DOE/WIPP 92-007

Waste Isolation Pilot Plant

Site Environmental Report for Calendar Year 1991

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PREFACE

This is the eighth Annual Site Environmental Report (ASER), for the U.S. Department of Energy (DOE), Waste Isolation Pilot Plant (WIPP). The most significant addition to the 1991 report is the inclusion of the first four appendices, the Radiological Baseline Program (DOE/WIPP 92-037), the Salt Impact Studies (DOE/WIPP 92-038), the Disturbed Land Reclamation Techniques (DOE/WIPP 92-039), and the Background Water Characterization for the WIPP (DOE/WIPP 92-013). These appendices are independently published and available to interested parties by the DOE reference number. These summaries will not be published in future ASER's. They will, however, be referenced as a basis for evaluating similar data collected during the Test and subsequent Operational phases of the WIPP.

The writers of this report appreciate any comments the readers of this report have to offer. Due to the wide distribution of this document, it is requested that all those who wish to remain on the direct mailing list, contact the Environment, Safety, and Health Department, Environmental Monitoring Section, at the address or phone number listed below. However, this report will always be provided to appropriate reading rooms, libraries, and centers where public documents are housed, as required by the DOE.

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.

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ACRONYMS AND ABBREVIATIONS

AEA	Atomic Energy Act
AL	U.S. Department of Energy, Albuquerque
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
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act (also known as Superfund)
CFM	Cubic Feet per Minute
CFR	Code of Federal Regulation
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-AL	U.S. Department of Energy, Albuquerque
DOE-EML	U.S. Department of Energy, Environmental Measurements Laboratory
DOL	U.S. Department of Labor
DOT	U. S. Department of Transportation
EA	Environmental Assessment
EC	Electrical Conductivity
EDF	Environmental Defense Fund

ACRONYMS AND ABBREVIATIONS
(Continued)

EEG	Environmental Evaluation Group
Eh	Oxidation-Reduction Potential
EID	New Mexico Environmental Improvement Division
EIS	Environmental Impact Statement
EMP	Ecological Monitoring Program
EO	*Executive Order*
EPA	U. S. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ESA	Endangered Species Act
FDA	Fluorescardiacetate Hydrolysis Assay
FEIS	Final Environmental Impact Statement
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FLPMA	Federal Land Policy Management Act
FR	Federal Register
FSAR	Final Safety Analysis Report
FT	Feet
FWPCA	Federal Water Pollution Control Act
GOCO	Government-Owned, Contractor Operated
HEPA	High Efficiency Particulate Air (filter)
HMTA	Hazardous Material Transportation Act
HPIC	High Pressure Ionization Chamber
HSWA	Hazardous and Solid Waste Amendments
ITAS	International Technologies Analytical Services Laboratory
MMI	Modified Mercalli Intensity
MOU	Memorandum of Understanding
MPS	Meters Per Second
NA	Not Applicable

ACRONYMS AND ABBREVIATIONS
(Continued)

NAAQS	National Ambient Air Quality Standards
NCP	National Contingency Plan
NCRP	National Council on Radiation Protection and Measurement
NEPA	National Environmental Policy Act
NES	Nonradiological Environmental Surveillance
NESHAPs	National Emissions Standard for Hazardous Air Pollutants
NHPA	National Historic Preservation Act
NMD	No-Migration Determination
NMED	New Mexico Environment Department
NMGF	New Mexico Department of Game and Fish
NMIMT	New Mexico Institute of Mining and Technology
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
NWPA	National Waste Policy Act
OEMP	Operational Environmental Monitoring Plan
OP	Optical Density
PCB	Polychlorinated Biphenyls
pH	Hydrogen-Ion Activity of a System
PSD	Prevention of Significant Deterioration
QA	Quality Assurance
QC	Quality Control
RBP	Radiological Baseline Program

ACRONYMS AND ABBREVIATIONS
(Continued)

RCRA	Resource Conservation and Recovery Act
RES	Radiological Environmental Surveillance
RH-TRU	Remote Handled Transuranic Waste
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
SE-2	Southeast 2
SEIS	Supplement Environmental Impact Statement
SERC	State Emergency Response Commission
SIC	Standard Industrial Code
SNL	Sandia National Laboratories
SNK	Student-Newman-Keuls
TDS	Total Dissolved Solids
TLD	Thermoluminescent Dosimeters
TOC	Top of Casing
TRU	Transuranic Waste
TSCA	Toxic Substances Control Act
TSDF	Treatment, Storage, and Disposal Facility
TSP	Total Suspended Particles
UIC	Underground Injection Control
USFWS	U.S. Fish and Wildlife Service
UST	Underground Storage Tank
VOCs	Volatile Organic Compounds
WAESD	Westinghouse Advanced Energy Systems Division
WIPP	Waste Isolation Pilot Plant
WPSO	WIPP Project Site 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, air, soil, and biotics are measured for background radiation. Nonradiological environmental monitoring activities include air quality, water quality, soil properties, meteorological, 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, and no waste has been received; certain elements required by DOE Order 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 compiled and presented in appendices at the end of this document.

It should be noted to the reader of this document that the New Mexico Environmental Improvement Division (EID) formally changed it's name to the New Mexico Environment Department (NMED) during 1991, thus EID and NMED are cited in this document as being the same agency.

1.1 COMPLIANCE SUMMARY

In 1991, the WIPP remained in compliance with applicable federal and state environmental regulations. The major environmental statutes and Executive Orders applicable to the WIPP, the compliance status of each, and significant issues, actions, and accomplishments at the WIPP facility in calendar year (CY) 1991 (and the first quarter of CY 92) related to each statute are described in Chapter 3 of this report. A summary of significant compliance-related issues and actions at the WIPP between January 1991 through March 1992 is given below.

The DOE-WIPP Project Site Office (WPSO) submitted Part A of the WIPP Resource Conservation and Recovery Act (RCRA) permit application to the New Mexico Environment Department (NMED) and U.S. Environmental Protection Agency (EPA) Region VI on January 22, 1991. The Part B permit application was delivered to the NMED on February 26 and to EPA Region VI on February 27, 1991. Revisions to the Part B application were delivered to the NMED on March 4, 1992. When granted, the RCRA permit will allow the WIPP to act as a treatment, storage, or disposal facility (for hazardous waste) as defined by the RCRA.

During 1991, the DOE-WPSO developed and implemented a volatile organic compound (VOC) monitoring program at the WIPP to satisfy the air monitoring requirement of the Conditional No-Migration Determination (NMD) for the Waste Isolation Pilot Plant issued by the EPA on November 14, 1990, (55 FR 47700). Air samplers have been installed at five locations (3 underground, 2 surface) and samples are being collected and analyzed on a routine basis.

A report titled, "No-Migration Determination Annual Report for the Period November 1990 Through September 1991," was submitted to EPA Region VI and EPA Headquarters on November 14, 1991, to satisfy the annual reporting requirement of the NMD. The second WIPP NMD report was submitted to EPA Region VI and EPA Headquarters on March 31, 1992.

In 1991, a procedure was written delineating the review and reporting of changes in the conditions at the WIPP and/or the environment which may affect the NMD. A task force is currently being established to implement this procedure.

The DOE-WPSO validated the bin-case reports for the first three bins of waste planned for shipment to the WIPP facility. These reports contain the results of waste characterization efforts conducted at the INEL for shipment to the WIPP. After review of these reports, the DOE-WPSO concluded that the bins may be emplaced in the WIPP repository in compliance with the NMD.

The DOE-WPSO submitted the Biennial report for generators of hazardous waste to NMED in February 1991, in accordance with RCRA. This report describes the types and quantities of hazardous waste shipped off site by the WIPP for treatment, storage, or disposal during 1990 and 1991.

The DOE calculated doses from future anticipated WIPP emissions are expected to be less than 1 percent of estimated dose equivalent of 10 mrem per year to any member of the public, as required by 40 CFR, Subpart H.

The DOE-WPSO removed and replaced two 8000 gallon petroleum underground storage tanks (USTs). As reported in the 1990 Site Environmental Report (DOE/WIPP 91-008), these tanks were tested for tightness on September 28, 1990, at which time a leak was detected in the associated piping above the tanks. The NMED granted the DOE-WPSO 180-day extensions to remove the tanks in March and September 1991. The tanks were removed on December 19, 1991, and the two new tank systems were installed on January 11, 1992.

The deposition of WIPP brines are released into the salt pile evaporation pond just north of the site.

In February 1992, the DOE-WPSO submitted the Emergency and Hazardous Chemical Inventory Report to the New Mexico State Emergency Response Commission, the Eddy County Local Emergency Planning Committee, and the local fire department with jurisdiction over the WIPP facility, as required by Section 312 of the Superfund Amendments and Reauthorization Act (SARA) Title III.

The DOE-WPSO submitted the report titled, "Final Safety Analysis Report Addendum, Dry Bin-Scale Test" (DOE/WIPP 02-9) to DOE Headquarters in August 1991.

An Environmental Assessment (EA) for expansion of the sewage lagoon has been transmitted to the DOE and is currently being evaluated. Upon DOE approval, appropriate submittal of this document will be made to the State of New Mexico and the Bureau of Land Management for approval for the sewage lagoon expansion.

The DOE-WPSO completed construction of a hazardous material storage area at the WIPP in 1991. This facility eliminates the need for numerous storage areas for both virgin materials and site-generated wastes (both regulated and nonregulated as hazardous under RCRA).

The DOE-WPSO initiated a graded training program aimed at educating all WIPP personnel of their responsibilities under RCRA. The level of training provided under the program is commensurate with the employee's job and duties. All employees now receive RCRA training as part of the General Employee Training program at the WIPP.

On February 3, 1992, a U.S. District Judge ruled on two cases which impact the WIPP. In the first case, Environmental Defense Fund (EDF) vs. Watkins, the EDF argued that the DOE was precluded from proceeding with the temporary storage of transuranic mixed wastes at the WIPP, because they had failed to obtain interim status to operate a treatment, storage, and disposal (TSD) facility under RCRA. In this case, the judge granted the EDF's motion for summary judgement. In essence, this ruling requires the DOE to obtain a RCRA permit from the NMED prior to accepting any Transuranic (TRU) mixed waste regulated under RCRA.

In the second case, New Mexico vs. Watkins, the judge ruled to permanently enjoin the DOE from proceeding with Public Land Order 6826 issued on January 22, 1991. As a result of this ruling, the DOE must either successfully appeal this court decision or obtain a legislative land withdrawal prior to commencement of the test phase.

1.2 ENVIRONMENTAL PROGRAM INFORMATION

The effort to establish environmental baseline conditions at the WIPP site before arrival of waste has 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, these programs will transition into the operational phase and pertinent data collection will continue through the life of the project.

1.2.1

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 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 sampling activities will continue to be performed at the established monitoring locations listed in earlier Annual Site Environmental Reports (ASERs). Monitoring parameters may be adjusted to account for variations which are not anticipated. Any adjustments are documented in the environmental monitoring files.

- **Raptor Research Program**

  In CY 91, 21 raptor nests were monitored. In these nest's 17 individual birds were banded with U.S. Fish and Wildlife Service bird bands. Reproductive success improved over proceeding years of low nest success rates. This continues to correlate with prey species that 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 91. Reclamation techniques and experimental parameters from the 1988 and the 1989 reclamation activities are addressed in Appendix 3.

1.3 ENVIRONMENTAL RADIOLOGICAL PROGRAM INFORMATION

The following subsections present monitoring topics for the subprograms of the OEMP. These programs are consistent with the Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance (DOE/EH-0173T).

With the WIPP status being preoperational, it is not required by DOE Order 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.

These five subprograms are presented in the statistical summary of the Radiological Baseline Program for the Waste Isolation Pilot Plant in Appendix 1 of this report.

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 1000 meters of the facility boundary, four at local ranches and communities, and one at 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 1991. The collected filters were counted at the Environmental Counting Laboratory at the WIPP, where the gross alpha and gross beta activities of each filter were calculated yielding weekly and quarterly averages 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 not collected in 1991. As required by DOE Order 5400.1, 2 years of baseline soil analyses are required. This baseline has been established and documentation is presented in Appendix 1.

1.3.3 Groundwater

Groundwater surveillance continued routinely throughout CY 91 with 14 wells sampled. Significant discussions pertaining to groundwater surveillance are contained in Chapter 7 of this document.

1.3.4 Surface Water and Sediment Sampling

Surface water and sediment samples were not collected in CY 91. As required by DOE Order 5400.1, 2 years of baseline analyses are required. This baseline has been established and documentation is presented in Appendix 1.

1.3.5 Beef, Game Animals, and Fish Samples

In CY 91, fish were collected, as directed in the OEMP. Beef, quail, and rabbit samples were not collected. The fish collected were processed and archived for future radiological analysis, should circumstances warrant analysis. Appendix 1 provides required documentation for the biotic samples analyzed for the baseline.

1.4 NONRADIOLOGICAL MONITORING INFORMATION

Nonradiological Environmental Surveillance (NES) was conducted by the Environmental Monitoring section. This program was preceded by the WIPP Biology Program (1975-1982), which combined scientific and 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 initiation of WIPP construction activities.

A significant portion of the NES was to document fugitive salt dust generated by the surface stockpiling activities on the surrounding ecosystem (Reith et al., 1985). This study is summarized in Appendix 2, "Summary of the Salt Impact studies at the Waste Isolation Pilot Plant 1984 to 1990."

1.4.1 Meteorology

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

The annual precipitation at the WIPP for 1991 was 48 cm (18.90 in), which is above the average for this area by 17 cm (6.69 in). The precipitation for 1991 was 17 percent greater than that recorded for 1990. This precipitation increase over 1988, 1989, and 1990 has helped to alleviate the drought effects in the WIPP area.

In CY 91 the winds in the WIPP area were consistent with previous wind direction data, with winds from the southeast being predominant.

1.4.2 Environmental Photography

Aerial photographs of the WIPP site were taken semiannually from 1982 until 1989, during the winter and summer seasons. In 1990, the decision was made to take aerial photographs annually during the peak growing season, late August through September. Any vegetative changes 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 U.S. Bureau of Land Management (BLM) lands. Thus, in September of 1991 the aerial photographs were taken to document changes in the WIPP area.

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. To date there has been virtually no surface impact. In September of 1991 the surface photography was conducted to document changes, if any, in the study plots. Incidently though, the 1991 photographs no change was recorded in the study plots.

1.4.3 Air Quality Monitoring

Seven 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.

1.4.4 Surface Water Quality and Sediment Monitoring

During CY 91, no surface water or sediment sampling was conducted. Preoperational monitoring began in 1985 and continued through 1988 with samples collected annually. It is currently proposed that surface water quality and sediment monitoring will be conducted biennially until the WIPP is operational.

1.4.5 Groundwater

Groundwater surveillance continued routinely throughout CY 91 with 14 wells sampled for water quality. Groundwater Level Surveillance took place utilizing 57 separate well bores, six of which were equipped with production inflatable 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.

1.4.6 Wildlife Population Monitoring

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

- **Bird Densities**

  In CY 91 data show a deviation from the previous years data in species diversity near the facility. Previous years data show greatest diversity near the site, whereas CY 91 data show a shift to the CT1 plot as having the greatest species diversity. There are currently not enough data to explain this shift. This change could be a natural shift of species diversity. The collection of additional data are necessary to reach any conclusions.

- **Small Nocturnal Mammal Population Densities**

  In CY 91, Ord's kangaroo rats remained the most common species encountered. Several Ord's kangaroo rats were recaptured 70-90 meters from their original capture location, while the average recapture ventured 30-50 meters from their original capture location. Grasshopper mice were the next most common species encountered. Other species encountered in this area were plains wood rats, white-footed mice, deer mice, and silky pocket mice.

1.4.7 Surface and Subsurface Soil

During CY 90, the quarterly sampling of the surface soil as well as the annual deep series was not conducted. When conducted the subsurface soil is collected at two depths, 30 to 45 centimeters (11.8 to 17.7 inches) 60 to 75 centimeters (23.6 to 29.5 inches), in the soil profile. However, with the WIPP being in a preoperational state during 1991, and with an adequate baseline established (Appendix 2) no samples were collected in CY 91. With the established baseline data, continuing the quarterly soil analysis was not required by the OEMP.

1.4.8 Vegetation Monitoring

The CY 91 vegetation monitoring data showed a continued decline in several parameters with increasing proximity to the salt tailings. The total coverage in all plots were relatively uniform over all distances from the tailings. The densities of annuals and species richness were also

relatively uniform across all plots. A pattern observed in the 1989 data that was also seen in the 1991 data is an increase in shrub cover with increasing proximity to the salt tailings and an approximately equal decrease in perennial grass cover. The responses of these plots to higher rainfall in later years will reveal whether this pattern is reflecting the start of changes in the structure of the plant community in the proximity of the salt tailings, or whether it is only a short-term effect caused by short-term weather conditions. Weather conditions had a uniform effect on vegetation in all plots. A differential effect resulting from salt-induced physiological stress near the salt tailings was not observed.

1.5 QUALITY ASSURANCE

This document adheres 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), and fulfills the requirements of the QA plan specified in DOE Orders 5400.1 (DOE, 1988d), 5400.3 (DOE, 1988e), 5700.6C (8/21/91) and the Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance (DOE/EH-0173T).

CHAPTER 2

INTRODUCTION

This is the WIPP Annual Site Environmental Report (ASER) for CY 91. The WIPP site is located in southeastern New Mexico and 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 as mandated by Public Law 96-164. This document is prepared in accordance with the guidance contained in DOE Order 5400.1, General Environmental Protection Program Requirements (DOE, 1990); DOE Order 5400.5, Radiation Protection of the Public and the Environment (DOE,1990); DOE/WIPP 91-054, Environmental Protection Implementation Plan, DOE/EH-0173T, Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance and Final Guidance for the preparation of Site Environmental Reports for calendar year 1991 as issued on February 13, 1992 by EH-22. These require 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 1991.

The WIPP facility will not receive test phase 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 Radiological Environmental Surveillance (RES) program, which is outlined in the Radiological Baseline Program (RBP) for the WIPP (WTSD-TME-057) (Westinghouse, 1985). Since the WIPP is in a preoperational state, meaning no radioactive defense facility waste has been shipped to the WIPP, certain elements of DOE Order 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 which all of the environmental monitoring programs follow. Its purpose is to; 1) ensure that all appropriate sampling efforts are in place to establish the amount and type of naturally occurring radioactivity in the WIPP area before the WIPP is operational and 2) to provide a database for comparisons between preoperational and operational environmental conditions once the WIPP is operating as a waste repository for transuranic waste.

