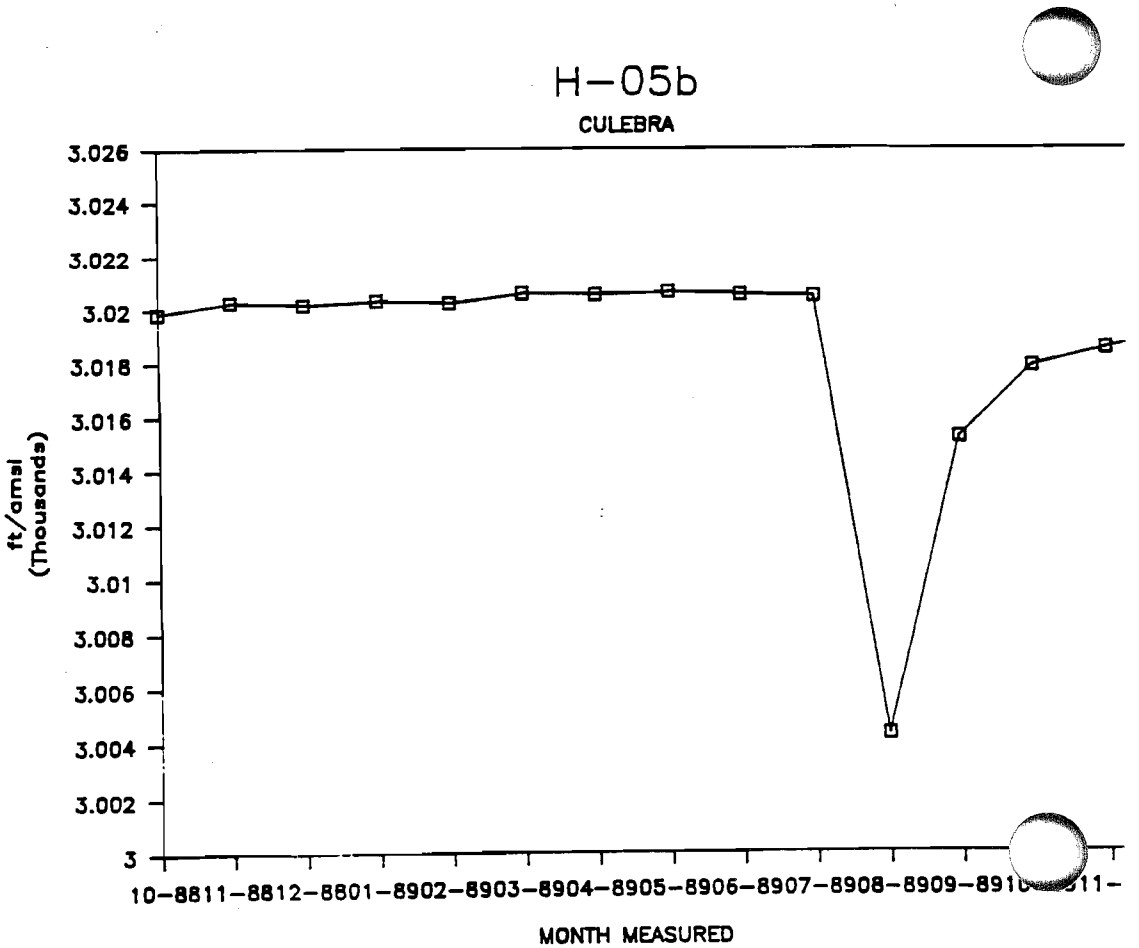

H-03d/49
FORTY-NINER
ft/amsl (Thousands)
3.08
3.078
3.076
3.074
3.072
3.07
3.068
3.066
3.064
3.062
3.06
3.058
3.056
3.054
3.052
3.05
10-88 11-88 12-88 01-89 02-89 03-89 04-89 05-89 07-89 08-89 09-89 10-89 11-89
MONTH MEASURED

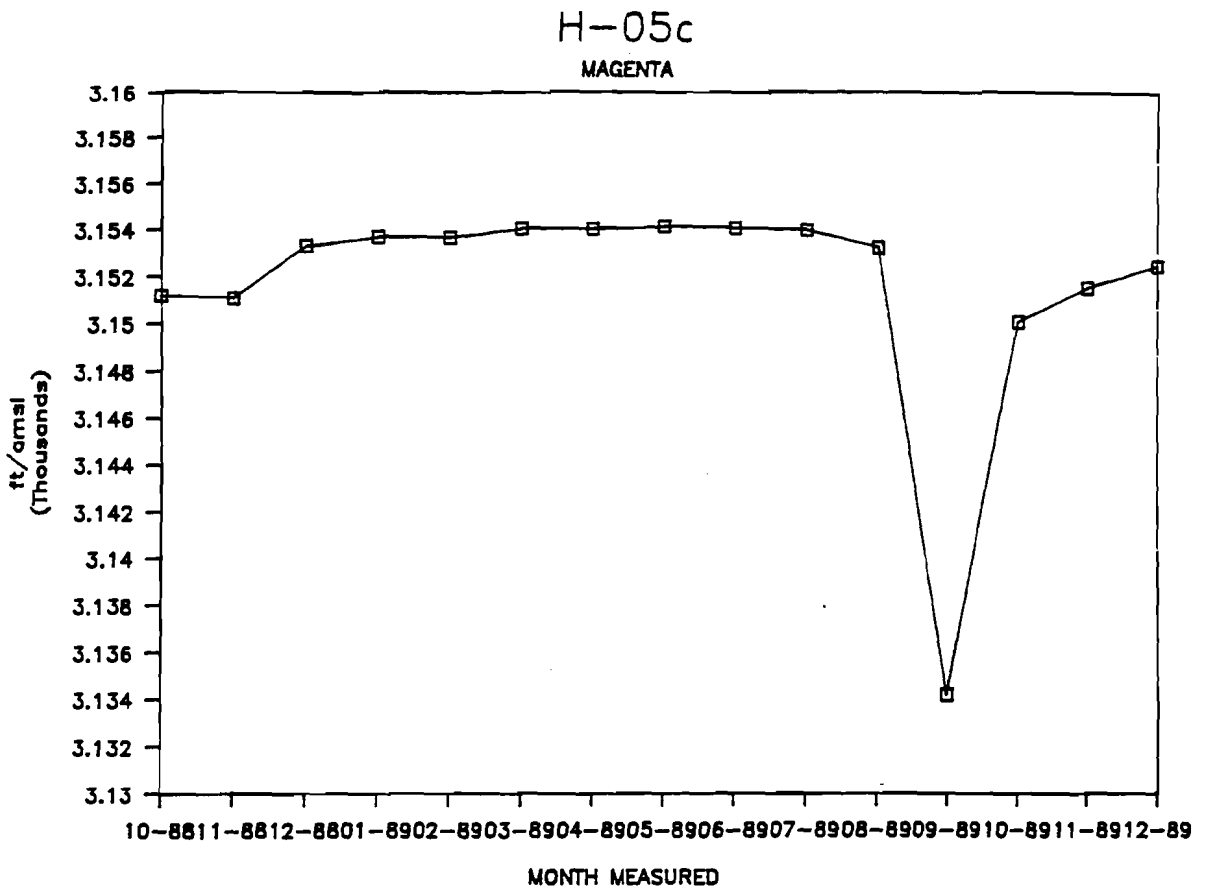

H-03d/DL
DEWEY LAKE
ft/amsl (Thousands)
3.09
3.089
3.088
3.087
3.086
3.085
3.084
3.083
3.082
3.081
3.08
10-88 11-88 12-88 01-89 02-89 03-89 04-89 05-89 07-89 08-89 09-89
MONTH MEASURED

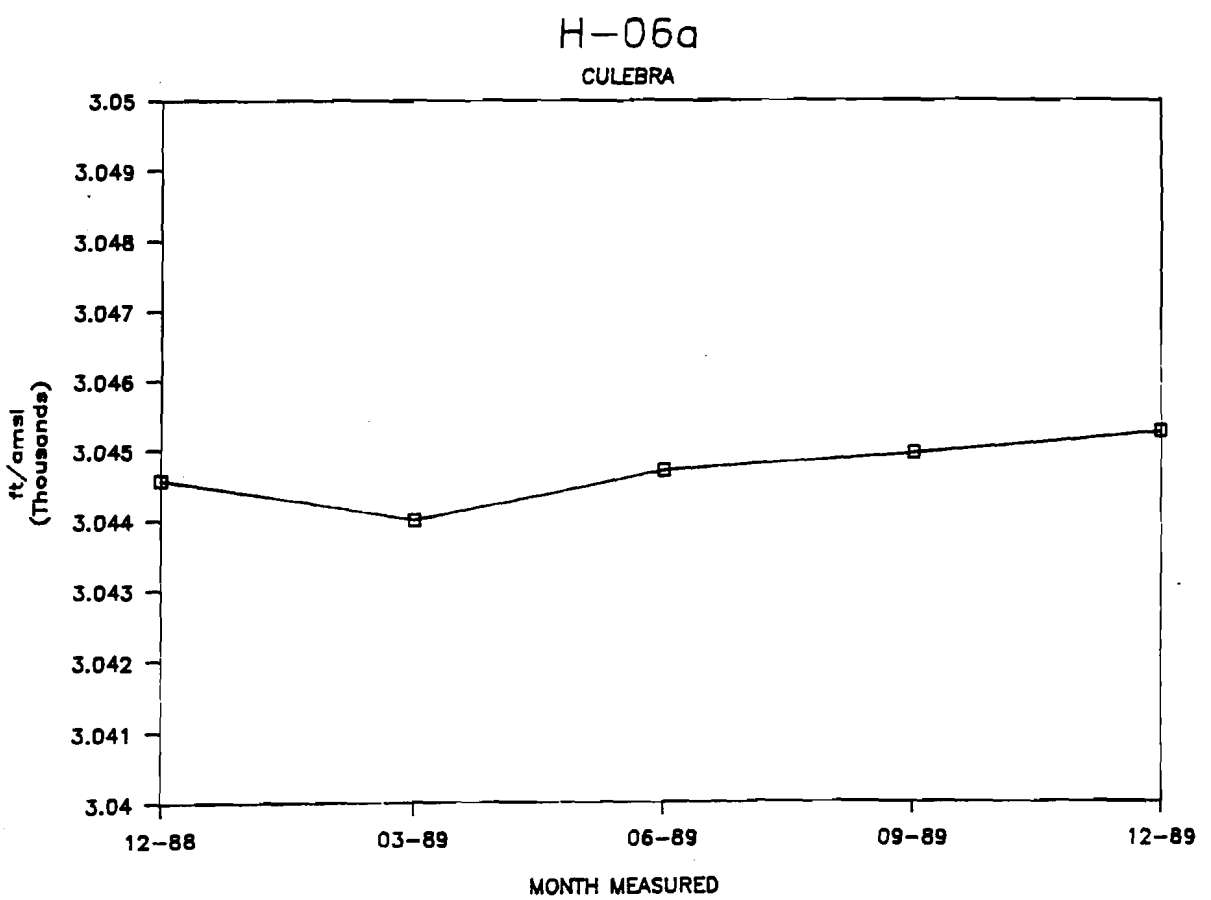

H-04b
CULEBRA
3
2.999
2.998
2.997
2.996
2.995
2.994
2.993
2.992
2.991
2.99
ft/amsl
(Thousands)
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-8912-89
MONTH MEASURED

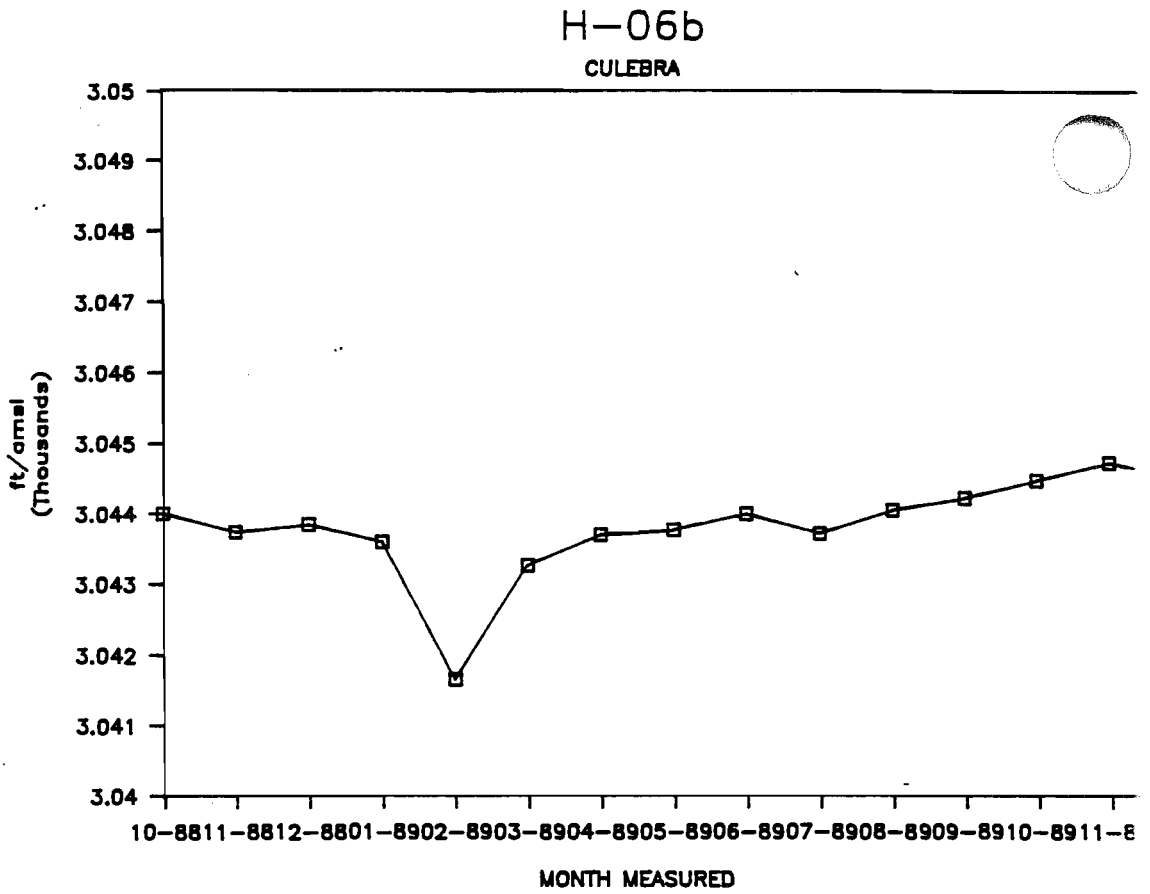

H-04c
MAGENTA
3.145
3.144
3.143
3.142
3.141
3.14
3.139
3.138
3.137
3.136
3.135
ft/amsl
(Thousands)
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-8912-89
MONTH MEASURED

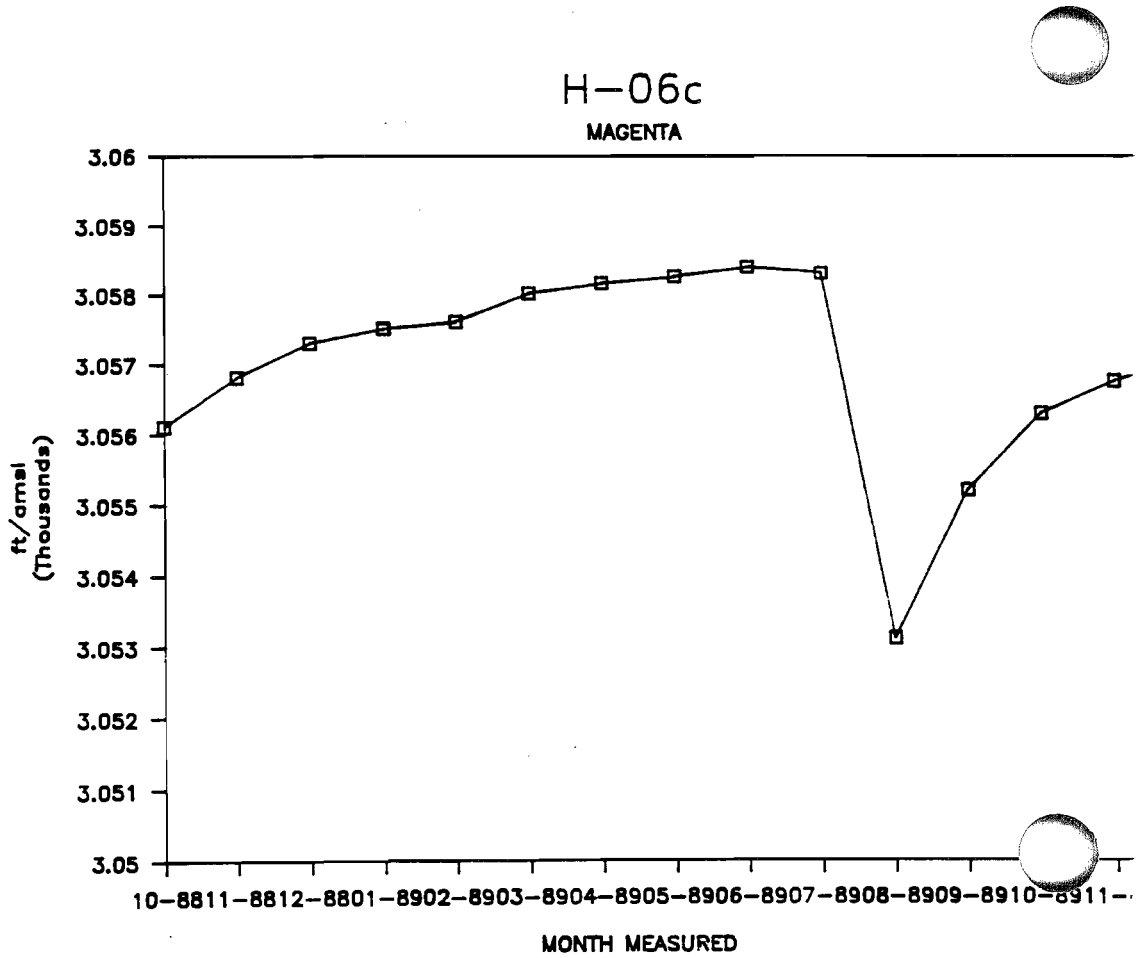

H-05a
CULEBRA
ft/amsl (Thousands)
3.03
3.029
3.028
3.027
3.026
3.025
3.024
3.023
3.022
3.021
3.02
3.019
3.018
3.017
3.016
3.015
12-88
03-89
06-89
09-89
MONTH MEASURED