The OEMP was prepared in accordance with the guidance contained in DOE Order 5400.1 and draft DOE Order 5400.5, Radiation Protection of the Public and the Environment (DOE, 1988b), that was subsequently issued as DOE Order 5400.5 in February, 1990 (DOE, 1990). Additional guidance for preparation of this annual report was received from DOE Headquarters, Office of Environment, Safety and Health, on February 13, 1992. This guidance was entitled "Final Guidance for the Preparation of the Site Environmental Reports for Calendar Year 1991." This guidance also responds to the requirements and guidelines presented in draft DOE Order 5400.6, Radiological Effluent Monitoring and Environmental Surveillance for U.S. DOE Operations (DOE, 1988c) that was subsequently issued as the Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance (DOE/EH-0173T) (DOE, 1991). Since waste has not been received and WIPP is still in a preoperational state, certain elements of DOE Order 5400.1 are not presented in this report. For example, no discussion of radionuclide emissions with subsequent calculation of doses to the public is included.

The OEMP will be reviewed and updated in late 1992 as required by DOE Order 5400.1, to account for enhancements and general changes that are being implemented due to experience gained from these monitoring programs.

2.1 DESCRIPTION OF THE WIPP PROJECT

Once designated as an operational facility by the DOE, TRU wastes will be transported from 10 generator and storage sites around the United States to the WIPP. Initially, the waste will be transported from the Idaho National Engineering Laboratory and the Rocky Flats Plant 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 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 DOE Order 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 via tractor-trailer trucks. Each truck can haul up to three transuranic package transporters (TRUPACT IIs) containing 14 55 gallon drums or two standard waste boxes. The TRUPACT II is a durable, reusable container that has been approved by the Nuclear Regulatory Commission (NRC) to transport the contact-handled transuranic waste to the WIPP.

Once the 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 hoist, and lowered to the repository level of 655 m (2150 feet) below the surface. Waste containers will then be removed from the hoist and emplaced in excavated storage rooms in the Salado formation, a thick sequence of salt beds deposited approximately 250 million years ago (Permian Age). After filling a storage area, specially designed seals and plugs will be placed in the excavated storage rooms and in the shafts. The plastic self-healing nature of the salt formation will result in gradual creep closure, causing encapsulation and isolation of the waste within the Salado formation. It is presently designated that the first five years of WIPP operations will be a test phase period, during which time tests will be performed to support the 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, the Salt Handling Shaft, and the Waste Handling Shaft, and exits through the exhaust shaft. 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 ventilation from the Waste Handling Building is continuously HEPA filtered to the atmosphere, and air emissions are not expected to be significant.

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 Medanos (the dunes), which is a sparsely inhabited plateau with little water and limited land uses. The land is 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 potash; exploring for and/or extracting oil and natural gas; recreational use such as hunting, trapping, and birdwatching; and other uses as permitted by the BLM.

The WIPP site consists of 16 sections (4,146 ha) of Federal land in Township 22 South, Range 31 East. Except for the 2.59 square kilometers (1 square mile) encompassing the facility (known as the DOE

Exclusive Use Area), surface land uses remain largely unchanged. Mining and drilling for purposes other than support of the WIPP project are restricted within this 16 section (4,146 ha) area.

The WIPP site is divided into zones as represented in Figure 2-1. Zone I, surrounded by a chain-link fence, includes all major surface facilities. The secured area boundary, bounded by a barbed wire fence, 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) beyond any underground development and is defined on the surface by the 16 section (4,146 ha) land withdrawal area. This boundary provides a functional barrier of intact salt between the underground region defined by Zone II and the accessible environment.

The approximate distribution of the local population in 1990 within 80 kilometers (50 miles) of the WIPP site is illustrated in Figure 2-2. The nearest residents to the site include eight individuals living at the Mills Ranch, 5.3 kilometers (3.5 miles) south-southwest of the site, and 2 individuals living at the Smith Ranch, 11.3 kilometers (7 miles) west-northwest of the site. Both neighboring ranches have been, and 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 14.5 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).

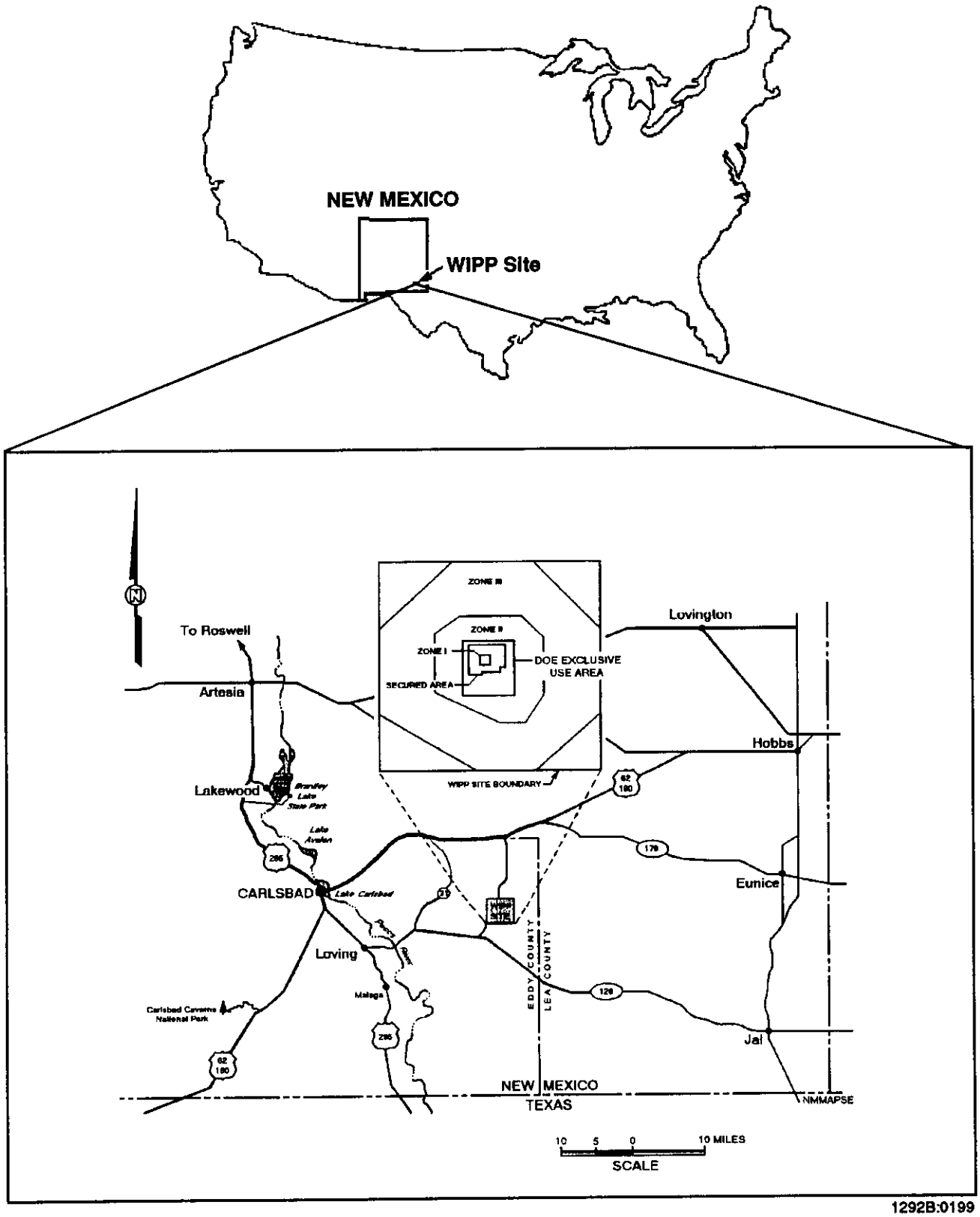
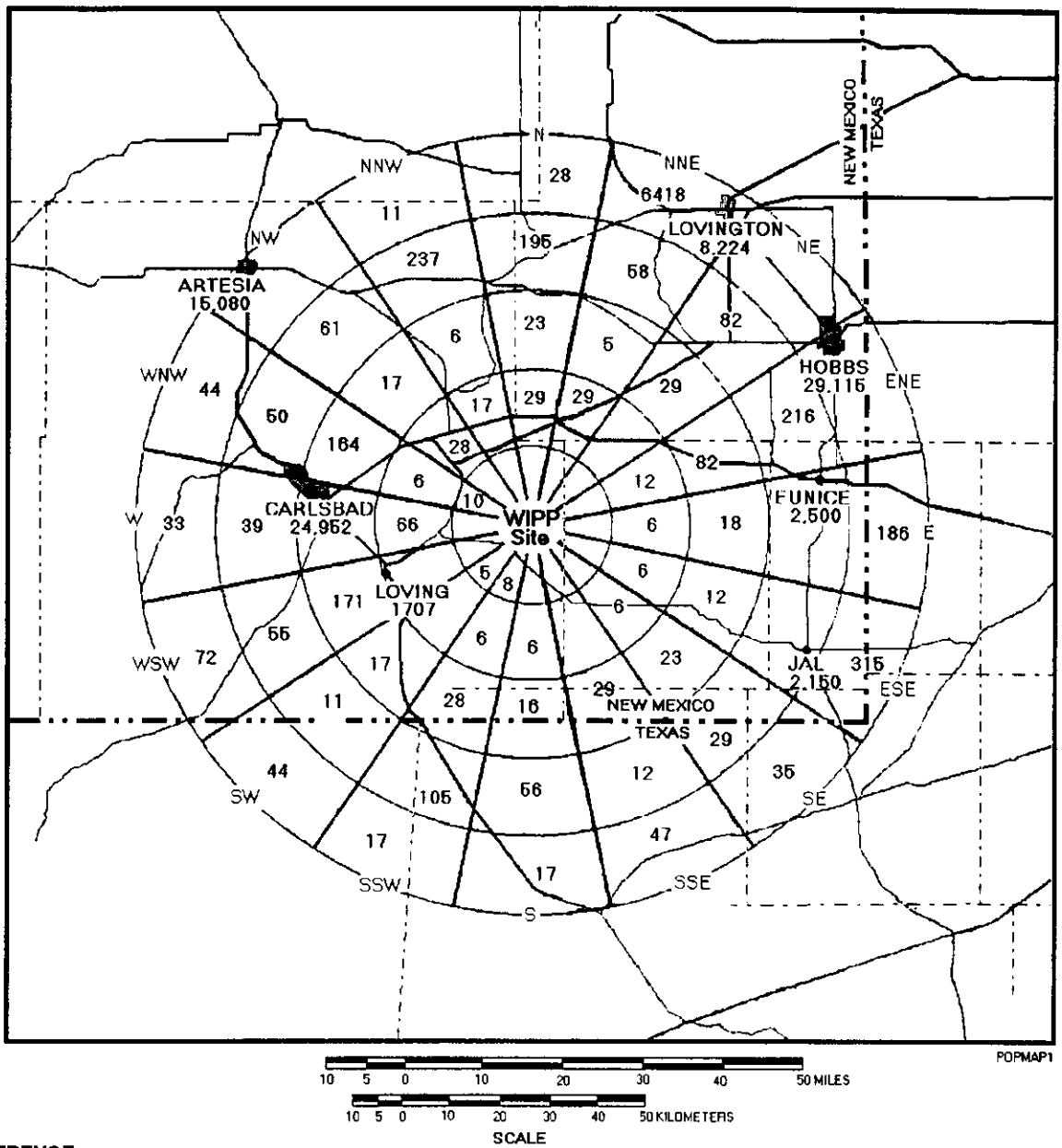


Figure 2-1
Location Of The WIPP Site



REFERENCE:
UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY, STATE OF NEW MEXICO:
COMPILED IN 1967 - REVISED 1990

REFERENCE:
UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY, STATE OF TEXAS;
COMPILED IN 1990
SCALE 1:500,000

Figure 2-2
1990 Population Within 50 Miles
of the WIPP Site

CHAPTER 3

COMPLIANCE SUMMARY

The WIPP is required to comply with all applicable federal and state laws and regulations such as those specified in DOE Order 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 (MOC). Regulatory requirements are implemented by incorporating them into facility plans and procedures.

Table 3-1 provides a summary of the major 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 details active environmental permits for the WIPP in CY 91 and the first quarter of CY 1992.

3.1 COMPLIANCE ASSESSMENT FOR CALENDAR YEAR 1991

In 1991, the WIPP remained in compliance with applicable federal and state environmental regulations. Section 3.2 lists the major environmental statutes and executive orders applicable to the WIPP followed by the WIPP compliance status with each, and significant issues, actions, and accomplishments at the WIPP facility in CY 91 related to each. Section 3.3 describes other significant environmental issues, actions, and accomplishments at the WIPP facility in CY 91.

3.2 COMPLIANCE STATUS

This section states the WIPP's status of compliance with the following regulatory requirements as required for the facility.

3.2.1 Atomic Energy Act of 1954 (AEA) (42 U.S.C. sec. 2011 et seq.)

The AEA establishes a national program for research, development, and utilization of atomic energy for both national defense and domestic civilian purposes. Section 161 of the AEA provides that the Atomic Energy Commission (succeeded by the DOE for national defense purposes) is authorized to prescribe regulations and orders to:

> {Govern any activity authorized pursuant to [the AEA], including standards, and restrictions governing the design, location, and operation of facilities used in the conduct of such activity, in order to protect health and to minimize danger to life or property}.

The authority of the DOE to develop policies, issue orders, and promulgate regulations addressing environmental, safety, and health protection aspects of radioactive waste and nuclear materials is derived directly from the AEA. However, the EPA has also derived its authority to establish radiation protection standards for TRU waste (Title 40 CFR Part 191) partially from the AEA.

The DOE, under the authority of the AEA and in accordance with various executive orders (EOs), uses a system of Orders, Notices, and Directives to carry out the mandate to implement effective and consistent programs to protect the public, the environment, and employees from adverse consequences resulting from DOE operations. Implementation of those Orders dealing

with environmental monitoring and surveillance is addressed in the Operational Environmental Monitoring Plan for the Waste Isolation Pilot Plant (Mercer et al., 1989).

Most of the waste to be managed at the WIPP facility is considered mixed waste, as it contains both radioactive components regulated by the AEA and hazardous components regulated by RCRA. RCRA contains (qualified) provisions making the act inapplicable to activities or substances authorized by or regulated under the AEA. Two different sections of RCRA address these exclusions:

- The Solid Waste Exclusion. RCRA sec. 1004(27) defines a solid waste as a solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, agricultural operations, and community activities. However, the definition specifically excludes "source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954, as amended."

- The Inconsistency Exclusion. RCRA sec. 1006(a) provides the following: "Nothing in this Act shall be construed to apply to (or to authorize any state, interstate, or local authority to regulate) any activity or substance which is subject to [listed acts] or the Atomic Energy Act of 1954 . . except to the extent that such application (or regulation) . . . is not inconsistent with the requirements of such Acts." [Emphasis added.]

Thus, radioactive mixed waste to be emplaced at the WIPP facility is subject to dual regulation under both the AEA and RCRA. The radioactive constituents of the waste are regulated under the AEA, whereas the hazardous constituents are regulated under RCRA. Nevertheless, there may be some circumstances under which RCRA regulation of the hazardous constituents would be found to be inconsistent with AEA health and safety requirements.

3.2.2 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 U.S.C. sec. 9601 et seq.), including the Superfund Amendments and Reauthorization Act of 1986 (SARA)

The CERCLA, or "Superfund," and the SARA establish a comprehensive federal strategy for responding to, and establishing liability for, releases of hazardous substances from a facility to the environment. Hazardous substance cleanup procedures are specified in the National Contingency Plan (NCP) in Title 40 CFR Part 300. To date, no release sites have been identified at the WIPP facility that would require cleanup under the provisions of the CERCLA. Any future spills of hazardous substances of reportable quantities will be reported to the National Response Center under the provisions of the CERCLA sec. 103 and Title 40 CFR Part 302.

The WIPP facility is required to report under Sections 311 and 312 of SARA Title III, also known as the Emergency Planning and Community Right-to-Know Act (EPCRA). Required reports under these two sections are submitted by the DOE-WPSO to the State Emergency Response Commission (SERC), the Local Emergency Planning Committee (LEPC), and the local fire department with jurisdiction over the WIPP. All reports issued by the WIPP under EPCRA have been submitted ahead of the stipulated reporting deadlines. In addition, the WIPP also submits Section 311 data and Section 312 annual reports to the Hobbs Fire Department and the Otis Fire Department. The DOE maintains Memoranda of Understanding (MOUs) with each of these agencies for emergency response purposes.

The WIPP facility is not required to report under Section 313 of the EPCRA. The WIPP is a research and development facility and, as such, does not fall under any of the applicable standard industrial codes (SICs) identifying facilities that are regulated under Section 313.

3.2.3 Resource Conservation and Recovery Act (RCRA)(42 U.S.C. sec. 3251 et seq.)

The RCRA was enacted in 1976, and implementing regulations were promulgated in May 1980. This body of regulations is intended to ensure that hazardous wastes are disposed of in an environmentally 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 (HSWA) of 1984 created a set of restrictions on the land disposal of hazardous wastes unless certain treatment standards can be satisfied. HSWA also places increased emphasis on waste minimization activities and serves as a mechanism to enforce cleanup.

WIPP has not received any Notices of Noncompliance, but did respond to three Notices of Deficiency against the RCRA Part A Permit Application. All three were rapidly answered with additional information, and that effort was concluded in October, 1991. WIPP has not received any Notices of Deficiency, however, against the RCRA Part B Permit Application to this date (July 22, 1992).

Hazardous-Waste Generator Compliance

In CY 91, the WIPP remained in compliance with the RCRA hazardous waste generator requirements as codified in Title 40 CFR Part 262. The DOE completed construction of a hazardous material/hazardous waste storage area at the WIPP. This facility eliminates the need for numerous storage areas for both virgin materials and site-generated wastes (both regulated and nonregulated as hazardous under RCRA). The hazardous waste satellite accumulation areas and the Hazardous Waste Staging Area at the WIPP are operated by written procedure and are inspected routinely in accordance with RCRA requirements. In January 1991, the NMED granted the DOE a 30-day extension to the 90-day accumulation time (as required by RCRA) for a shipment of hazardous waste from the WIPP facility. This shipment was transported off-site for disposal at an approved treatment storage, and disposal facility (TSDF) within the 30-day extension time frame. All remaining hazardous waste generated at the WIPP facility in 1991 was transported off-site for disposal at an approved TSDF within the 90-day accumulation time required by RCRA.

No-Migration Determination Compliance

On November 14, 1990, the EPA published the NMD for the WIPP in the *Federal Register* (55 FR 47700). Three of the conditions stipulated in the NMD are listed below:

- Implementation of an air monitoring plan as described in Section IV.K of the proposed variance (55 FR 13068, April 6, 1990)
- Submission of annual written NMD reports
- Notification of EPA of any changes in the unit and/or environment that significantly depart from the conditions described in the variance and affect the potential for migration of hazardous constituents from the unit.

During 1991, the DOE-WPSO developed and implemented a volatile organic compound (VOC) monitoring program at the WIPP to satisfy the air monitoring requirement of the NMD. Air samplers have been installed at five locations (three underground and two on the surface), and samples are collected and analyzed on a routine basis. One of these samplers is considered a source monitor, as it is designed to collect gases vented from the test bins containing experimental waste. The gases are diverted via a manifold system through a carbon adsorption device, which is designed to achieve a control efficiency of greater than 95%, prior to collection.

A report entitled, Waste Isolation Pilot Plant "No-Migration Determination Annual Report for the Period November 1990 through September 1991, (DOE/WIPP 91-059)" was submitted to EPA Region VI and EPA Headquarters on November 14, 1991, to satisfy the annual reporting requirement of the NMD.
This report contains the following information regarding WIPP activities in CY 1991:

- A description of the tests to date and their results [Tests are described in "WIPP Test Phase Plan: Performance Assessment" (DOE, 1990e)]
- Modifications to the test plan
- A summary of DOE's understanding of the repository's performance
- Waste characterization data from pretest waste characterization
- An annual data summary of air monitoring data

Any changes in conditions that depart significantly from the conditions described in the *No-Migration Variance Petition* (DOE, 1990d) and that affect the potential for hazardous constituents to migrate from the unit must be reported in writing to the EPA. In addition, the detection of any migration of hazardous constituents will trigger the suspension of receipt of mixed waste at the WIPP and must be reported to the EPA. A WIPP procedure has been issued to ensure that these conditions are met. The procedure requires the establishment of the No-Migration Determination Review Task Force to review proposed and unplanned changes in conditions at the WIPP and/or the surrounding environment, evaluate the significance of those changes with respect to the conditions set forth in the NMD, and recommend that appropriate action be taken. Establishment of this task force is currently in progress.

In August 1991, the DOE-WPSO validated the bin-case report for the first bin of waste planned for shipment to the WIPP facility. This report contains the results of waste characterization efforts conducted at the sites generating waste planned for shipment to the WIPP. After review of this report, the DOE-WPSO concluded that this bin could be emplaced and safely managed at the WIPP facility in compliance with the NMD and other applicable regulatory criteria.

Mixed-Waste Management, Test Phase

On July 25, 1990, the state of New Mexico received final EPA authorization to regulate radioactive mixed waste. In a letter dated August 27, 1990, the state of New Mexico notified the WIPP that Parts A and B of the RCRA permit application for the WIPP were due by January 22 and February 28, 1991, respectively. On January 22, 1991, the Part A permit application was hand-carried to the State and the EPA Region VI Office in Dallas, Texas (DOE, 1991b). The Part B permit application was delivered to the State on February 26 and to EPA Region VI on February 27, 1991.

Underground Storage Tanks

During 1991, the DOE-WPSO removed and replaced two 8000-gallon underground storage tanks (USTs) utilized for storage of petroleum fuel products at the WIPP. As reported in the 1990 Site Environmental Report (DOE, 1991c), these tanks were tested for tightness on September 28, 1990, at which time a leak was detected in the associated piping above the tanks. The NMED granted the DOE-WPSO two 180-day extensions to remove the tanks (in March and September 1991). The tanks were removed on December 19, 1991, and the two new tank systems were installed on January 11, 1992.

Training

The DOE-WPSO initiated a graded training program aimed at educating all WIPP personnel to their responsibilities under the RCRA. The level of training provided under the program is commensurate with the employee's job and duties. A training matrix has been developed which delineates each employees position title, RCRA course requirements, and course completion. This matrix is reviewed monthly by WIPP managers to ensure that employee training is current. All WIPP employees now receive the RCRA training.

3.2.4 National Environmental Policy Act (NEPA) (42 U.S.C. sec. 4321 et seq.)

The NEPA was enacted to, among other things, "assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings." The NEPA directs the federal government to use "all practicable means" to improve and coordinate federal plans, functions, programs, and resources to that end. NEPA contains several "action-forcing" provisions, such as: utilizing an interdisciplinary approach in planning and decision making, ensuring appropriate consideration of unquantified environmental values, developing alternatives to proposals involving conflicts over use of resources, making environmental information generally available, and including a "detailed statement" on environmental impacts of "major federal actions significantly affecting the quality of the human environment." Because NEPA procedural objectives and extensive public involvement requirements are detailed in Council on Environmental Quality regulations implementing NEPA in Title 40 CFR Parts 1500-1508, the Act has often been referred to as a "public disclosure law."

To satisfy NEPA requirements, the Final Environmental Impact Statement (FEIS) was issued in October 1980 (DOE, 1980) followed by the Record of Decision (ROD) to the FEIS (DOE, 1981), which was published in the *Federal Register* on January 28, 1981.

The ROD concluded that the Los Medanos (WIPP) site in southeastern New Mexico would be acceptable for the long-term disposal of transuranic (TRU) waste with "minimal risk of any release of radioactivity to the environment." The ROD noted:

If significant new environmental data results from the Site Preliminary and Design Validation (SPDV) program or other WIPP project activities, the FEIS will be supplemented as appropriate to reflect such data, and this decision to proceed with phased construction and operation of the WIPP facility will be reexamined in the light of that supplemental NEPA review.

Consistent with this commitment, the DOE issued the Final Supplement Environmental Impact Statement (SEIS) in January 1990 (DOE, 1990a) to address changes in the proposed action and the development of new geologic and hydrologic information. Changes addressed in the SEIS included altering the composition of the waste inventory, transporting waste to the WIPP facility, conducting a Test Phase, and managing TRU waste mixed with hazardous constituents. The DOE's ROD to proceed with the Test Phase was published on June 22, 1990 (DOE, 1990c).

In accordance with the commitments made in the ROD for the WIPP SEIS, the DOE will issue another SEIS prior to deciding whether to proceed with the Disposal Phase at the WIPP site.

The DOE released a new revision of DOE Order 5440.1D, National Environmental Policy Act Compliance Program, on February 2, 1991 (DOE, 1991d). This revision incorporates a much more conservative interpretation of NEPA, with a number of new requirements. One of these new requirements is that a mitigation action plan (MAP) be prepared "for implementation of any commitments made in an EIS/ROD for mitigation of environmental impacts associated with an action" [DOE, 1991d, 7(a)(23)]. Because of this new requirement, a MAP was prepared based on both RODs. The final MAP was submitted to DOE on July 10, 1991. The commitments

described in the MAP will be tracked and reported annually as required by DOE Order 5440.1D [7(a)(24)].

A NEPA compliance program has been developed to ensure that compliance with the requirements of the NEPA is fulfilled at all WIPP locations. The WIPP NEPA Compliance Program (NCP) ensures that those responsible for the planning, coordination, and performance of work follow the provisions of NEPA and is applied appropriately for all work performed at the WIPP Project at all locations. Furthermore, the NEPA compliance Program details the actions taken in the evaluation of work documents to ensure NEPA compliance in accordance with DOE Order 5440.1D and SEN 15-90.

The WID NEPA Coordinator tracks and monitors related work for compliance to the NEPA and provides input and evaluation of the NEPA training module that trains those responsible for the planning, coordination, and performance of work a the WIPP in the requirements of NEPA. By training these personnel in how to obtain NEPA authorization from the NEPA coordinator, proper NEPA evaluation will be made at the proper time.

The NEPA Compliance Program currently resides with the WIPP Project Site Office for review and approval. However, due to the promulgation of the new DOE NEPA Rule (10 CFR 1021) and other DOE-AL NEPA guidance, revisions to the NCP will be made to incorporate these new documents. These changes include but are not limited to evaluation of cumulative impacts, timing of NEPA documents, and expansion of NEPA training.

3.2.5 Clean Air Act (CAA) (42 U.S.C. sec. 7401 et seq.)

The CAA provides for the preservation, protection, and enhancement of air quality, principally in areas of special natural, recreational, scenic, or historic value.

Hazardous air pollutant emissions are regulated under Title 40 CFR Part 61, the National Emission Standards for Hazardous Air Pollutants (NESHAPs) of the CAA. Title 40 CFR Part 61, Subpart H, applies to the WIPP facility with respect to future emissions of radionuclides from a DOE facility. A revised standard for Subpart H radionuclide emissions was promulgated by the EPA in a final rule published in the *Federal Register* on December 15, 1989 (EPA, 1989). In a NESHAPs data package submitted to EPA Region VI and EPA Headquarters in February 1991, the DOE calculated the doses from future anticipated WIPP facility emissions to be less than 1 percent of the effective dose equivalent of 10 millirem (mrem) per year to any member of the public. On site and off site monitoring systems have been installed to quantify radionuclide emissions from the WIPP facility and to verify compliance with the standard.

Notification of incipient startup is required under NESHAPs. On June 26, 1991, the DOE-WPSO sent a letter to the EPA notifying them of incipient startup. Since startup activities were not initiated, the DOE-WPSO sent a follow-up letter to the EPA on August 8, 1991, and is maintaining communications with the EPA on this issue.

3.2.6 Clean Water Act (CWA) (or Federal Water Pollution Control Act of 1972) (33 U.S.C. sec. 1251 et seq.)

Section 402 of the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) program establishes the requirements for regulating point source discharges into waters of the United States. At this time the WIPP has no process point source discharges, and is not required to obtain a standard NPDES permit. However, the WIPP is required to comply with the storm water permit requirements of the NPDES program. The new storm water regulations govern storm water discharges associated with industrial activities that discharge to waters of the united States. The WIPP will demonstrate that the facility does not have a discharge of regulated storm waters through the use of engineering controls, storm water

retention basins, and the reclamation of disturbed areas. By implementing these controls the WIPP will be exempted from the NPDES storm water permit application requirements. Approximately 40,000 gallons of non-hazardous brine are generated at the WIPP each month. These waters are generated by seepage between stratigraphic formations in the ungrouted air intake shaft, and from the pumping of observation wells at the WIPP. In the past WIPP brines were collected, analyzed for hazardous constituents, and then transported off-site for disposal as non-regulated waste water.

WIPP brines were sent to a Oil Conservation Division permitted brine disposal facilities located at Laguna Quatro and Laguna Tres. Laguna Quatro and Laguna Tres are manmade salt lakes located about seven miles from the WIPP site. However, during 1991, the EPA found radioactivity and some hazardous constituents (heavy metals) in Laguna Quatro. Although WIPP brine waters are neither radioactive nor hazardous, a decision was made to discontinue off-site disposal of WIPP brines.

In order to accommodate the 40,000 gallons of brines generated monthly an emergency discharge permit was applied for and received from the NMED in January 1992. Mine water is now collected in portable tanks and is hoisted to the surface where it is pumped to a holding tank. Initially brines were sampled and analyzed to demonstrate that they were non-hazardous prior to disposal. Successive analytical studies have demonstrated that site-generated brines are non-hazardous and can be pumped to the main salt pile evaporation basin for disposal.

The permanent disposal of site-generated brines will be accomplished by the expansion of the WIPP sewage treatment facility. The facility expansion has a dual purpose, to provide an evaporation facility for site generated brines, and to accommodate the present population at the WIPP.

The WIPP has applied for and received an approved discharge plan for the expansion of the WIPP sewage facility. The discharge plan approves the construction of a lined evaporation lagoon which is divided into two "cells". The NMED Discharge Plan allows the WIPP to dispose of site-generated brines in the salt pile evaporation pond until permanent disposal facilities can be constructed. Additionally, National Environmental Policy Act (NEPA) documentation has been prepared for the proposed sewage lagoon expansion. The approval of appropriate NEPA documentation is required to evaluate federal actions to determine potential impacts to the environment and human health. On April 15, 1992, the DOE/AI. NEPA Compliance Officer approved the expansion of the WIPP sewage lagoon. Construction of the sewage lagoon expansion should begin in the fall of 1992.

The new evaporation lagoon consisting of two new cells will be located down-gradient of the existing evaporation lagoon. The south cell of the new lagoon will be used to evaporate sewage effluent only. The north cell of the new lagoon will be used to evaporate nonhazardous brine waters from mine de-watering and for evaporation well pumped water that has been mixed with sewage effluent. Brine waters will be hauled to the north cell by water truck, and them pumped from the water truck into the north cell.

3.2.7 Safe Drinking Water Act (SDWA) (42 U.S.C. sec. 300f et seq.)

The SDWA of 1974, as amended, provides the regulatory strategy for protecting public water supply systems and underground sources of drinking water. As defined in implementing regulations in Title 40 CFR Part 141.2, these are systems that provide water for human consumption and that have at least 15 connections or regularly serve at least 25 people.

The SDWA also protects underground sources of drinking water from underground injections of contaminated fluids. Underground injection, defined as "subsurface emplacement of fluids by

well injection" in sec. 1421(d) of the SDWA, is governed by the Underground Injection Control (UIC) program under the Part C regulations in Title 40 CFR Part 144.

Because the WIPP facility receives water from an off-site supplier, the facility has neither developed nor does it maintain a public water supply system within the meaning of the SDWA and its implementing regulations. Also, the WIPP facility does not qualify for regulation under the UIC program because none of the TRU waste will be emplaced by well injection of fluids. The nearest underground source of drinking water to the WIPP facility is the Dewey Lake Redbeds, a perched water table located approximately 3.5 miles to the south with no hydrogeologic connection to the WIPP site. Therefore, the SDWA and its implementing regulations do not apply to the WIPP facility.

{Note: In Natural Resources Defense Council NRDC v. EPA [824 F.2d 1258 (1987)], the court linked deep geologic disposal of nuclear wastes to the UIC concept in the SDWA. The individual protection requirements of the EPA radiation protection standards in Title 40 CFR Part 191.15 were remanded because the 25 mrem and 75 mrem dose limits were deemed inconsistent with the SDWA standard of 4 mrem for public drinking water supplies. These regulations have not yet been repromulgated.}

3.2.8 Toxic Substances Control Act (TSCA) (15 U.S.C. sec. 2601 et seq.)

The TSCA applies primarily to manufacturers, importers, and processors of toxic chemicals for commercial purposes. The WIPP facility is not considered a manufacturer or processor of chemical products; therefore, most of the provisions of TSCA do not apply. However, TSCA regulates the use of polychlorinated biphenyls (PCBs), asbestos, and materials containing PCBs and asbestos. DOE policy prohibits the use of PCB-containing materials in DOE-installed equipment at facilities such as the WIPP facility. Therefore, TSCA would not apply to DOE-installed equipment. At the present time, TSCA does not apply to the WIPP repository because there are no plans to ship PCB-contaminated wastes to the facility. The WIPP facility will comply with TSCA regulations contained in Title 40 CFR Parts 761.60 and 761.65, with respect to any possible future storage or disposal of PCB-contaminated materials. Procurement of asbestos containing materials is also prohibited at the WIPP facility.

3.2.9 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (7 U.S.C. sec. 136 et seq).

The FIFRA authorizes the EPA to regulate the registration, certification, use, storage, disposal, transportation, and recall of pesticides. The EPA, at its discretion, may exempt federal agencies from any FIFRA provisions if emergency conditions exist (Title 40 CFR Part 166). Recommended procedures for storage and disposal of pesticides and pesticide containers are contained in Title 40 CFR Part 165. FIFRA standards are considered mandatory for DOE facilities. DOE will continue to comply with the standards of FIFRA at the WIPP facility.

3.2.10 Endangered Species Act (ESA) (16 U.S.C. sec. 1531 et seq).

The ESA provides protection for threatened or endangered species of flora and fauna. Under Section 7 of the Act and implementing regulations in Title 50 CFR Part 402, the EPA is prohibited from authorizing activities likely to jeopardize the continued existence of any threatened or endangered species or its critical habitat. The Section 7 process may involve a biological assessment and "formal consultation," followed by the issuance of a "biological opinion" by the U.S. Fish and Wildlife Service for any species that is determined to be in potential jeopardy. According to the WIPP FEIS (DOE, 1980) and the SEIS (DOE, 1990a), the U.S. Fish and Wildlife Service lists four threatened or endangered species of plants or animals that could occur at the

WIPP site. The U.S. Fish and Wildlife Service has determined that WIPP facility activities will have no adverse impacts on these species (Stigman, 1979).

The New Mexico Department of Game and Fish, and the U.S. Fish and Wildlife Service also lists a number (52) of possible threatened and endangered species to be encountered in southeastern New Mexico. In addition, no critical habitat for terrestrial endangered species has been identified at the WIPP site (Stigman, 1979). Consequently, neither formal consultation nor biological opinion processes have been required for the WIPP project by the U.S. Fish and Wildlife Service under Section 7.

3.2.11 National Historic Preservation Act (NHPA) (16 U.S.C. sec. 470 et seq.)

The NHPA was enacted to protect the nation's cultural resources and established, among other things, the National Register of Historic Places (National Register). Since 1976, cultural resources investigations have recorded approximately 98 archeological sites and numerous isolated artifacts within the 16-square-mile area enclosed by the WIPP site boundary. Thirty-three sites recorded within the central 4-square-mile area, including all of Zones I and II, were determined eligible for inclusion in the National Register as an archeological district. Investigations since 1980 have recorded an additional 14 individual sites outside the central 4-square-mile area that are considered eligible for inclusion in the National Register (DOE, 1990a). The average site density on WIPP facility lands, according to the WIPP FEIS (DOE, 1980), is 7.5 sites per square mile. A mitigation plan describing the avoidance and/or excavation of sites was submitted to the New Mexico State Historic Preservation Officer (SHPO) (Hart and Brausch, 1980; DOE and BLM, 1983). A determination of "no adverse effect from WIPP facility activities" on cultural resources was made by the SHPO in May 1980 (Merlan, 1980). A similar plan was submitted to the National Advisory Council on Historic Preservation. The Council concurred that the WIPP Mitigation Plan is appropriate to protect cultural resources (National Advisory Council on Historic Preservation, 1981).