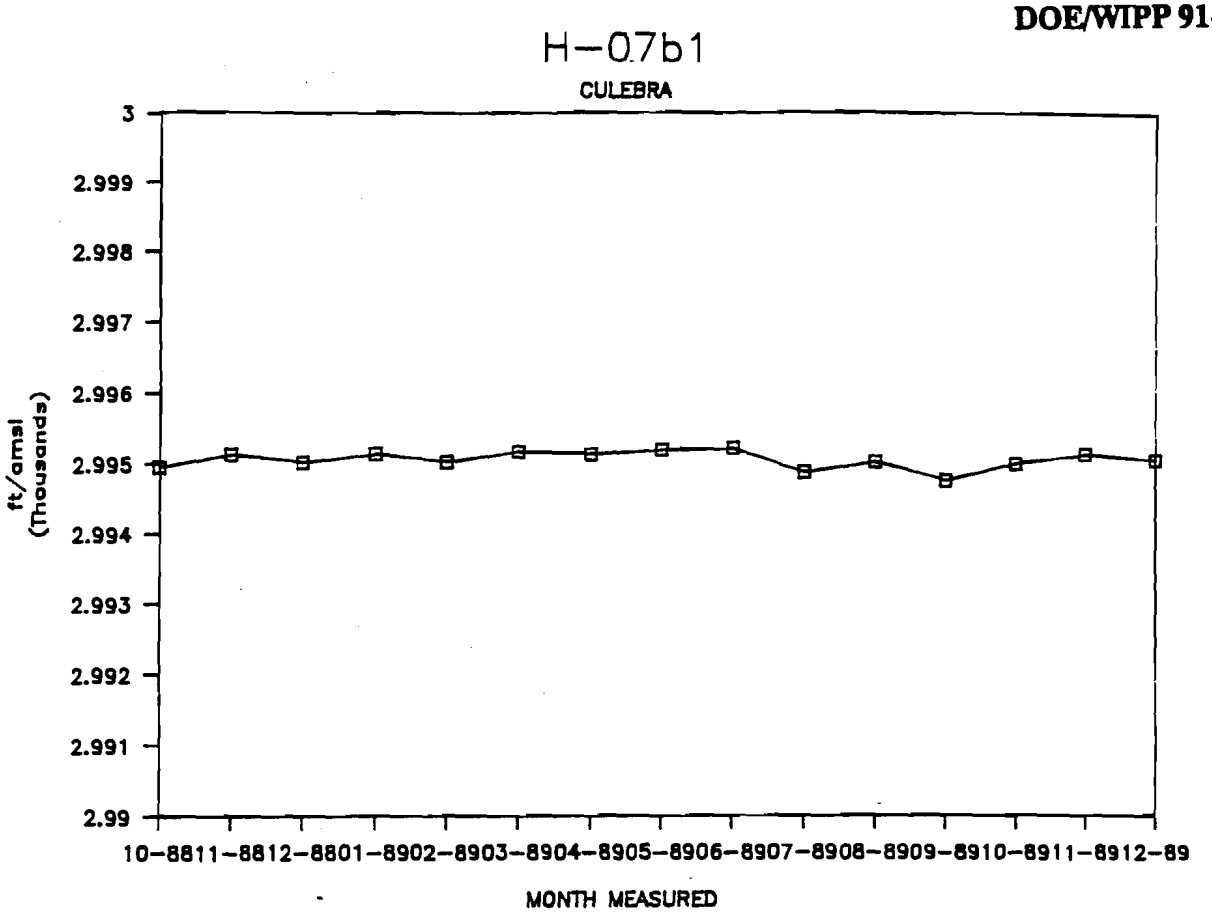

H-05b
CULEBRA
ft/amsl (Thousands)
3.026
3.024
3.022
3.02
3.018
3.016
3.014
3.012
3.01
3.008
3.006
3.004
3.002
3
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-
MONTH MEASURED

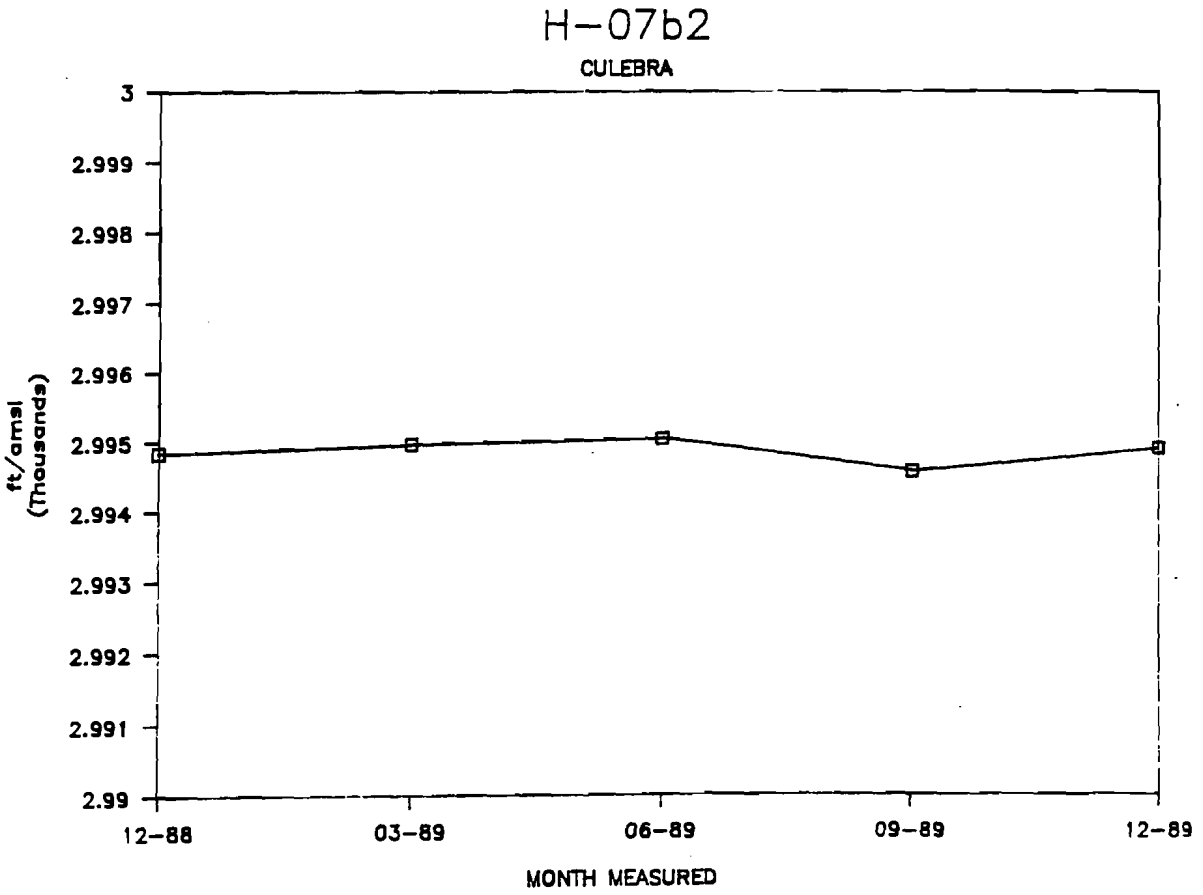

H-05c
MAGENTA
3.16
3.158
3.156
3.154
3.152
3.15
3.148
3.146
3.144
3.142
3.14
3.138
3.136
3.134
3.132
3.13
ft/amsl (Thousands)
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-8912-89
MONTH MEASURED

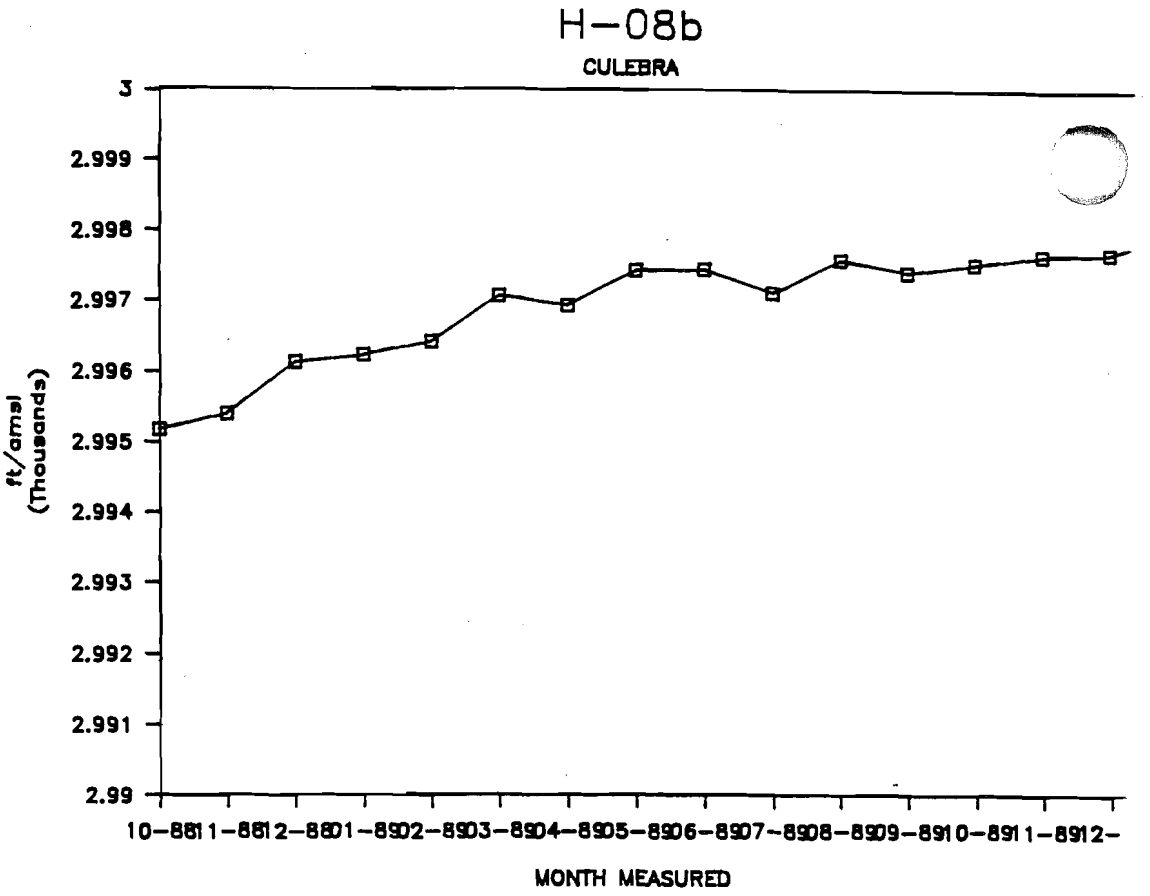

H-06a
CULEBRA
3.05
3.049
3.048
3.047
3.046
3.045
3.044
3.043
3.042
3.041
3.04
ft/amsl (Thousands)
12-88
03-89
06-89
09-89
12-89
MONTH MEASURED

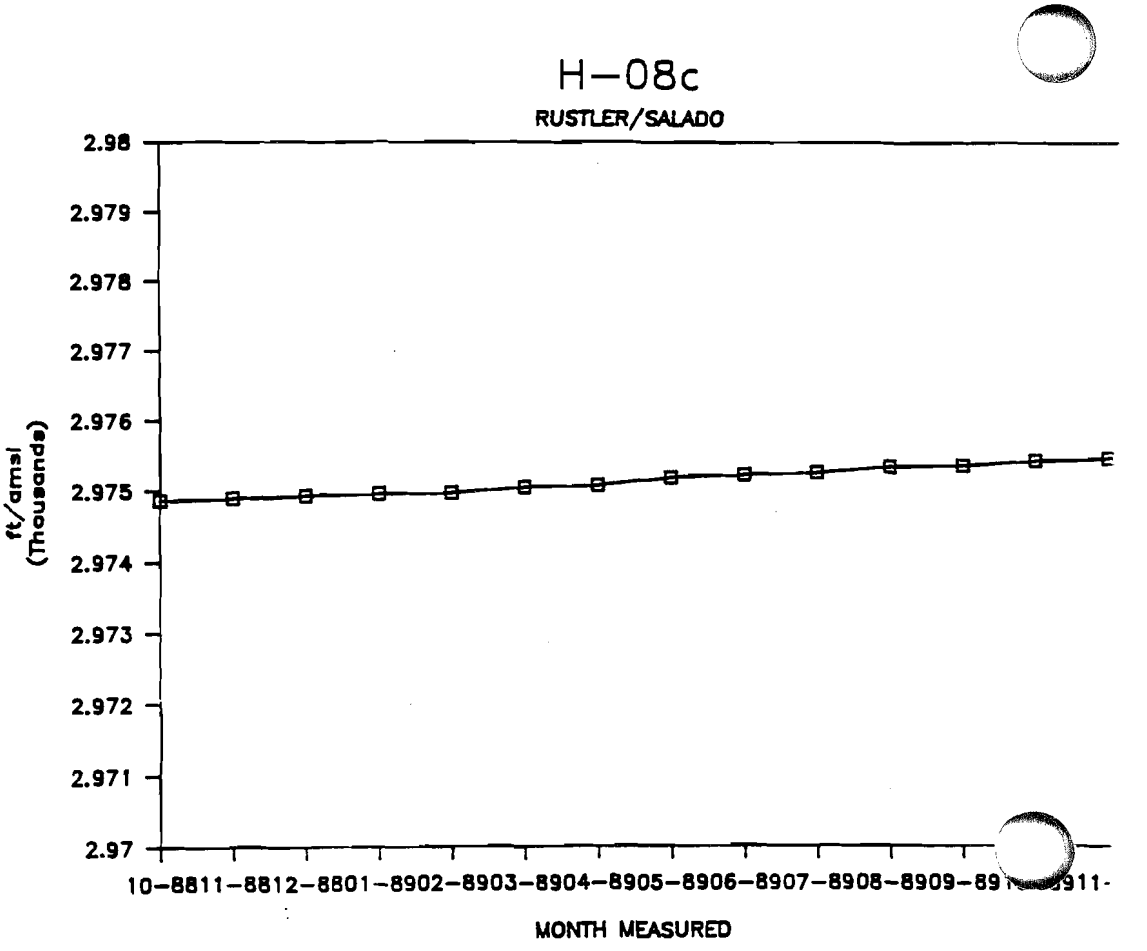

H-06b
CULEBRA
3.05
3.049
3.048
3.047
3.046
3.045
3.044
3.043
3.042
3.041
3.04
ft/amsl (Thousands)
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-8
MONTH MEASURED

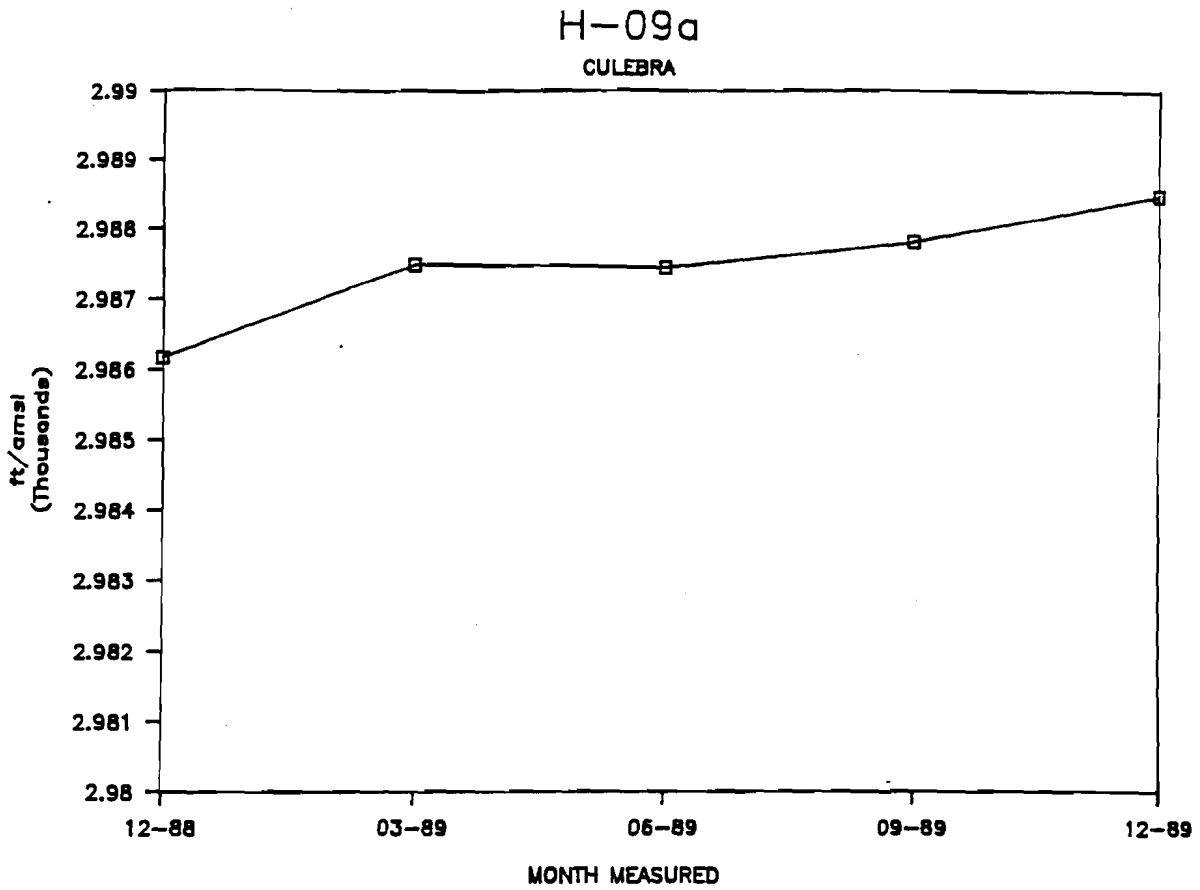

H-06c
MAGENTA
3.06
3.059
3.058
3.057
3.056
3.055
3.054
3.053
3.052
3.051
3.05
ft/amsl (Thousands)
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-
MONTH MEASURED

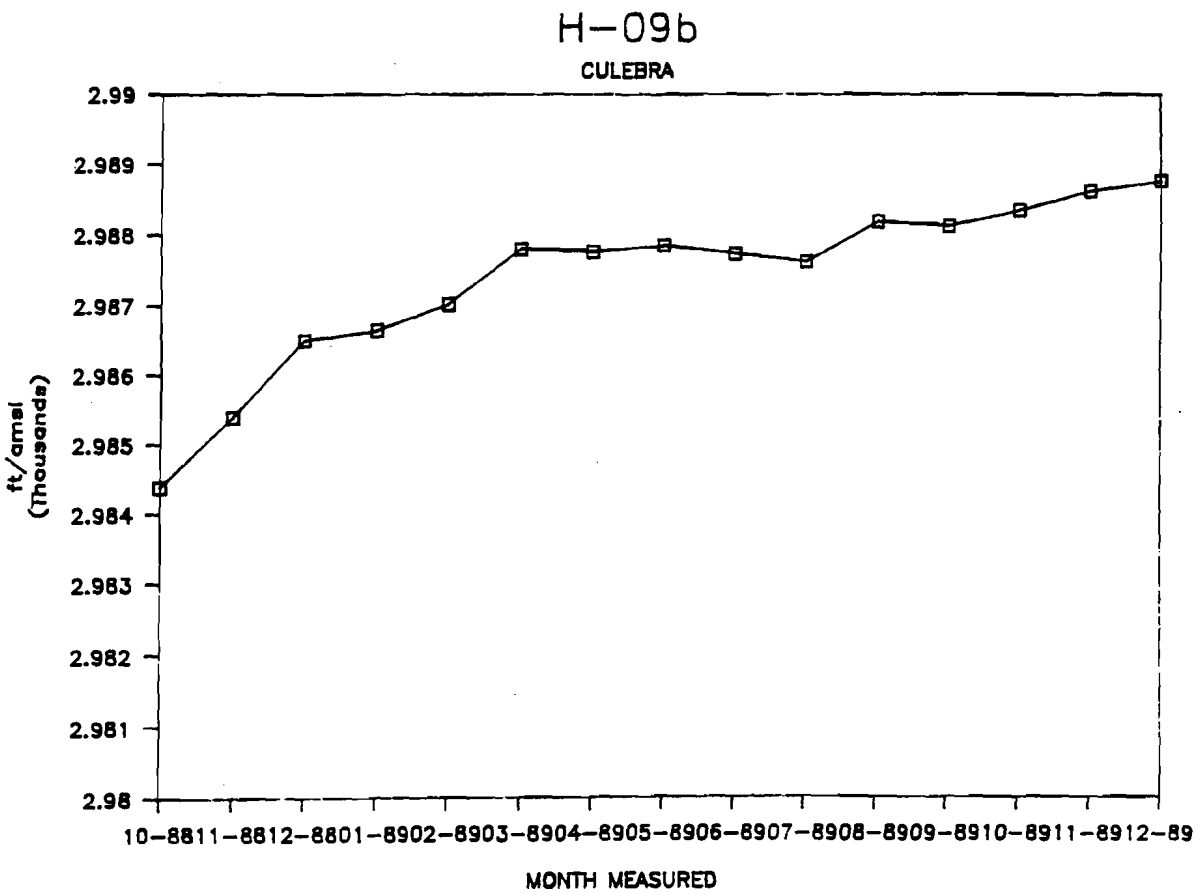

H-07b1
CULEBRA
3
2.999
2.998
2.997
2.996
2.995
2.994
2.993
2.992
2.991
2.99
ft/amsl
(Thousands)
10-88
11-88
12-88
01-89
02-89
03-89
04-89
05-89
06-89
07-89
08-89
09-89
10-89
11-89
12-89
MONTH MEASURED

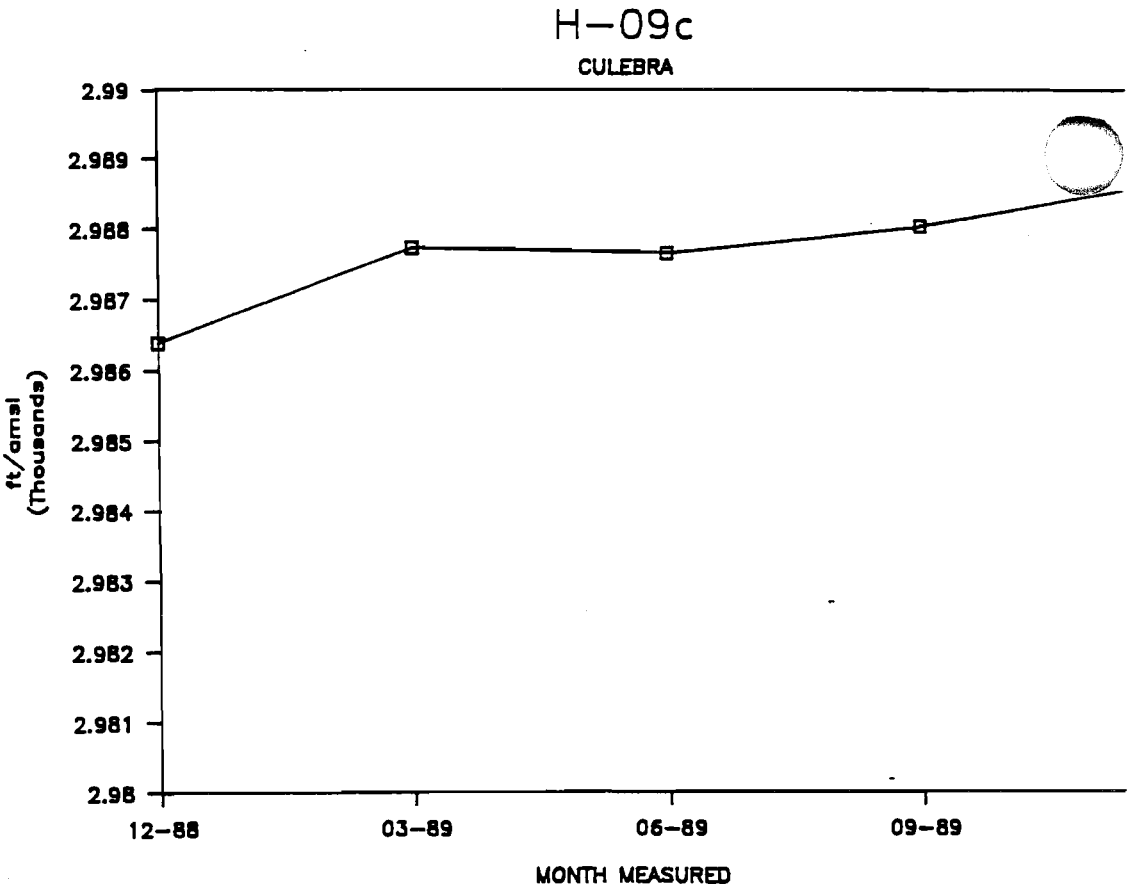

H-07b2
CULEBRA
3
2.999
2.998
2.997
2.996
2.995
2.994
2.993
2.992
2.991
2.99
ft/amsl
(Thousands)
12-88
03-89
06-89
09-89
12-89
MONTH MEASURED

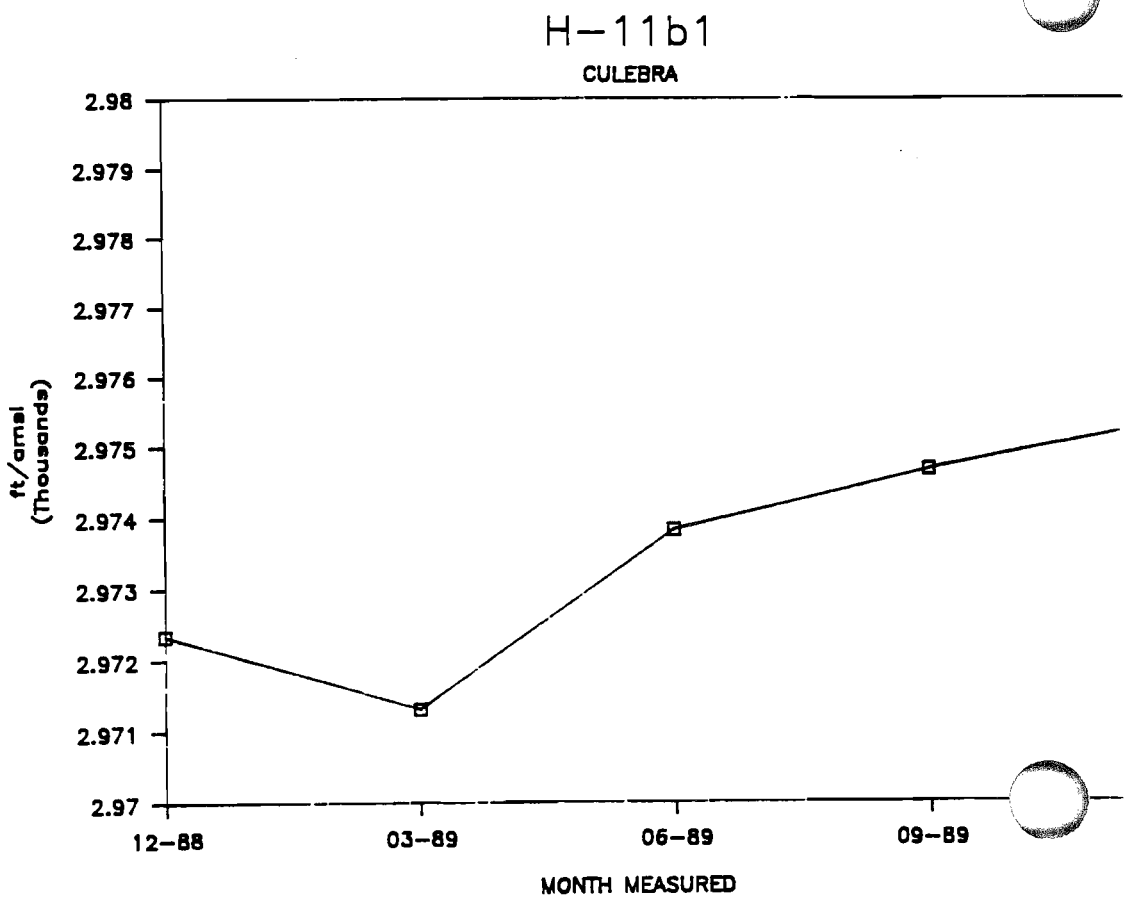

H-08b
CULEBRA
3
2.999
2.998
2.997
2.996
2.995
2.994
2.993
2.992
2.991
2.99
ft/amsl (Thousands)
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-8912-
MONTH MEASURED

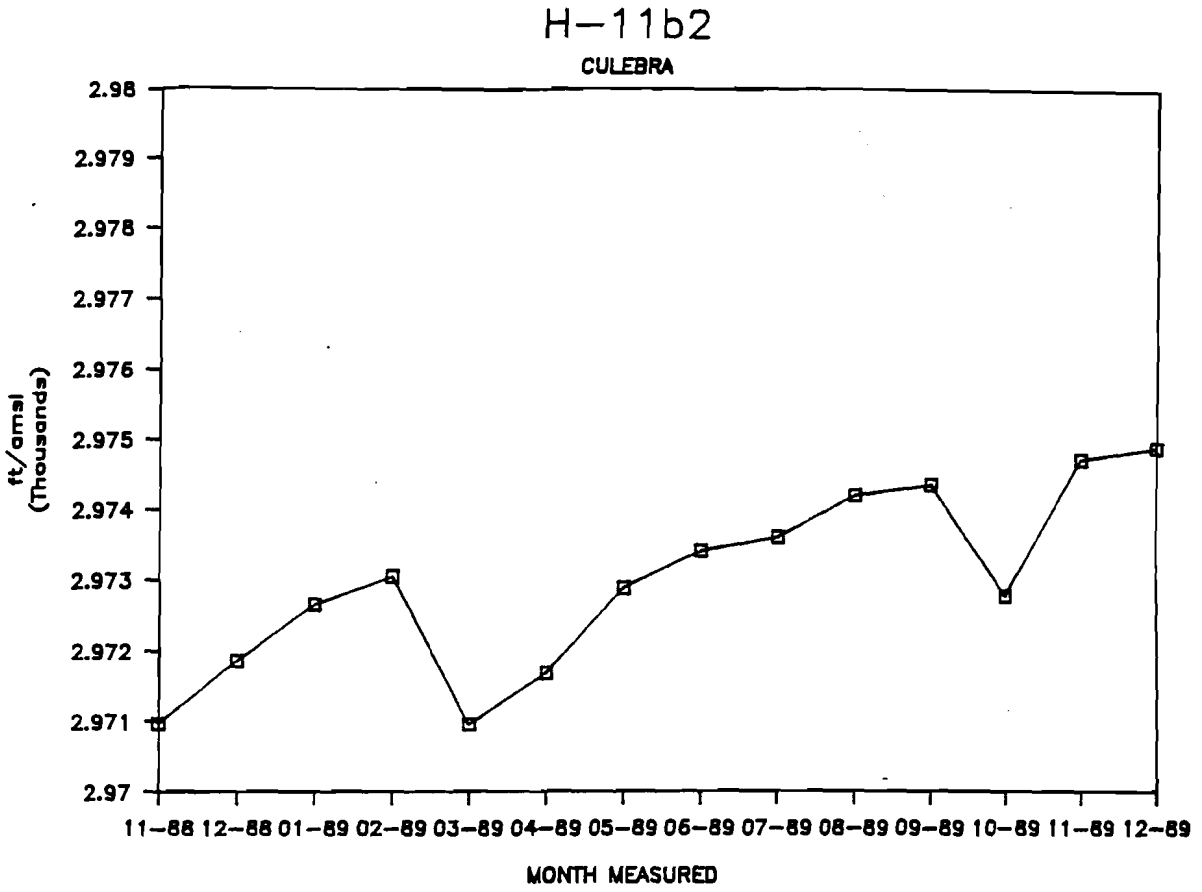

H-08c
RUSTLER/SALADO
2.98
2.979
2.978
2.977
2.976
2.975
2.974
2.973
2.972
2.971
2.97
ft/amsl (Thousands)
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8911-
MONTH MEASURED

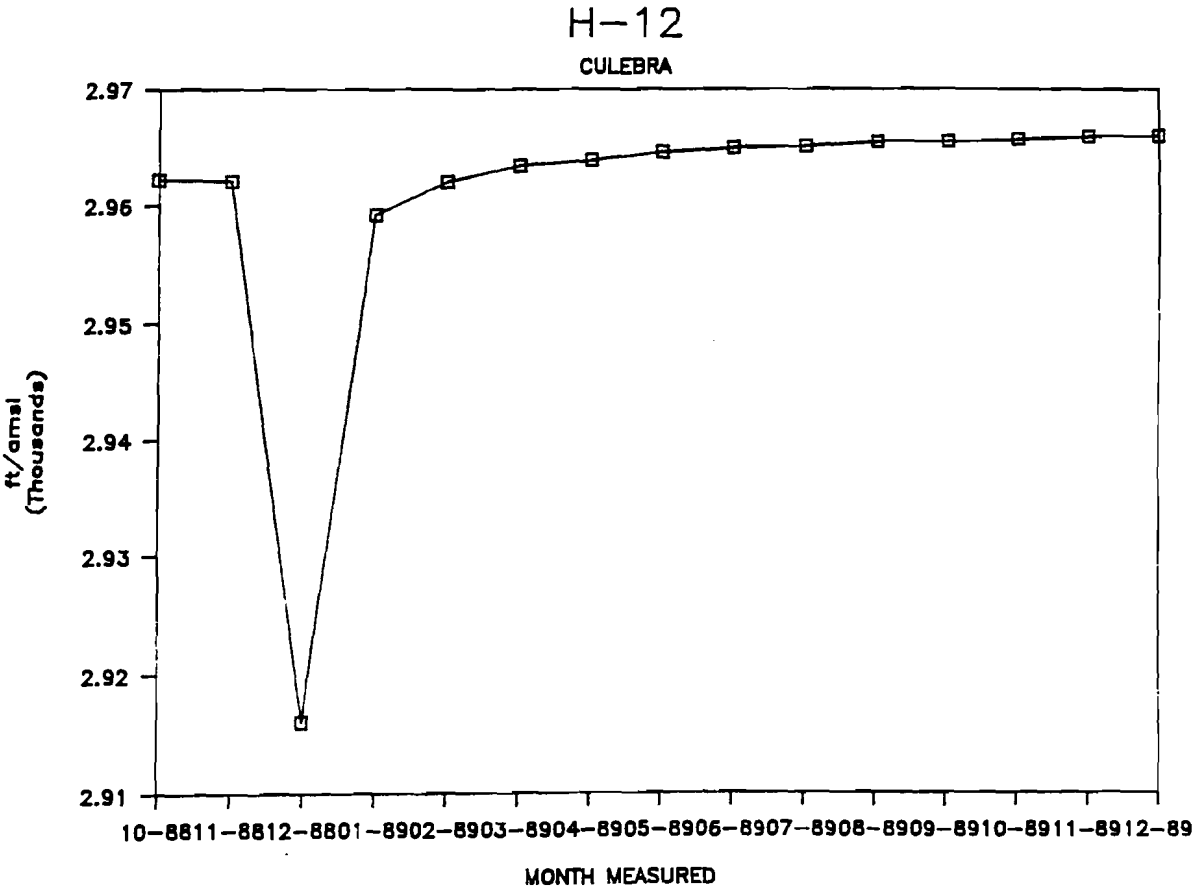

H-09a
CULEBRA
2.99
2.989
2.988
2.987
2.986
2.985
2.984
2.983
2.982
2.981
2.98
ft/amsl
(Thousands)
12-88
03-89
06-89
09-89
12-89
MONTH MEASURED