The NHPA has been amended by the Archeological and Historic Preservation Act (16 U.S.C. sec. 469a et seq.), which directs federal agencies to recover and preserve historic and archeological data that would otherwise be lost as a result of federal construction or activities. It has also been amended by the Archeological Resources Protection Act (16 U.S.C. sec. 470aa et seq.), which requires a permit from the U.S. Department of the Interior for excavation or removal of archeological resources from public or Indian lands. Both of these statutes apply to known cultural resources or resources recorded in the future on WIPP facility lands. In accordance with the WIPP Mitigation Plan, four archeological sites that could have been or that were actually disturbed by construction activities have been excavated. The DOE avoids other sites so that there will be no adverse effects on known cultural resources from WIPP facility activities. No additional archeological sites have been slated for excavation.

3.2.12 Floodplain Management (Executive Order 11988)

EO 11988 directs federal agencies to avoid adverse impacts associated with the modification of floodplains, to consider alternatives to a proposed action, to provide early public review of proposed actions, and to propose mitigation measures for proposed actions within floodplains. Because the WIPP site is not located within a floodplain zone, EO 11988 does not apply to the WIPP facility.

3.2.13 Protection of Wetlands (Executive Order 11990)

EO 11990 requires that federal agencies consider the effects of proposed actions in wetlands, determine whether wetlands are present, assess the impacts, consider alternatives to a proposed action, provide for early public review, and propose mitigation measures for proposed actions

that could affect wetlands. The WIPP facility is not located within and will not impact a wetlands area; therefore, EO 11990 does not apply to the WIPP facility.

3.2.14 Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes (Title 40 CFR Part 191)

The authority of the EPA to establish radiation protection standards for nuclear wastes is derived from the Atomic Energy Act (AEA), as amended; the Reorganization Plan No. 3 of 1970; and the Nuclear Waste Policy Act (NWPA) (Pub. L. 97-425). The standards apply to spent nuclear fuel, high-level radioactive waste as defined by the NWPA, and TRU waste that contains more than 100 nanoCuries per gram of waste of alpha-emitting TRU radionuclides with half-lives greater than 20 years. The standards, divided into two subparts (A and B), are described below.

Subpart A, Standards for Management and Storage, sets the operational term requirements limiting annual doses to members of the public from management and storage operations at disposal facilities that are operated by DOE and are not regulated by the U.S. Nuclear Regulatory Commission (NRC) or by agreement states. The annual dose equivalent to any member of the public in the general environment shall exceed 25 mrem to the whole body and 75 mrem to any critical organ. Because the WIPP facility will not qualify as a disposal facility as defined by Title 40 CFR Part 191 during the Test Phase, Subpart A does not apply to management and storage operations during that period. However, in accordance with DOE policy as delineated in DOE Order 5400.5, the WIPP facility, maintains compliance with 40 CFR 191, Subpart A requirements. In addition, the Second Modification to the Agreement for Consultation and Cooperation, dated August 4, 1987, the DOE agreed with the State of New Mexico that the WIPP facility will comply with the standards of Subpart A upon the initial receipt of waste and thereafter.

Subpart B, Standards for Disposal, establishes several sets of long-term requirements for containment, assurance (that containment requirements can be met), individual protection, and groundwater protection and provides guidance for implementation. The containment provisions of Title 40 CFR Part 191.14 require that radioactive waste disposal systems be designed to provide a reasonable expectation that cumulative releases of radionuclides from the repository over 10,000 years will not exceed levels specified in the standards. This degree of assurance is to be provided by a performance assessment which is being conducted by DOE.

As the result of a challenge to the EPA standards by the NRDC and others, the U.S. Court of Appeals for the First Circuit vacated and remanded Subpart B of the regulation (NRDC v. EPA, see Section K-8). Thus, legally, Subpart B portions of Title 40 CFR Part 191 are not now in effect. Nevertheless, the Second Modification to the Agreement for Consultation and Cooperation between the DOE and the State of New Mexico, dated August 4, 1987, specifies that, although the standards are on remand, the DOE will continue to guide its performance assessment planning efforts as though the vacated regulations are still in effect.

3.2.15 Hazardous Materials Transportation Act (HMTA) (49 App. U.S.C. sec. 1801 et seq.; Title 49 CFR Parts 106-179)

The HMTA provides for safe intra- and inter-state transportation of hazardous materials (including nuclear materials). The HMTA allows states to regulate the transport of hazardous/nuclear materials as long as such regulations are consistent with the HMTA or U.S. Department of Transportation (DOT) regulations. The DOT regulations for hazardous/radioactive materials are contained in Title 49 CFR Parts 171-177. Specifications for the kinds and design of packages to be used for the transport of various types of radionuclides are contained in Title 49 CFR Part 173, Subpart I (and parallel NRC regulations in Title 10 CFR Part 71). DOT regulations in Title 49 CFR Part 177 provide a routing and quantity rule for highway shipments of radioactive material;

Title 49 CFR Part 174 contains segregation rules for shipment by rail. In the Second Modification to the Agreement for Consultation and Cooperation, dated August 4, 1987, the DOE agreed to comply with all applicable DOT regulations and the corresponding regulations of the NRC.

3.2.16 Packaging and Transportation of Radioactive Materials(Title 10 CFR Part 71)

Regulations for shipping containers and the safe packaging and transportation of radioactive materials are under the authority of the NRC and DOT. In the Second Modification to the Agreement for Consultation and Cooperation, dated August 4, 1987, DOE agreed to comply with the applicable transportation regulations of the NRC. Packaging requirements for radioactive materials, including Type B packages to be used to transport waste to the WIPP facility, are detailed in DOT regulations (Title 49 CFR Part 173, Subpart I), which reference the NRC regulations. In turn, the NRC regulations in Title 10 CFR Part 71 reference the DOT regulations in Title 49 CFR Part 173.

The NRC requirements for shipping containers apply to the certification of the TRUPACT-II shipping container by the NRC. The container will be used to transport radioactive waste to the WIPP facility. The TRUPACT-II container, to be used to transport transuranic waste, was certified by the NRC on August 30, 1989, after compliance with Title 10 CFR Part 71 requirements for Type B packaging was demonstrated (NRC, 1990).

3.2.17 Department of Energy National Security and Military Applications of Nuclear Energy Authorization Act of 1980 (Public Law 96-164)

This Act, which authorized the WIPP Project, provides as follows:

> Not withstanding any other provision of law, the Waste Isolation Pilot Plant is authorized as a defense activity of the Department of Energy . . . for the express purpose of providing a research and development facility to demonstrate the safe disposal of radioactive wastes resulting from the defense activities and programs of the United States. . . .

The statute provides for DOE consultation and cooperation with appropriate officials of the state of New Mexico with respect to public health and safety concerns. It also provides for a written agreement between DOE and the appropriate officials of the state of New Mexico setting forth the procedures under which to carry out consultation and cooperation. In compliance, the DOE has entered into two agreements with the state of New Mexico: the Consultation and Cooperation (C&C) Agreement and the Working Agreement for the C&C Agreement. Both agreements have been modified several times (see Table 3-3). The most recent modification of the C&C Agreement is the Second Modification to the Consultation and Cooperation Agreement, dated August 4, 1987. The Working Agreement for the C&C Agreement was last modified in March 1988. The agreements are implemented through the DOE and the New Mexico Radioactive Waste Consultation Task Force. In addition, the DOE interfaces regularly with the NMED and the New Mexico Legislature's Radioactive and Hazardous Waste Committee.

3.2.18 Waste Isolation Pilot Plant Land Withdrawal Act of 1991 (S. 1671; introduced in the 102d Congress, August 2, 1991)

This bill provides for the transfer of the WIPP site lands from the Department of the Interior to the Department of Energy. The Secretary of Energy is directed to create a management plan to provide for grazing, hunting, trapping, wildlife habitat, and the disposal of salt tailings, in accordance with appropriate land use Acts. The land has been and will remain closed to surface entry and mining but has been, and will remain open to mineral leasing. Subject to the

passage of S.1671 (or similar legislation), compliance with the following statutes or executive orders is required:

- Taylor Grazing Act
- Subchapter IV of the Federal Land Policy and Management Act
- Public Rangelands Improvement Act
- EO 12548 -- Grazing Fees
- Materials Act of 1947
- Federal Mine Safety and Health Act of 1977.

The bill further provides that the Secretary of Energy may enter into agreements with the Secretary of the Interior and the state of New Mexico in order to administer grazing, wildlife habitat, and mining programs. Requirements for an experimental program using TRU waste, EPA standards, inclusion of engineered barriers, limitations on the amount of TRU waste, prohibition of high-level radioactive waste, retrievability, transportation, economic assistance, decommissioning, and oil and gas leases are also addressed in S.1671.

3.2.18.1 Federal Land Policy and Management Act (43 U.S.C. secs. 1701-1782)

The Federal Land Policy and Management Act was enacted to ensure, among other things, that:

"...public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for aquatic fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use...."

The 10,240 acres occupied by the WIPP facility are now public lands under the jurisdiction of the Bureau of Land Management (BLM). The DOE has conducted site validation investigations and construction under two successive administrative land withdrawals, but the withdrawals did not permit receipt and storage of TRU or TRU mixed waste. The DOE subsequently obtained modification of the latest Public land Order to permit emplacement of TRU waste at WIPP. However, the case of New Mexico v. Watkins (January 31, 1992) overturned this administrative land withdrawal (see Section 3.4.1). As a result of this decision, WIPP must either obtain a legislative land withdrawal or successfully appeal this court decision prior to proceeding with the Test Phase.

Under S. 1671, the Secretary of Energy is required to comply with Subchapter IV of the Federal Land Policy and Management Act. Subchapter IV establishes the authority for grazing fees, range betterment funds, grazing permits, and grazing advisory boards. Under the proposed WIPP facility land withdrawal act, or similar legislation, the Secretary of Energy would be empowered to administer these programs.

3.2.18.2 Taylor Grazing Act (43 U.S.C. sec. 315 et seq.)

This act is intended to prohibit injury to public grazing lands by preventing overgrazing and soil deterioration. The Act promotes the orderly use of and improvement to public grazing lands by establishing grazing districts and a grazing permit system. Under the proposed land withdrawal legislation (S. 1671), DOE must allow grazing to continue on WIPP facility land where grazing districts had been established prior to the date of enactment of the withdrawal act. The Secretary of Energy is empowered to issue grazing permits on WIPP facility land.

3.2.18.3 Public Rangelands Improvement Act (43 U.S.C. sec. 1901 et seq.)

The Public Rangelands Improvement Act establishes a national policy and commitment to:

- Inventory and identify current public rangeland conditions and trends
- Manage, maintain, and improve the condition of public rangelands so that they become as productive as is feasible
- Continue the policy of protecting wild free-roaming horses and burros, while at the same time facilitating the removal and disposal of excess wild free-roaming horses and burros that pose a threat to themselves, their habitat, and other rangeland values.

Under the proposed land withdrawal act (S. 1671), DOE must inventory and administer WIPP facility lands as public rangelands.

3.2.18.4 EO 12548 – Grazing Fees

EO 12548 orders the establishment of fees for grazing of domestic livestock on public rangelands. Under the proposed land withdrawal act (S. 1671), the Secretary of Energy is empowered to establish grazing fees.

3.2.18.5 Material Act of 1947 (30 U.S.C. 601 et seq.)

The Materials Act of 1947 pertains to the disposal of mineral materials (including, but not limited to, sand, stone, gravel, pumice, cinders, and clay) on public lands. The disposal of vegetative materials (e.g., yucca, manzanita, mesquite, cactus, and timber or forest products) is also addressed. Under the proposed land withdrawal legislation (S. 1671), the WIPP facility must dispose of salt tailings in accordance with the bidding, advertising, contract negotiation, and disposition of monies provisions (secs. 602-603) of the Materials Act.

3.2.18.6 Federal Mine Safety and Health Act of 1977 (30 U.S.C. sec. 801 et seq.)

Under the Federal Mine Safety and Health Act of 1977, the U.S. Department of Labor (DOL) is responsible for developing and enforcing regulations and standards to protect mine workers. Under a memorandum of understanding (MOU) between DOE and DOL (DOE and DOL, 1987), effective July 9, 1987, the Mine Safety and Health Administration (MSHA) conducts periodic health and safety compliance inspections of WIPP facility underground operations. Because the MSHA does not have formal regulatory jurisdiction over the WIPP facility, it advises DOE of appropriate actions to be taken to ensure the timely correction of any deficiencies noted during these inspections. MSHA also may, at the request of DOE, participate in investigations in the event of an accident or fatality at the WIPP facility.

3.2.19 Bald and Golden Eagle Protection Act (16 U.S.C. secs. 668-668d)

The Bald and Golden Eagle Protection Act makes it unlawful to take (capture, kill, or destroy), molest, or disturb bald (American) and golden eagles, their nests, or their eggs anywhere in the United States. A permit must be obtained from the U.S. Department of the Interior to relocate a nest that interferes with resource development or recovery operations. The Act potentially applies to the WIPP facility because there is a possibility that bald and golden eagles could be present on WIPP facility lands.

Surveys to identify raptor nests on WIPP facility lands since 1985 have not recorded any bald or golden eagle nests near operational activities. Through the Cooperative Raptor Research and

Management Program at the WIPP facility, the DOE will continue to monitor for raptor nests on WIPP lands and near operational buildings.

3.2.20 Migratory Bird Treaty Act (16 U.S.C. sec. 703 et seq.)

The Migratory Bird Treaty Act is intended to protect birds that have common migration patterns between the United States and Canada, Mexico, Japan, and Russia. The Act stipulates that it is unlawful to indiscriminately "kill . . . any migratory bird." It regulates the harvest of migratory birds by specifying the mode of harvest, hunting seasons, bag limits, etc. Although the WIPP facility is not located within a major migration corridor, there are migratory birds to be present on WIPP facility lands. As required by the Migratory Bird Treaty Act, the DOE will consult annually with the U.S. Fish and Wildlife Service with respect to impacts on migratory birds from the hunting activities permitted on WIPP facility lands.

3.2.21 Noise Control Act of 1972 (42 U.S.C. sec. 4901 et seq.)

According to the Act's policy clause in sec. 2(a)(3), the primary responsibility for noise control is vested in state and local governments. Federal regulation is deemed essential only for commercial noise sources requiring national uniformity of treatment (e.g., aircraft noise). However, federal agencies are required to comply with federal, state, interstate, and local requirements respecting control and abatement of environmental noise "to the fullest extent consistent with their authority" [sec. 4(a) and (b)(1), (2)].

The DOE facilities are required to comply with the Occupational Safety and Health Administration (OSHA) standards in 29 CFR Part 1910, which include the Occupational Noise Exposure standards in 29 CFR 1910.95. Any WIPP facility noise sources that exceed these standards will be mitigated. For example, noise dampers have been installed in the WIPP facility underground air exhaust fans. There are no noise sources at the WIPP facility that would affect the general public.

3.2.22 Occupational Safety and Health Administration (OSHA) Regulations (29 CFR Parts 1900-1999)

Section 6(a) of the Williams-Steiger Occupational Safety and Health Act of 1970 provides that the Department of Labor (DOL) establish employee safety and health standards with which industries are generally familiar and that have been found to be national consensus standards or established federal standards. DOE voluntarily complies with OSHA standards for all WIPP facility activities. The WIPP facility has established safety procedures in accordance with DOE policy.

3.2.23 National Defense Authorization Act – Fiscal Year 1989

The DOE has entered into a contract with the New Mexico Institute of Mining and Technology to conduct independent reviews of the health and safety aspects of the design, construction, and operations of the WIPP facility, as required by the National Defense Authorization Act of 1989. The Environmental Evaluation Group (EEG) performs the reviews for the Institute. The DOE will cooperate, as appropriate, with the EEG reviews of health and safety practices at the WIPP facility.

3.2.24 Protection and Enhancement of Environmental Quality (EO 11514, as amended by EO 11991)

EO 11514 directs federal agencies to:

- *Monitor, evaluate, and control their agency's activities so as to protect and enhance the quality of the environment.*
- Develop procedures to ensure public information and understanding of federal programs with environmental impact.
- Ensure that information regarding existing or potential environmental problems as a result of research, development, demonstration, test, or evaluation activities is made available to federal agencies, states, counties, municipalities, institutions, and other appropriate entities.
- *Review their agency's statutory authority, regulations, policies, and procedures in order to identify any deficiencies or inconsistencies that limit compliance with NEPA.*
- Comply with Council on Environmental Quality (CEQ) regulations except where such compliance would be inconsistent with statutory requirements.

The DOE complies with CEQ regulations and public disclosure requirements by preparing NEPA documentation on WIPP Project activities as necessary. The DOE also conducts continuing comprehensive environmental monitoring programs at the WIPP site, such as the Operational Environmental Monitoring Plan and the Cooperative Raptor Research and Management Program.

3.2.25 Federal Compliance with Pollution Control Standards (EO 12088)

The EO 12088 directs the head of each federal agency to ensure that all necessary actions are taken for the prevention, control, and abatement of environmental pollution. Each agency is responsible for compliance with applicable pollution control standards established by such statutes as the Clean Water Act, the Clean Air Act, radiation guidance under the AEA of 1954, and others. Each agency must submit an annual plan for the control of environmental pollution at its facilities. This EO applies to the DOE in controlling pollution at the WIPP facility. The Waste Minimization and Pollution Prevention Awareness Plan for the WIPP facility is being reviewed by DOE-WPSO.

3.3 OTHER SIGNIFICANT ENVIRONMENTAL ISSUES, ACTIONS, AND ACCOMPLISHMENTS

The report entitled, "Final Safety Analysis Report Addendum, Dry Bin-Scale Test" (DOE, 1991a) was submitted by DOE Headquarters in August 1991, and subsequential approved by the DOE in June 1992.

3.4 COMPLIANCE STATUS FOR JANUARY - MARCH 1992

This section addresses compliance issues and actions at or affecting the WIPP in the first quarter of 1992.

3.4.1 Current Issues

On January 31, 1992, U.S. District Judge J. G. Penn ruled on two cases that impact the WIPP. In the case of Environmental Defense Fund v. Watkins (Civ. Action No. 91-2929), the plaintiff (EDF) argued that the DOE was precluded from proceeding with the temporary storage of TRU

mixed wastes at the WIPP, because the department failed to obtain interim status to operate a Temporary Storage and Disposal Facility (TSDF) under RCRA. In this case, the Judge granted the EDF's motion for summary judgement. As it now stands, this ruling would require the DOE to obtain a RCRA permit from the NMED prior to accepting any TRU mixed waste regulated under RCRA.