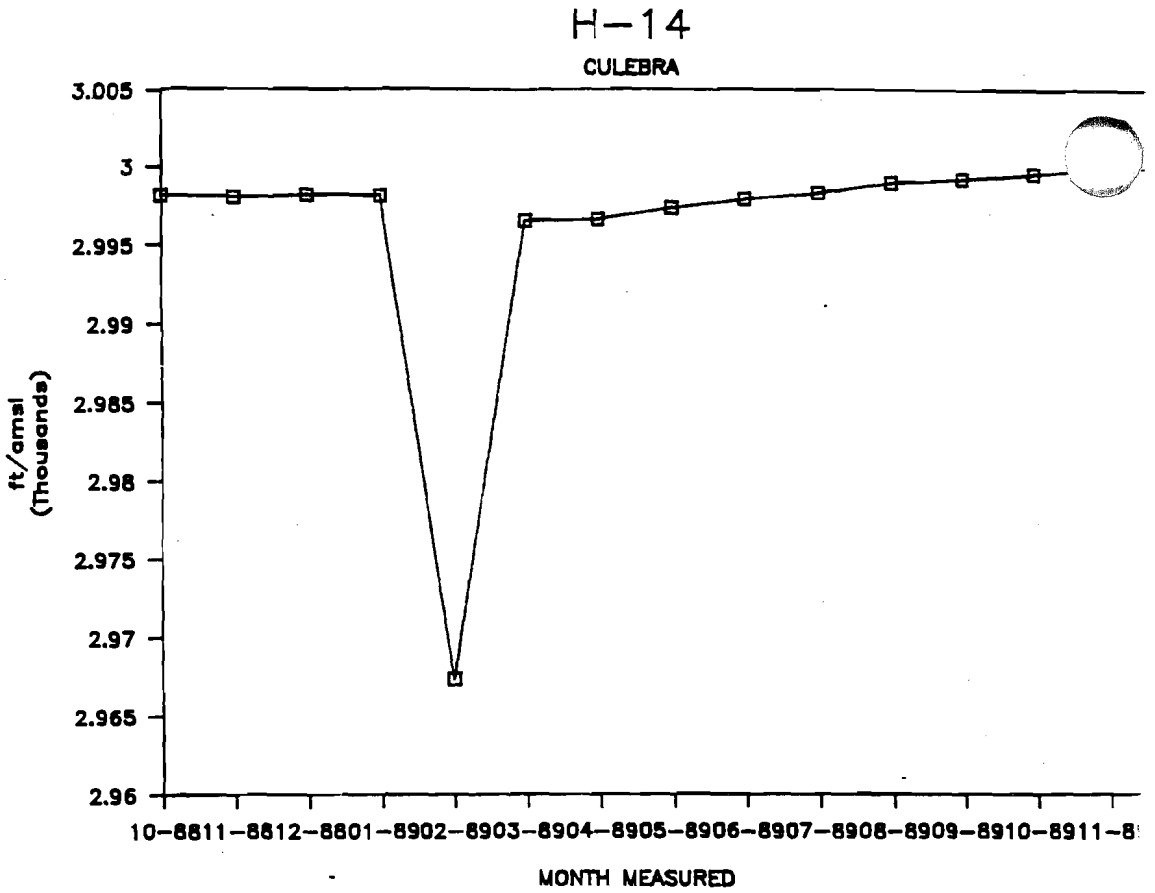

H-09b
CULEBRA
2.99
2.989
2.988
2.987
2.986
2.985
2.984
2.983
2.982
2.981
2.98
ft/amsl
(Thousands)
10-88
11-88
12-88
01-89
02-89
03-89
04-89
05-89
06-89
07-89
08-89
09-89
10-89
11-89
12-89
MONTH MEASURED

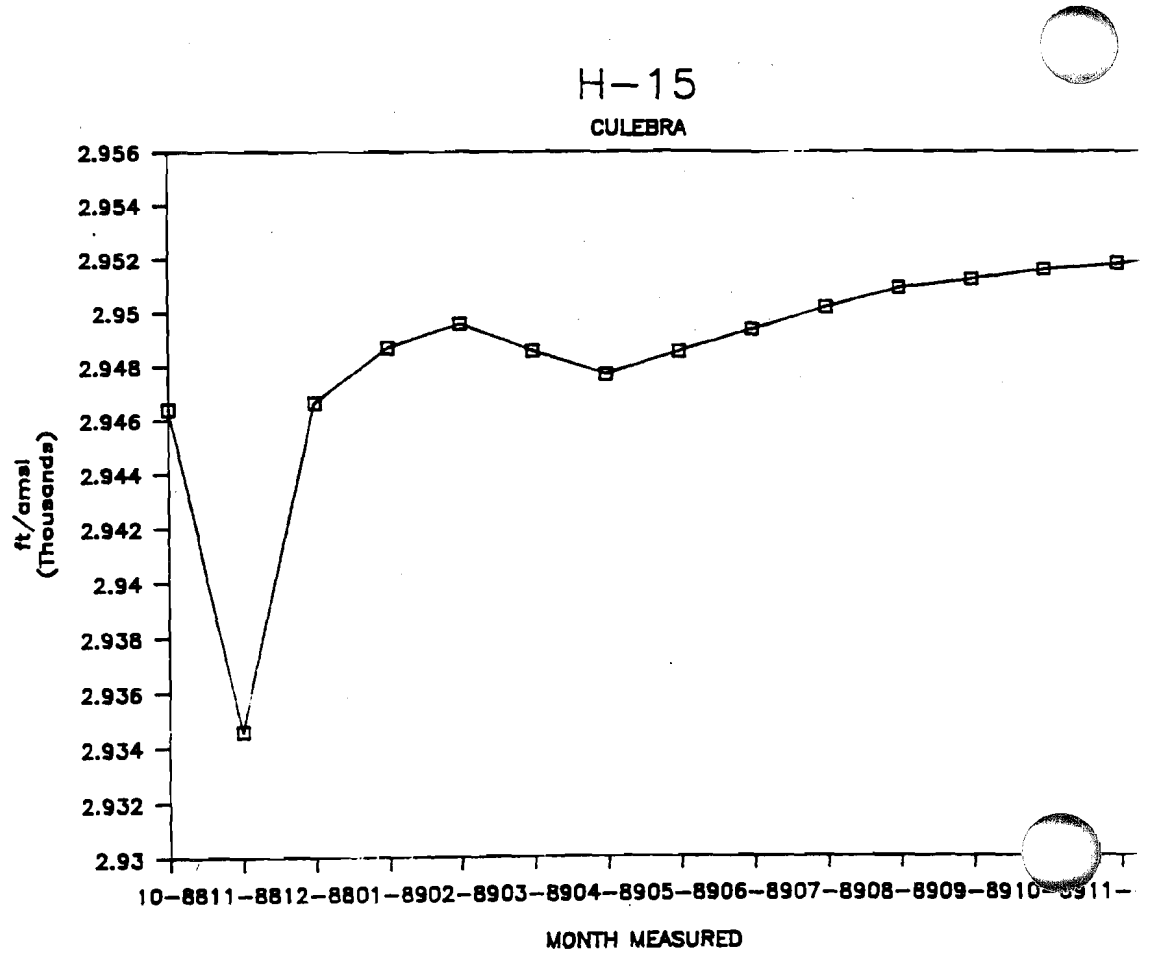

H-09c
CULEBRA
2.99
2.989
2.988
2.987
2.986
2.985
2.984
2.983
2.982
2.981
2.98
ft/amsl
(Thousands)
12-88
03-89
06-89
09-89
MONTH MEASURED

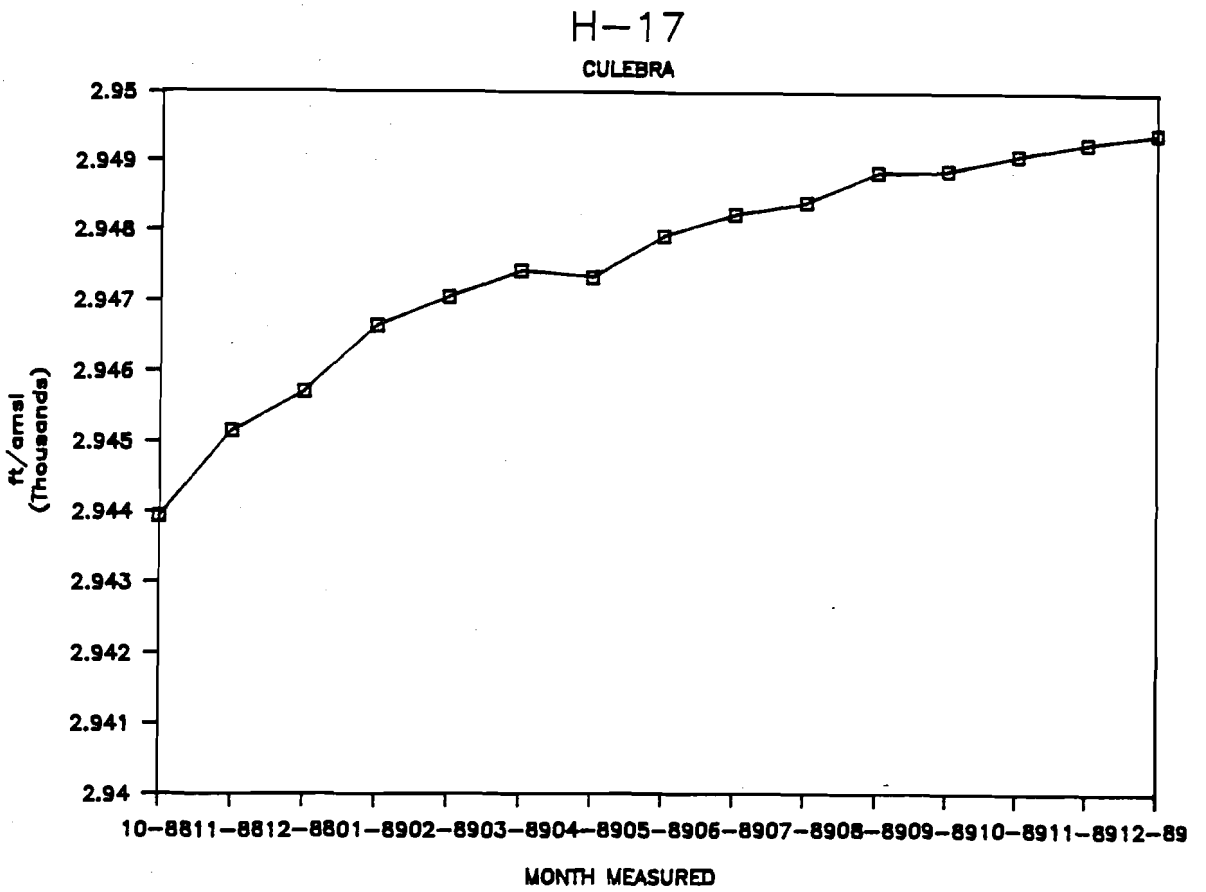

H-11b1
CULEBRA
2.98
2.979
2.978
2.977
2.976
2.975
2.974
2.973
2.972
2.971
2.97
ft/amsl
(Thousands)
12-88
03-89
06-89
09-89
MONTH MEASURED

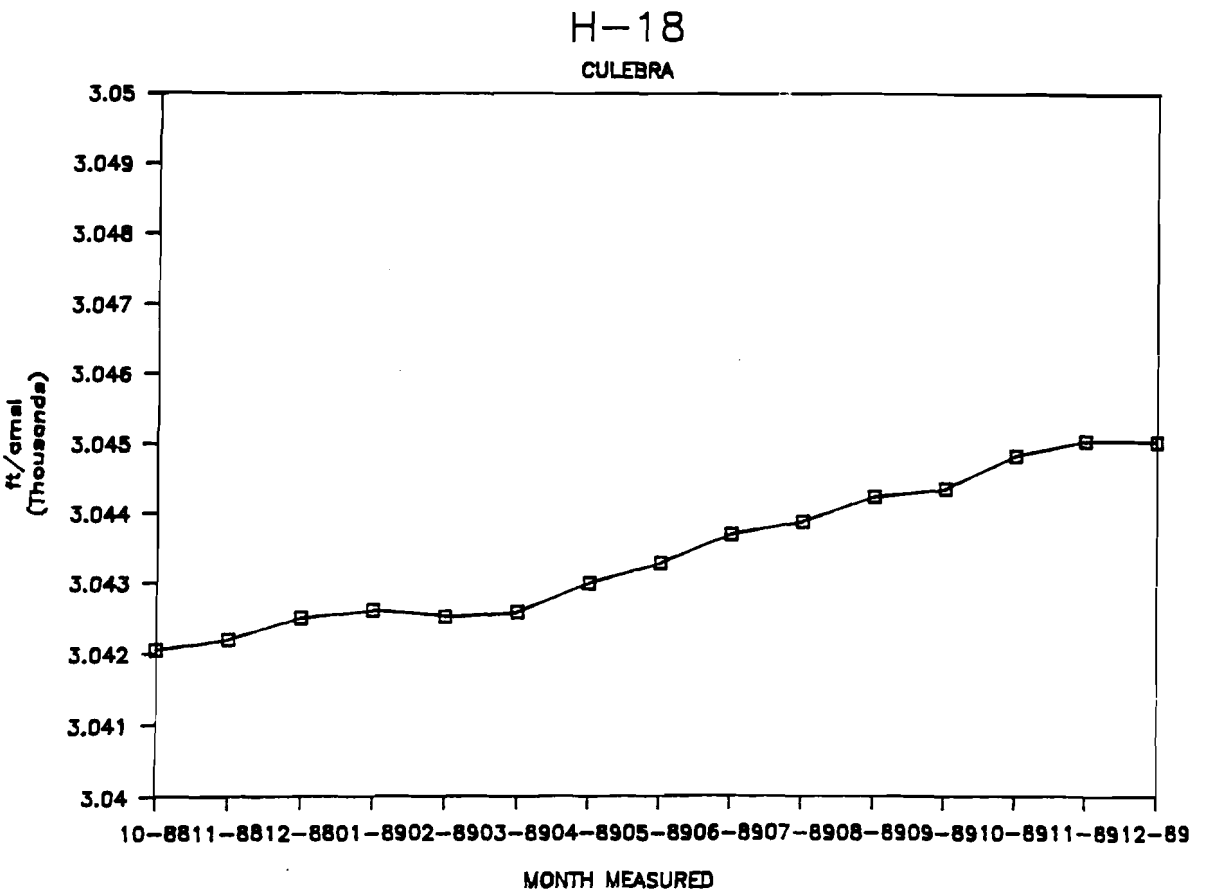

H-11b2
CULEBRA
2.98
2.979
2.978
2.977
2.976
2.975
2.974
2.973
2.972
2.971
2.97
ft/amsl (Thousands)
11-88 12-88 01-89 02-89 03-89 04-89 05-89 06-89 07-89 08-89 09-89 10-89 11-89 12-89
MONTH MEASURED

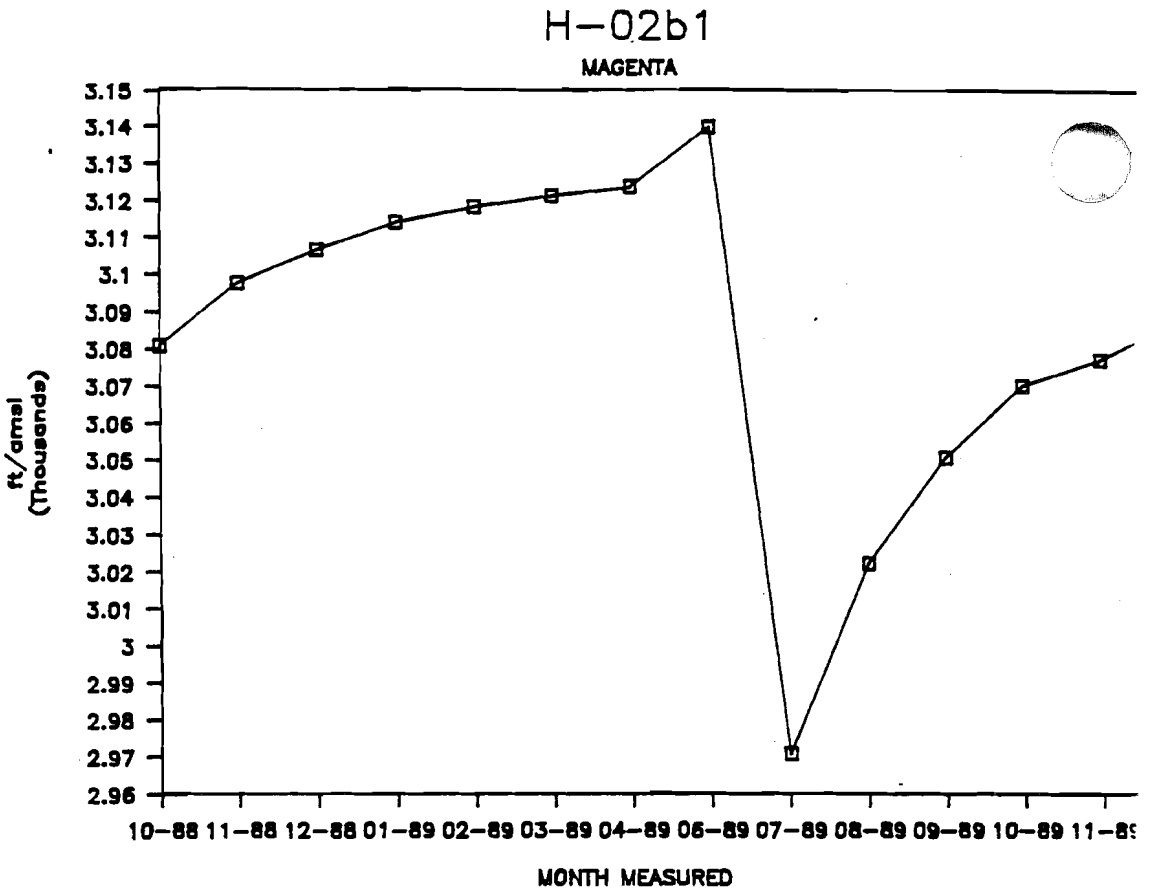

H-12
CULEBRA
2.97
2.96
2.95
2.94
2.93
2.92
2.91
ft/amsl (Thousands)
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-8912-89
MONTH MEASURED

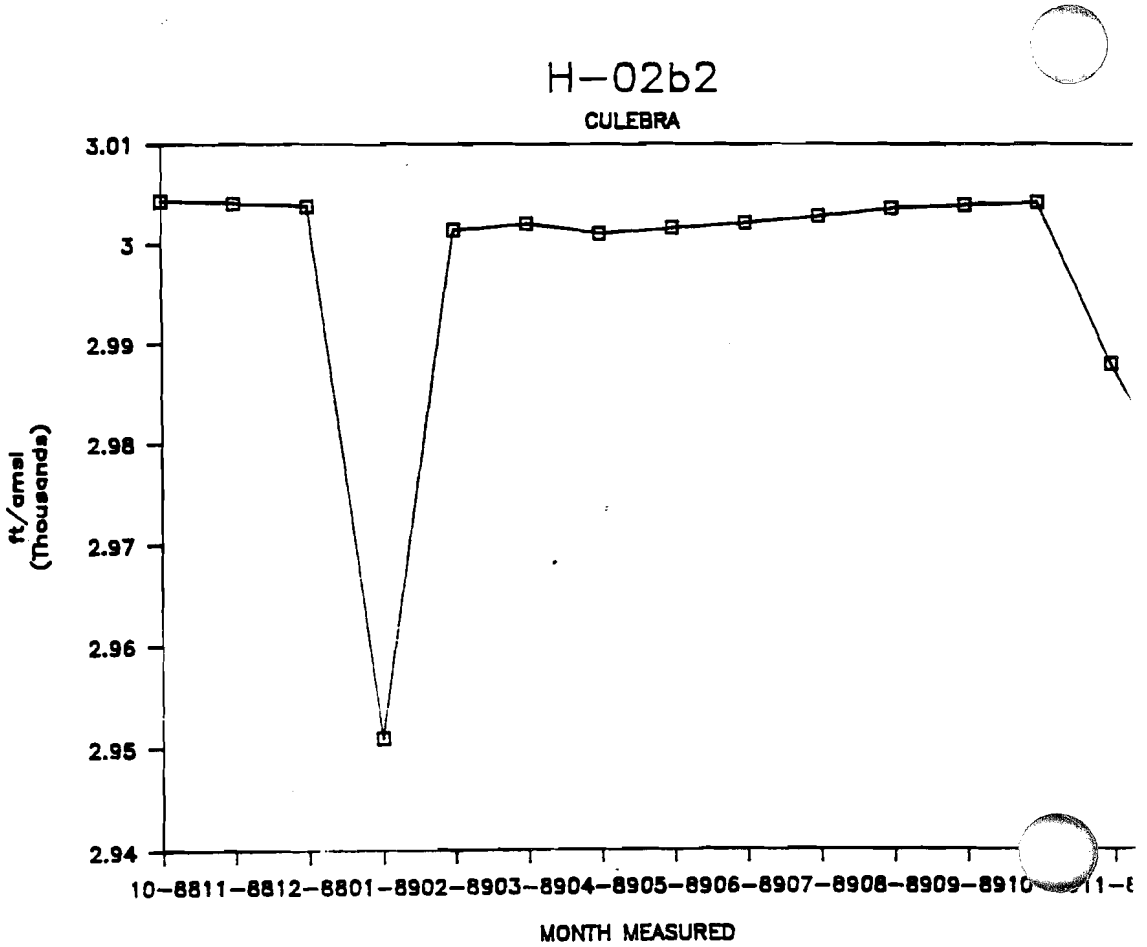

H-14
CULEBRA
3.005
3
2.995
2.99
2.985
2.98
2.975
2.97
2.965
2.96
ft/amsl (Thousands)
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-8
MONTH MEASURED

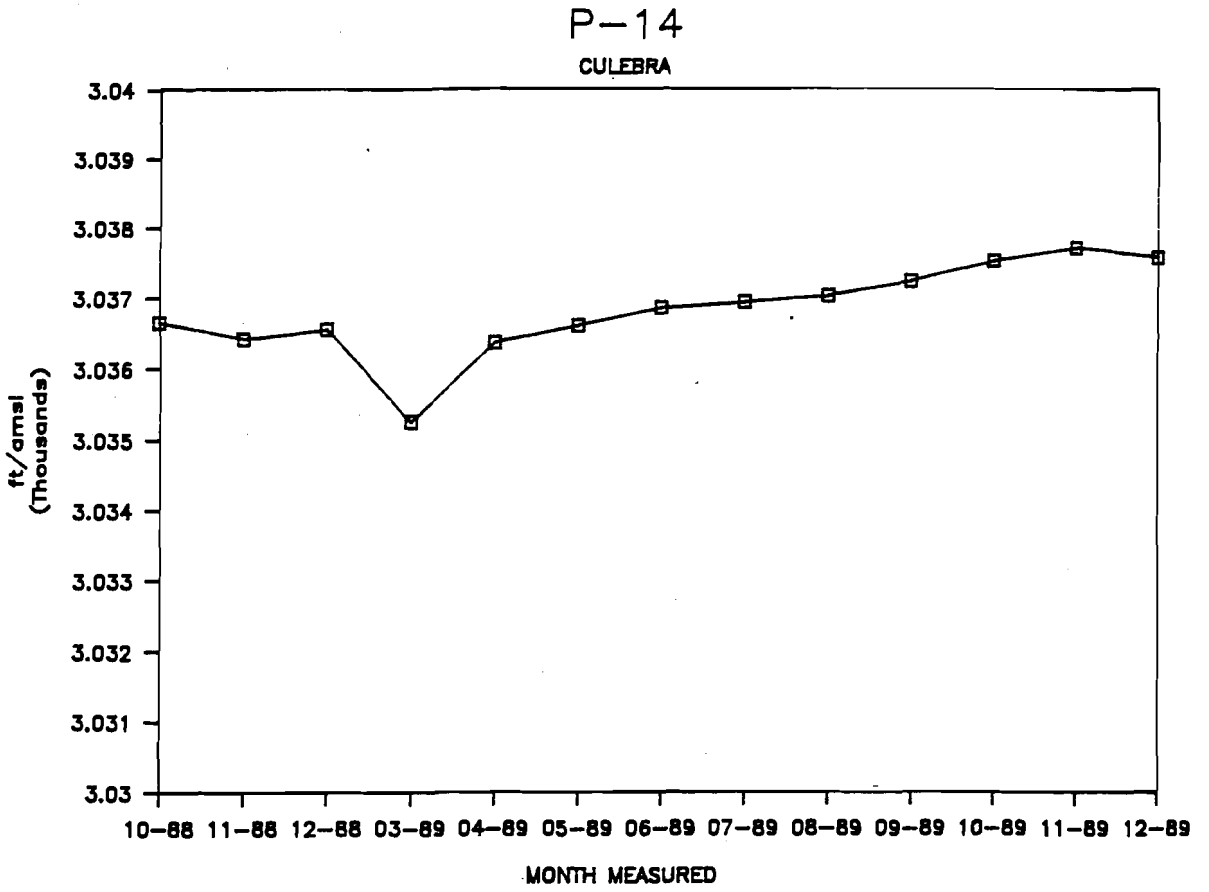

H-15
CULEBRA
2.956
2.954
2.952
2.95
2.948
2.946
2.944
2.942
2.94
2.938
2.936
2.934
2.932
2.93
ft/amsl (Thousands)
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-
MONTH MEASURED

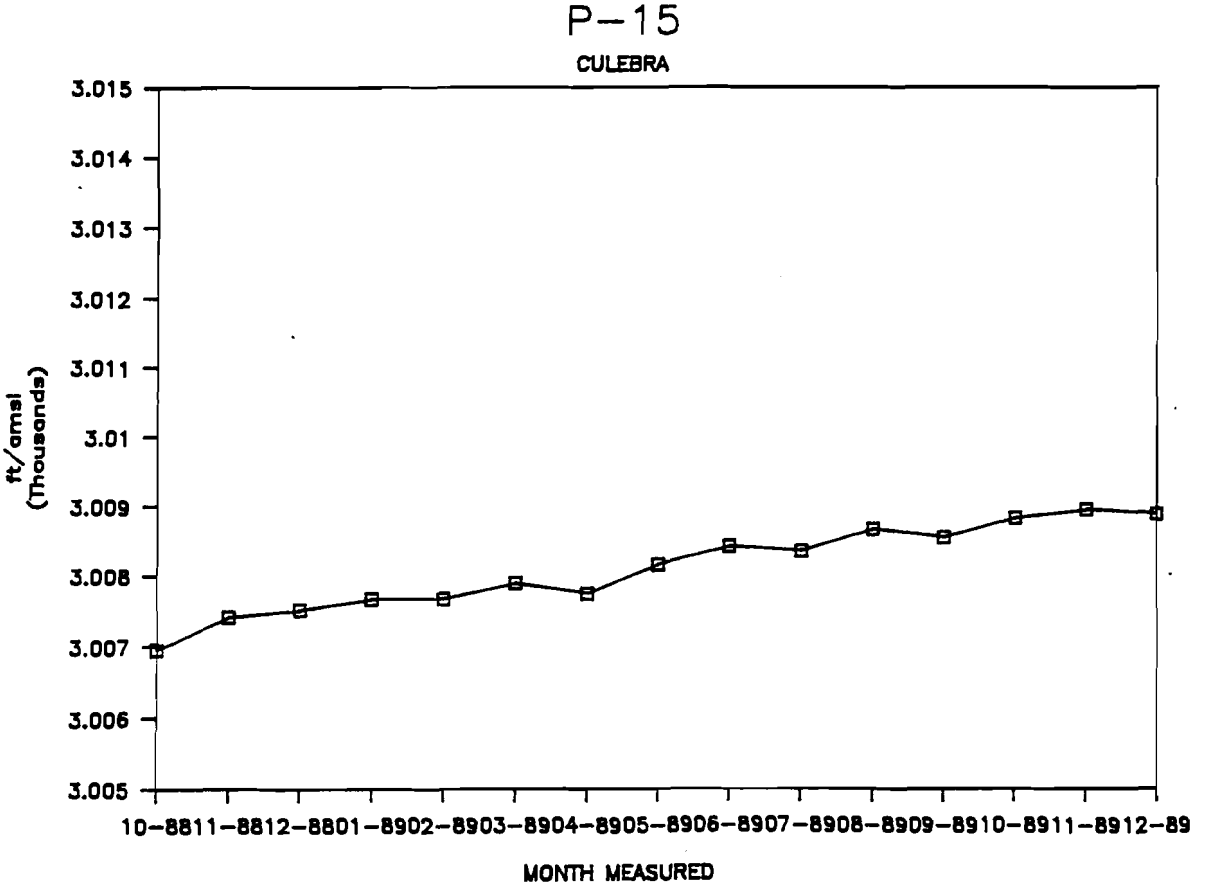

H-17
CULEBRA
2.95
2.949
2.948
2.947
2.946
2.945
2.944
2.943
2.942
2.941
2.94
ft/amsl
(Thousands)
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-8912-89
MONTH MEASURED

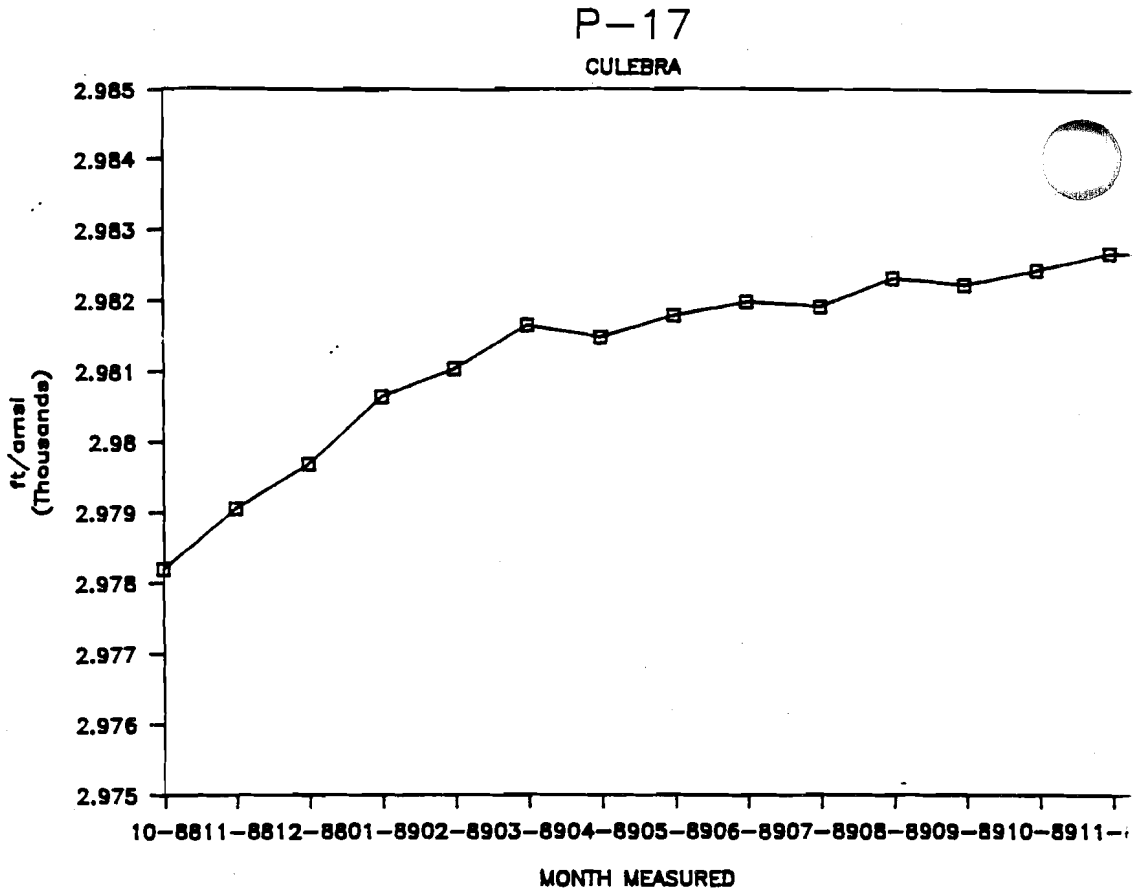

H-18
CULEBRA
3.05
3.049
3.048
3.047
3.046
3.045
3.044
3.043
3.042
3.041
3.04
ft/amsl
(Thousands)
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-8912-89
MONTH MEASURED