In the second case, New Mexico v. Watkins (Civ. Action No. 91-2527), the judge ruled to permanently enjoin the defendants (DOE) from proceeding with Public Land Order 6826 issued on January 22, 1991. This ruling invalidates the administrative land withdrawal action which permitted the DOE to proceed with the WIPP Test Phase using TRU waste. As a result of this ruling, the DOE must either obtain a legislative land withdrawal or successfully appeal this decision prior to commencement of the Test Phase. Both cases have been consolidated on appeal to the U. S. Court of Appeals for the District of Columbia.

3.4.2 Current Actions

During January-March 1992, compliance with the applicable environmental regulations was maintained at the WIPP. Significant environmental compliance actions that were accomplished during the first quarter of CY 1992 are described below.

RCRA

The DOE submitted for review revisions to Part B of the WIPP RCRA permit application to the NMED on March 4, 1992 (DOE, 1992) as requested by New Mexico.

The DOE-WPSO submitted the biennial report for generators of hazardous waste to NMED and EPA Region VI in February 1991. This report describes the types and quantities of hazardous waste shipped off site by the WIPP for treatment, storage, or disposal during 1990 and 1991.

SARA

In February 1992, the DOE-WPSO submitted the Emergency and Hazardous Chemical Inventory Report to the New Mexico State Emergency Response Commission, the Eddy County Local Emergency Planning Committee, and the local fire department with jurisdiction over the WIPP facility, as required by Section 312 of the Superfund Amendments and Reauthorization Act (SARA) Title III.

3.5 SUMMARY OF PERMITS, APPROVALS, AND NOTIFICATIONS

The permits received, permit applications in preparation, and notifications and approvals required are described below. More specific information is provided in the permit matrix presented as Table 3.2.

As stated previously, the DOE submitted Part A of the WIPP RCRA permit application to the NMED and EPA Region VI on January 22, 1991 (DOE, 1991b). The Part B permit application was delivered to the NMED on February 26 and to EPA Region VI on February 27, 1991. Revisions to the Part B application were delivered to the NMED on March 4, 1992 (DOE, 1992).

An annual $200 fee was paid to the Underground Storage Tank (UST) Bureau of the NMED to keep registration of the storage tanks current. This registration and careful maintenance of inventory control records for WIPP USTs are necessary to comply with provisions contained in the New Mexico Groundwater Protection Act.

An Open Burning Permit was obtained on March 8, 1991, from the NMED for the purpose of fire-fighter training at the WIPP.

Two permits are obtained annually from the New Mexico Department of Game and Fish (NMGF). One permit allows for the collection of biological samples which was granted on January 25, 1991. The other permit was granted on February 27, 1991, allows the banding of non-threatened and non-endangered raptors. Both permits require the submittal of an annual report to the NMGF describing the species captured and banded.

A federal raptor banding permit is maintained with the U.S. Fish and Wildlife Service (USFWS) of the U.S. Department of the Interior. This permit operates concurrently with the New Mexico State Raptor Banding Permit. The federal raptor banding permit requires that an annual permit report be submitted to the regional USFWS office.
All three of these permits provide data to support raptor population and raptor prey-base studies. These permits are required for compliance with the ESA and the Migratory Bird Treaty Act. Concurrence was obtained in 1980 from the NMGF that the construction activities of the WIPP would have no significant adverse impacts upon threatened or endangered species.

Compliance with the Federal Land Policy and Management Act (FLPMA) is maintained through cooperative efforts with the BLM. Currently, the WIPP has nine active BLM Right-of-Way permits. These permits allow WIPP employees access across federal lands to air sampling stations, subsidence monuments, the WIPP north access road, the WIPP railroad spur, and the water supply pipeline.

The DOE-WPSO submitted an Environmental Assessment (EA) for the proposed sewage lagoon expansion to the DOE WIPP Project Integration Office (WPIO) on February 14, 1992. The WIPP anticipates that a Finding of No Significant Impact (FONSI) will be issued by the DOE-EM office for this project.

The NEPA requires that the state and local permit requirements associated with proposed projects be addressed in conjunction with the NEPA documentation process. To expand the sewage lagoon, an approved Discharge Plan is required to comply with the New Mexico Water Quality Commission's Regulations. The DOE submitted a discharge plan application to the NMED on January 7, 1992. The NMED issued an approved discharge plan for the expansion of the WIPP sewage lagoon on January 16, 1992. In order to assure compliance with the discharge plan, effluent sampling must be completed and the effluent sampling results must be submitted quarterly to the NMED. The first quarterly report will be due to the NMED on April 16, 1993. The new sewage facility will not be constructed until a FONSI has been issued for the sewage facility expansion EA.

The DOE is currently preparing a comprehensive NEPA Compliance Program for the WIPP. This program is already in use at the WIPP. The NEPA Compliance Program contains a compliance plan, two compliance procedures, and a NEPA training module. Adherence to the NEPA compliance procedures will ensure that decisions to proceed with proposed WIPP projects (those not "categorically excluded" from NEPA by the DOE) are made only after the proper level of NEPA documentation has been prepared and approved by the appropriate DOE office.

Table 3-1

COMPLIANCE STATUS WITH MAJOR ENVIRONMENTAL REGULATIONS APPLICABLE TO THE WIPP PROJECT

STATUTE/REGULATION	STATUS
Atomic Energy Act	No radioactive waste was received during the 1991 calendar year.
Clean Air Act	NESHAPs data package and letter of notification submitted. No monitoring/reporting required until after receipt of waste.
Clean Water Act	See "New Mexico Water Quality Act."
Comprehensive Environmental Response, Compensation, and Liability Act/Superfund Amendments and Reauthorization Act	No Land Disposal Units (LDUs) on site requiring cleanup under CERCLA. Reports filed as required under SARA for hazardous substances maintained on site.
Endangered Species Act	Permit to collect biological samples and to band non-endangered species of raptors obtained.
Federal Land Policy and Management Act	Administrative land withdrawal requested and granted by Department of Interior. Law suit filed and court injunction in effect, pending appeal.
Federal Insecticide, Fungicide, and Rodenticide Act	All use of pesticides is approved by Industrial Safety and is performed by subcontractors.
Hazardous Materials Transportation Act	Hazardous wastes to be sent off site are reviewed to ensure compliance with HMTA.
National Environmental Policy Act (as supplemented by DOE Order 5440.1D (02/22/91), National Environmental Policy Act Compliance Program)	Mitigation Action Plan was prepared based on the RODs to the two WIPP EISs. All WIPP activities subject to NEPA under DOE Order 5440.1D (02/22/91) are reviewed, and the appropriate NEPA documentation is filed with the DOE-WPSO.
National Historic Preservation Act	See "New Mexico Cultural Properties Act."
New Mexico Air Quality Control Act	New Mexico does not yet have primacy for NESHAP for radionuclide emissions from DOE facilities.
New Mexico Cultural Properties Act	Land within the fenced area of the site has been surveyed as required. Activities such as excavation outside the fence are examined on a case-by-case basis to ensure that the area has been properly surveyed prior to initiating said activities.

STATUTE/REGULATION	STATUS
New Mexico Emergency Management Act	See "Comprehensive Environmental Response, Compensation, and Liability Act."
New Mexico Hazardous Waste Management Regulations	See "Resource Conservation and Recovery Act." NMED does not yet have primacy for all areas of RCRA.
New Mexico Radioactive Materials Act	No radioactive wastes had been received at the WIPP by the end of CY 1991.
New Mexico Water Quality Act	Emergency discharge permit applied for and obtained. Expansion of sewage lagoon required to accommodate waste waters generated from condensate. Discharge plan for sewage lagoon expansion submitted to NMED and approved. New Mexico Environment Department does not yet have primacy for the NPDES storm water requirements.
New Mexico Wildlife Conservation Act	See "Endangered Species Act."
Resource Conservation and Recovery Act	*Hazardous-waste generator compliance:* 30-day extension to the 90-day accumulation time granted in January 1991 for remainder of site generated waste. *No-Migration Determination compliance:* Air monitoring program for VOCs initiated in accordance with the NMD. First annual report submitted to EPA on November 14, 1991. Procedure has been issued to examine planned and unplanned changes and any migration of hazardous constituents to ensure proper reporting to EPA. *Mixed-waste management, Test Phase:* The Part A RCRA Permit application submitted to NMED/EPA Region VI on January 22, 1991 (DOE, 1991b). Part B RCRA Permit application submitted to NMED and Region VI EPA on February 26 and February 27, 1991, respectively. Revision of Part B permit application submitted to NMED on March 4, 1992 (DOE, 1992). *Underground Storage Tanks:* Two USTs removed on December 19, 1991, and replaced with two new tanks on January 11, 1992.
Toxic Substances Control Act	Procurement of asbestos-/PCB-containing materials not allowed. Other portions of TSCA not applicable.

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	02/22/91	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.
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, 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.
DOE/EH-0173T	January 1991	Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance	Established guidelines for environmental monitoring at DOE Facilities.

Table 3-2

DOE ORDERS AND AGREEMENTS AFFECTING THE WIPP ENVIRONMENTAL PROGRAM (Continued)

ORDER NO.	DATE	TITLE	ANNOTATION
DOE 5481.1B	09/23/86	Safety Analysis and	To establish uniform requirements for the preparation and review of safety analyses of DOE operations which include: identification of hazards, their elimination or control, assessment of the risk, and documented management authorization of the operation.
DOE 5482.1B	09/23/86	Environmental, Safety and Health Appraisal Program	To establish the Environmental Protection, Safety, and Health (ES&H) appraisal program for the DOE.
DOE 5500.3A	04/30/91	Planning, and Preparedness, for Operational Emergencies	To establish requirements for the development of DOE site-specific emergency plans and procedures for radiological emergencies occurring in existing or planned DOE reactors and nonreactor nuclear facilities. Furthermore, it requires that comprehensive emergency actions are planned, coordinated, and implemented to respond effectively to the on-site and off-site consequences of a radiological emergency at these facilities and it provides for appropriate coordination between DOE and off-site officials to ensure the protection of on-site personnel, public health and safety, and the environment.
DOE 5700.6C	08/21/91	Quality Assurance	To provide DOE policy, set forth principles, and assign responsibilities for establishing, implementing, and maintaining programs of plans and actions to ensure quality achievement in DOE programs.
DOE 5820.2A	09/26/88	Radioactive Waste Management	Establishes policies and guidelines by which DOE manages radioactive waste, waste byproducts, and radioactively contaminated surplus facilities.
DOE 6430.1A	04/06/89	General Design Criteria	To provide general design criteria for use in the acquisition of DOE facilities and to establish responsibilities and authorities for the development and maintenance of these criteria.

Table 3-3

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

Stipulated Agreement on Civil Action No. 81-0363 JB -- This agreement, approved by the U.S. District Court when it stayed (held in abeyance) proceedings in the lawsuit against DOE by the State of New Mexico, was executed on July 1, 1981. The eight-page agreement assures that a binding, enforceable "consultation and cooperation" agreement will be entered into by DOE and the state and that 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 DOE for the Site Preliminary and Design Validation phase of the WIPP facility. It was signed by Jeff Bingaman, Attorney General, State of New Mexico, and Myles Flint, Attorney, U.S. Department of Justice, and issued July 1, 1981, by Juan G. Burciaga, U.S. District Judge, District of New Mexico.

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. It was signed in July 1981 by Bruce King, Governor, State of New Mexico, and James B. Edwards, Secretary, U.S. Department of Energy.

Working Agreement for Consultation and Cooperation, Appendix B, Article IV, Revision I -- 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 facility that must be reviewed by the state before they are commenced. Many environmental items are included. It was signed in March 1983 by Robert McNeill, Chairman, Radioactive Waste Task Force, and R. G. Romotowski, Manager, Albuquerque Operations Office, U.S. Department of Energy. (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 Environmental Monitoring Program. The concerns addressed are: state liability (for a nuclear incident), emergency response preparedness, transportation monitoring of the WIPP facility waste, the WIPP facility environmental monitoring by the state, and upgrading of state highways. It was signed in December 1982 by Bruce King, Governor, State of New Mexico, et al., and R. G. Romotowski, Manager, Albuquerque Operations Office, U.S. Department of Energy.

First Modification to the July 1, 1981, Agreement for Consultation and Cooperation on WIPP by the State of New Mexico and the U.S. Department of Energy -- This modification was signed November 30, 1984, wherein DOE and the state agree to address certain concerns of the state regarding: (1) the specific mission of the WIPP Project, (2) a demonstration of retrievability 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 on the hiring of New Mexico residents at the WIPP Project. It was signed in November 1984 by Joseph Goldberg, Secretary, Health and Environment Department, State of New Mexico, and R. G. Romotowski, Manager, Albuquerque Operations Office, U.S. Department of Energy.

Table 3-3

SUMMARY OF AGREEMENTS BETWEEN DOE AND THE STATE OF NEW MEXICO THAT AFFECT THE WIPP ENVIRONMENTAL PROGRAM *(Continued)*

Second Modification to the July 1, 1981, Agreement for Consultation and Cooperation on WIPP by the State of New Mexico and the U.S. Department of Energy -- Signed August 4, 1987, wherein 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 U.S. Environmental Protection Agency, U.S. Department of Transportation, and U.S. Nuclear Regulatory Commission regulations. It was signed in August 1987 by Garrey Carruthers, Governor, State of New Mexico, et al., and R. G. Romotowski, Manager, Albuquerque Operations Office, U.S. Department of Energy.

1988 Modification to the Working Agreement of the Consultation and Cooperation Agreement Between the U.S. Department of Energy and the State of New Mexico on the Waste Isolation Pilot Plant -- 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. It was signed in March 1988 by Kirkland Jones, Deputy Director, New Mexico Environmental Improvement Division, State of New Mexico, et al., and R. G. Romotowski, Manager, Albuquerque Operations Office, U.S. Department of Energy.

Environmental Oversight and Monitoring Agreement -- This agreement states that DOE will provide additional technical and financial support for state activities in environmental oversight, monitoring, access, and emergency response to ensure compliance with applicable federal, state, and local laws at several DOE facilities including the WIPP facility. It was signed in October 1990 by Garrey Carruthers, Governor, State of New Mexico; Dennis Boyd, Secretary, Health and Environment Department; and Bruce G. Twining, Manager, Albuquerque Operations Office, U.S. Department of Energy.

Table 3-4

ACTIVE/PENDING PERMITS FOR THE WASTE ISOLATION PILOT PLANT DURING 1991 AND THE FIRST QUARTER OF 1992

Granting Agency	Type of Permit	Permit Number	Granted/ Submitted	Expiration	Permit Status
Department of the Interior, Bureau of Land Management	Right-of-Way for Water Pipeline	NM53809	8/17/83	None	Active
Department of the Interior, Bureau of Land Management	Right-of-Way for the North Access Road	NM55676	8/24/83	None	Active
Department of the Interior, Bureau of Land Management	Right-of-Way for Railroad	NM55699	9/27/83	None	Active
Department of the Interior, Bureau of Land Management	Right-of-Way for Dosimetry and Aerosol Sampling Sites	NM63136	7/3/86	None	Active
Department of the Interior, Bureau of Land Management	Right-of-Way for Seven Subsidence Monuments	NM65801	11/7/86	None	Active
Department of the Interior, Bureau of Land Management	Right-of-Way for Aerosol Sampling Site	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	9/12/89	12/13/2019	Active
Department of the Interior, Bureau of Land Management	Right-of-Way for Survey Monument Installation	NM82245	12/13/89	12/13/2019	Active
Department of the Interior, Bureau of Land Management	Approval to Drill 2 New Test Wells on Existing Pads at P-1 and P-2	None	9/18/86	None	Active
New Mexico Environment Department	Open Burning Permit to Train Fire Control Crews	None	2/4/92	2/4/93	Active
New Mexico Environment Department	Temporary Permission for Disposal of Brine	None	9/18/91	1/16/92	Superseded by the issuance of Discharge Plan Approval
New Mexico Environment Department	Discharge Plan Approval	DP-831	1/16/92	1/16/97	Active

Granting Agency	Type of Permit	Permit Number	Granted/ Submitted	Expiration	Permit Status
New Mexico Environment Department	Submittal of Part A RCRA Permit Application		Submitted to NMED and EPA Region VI 1/22/91		Awaiting Approval
New Mexico Environment Department	Submittal of Part B RCRA Permit Application		Submitted to NMED and EPA Region VI on 2/26/92 and 2/27/92 respectively Revisions were delivered to the NMED on 3/4/92		Awaiting Approval
New Mexico Environment Department	Acknowledgement of Notification of Hazardous Waste Activity (WIPP)	NM489013 9088	1/88 Latest report delivered on 2/28/92	None - Contingent upon delivery of biennial report	Active
New Mexico Department of Game and Fish	Master Banding	1608	2/27/91	12/31/91	Inactive
New Mexico Department of Game and Fish	Individual Banding	1961	10/22/91	12/31/91	Inactive
New Mexico Department of Game and Fish	Master Collecting	1894	1/25/91	12/31/91	Inactive
New Mexico Department of Game and Fish	Concurrence that WIPP construction activities will have no significant impact on State-listed threatened or endangered species	None	5/26/89	None	Active
U.S. Department of the Interior, Fish and Wildlife Service	Master Personal Banding	22478	1/28/91	6/30/93	Active
U.S. Department of the Interior, Fish and Wildlife Service	Concurrence that WIPP construction activities will have no significant impact on Federally-listed threatened or endangered species	None	5/29/80	None	Active
New Mexico Commissioner of Public Lands	Right-of-Way for High Volume Air Sampler	RW-22789	10/3/85	10/3/2020	Active

Granting Agency	Type of Permit	Permit	Granted/ Submitted	Expiration	Permit Status
New Mexico Department of Finance and Administrative Planning Division, Historic Preservation Bureau	Concurrence that the DOE Archaeological Resources Protection Plan is adequate to mitigate any adverse impacts upon cultural resources resulting from construction of the WIPP facility	None	7/25/83	None	Active
U.S. Environmental Protection Agency	Notification of the presence of 2 Underground Storage Tanks	None	4/15/86	None	Active
U.S. Environmental Protection Agency	NESHAPS (Radionuclides)	None	2/19/91 Data package submitted to the EPA		

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 PLAN

The WIPP OEMP monitors a comprehensive set of parameters in order to detect and quantify any present or potential future environmental impacts. Nonradiological portions of the plan 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, environmental significance, identify corrective 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.