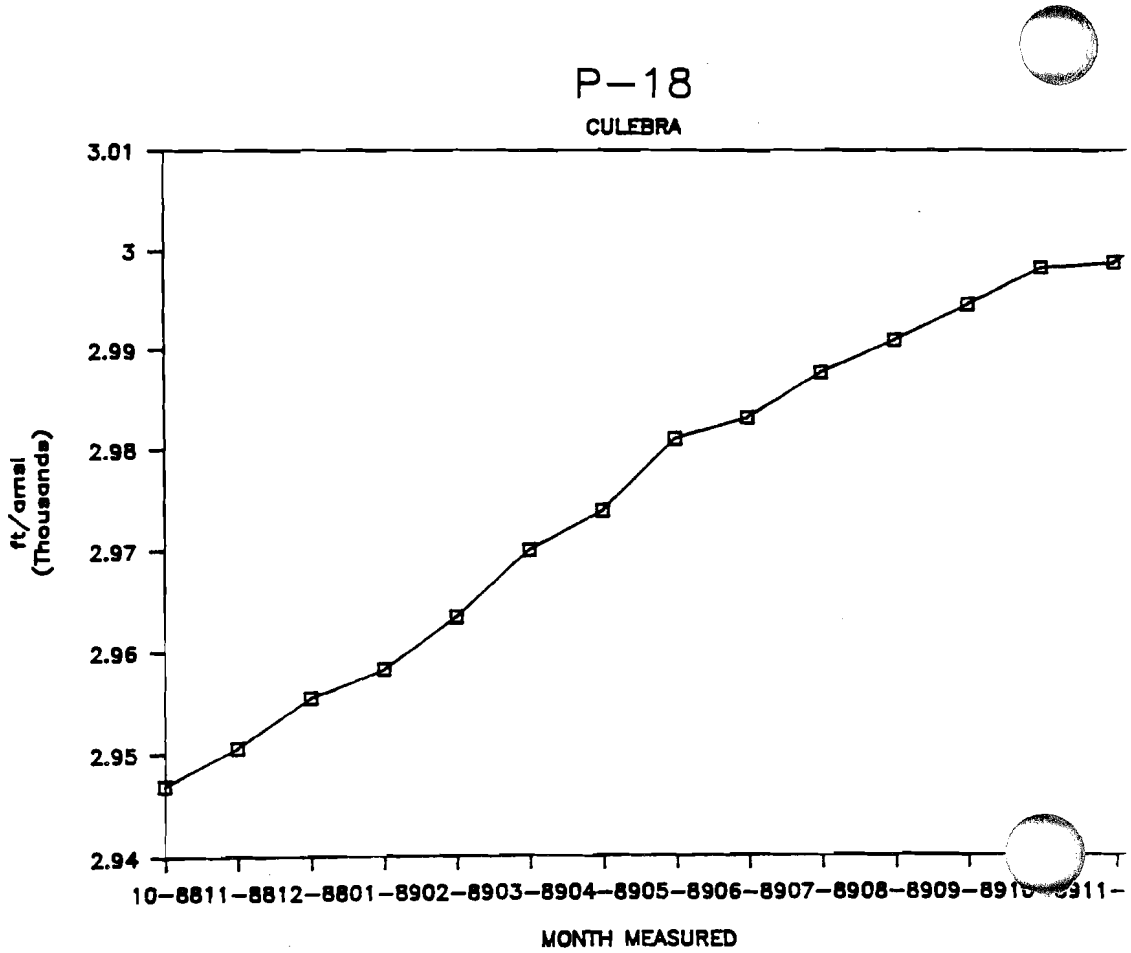

H-02b1
MAGENTA
ft/amsl (Thousands)
3.15
3.14
3.13
3.12
3.11
3.1
3.09
3.08
3.07
3.06
3.05
3.04
3.03
3.02
3.01
3
2.99
2.98
2.97
2.96
10-88 11-88 12-88 01-89 02-89 03-89 04-89 06-89 07-89 08-89 09-89 10-89 11-8
MONTH MEASURED

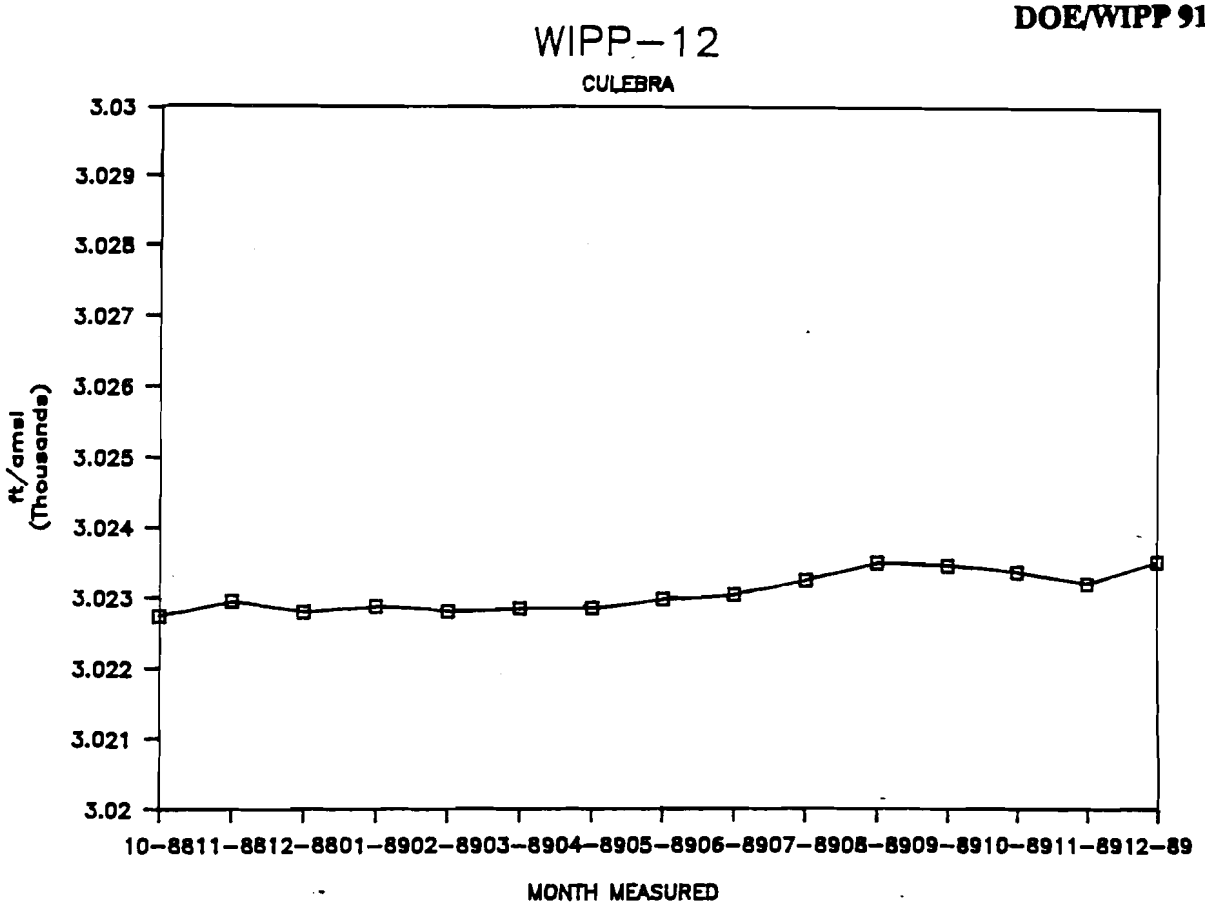

H-02b2
CULEBRA
ft/amsl (Thousands)
3.01
3
2.99
2.98
2.97
2.96
2.95
2.94
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-11-8
MONTH MEASURED

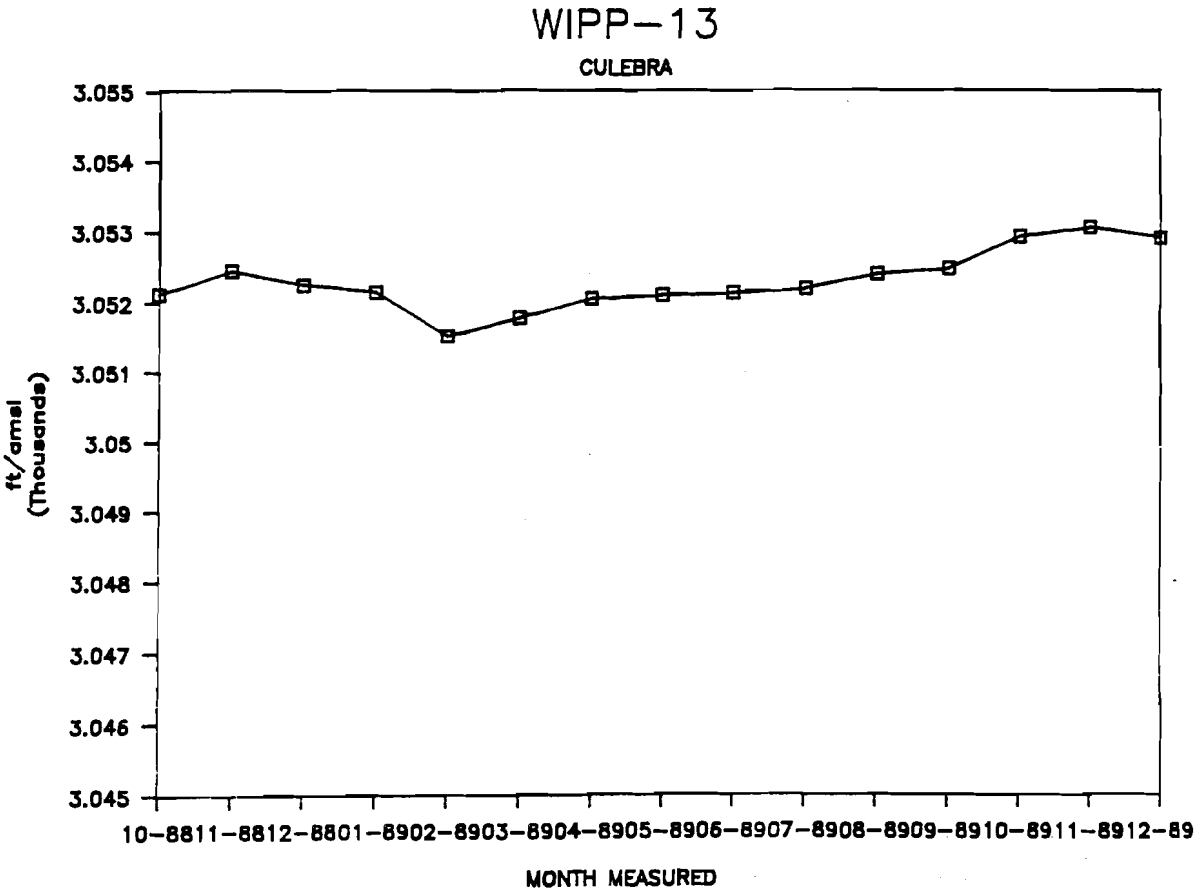

P-14
CULEBRA
3.04
3.039
3.038
3.037
3.036
3.035
3.034
3.033
3.032
3.031
3.03
ft/amsl (Thousands)
10-88 11-88 12-88 03-89 04-89 05-89 06-89 07-89 08-89 09-89 10-89 11-89 12-89
MONTH MEASURED


P-15
CULEBRA
3.015
3.014
3.013
3.012
3.011
3.01
3.009
3.008
3.007
3.006
3.005
ft/amsl (Thousands)
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-8912-89
MONTH MEASURED


P-17
CULEBRA
2.985
2.984
2.983
2.982
2.981
2.98
2.979
2.978
2.977
2.976
2.975
ft/amsl
(Thousands)
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-
MONTH MEASURED


P-18
CULEBRA
3.01
3
2.99
2.98
2.97
2.96
2.95
2.94
ft/amsl
(Thousands)
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-
MONTH MEASURED


WIPP-12
CULEBRA
3.03
3.029
3.028
3.027
3.026
3.025
3.024
3.023
3.022
3.021
3.02
ft/amsl
(Thousands)
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-8912-89
MONTH MEASURED

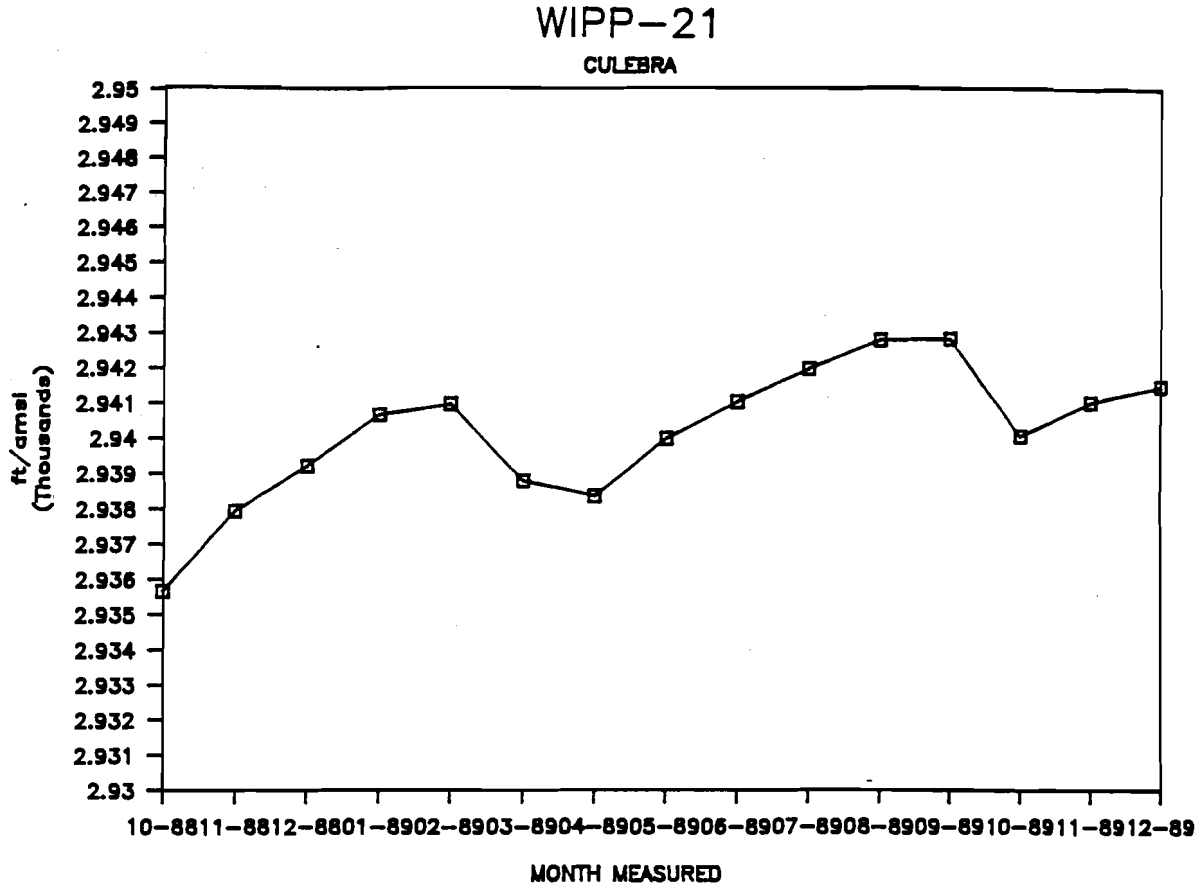

WIPP-13
CULEBRA
3.055
3.054
3.053
3.052
3.051
3.05
3.049
3.048
3.047
3.046
3.045
ft/amsl
(Thousands)
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-8912-89
MONTH MEASURED

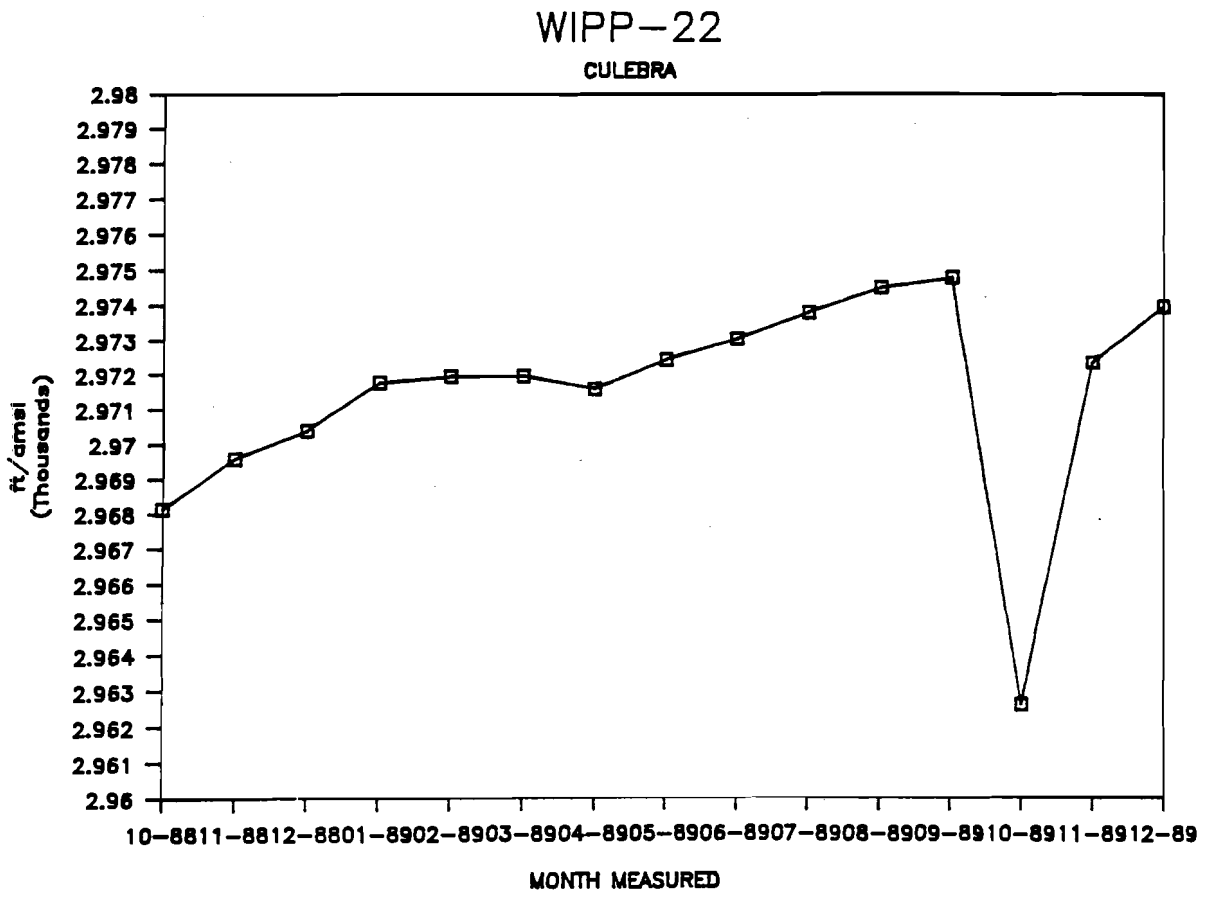
FRACTIONS AND MULTIPLES OF UNITS

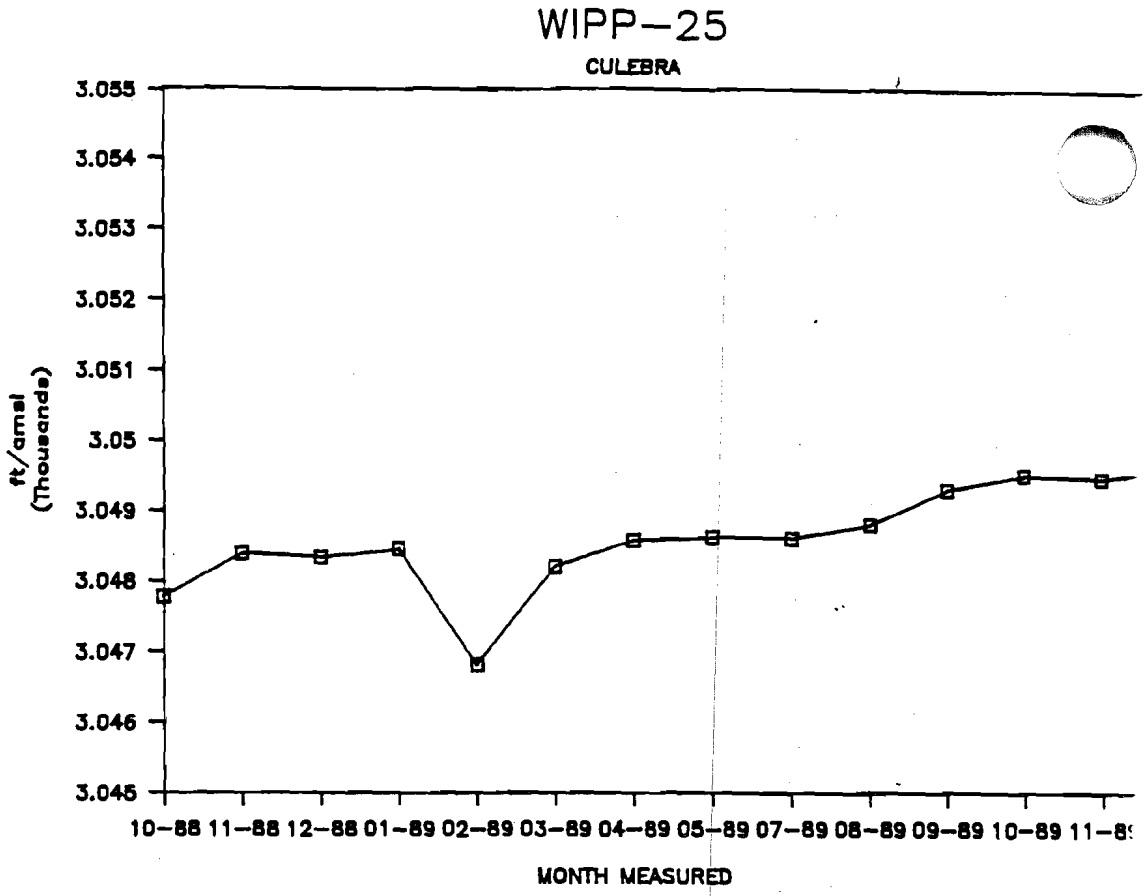
Multiple	Decimal Equivalent	Prefix	Symbol
10^6	1,000,000	mega-	M
10^3	1,000	kilo-	k
10^2	100	hecto-	h
10	10	deka-	da
10^{-1}	0.1	deci-	d
10^{-2}	0.01	centi-	c
10^{-3}	0.001	milli-	m
10^{-6}	0.000001	micro-	µ
10^{-9}	0.000000001	nano-	n
10^{-12}	0.000000000001	pico-	p
10^{-15}	0.000000000000001	femto-	f
10^{-18}	0.000000000000000001	atto-	a

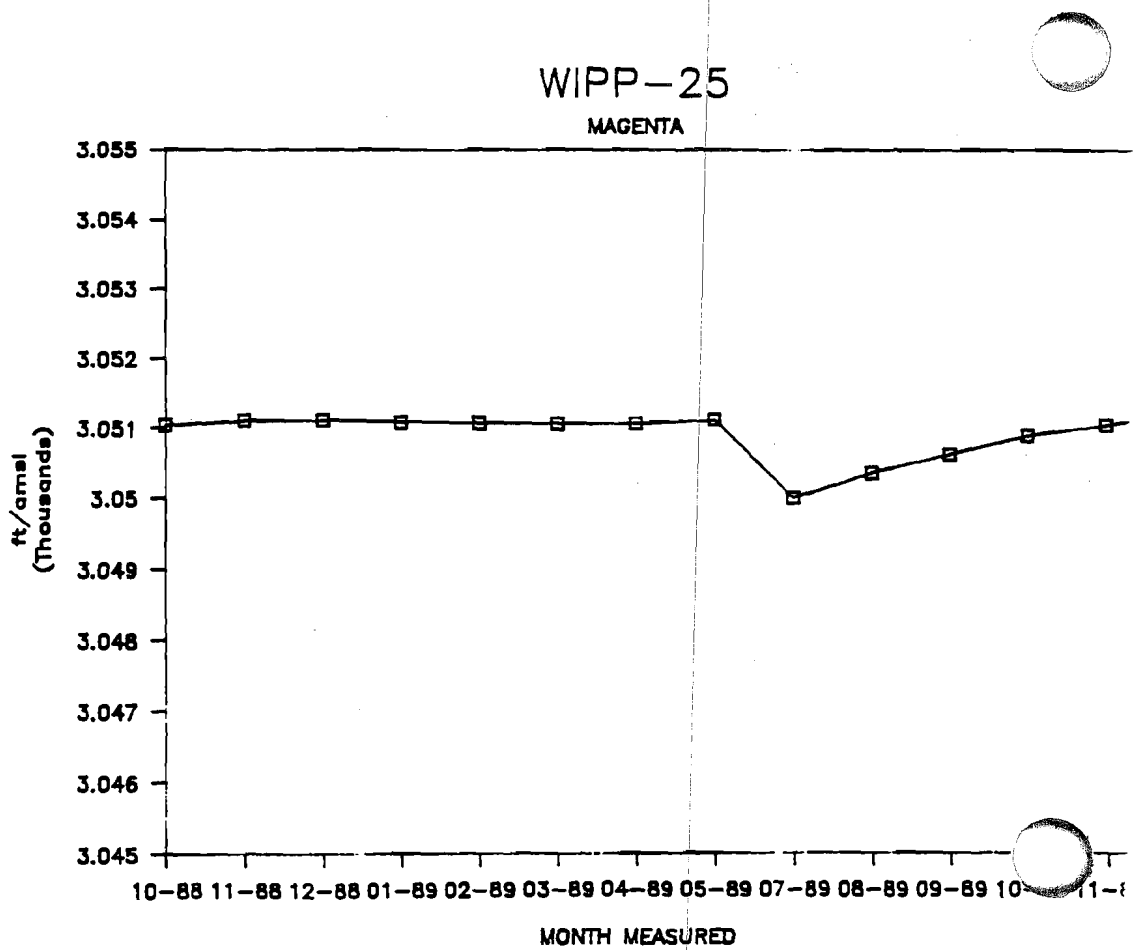
CONVERSION TABLE

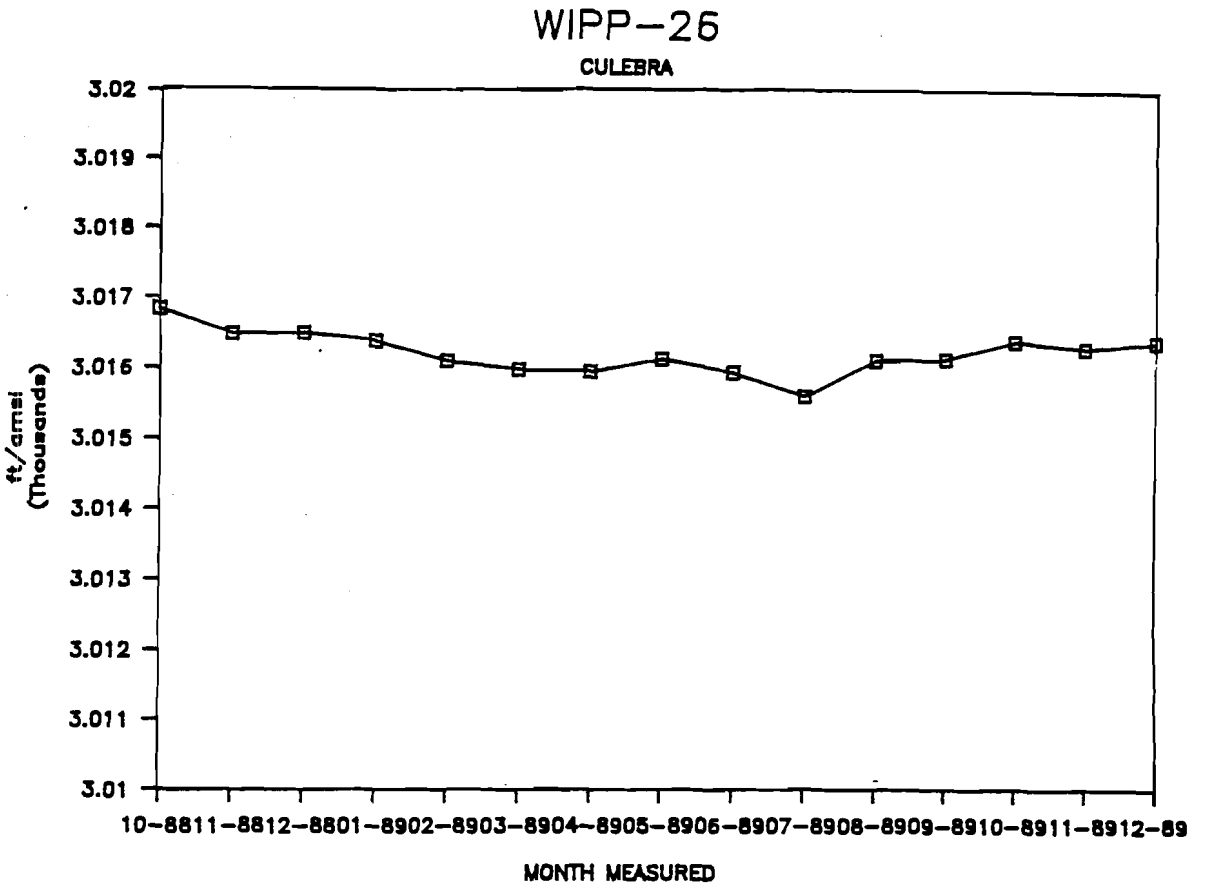
Multiply	By	To Obtain	Multiply	By	To Obtain
in.	2.54	cm	cm	0.394	in.
ft	0.305	m	m	3.28	ft
mi	1.61	km	km	0.621	mi
lb	0.4536	kg	kg	2.205	lb
liq qt - U.S.	0.946	L	L	1.057	liq qt - U.S.
ft^2	0.093	m^2	m^2	10.764	ft^2
mi^2	2.59	km^2	km^2	0.386	mi^2
ft^3	0.028	m^3	m^3	35.31	ft^3
mCi/mi^2	0.386	mCi/km^2 (nCi/m^2)	mCi/km^2	2.59	mCi/mi^2
d/m	0.450	pCi	pCi	2.22	d/m
nCi	1×10^3	pCi	pCi	1×10^{-3}	nCi
d/m/L	0.45×10^{-9}	µCi/cc	µCi/cc	2.22×10^9	d/m/L
$d/m/ft^2$	0.01256	mCi/mi^2	mCi/mi^2	79.6	$d/m/ft^2$
pCi/L (water)	10^{-9}	µCi/mL (water)	µCi/mL (water)	10^9	pCi/L (water)
pCi/m^3 (air)	10^{-12}	µCi/cc (air)	µCi/cc (air)	10^{12}	pCi/m^3 (air)
mCi/km^2	1	nCi/m^2	nCi/m^2	1	mCi/km^2

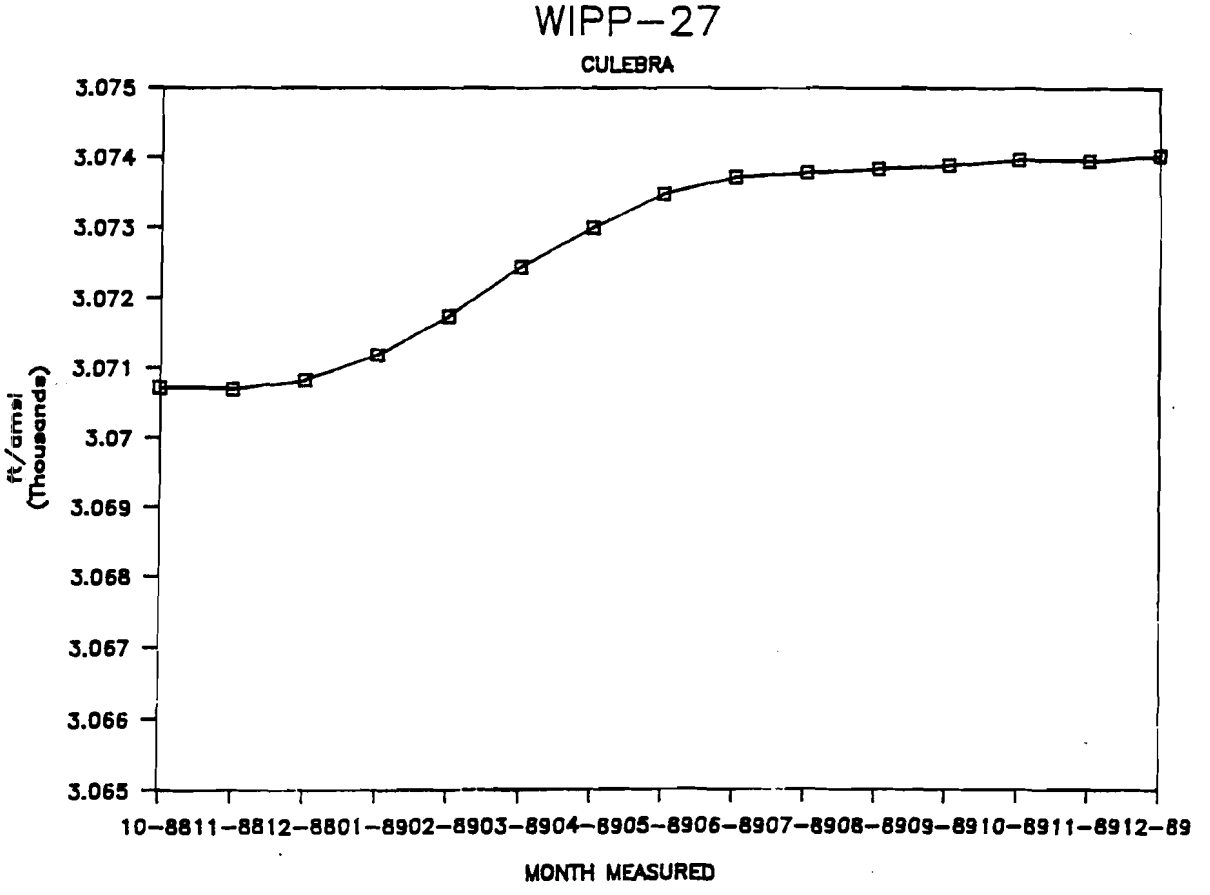

WIPP-21
CULEBRA
ft/amsl (Thousands)
2.95
2.949
2.948
2.947
2.946
2.945
2.944
2.943
2.942
2.941
2.94
2.939
2.938
2.937
2.936
2.935
2.934
2.933
2.932
2.931
2.93
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-8912-89
MONTH MEASURED

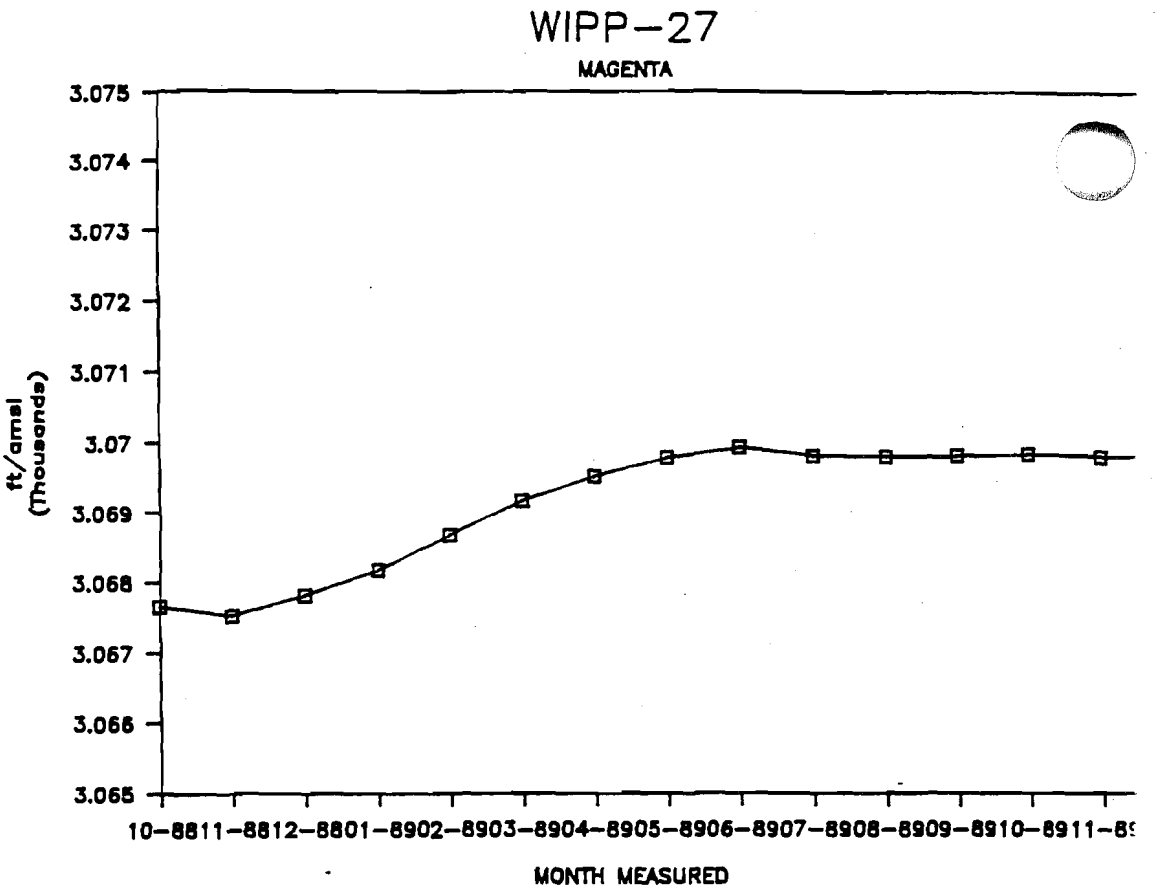

WIPP-22
CULEBRA
ft/amsl (Thousands)
2.98
2.979
2.978
2.977
2.976
2.975
2.974
2.973
2.972
2.971
2.97
2.969
2.968
2.967
2.966
2.965
2.964
2.963
2.962
2.961
2.96
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-8912-89
MONTH MEASURED