As required by DOE Order 5400.1, the OEMP is under review and will be issued as an updated document by the end of 1992. This update will incorporate changes that are needed to more accurately describe the environmental monitoring program in place at the WIPP.

4.2 ACCIDENTAL RELEASES

The WIPP site had no accidental releases into the environment during 1991. In the future during operations if a release occurs all state and federal regulatory agencies will be promptly notified of the release.

4.3 SIGNIFICANT ENVIRONMENTAL ACTIVITIES

This section addresses significant environmental activities that occurred during 1991.

4.3.1 Waste Minimization and Pollution Prevention Awareness Plan

The WIPP Waste Minimization and Pollution Prevention Awareness Plan was completed in draft form on September 13, 1991.

In 1991, the WIPP accomplished the following waste minimization activities:

- Off-site recycling of approximately 6,000 gallons of waste oil
- Reuse of cold-degreasing solvents at 15 solvent stations used for cleaning parts
- Off-site reclamation of 1,600 gallon cold-degreasing solvents
- Product substitution for hazardous materials
- Elimination of methylene chloride, 1,1,1-trichloroethane, benzene, carbon tetrachloride, and toluene on site.

The annual waste reduction report required by DOE Order 5400.1 was completed on January 6, 1992. This report delineates waste reduction activities conducted at the WIPP in 1991.

4.3.2 Environmental Training

During 1991 there were eight environmental training courses offered to WIPP personnel these were:

- Air Sampling for Radioactive Materials
- 40 Hour Hazardous Waste Operations
- RCRA Training
- Environmental Regulations
- Environmental Radiation Detection
- Basic Environmental Training
- Fundamentals of Groundwater and Wells
- Westinghouse School for Environmental Excellence

4.3.3 Reclamation of Disturbed Lands

In CY 91, 10 reserve pits on WIPP well pads were filled, but not seeded. An 11th was not filled due to adverse weather conditions. This is out of 85 total wells pads, which will have reclamation performed on them in the years to come.

In CY 92 reclamation activities will entail contouring a decommissioned caliche pit one mile north of the site. This project will represent an improved wildlife habitat and will be seeded with species endemic to southeastern New Mexico and the Los Medaños. A water absorbing polymer will be utilized to provide a ready water source to young seedlings. A pulverized version of the polymer will be used in the main basin of the borrow pit to act as a water barrier, thus creating a water catchment to pool water during rainy periods. Although using the polymer in this fashion has never been attempted in North America, this should have results similar to those of bentonite clays.

4.3.4 Seismic Activity

The Rattlesnake Canyon earthquake (5.0 Richter) of January 2, 1992 occurred above or within a large buried north-south oriented structure called the Central Basin Platform. The known seismic history of this structure suggests events of at least a magnitude of 5.0 might be expected from time to time along its entire length. Most of the strong seismic events prior to the January 2, 1992 event occurred 40 to 60 km. south of the Rattlesnake Canyon earthquake epicenter located midway between Eunice and Jal, New Mexico, and about 3 km. east of the highway connecting these communities. Other earthquakes along the Central Basin Platform have rarely occurred as single isolated events. More generally, they are observed in clusters lasting a few months to a few years. It is likely that seismic activity will continue in this region.

Historically, the seismic information for the WIPP facility region before 1962 is based on chronicles of the effects of those tremors on people, structures, and land forms (called macroseismic evidence). Since 1962 virtually all seismic information is based on instrumental data recorded at various seismograph stations. Currently, seismicity is being monitored at New Mexico Institute of Mining and Technology (NMIMT) using data from four stations telemetered to the NMIMT campus from coordinates around the site. Seismicity is also being monitored from other New Mexico stations and bordering states.

Pre-1962 seismicity reported in New Mexico occurred in the Rio Grande valley area between Albuquerque and Socorro and is associated with a structure known as the Rio Grande Rift. These earthquakes had intensities of Modified Mercalli Intensity (MMI) V or greater. One earthquake with a MMI VII intensity, Valentine, Texas August 16, 1931, occurred about 120 miles south-southwest of the WIPP facility. The area within 120 miles of the facility has experienced only low-intensity earthquakes (intensity V or less). More recently, seismicity near the site has been registered with readings as great as 3.8 in magnitude from January 1, 1962 through November 28, 1974. Sources of ground vibrations originated from earthquakes from the west and from the Central Basin Platform.

Geologic structures and tectonism of the Permian Basin are associated with large-scale basin, interbasin, and basin margin subsidence or emergence which occurred during the Paleozoic era. The WIPP facility is about 60 miles from the western margin of the Permian Basin which is a broad structural feature made up of a series of Paleozoic sedimentary basins whose last episodes of major subsidence occurred during late Permian time. The area today is characterized by the basin filled with thick evaporite layers and bordered by the Amarillo uplift to the north, the Marathon thrust belt to the south, and the Diablo Platform, Sacramento and Guadalupe Mountains to the west. All major tectonic elements of the Permian Basin were completely formed before deposition of the Permian salt-bearing rocks, and the region has been relatively stable since that time. Deep-seated faults are rare except along the west margin of the basin and no indications of younger deep-seated faults are noted.

Central Basin Platform related seismicity may not be entirely tectonic, but instead, may be related to water injection and withdrawal for secondary recovery operations in oil fields. Similar evidence suggests that the June 16, 1978 event near Snyder, Texas may have been induced by secondary oil recovery operations. The depth of the earthquake closely approximates the bottom of drillholes located in this gas producing area.

There is little indication that significant magnitude events are likely to occur in the WIPP facility zone. There is no Quaternary fault offset, and seismic activity is low. Analysis of risk for the WIPP facility source zone considers 4.5 magnitude the maximum historical event near the site of tectonic origin plus about one magnitude unit. And 5.5 as the maximum event recorded anywhere within the Permian Basin subregion, plus about one magnitude unit. Thus, this area of New Mexico and West Texas is geographically very stable with little indication of a potential seismic event capable of detrimental effects to the WIPP.

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 Direction, Precipitation, Dew Point, Barometric Pressure
Exposure Rate Meter	Penetrating Radiation
Atmospheric Particulate	Gross α, Gross β, TSP, Specific Radionuclide
Air Quality	O_3, CO, H_2S, SO_2, NOx
Vegetation Radioanalysis	Specific Radionuclides
Beef	Specific Radionuclides
Game Birds	Specific Radionuclides
Rabbits	Specific Radionuclides
Soil Radioanalysis	Specific Radionuclides
Surface Water	Specific Radionuclides TSS, pH
Groundwater	Specific Radionuclides, pH
Fish	Specific Radionuclides
Sediment	Specific Radionuclides
Aerial Photography	Area of Land Disturbed

TABLE 4-2

OEMP ANALYTICAL ARRAY

(Continued)

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

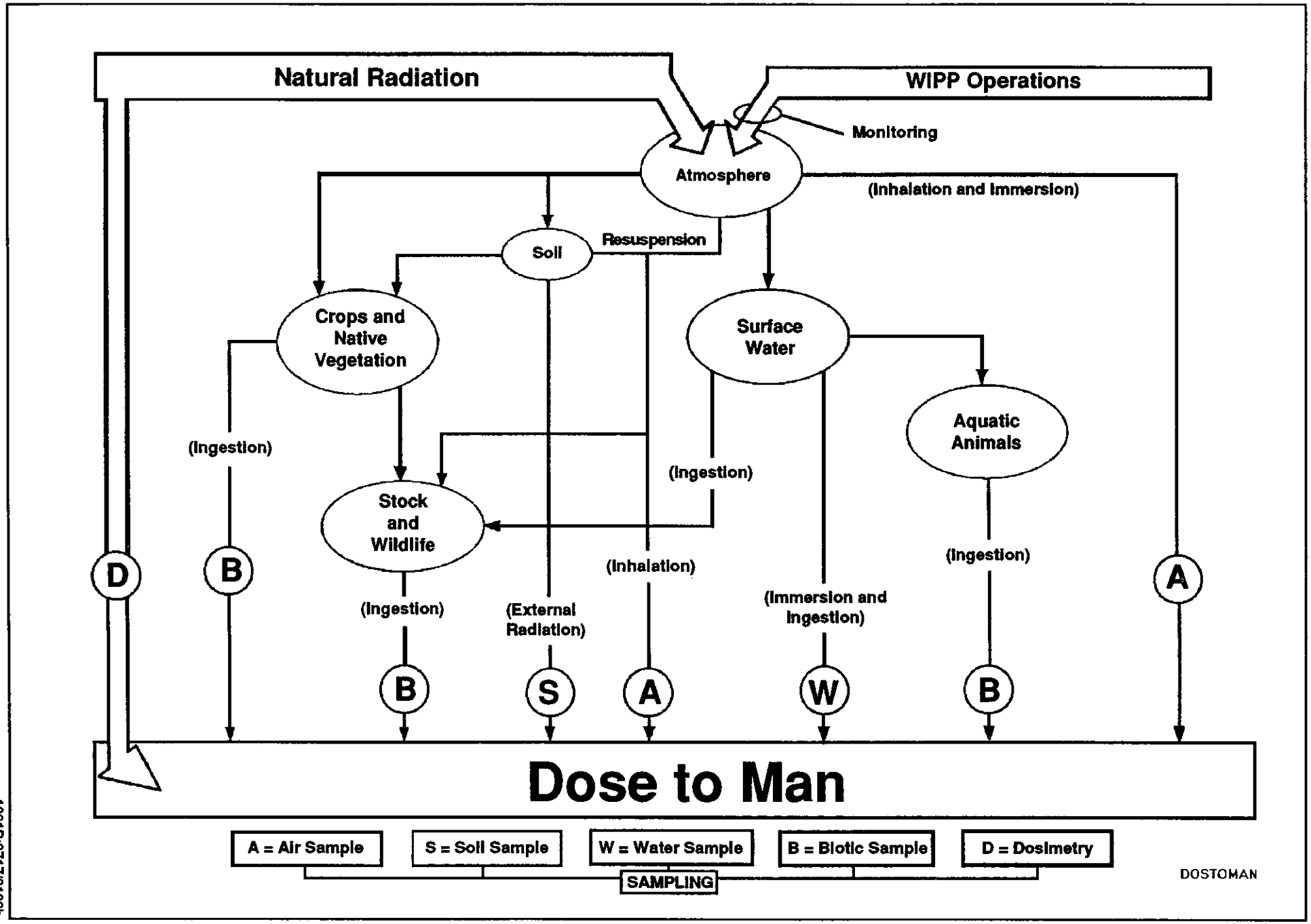
TSS = Total Suspended Solids
TSP = Total Suspended Particulates
EC = Electrical Conductivity

Specific Radionuclides = ^{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 carbon, total organic halogen, arsenic, barium, cadmium, chromium, fluoride, lead, mercury, nitrate, selenium, silver, endrin, methoxychlor, toxaphene, 2, 4-D, 2, 4, 5-T, silvex.

Figure 4-1

PRIMARY PATHWAYS TO MAN FOR RADIOACTIVE RELEASES FROM THE WIPP SITE



CHAPTER 5

ENVIRONMENTAL RADIOLOGICAL PROGRAM INFORMATION

The following sections provide a description of the various subprograms constituting the OEMP at the WIPP. A comprehensive statistical summary of the Radiological Baseline Program for the WIPP is presented in Appendix 1 of this report. The radiological data analyzed covers the period from 1985 through 1989. Sample types included in this report are airborne particulates, soil, surface water, groundwater, and biotic.

5.1 RADIOACTIVE EFFLUENT MONITORING

This program is described in the OEMP. This plan defines the scope and extent of the WIPP effluent and environmental monitoring programs during the operational life of the facility.

The Environmental Regulatory Guide for Effluent Monitoring and Environmental Surveillance, (DOE/EH-0173T) (DOE, 1991) requires that monitoring of liquid waste effluent streams be adequate to demonstrate compliance with dose limits in DOE Order 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 1991, no effluent sampling or release data are reported in this document.

5.2 ENVIRONMENTAL RADIOACTIVITY MONITORING

The following subsections present the monitoring results of the various subprograms of the OEMP for 1991. These include aerosol monitoring, ambient radiation, terrestrial radioactivity, hydrologic radioactivity, and biotic radioactivity baseline subprograms.

5.2.1 Atmospheric Radiation Baseline

Continuous particulate aerosol samplers operate at eight locations, three within 1000 meters of the facility, four at local ranches and communities, and one as a sample control site (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 by quarter for 1991.

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 1991. These filters were analyzed at the Environmental Low-Level 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 locations. The individual gross alpha concentrations reported for each location are documented in Appendix 5. The mean gross alpha concentrations in Figure 5-2 show limited fluctuation throughout the year and are consistently less than 0.90 E-9 Bq/ml. These fluctuations appeared to be consistent among all sampling locations.

The mean gross beta concentrations in Figure 5-3 fluctuate throughout the year, typically within the range of 0.6-1.6 E-9 Bq/ml. Appendix 5 shows the 1991 gross beta concentration for each individual sampling location that was used to establish the mean.

Gross beta and alpha measurements provide an indication of total radionuclide concentration or may indicate changes in a specific radionuclide concentration. These measurements are also used for screening to ensure that important radionuclides are not overlooked when performing a specific measurement. 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 been performed by a contract laboratory.

5.2.2 Ambient Radiation Baseline

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

The Reuter-Stokes shows a rise in the average radiation level for the fourth quarter. A seasonal rise in ambient radiation has been observed in the first and fourth quarters each year. As stated in previous reports, it is speculated that this fluctuation may be due to variations in the emission 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 slow the radon and its progeny from dispersing.

5.2.3 Radiological Soil Monitoring

There were no radiological soil samples collected in CY 91. A substantial baseline of soil sample analyses that meets the requirements of DOE Order 5400.1 is presented in Appendix 1.

5.2.4 Hydrologic Radioactivity

This subprogram is designed to establish characteristic radioactivity levels in surface water bodies, bottom sediments, and groundwater. The following discussion of the hydrologic program includes sampling locations, times and data collected during 1991, and refinements made to the program since the publication of the RBP Sampling Plan (Reith and Daer, 1985).

- **Radiological Surface Water and Sediment Monitoring**

  A substantial baseline of surface water and sediment analyses which meets the requirements of DOE Order 5400.1 is presented in Appendix 1.

- **Radiological Groundwater Characterization**

  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 groundwater 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. In 1991, groundwater data were gathered at 14 well locations. Data were collected at seven locations completed in the Culebra dolomite and four locations completed in the Magenta dolomite. Water quality data were also collected from three privately owned wells in the vicinity of the WIPP that are completed in the Dewey Lake Redbeds. The three private wells provide water for area livestock and one, Barn well, is believed to provide water for human consumption. An in-depth discussion of groundwater hydrology, including a figure with well locations is presented in Chapter 7.0, Groundwater Protection, of this report.

There is extensive oil and gas production in the WIPP vicinity as well as 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 Gnome site, a Plow Shares for Peace project under the Atomic Energy Commission was a peaceful application of atomic energy. The study was to see if the salt in the Salado formation could store thermoenergy generated by a atomic explosion. The theory, in this conceived application, did not succeed. The salt did not retain significant amounts of heat to be tapped as a energy source.

Radiological groundwater samples collected in 1991 were archived. A substantial baseline of groundwater sample analyses, that meets the requirements of DOE Order 5400.1, is presented in Appendix 1.

5.2.5 Biotic Radioactivity

This subprogram characterizes background radioactivity levels in key organisms along possible 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 1991, samples of fish and vegetation were collected and archived since the required number of baseline biotic samples had already been collected and analyzed for the OEMP. There were no quail, rabbits, or beef samples collected during CY 91. Appendix 1 of this report provides an in-depth statistical analysis for 1985-1989 for all biotic samples collected. Representative sample locations are shown in Figure 5-3.

5.3 ASSESSMENT OF POTENTIAL DOSE TO THE PUBLIC

There was no waste received at the WIPP in 1991, therefore, there was no exposure of the public to radiation due to WIPP operations. Documentation of naturally occurring background radiation is discussed in Section 5.2.2, Ambient Radiation Baseline.

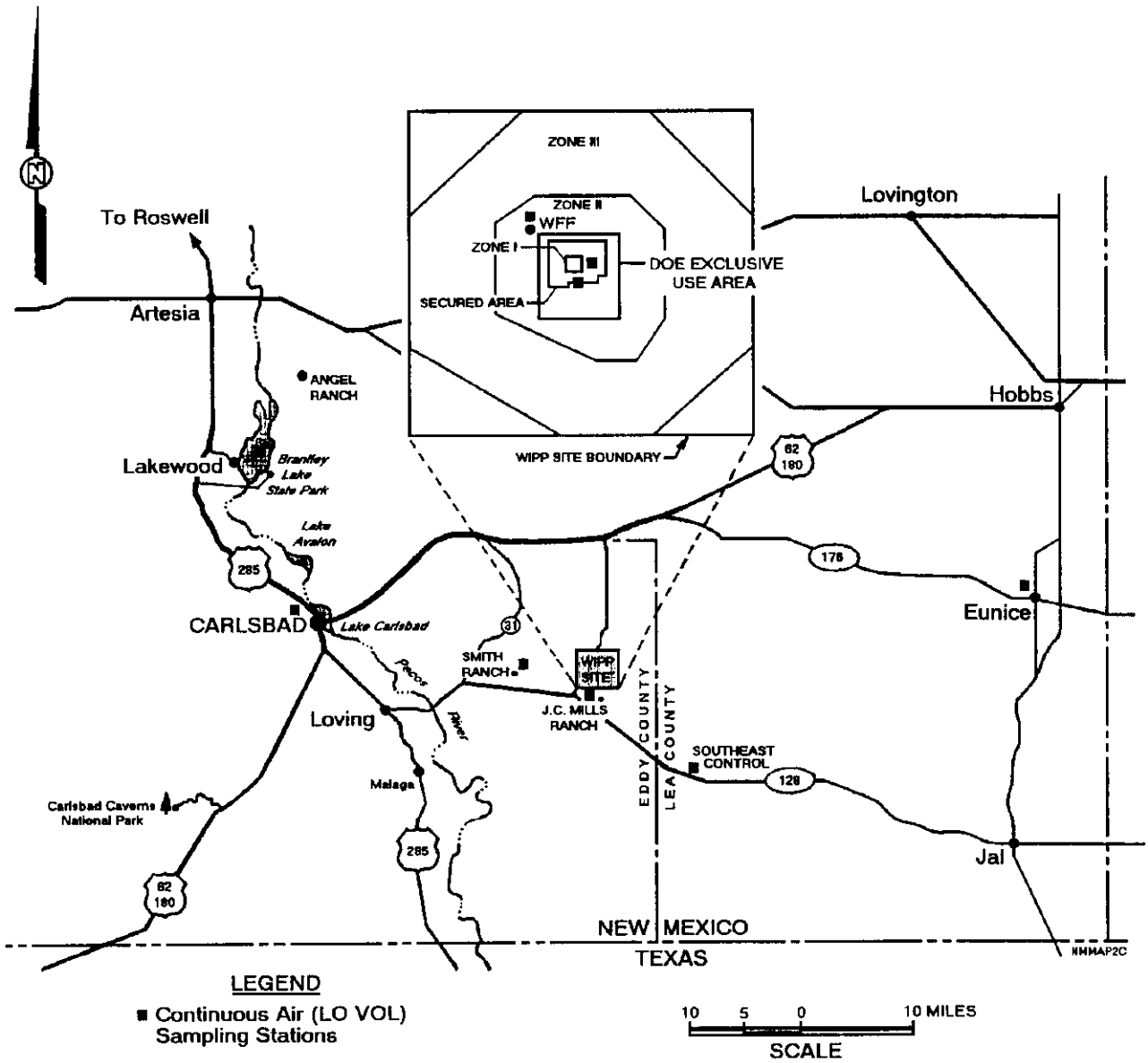


Figure 5-1
Continuous Air Sampling Stations

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TABLE 5-1

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

FIRST QUARTER 1991

LOCATION	ALPHA	BETA
Carlsbad	7.1 E-10	8.8 E-10
Smith Ranch	6.9 E-10	9.6 E-09
Mills Ranch	7.0 E-10	9.4 E-10
WIPP Far Field	6.7 E-10	9.9 E-10
WIPP South	7.0 E-10	8.5 E-10
WIPP East (1)	7.9 E-10	9.9 E-10
WIPP East (2)	6.3 E-10	8.2 E-10
Eunice	7.1 E-10	8.2 E-10
South East Control	6.4 E-10	7.9 E-10

SECOND QUARTER 1991

LOCATION	ALPHA	BETA
Carlsbad	5.4 E-10	7.0 E-10
Smith Ranch	5.9 E-10	7.9 E-10
Mills Ranch	6.5 E-10	8.9 E-10
WIPP Far Field	6.3 E-10	9.0 E-10
WIPP South	5.3 E-10	7.4 E-10
WIPP East (1)	6.2 E-10	8.1 E-10
WIPP East (2)	5.9 E-10	7.1 E-10
Eunice	5.7 E-10	7.3 E-10
South East Control	5.8 E-10	8.4 E-10

THIRD QUARTER 1991

LOCATION	ALPHA	BETA
Carlsbad	3.4 E-10	5.5 E-10
Smith Ranch	5.7 E-10	1.0 E-09
Mills Ranch	6.5 E-10	1.0 E-09
WIPP Far Field	5.6 E-10	8.6 E-10
WIPP South	5.4 E-10	9.5 E-10
WIPP East (1)	7.7 E-10	1.1 E-10
WIPP East (2)	6.6 E-10	1.0 E-09
Eunice	3.1 E-10	7.1 E-10
South East Control	5.3 E-10	9.1 E-10

TABLE 5-1
CONTINUED

FOURTH QUARTER 1991

LOCATION	ALPHA	BETA
Carlsbad	6.9 E-10	1.4 E-09
Smith Ranch	8.6 E-10	1.5 E-09
Mills Ranch	7.3 E-10	1.4 E-09
WIPP Far Field	9.0 E-10	1.5 E-09
WIPP South	8.9 E-10	1.3 E-10
WIPP East (1)	8.4 E-10	1.6 E-10
WIPP East (2)	7.5 E-10	1.3 E-09
Eunice	7.2 E-10	1.5 E-09
South East Control	8.1 E-10	1.4 E-09

FIGURE 5-2

ALPHA CONCENTRATION

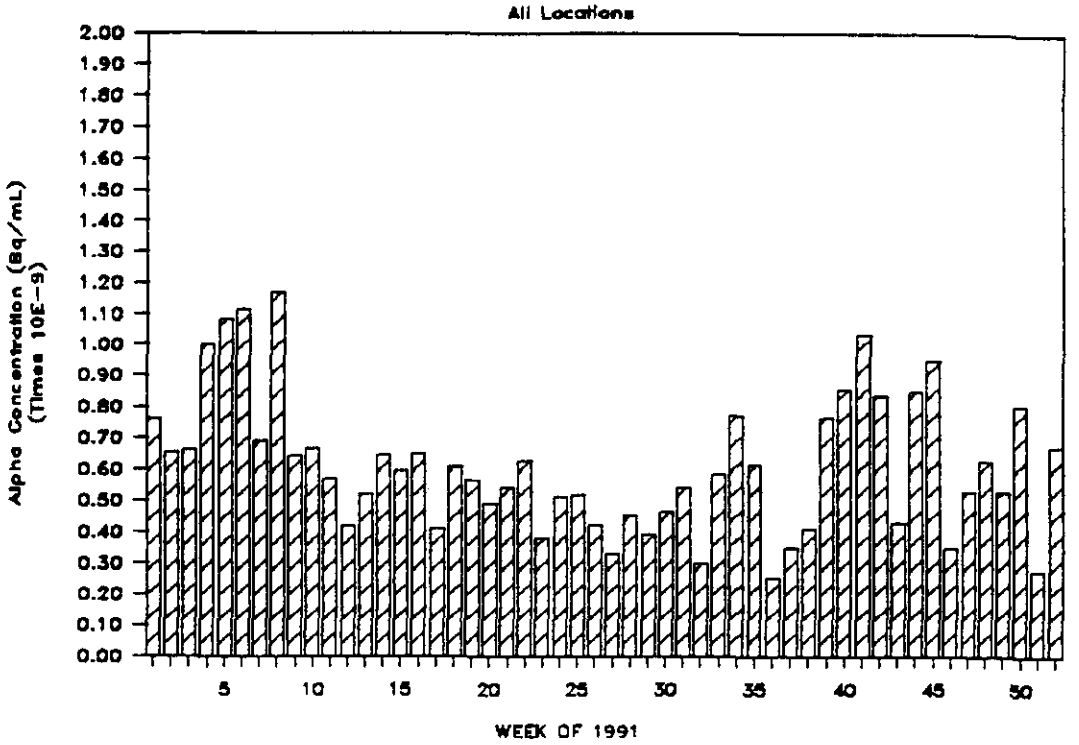
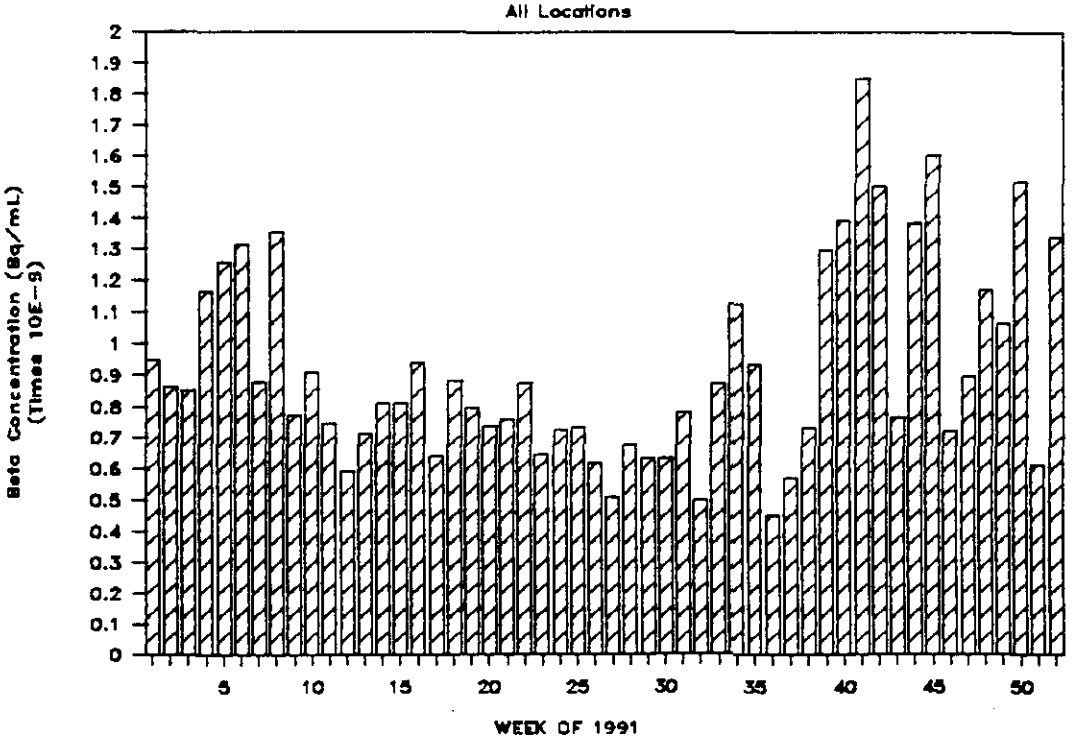


FIGURE 5-3

BETA CONCENTRATION



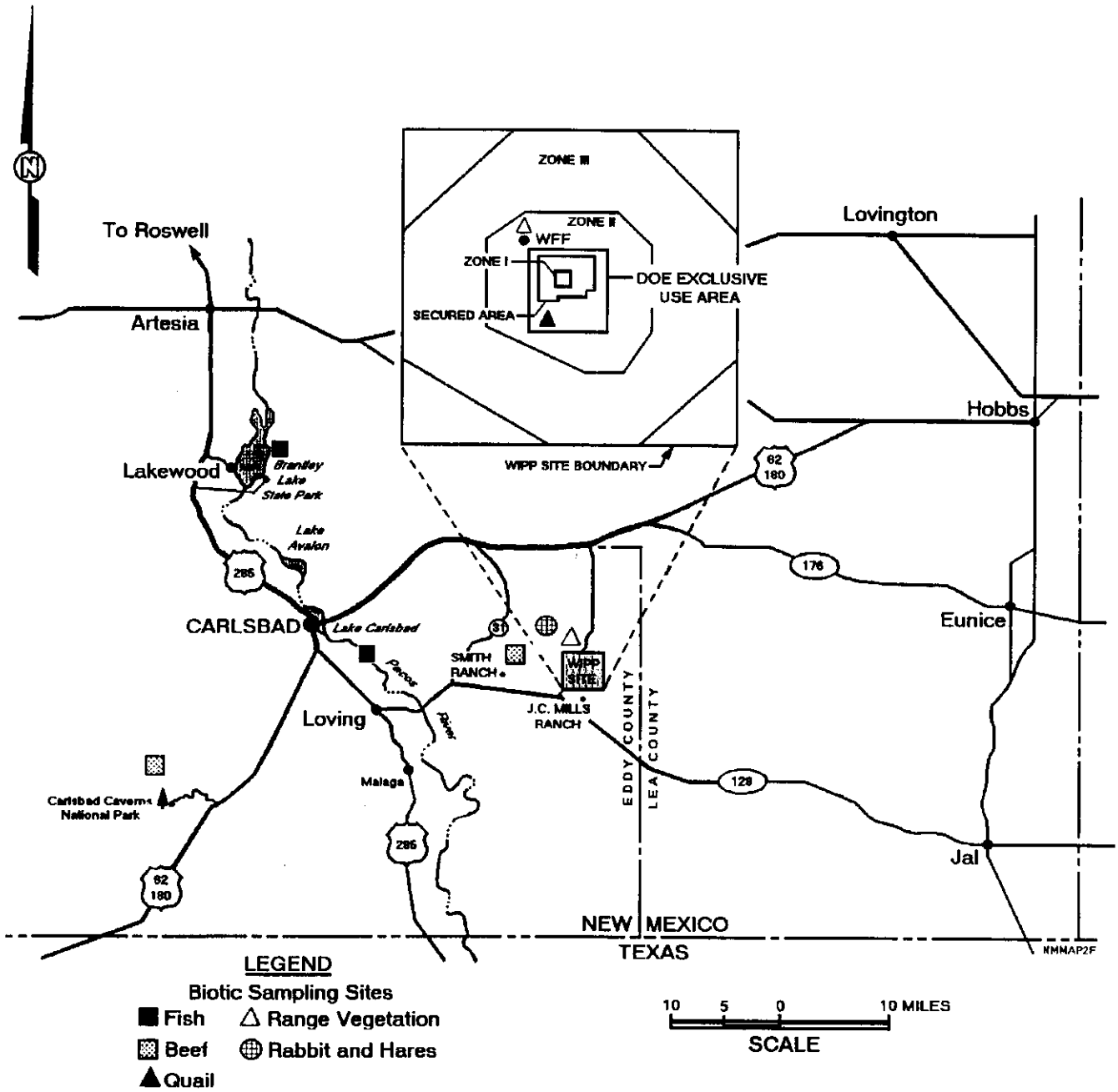


Figure 5-4
Biotic Sampling Sites

CHAPTER 6

ENVIRONMENTAL NONRADIOLOGICAL PROGRAM INFORMATION

This program is described in the OEMP (DOE/WIPP 88-025) for the WIPP. This plan defines the scope and extent of the WIPP effluent and environmental monitoring programs and quality assurance and quality control programs during the operational life of the facility. Nonradiological Environmental Surveillance (NES) is conducted by the Environmental Monitoring Section of the Environment, Safety, and 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 or unexpected elements in the ecological data bases
- To provide environmental data that 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, 1991, and December 31, 1991, 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) with the modifications described in subsequent ASER reports (Fisher et al., 1985; Fisher, 1987; Fisher, 1988; Jones et al., 1989,1990).

Appendix 2, Summary of the Salt Impact Studies at the Waste Isolation Pilot Plant, 1984 to 1989, Appendix 3, A Study of Disturbed Land Reclamation Techniques for the Waste Isolation Pilot Plant, and Appendix 4, Water Quality Sampling Program Baseline Report for the Waste Isolation Pilot Plant are placed at the end of this report. These appendices are pertinent to a thorough documentation of nonradiological studies which are conducted at the WIPP.

6.1 METEOROLOGY

The WIPP NES includes a 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 meteorological station, the WIPP is equipped with an atmospheric monitoring station (AMS) which monitors pollutant gases. The AMS also measures and records temperature and barometric pressure, with wind speed and wind direction at 30 feet (10 meters).

6.1.1 Climatic Data Summary

In 1991, the average annual temperature for the WIPP was 17°C (63°F). The monthly mean temperatures for the WIPP area ranged from 9° to 26°C (48° to 79°F). (Daily maximum, minimum, and average temperature are presented in Appendix 6). Maximum temperatures occur April through August and minimums occurred from November through February. Any data values missing from Appendix 6 are due to a lack of data availability.

The last freezing day of the 1990-91 winter season was March 31, 1991, with a temperature of -5°C (23°F). The first freezing day of the 1991-92 winter season occurred October 30, 1991 with -3°C (21°F). The maximum temperature recorded was 43°C (109°F) on June 23, 1991. The lowest temperature was -8°C (18°F) on December 2, 1991. Thus, the non-freezing period for 1991 occurred from April 1 through October 29, 1991.

The annual precipitation for 1991 was 48 cm (18.90 in.), which is above the average for this area by 17 cm (6.69 in.). The precipitation for 1991 was 17% more than that recorded for 1990. Figure 6-1 displays the monthly precipitation at the WIPP for the CY 91.

6.1.2 Wind Direction and Wind Speed

In 1991, the predominate winds originated from the southeast sector. This was illustrated in Figure 6-2, 1991 Annual Wind Rose. Other notable winds occurred in late spring and were primarily from the west. Various storm systems moved through this area that briefly altered the predominate southeasterly winds. Wind speed noted as calm (less than 0.5 meters per second (mps) occurred less than five percent of the time). Winds of 3.7 through 19.2 mps were the most prevalent in 1991. Monthly wind roses are presented in Appendix 7.

6.2 ENVIRONMENTAL PHOTOGRAPHY

Aerial photographs were taken in August of 1991 to document surface disturbance, development, and reclamation activities at the WIPP site and surrounding BLM/DOE lands. Spot photos, section photos, and aerial flight lines are archived for future reference and comparisons.

Surface photography has been conducted at seven ecological study plots since 1984. Photographs are used to document year to year surface impacts at the study plots and are archived for future reference. Although some paths are noticeable in some plots due to foot traffic, very little impact has been seen in 1992 through comparative examination of the photographs.

6.3 AIR QUALITY MONITORING

Seven classes of pollutant gases are monitored 1000 meters (0.6 mile) northwest of the exhaust shaft at the WIPP site on a continuous basis. These are: sulfur dioxide (SO_2), carbon monoxide (CO), ozone (O_3), hydrogen sulfide (H_2S), and oxides of nitrogen (NO, NO_2, NO_x).

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	0.02 ppm	annual average
		0.10 ppm	*24-hour average*

•	CO	8.70 ppm	per eight hour average
•	O_3	0.06 ppm	per one hour average
•	NO_2	0.10 ppm	24-hour average
•	H_2S	0.10 ppm	per one half hour average

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

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. These filters can load with dust particles due to the arid climate of this area; however, this poses no health concern.

6.4 WILDLIFE POPULATION MONITORING

Population density measurements of raptors, breeding birds, and small nocturnal mammals are performed annually to assess the affects of the WIPP activities on wildlife populations. Two permanent study plots 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 activities on wildlife populations. Trap grids are used to measure small mammal populations, and 2,500 foot long Emlen transects are used to measure bird population densities.

6.4.1 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 to this program, which is currently being conducted by WIPP personnel, is to evaluate the impacts of WIPP activities on the breeding success of the unusually large number of raptors which utilize the area.

During CY 91, 21 active raptor nests were located and monitored in the study area. In these nests 17 individual birds were banded and released. Reproductive success was improved over previous years with only one recorded nest failure for Harris' Hawks. Disturbances, unrelated to WIPP activities, having lessened, and less aggressive monitoring protocol by researchers probably accounted for the improvement in recruitment numbers within the study area.

In CY 91 the University of New Mexico subcontract was canceled. As a result, the Raptor Monitoring Program will continue to be managed by the WIPP Environmental Monitoring Section.

6.4.2 Breeding Bird Densities

Insect dependent species continue to be more abundant near the site than in previous years. An example is seen in greater numbers of observed flycatchers which account for the largest increase of birds near the facility (Table 6-1). Populations of nesting barn swallows also seem to be on the rise around the facility. Pigeons have been seen flying over the site but, to date, no nests have been found.