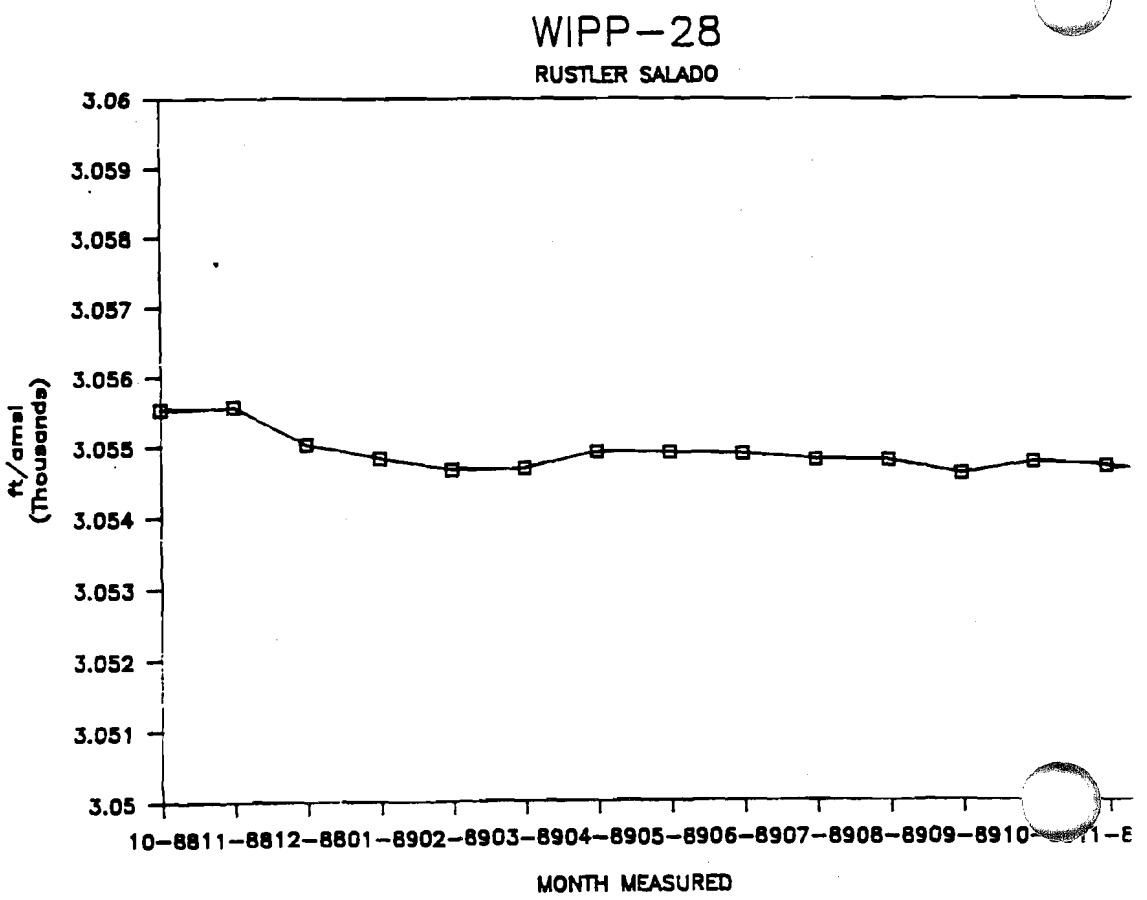

WIPP-25
CULEBRA
ft/amsl (Thousands)
3.055
3.054
3.053
3.052
3.051
3.05
3.049
3.048
3.047
3.046
3.045
10-88 11-88 12-88 01-89 02-89 03-89 04-89 05-89 07-89 08-89 09-89 10-89 11-8
MONTH MEASURED

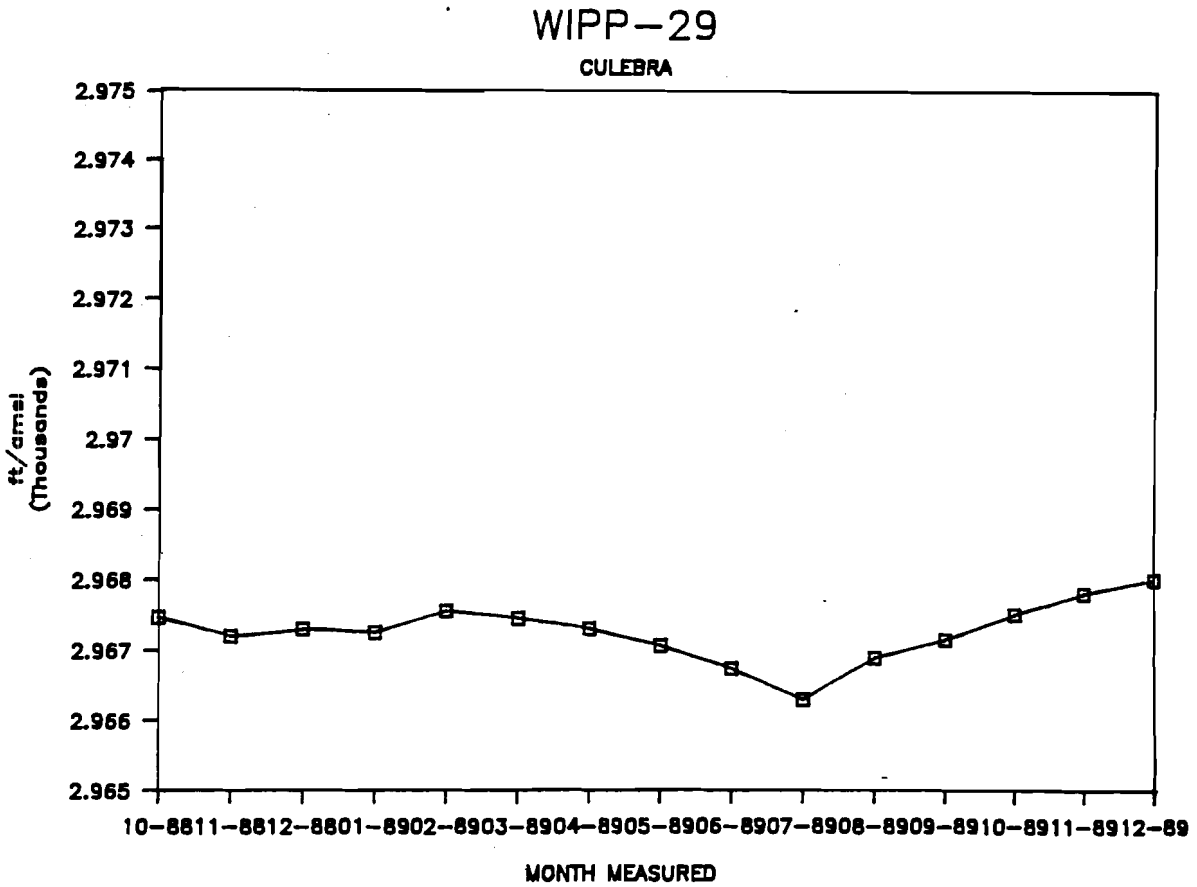

WIPP-25
MAGENTA
ft/amsl (Thousands)
3.055
3.054
3.053
3.052
3.051
3.05
3.049
3.048
3.047
3.046
3.045
10-88 11-88 12-88 01-89 02-89 03-89 04-89 05-89 07-89 08-89 09-89 10
MONTH MEASURED

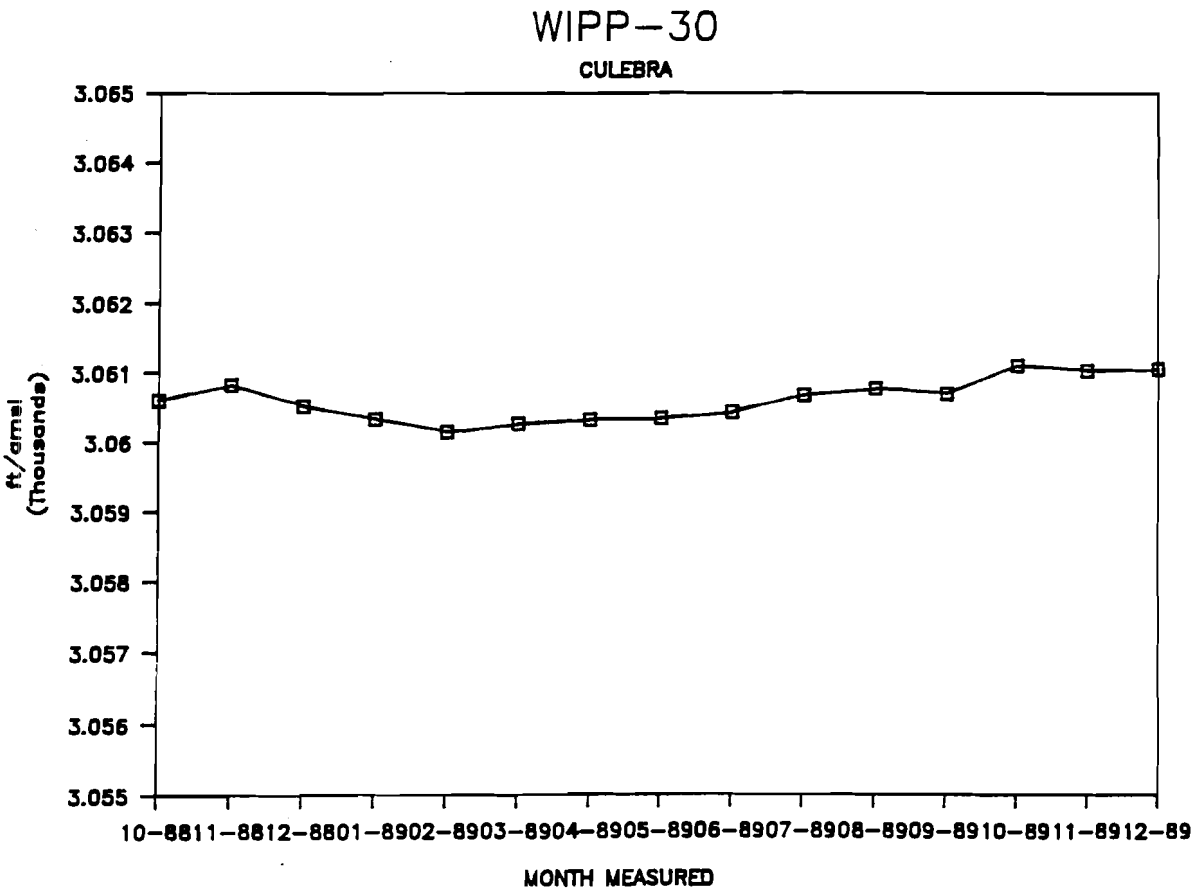

WIPP-26
CULEBRA
3.02
3.019
3.018
3.017
3.016
3.015
3.014
3.013
3.012
3.011
3.01
ft/amsl
(Thousands)
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-8912-89
MONTH MEASURED

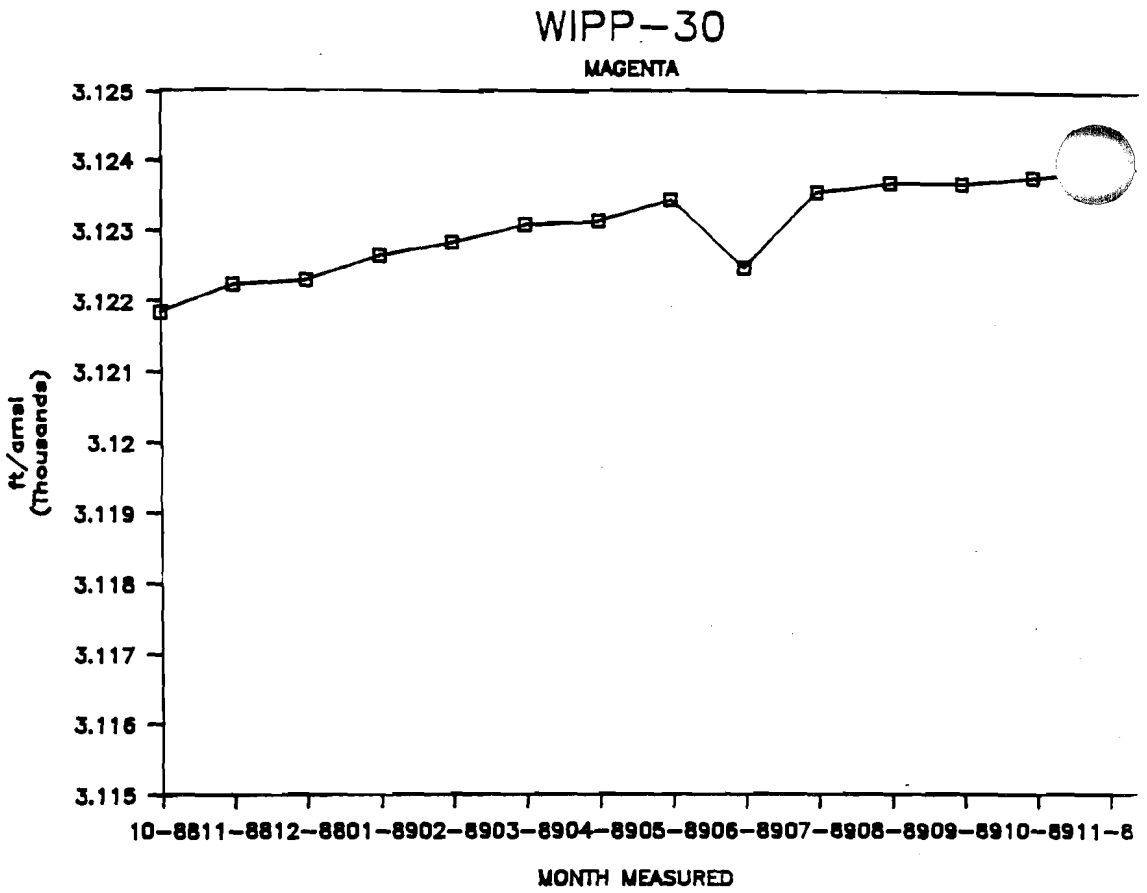

WIPP-27
CULEBRA
3.075
3.074
3.073
3.072
3.071
3.07
3.069
3.068
3.067
3.066
3.065
ft/amsl
(Thousands)
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-8912-89
MONTH MEASURED


WIPP-27
MAGENTA
3.075
3.074
3.073
3.072
3.071
3.07
3.069
3.068
3.067
3.066
3.065
ft/amsl
(Thousands)
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-8
MONTH MEASURED


WIPP-28
RUSTLER SALADO
3.06
3.059
3.058
3.057
3.056
3.055
3.054
3.053
3.052
3.051
3.05
ft/amsl
(Thousands)
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-8
MONTH MEASURED


WIPP-29
CULEBRA
2.975
2.974
2.973
2.972
2.971
2.97
2.969
2.968
2.967
2.966
2.965
ft/amsl
(Thousands)
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-8912-89
MONTH MEASURED


WIPP-30
CULEBRA
3.065
3.064
3.063
3.062
3.061
3.06
3.059
3.058
3.057
3.056
3.055
ft/amsl
(Thousands)
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-8912-89
MONTH MEASURED


WIPP-30
MAGENTA
3.125
3.124
3.123
3.122
3.121
3.12
3.119
3.118
3.117
3.116
3.115
ft/amsl
(Thousands)
10-8811-8812-8801-8902-8903-8904-8905-8906-8907-8908-8909-8910-8911-8
MONTH MEASURED

FRACTIONS AND MULTIPLES OF UNITS

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10^{-2}	0.01	centi-	c
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10^{-6}	0.000001	micro-	µ
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10^{-18}	0.000000000000000001	atto-	a

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nCi	1×10^3	pCi	pCi	1×10^{-3}	nCi
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$d/m/ft^2$	0.01256	mCi/mi^2	mCi/mi^2	79.6	$d/m/ft^2$
pCi/L (water)	10^{-9}	µCi/mL (water)	µCi/mL (water)	10^9	pCi/L (water)
pCi/m^3 (air)	10^{-12}	µCi/cc (air)	µCi/cc (air)	10^{12}	pCi/m^3 (air)
mCi/km^2	1	nCi/m^2	nCi/m^2	1	mCi/km^2