Migratory birds observed around the facility are numerous. A new 25 mile line transect, began in September of 1991, is being conducted monthly to assess which species utilize this region year-round or as a fly-way during migration (Table 6-2). The transect begins on pipeline road number 31, on Grama Ridge and takes a southeastern route through the WIPP proposed land withdrawal

area, entering in section 15 and exiting in section 19, and ends on Tamarisk Flat at Laguna Grande de la Sol.

Beginning September 17, 1991, numerous dead Wilsons Warblers were found around the site. This phenomenon is better known in the eastern half of the U.S. as warbler migration takes a toll on many of the birds. Warblers are almost exclusively night migrators and often perish while flying into fences, power lines, buildings, and other structures.

6.4.3 Small Nocturnal Mammal Population Densities

Tables 6-3 and 6-4 summarize the results of the 1991 small mammal surveys in the Control 1 and 2 (CT1 and CT2), and WIPP Northwest 2 and Southeast 2 (NW2 and SE2) 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 June 11, 1991 for the NW2 and CT2 grids and ended on June 19, 1991. In SE2 and CT1 grids were initiated June 24, 1991 and completed July 11, 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. A slight modification in the procedure was made concerning the silky pocket mice, *Perognathus*. A common method for mark and recapture is to clip a rear left or right outer digit, then release the animal. This will no longer be a practice for WIPP transects, now the smaller mammals will be marked with a permanent stain which will have no adverse effects or cause trauma to the animal. Larger mammals such as kangaroo rats, wood and hispid cotton rats, deer mice, and grasshopper mice, are tagged with numbered ear tags to identify individuals. Grid location of trapped individuals as well as genus, species, new or recapture, tag number or location of stain, sex and weight were logged. From this data, population densities, actual numbers of captures for each genus, travel distances for recaptured individuals, and male/female ratios were calculated.

Population densities were calculated using the Schnabel Method (Tanner 1978) for mark and recapture mammal trapping. Kangaroo rats were the most common species encountered and are, based on numbers, the only genus calculable (Table 6-3) for determining the maximum likely estimation of population and variance. All other genera were generally too small in number to calculate population densities using the Schnabel Method and are listed in Table 6-4 which lists the actual number of captures (including kangaroo rats) rather than statistical populations for each plot.

Within each grid, all the rodents occupy a certain territory and range. By using the data collected and plotting all recaptured animals, grid locations and, total distances each animal traveled within the grids during the two trapping sessions was determinable. Of the 96 kangaroo rats surveyed, 23 were recaptured each night in the same trap location. This may be due to home ranges or lactating females. The longest distance traveled was a female in CT2 which traveled 208m (682 ft.) from the original point of capture. The average distance males traveled in all plots was 32.6m (107 ft.), females traveled an average of 46.6m (153 ft.).

The CT1 population was 50% female and 50% male, CT2 was 49% female and 51% male, SE2 was 35% female and 65% male, and NW2 was 57% female and 43% male. These figures are a complete reversal from CY 90 data where females were dominant in all plots except NW2.

Densities were generally higher in all species in 1991 than the six year average, however, they were lower than the 1990 population. Silky Pocket Mice were most dense in the SE2 plot. Populations of White-footed and Deer Mice were most prevalent around the site. A total of five Wood-rats were trapped in all plots for CY 91.

6.5 SURFACE AND SUBSURFACE SOIL MONITORING

Surface and subsurface soil monitoring was temporarily discontinued in CY 91. Substantial analysis of soil was performed from 1984 to 1990. A summary of this program is discussed in section 4 of Appendix 2 of this report.

6.6 SOIL MICROBIOTA

Soil microbiota monitoring was discontinued in CY 91. Substantial analysis of the soil microbiota was performed from 1984 to 1990. A summary of this program is discussed in section 5 of Appendix 2 of this report. This program could be reinstated if detection of elevated salt levels were suspected in the topsoil adjacent to the salt storage piles.

6.7 VEGETATION MONITORING

Vegetation in each of the seven ecological monitoring plots was measured in the fall (September and October) to assess the effect of the salt tailings on the 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.) The frequency of a species is defined as the proportion (percent) of the quadrants containing that species. Summaries of the data will be presented in Table 6-5 of this report.

The 1991 vegetation monitoring data showed a continual increase in shrub cover and a continual decrease in grasses in proximity to the salt tailings. These values are consistent with previous years 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 only a short-term effect caused by short-term weather conditions. Salt-induced physiological stress near the tailings has not been observed. The salt tailings may not be having effects on the surrounding plant communities in the form of salt deposition. The nature of the salt is to become compacted and solidified by the heavy machinery and precipitation. Any water run-off is collected in the catchment basin where it is evaporated to the atmosphere or absorbed into the soil. Any resulting salt crust is then weathered and partially dispersed to the surrounding area. This represents only a minimal deposit. Interestingly, wildlife has been observed using the salt tailings as a source of salt, similar to cattle and salt licks.

6.8 NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM DATA

As stated in Section 3.2.5 there are no discharges from point sources into navigable (surface) waters from the WIPP facility that would necessitate an NPDES permit. Consequently, no NPDES data are available.

6.9 VOLATILE ORGANIC COMPOUNDS MONITORING

As stated in Section 3.2.3, the WIPP has developed and implemented a volatile organic compounds (VOC) monitoring program to satisfy the air monitoring requirements of the Conditional No-Migration Determination (NMD) for the WIPP (55 FR 47700). The data resulting from this program are reported the NMD annual reports submitted to the EPA. As stated in Section 3.2.3, the most recent report entitled, "Waste Isolation Pilot Plant No-Migration Determination Annual Report for the Period November 1990 through September 1991" (DOE/WIPP 91-059), was submitted to the EPA on November 14, 1991.

Unlike the other programs listed in this chapter, the WIPP VOC Monitoring Program is not included in the OEMP for the WIPP (DOE/WIPP 88-025) and is not implemented by the Environmental Monitoring Section. Rather, the WIPP VOC Monitoring Program is implemented by the Dosimetry and Analytical Technology Section of the Environment, Safety and Health Department, and the implementing

documents are specific to the program. These include, "VOC Monitoring Plan for Bin-Room Tests (WP 12-6)" and "Volatile Organic Compounds Monitoring Quality Assurance Program Plan (WP 12-7)."

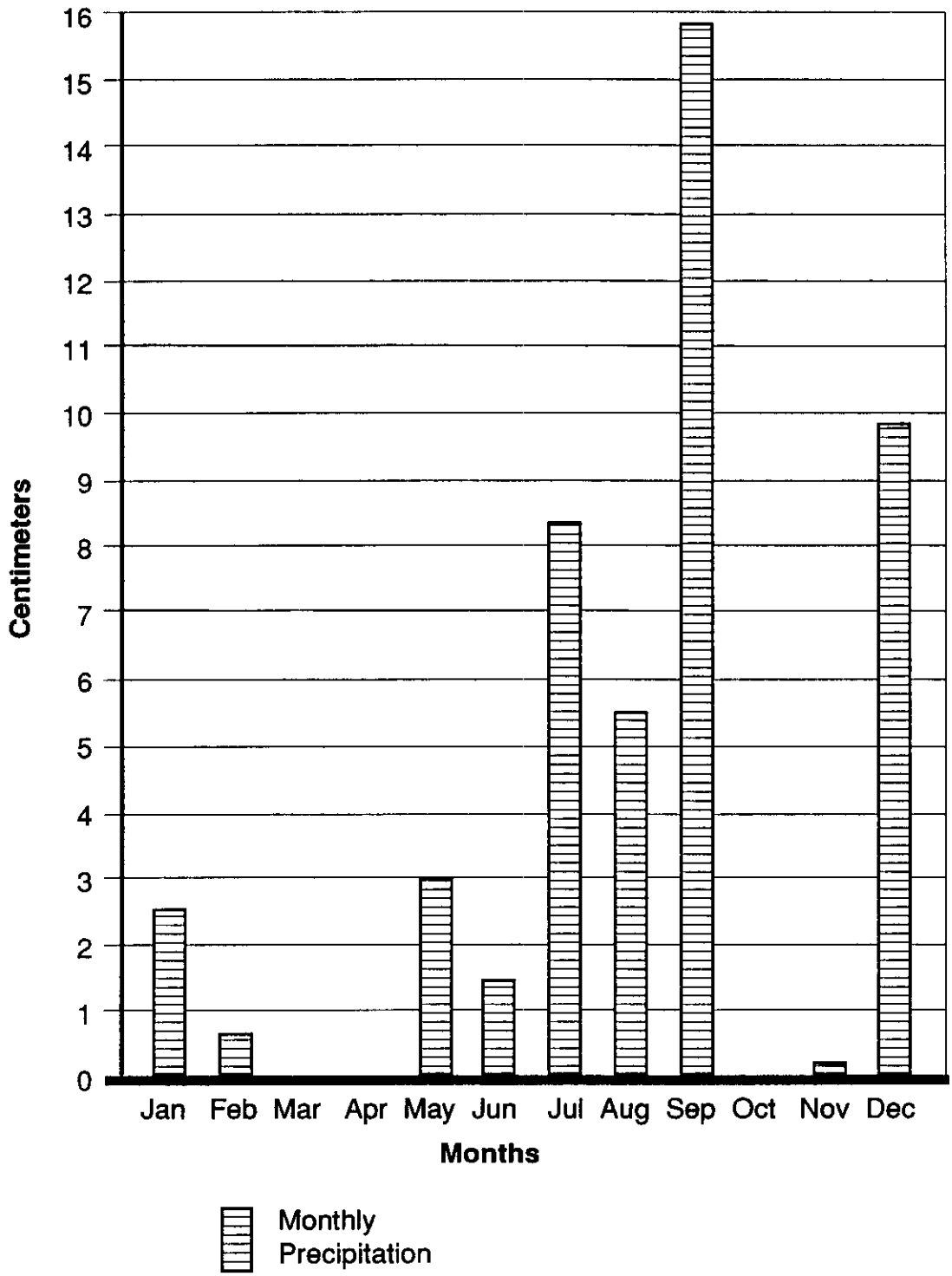


Figure 6-1
1991 Precipitation

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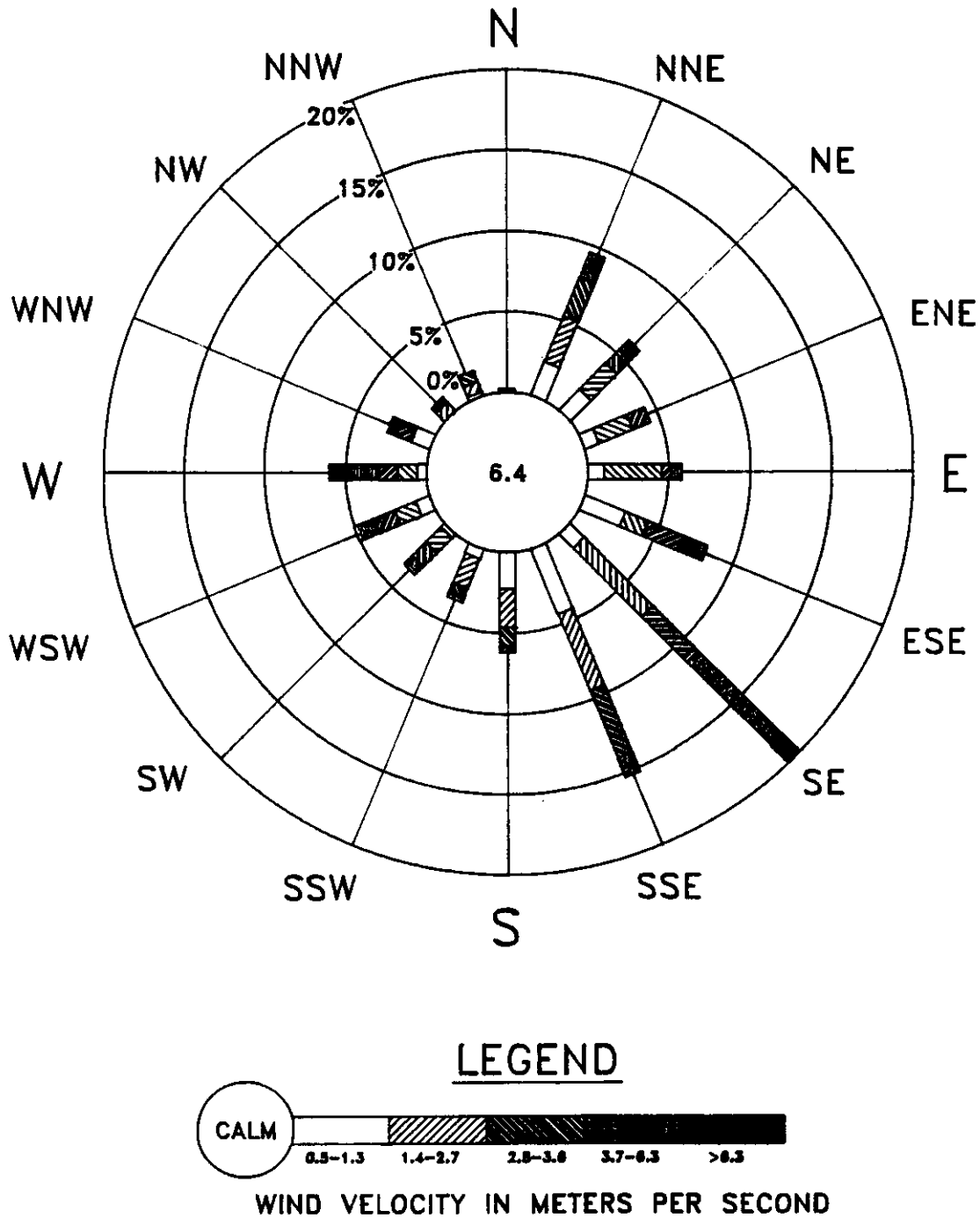

FIGURE 6-2 1991 ANNUAL WINDROSE

TABLE 6-1

SUMMARY OF THE 1991 BREEDING BIRD DENSITY MEASUREMENTS (in birds per 40ha.)

SPECIES PLOTS:	CT1	CT2	NW2	SE1
ASH-THROATED FLYCATCHER				
BARN SWALLOW				
BELL'S VIREO				
BLACK-THROATED SPARROW	34.4	34.4	17.2	34.4
BREWER'S SPARROW				
BROWN-HEADED COWBIRD				
BURROWING OWL	1.1			
CACTUS WREN	4.3	17.2		
CASSIN'S SPARROW	4.3			
CHIHUAHUAN RAVEN				
COMMON NIGHTHAWK				8.6
CURVE-BILLED THRASHER	4.3			
SCALED QUAIL	4.3			
EASTERN MEADOWLARK	34.4	17.2		
GREAT HORNED OWL				
GREATER ROADRUNNER				
HARRIS' HAWK				
HORNED LARK	2.2			
HOUSE SPARROW				
HOUSE FINCH				17.2
HUMMINGBIRD (BLACK-CHINNED)	1.1			
KILLDEER				
LADDER-BACKED WOODPECKER	1.1		2.2	
LARK BUNTING		17.2		25.8
LARK SPARROW				
LESSER GOLDFINCH				
LOGGERHEAD SHRIKE	8.6	17.2	17.2	17.2
MOURNING DOVE	12.9	17.2	25.8	
NORTHERN BOBWHITE	4.3	8.6		4.3
NORTHERN ORIOLE				
NORTHERN MOCKINGBIRD		17.2		4.3
ORCHARD ORIOLE				8.6
POORWILL				
PYRRHULOXIA	17.2	25.8	17.2	12.9
SCISSOR-TAILED FLYCATCHER	1.1			
SWAINSON'S HAWK				
CRISSAL THRASHER	1.1			2.2
UPLAND SANDPIPER				8.3
WESTERN KINGBIRD				4.3
YELLOW WARBLER				
YELLOW-HEADED BLACKBIRD	8.6			

NOTE: Species without density figures were observed in previous years but not in 1991.

TABLE 6-2

OBSERVED BIRDS OF LOS MEDAÑOS AND SURROUNDING AREA

AMERICAN KESTREL
ASH-THROATED FLYCATCHER
BARN SWALLOW
BEWICK'S WREN
CACTUS WREN
CHIHUAHUAN RAVEN
EMPIDONAX FLYCATCHER
HARRIS' HAWK
MOURNING DOVE
NORTHERN HARRIER
NORTHERN BOBWHITE
OSPREY
PECTORAL SANDPIPER
PRAIRIE FALCON
RED-TAILED HAWK
SCALED QUAIL
SWAINSON'S HAWK
TURKEY VULTURE
UPLAND SANDPIPER
VERDIN
GRASSHOPPER SPARROW
CASSIN'S SPARROW
CHIPPING SPARROW
EASTERN MEADOWLARK
WESTERN MEADOWLARK
WHITE-CROWNED SPARROW
FIELD SPARROW
GREEN-TAILED TOWHEE
BLACK-THROATED SPARROW
AMERICAN PIPIT
VESPER SPARROW
RUFOUS-SIDED TOWHEE
LOGGERHEAD SHRIKE
BAIRD'S SPARROW
YELLOW-RUMPED WARBLER
LARK SPARROW
PYRRHULOXIA
SAGE THRASHER
NORTHERN MOCKINGBIRD
LARK BUNTING

NOTE: Other species observed in the region, but not on the 25 mile transect were:

EARED GREBE
BLACK-CROWNED NIGHT-HERON
SNOWY EGRET
GREAT BLUE HERON
SANDHILL CRANE
AMERICAN AVOCET
BLACK-NECKED STILT
SNOWY PLOVER
KILLDEER
LONG-BILLED CURLEW
GREATER YELLOWLEGS
LONG-BILLED DOWITCHER
GOLDEN EAGLE (2 WITHIN 16 SECTIONS)
SHARP-SHINNED HAWK
COOPERS'S HAWK
ROUGH-LEGGED HAWK
FERRUGINOUS HAWK
MERLIN
PEREGRINE FALCON
LESSER PRAIRIE CHICKEN
WHITE-WINGED DOVE
GREATER ROAD RUNNER
COMMON BARN OWL
EASTERN KINGBIRD
WILSON'S WARBLER
DARK-EYED JUNCO
YELLOW-HEADED BLACKBIRD
RED-WINGED BLACKBIRD
NORTHERN ORIOLE

TABLE 6-3

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

ORD'S KANGAROO RAT	CT1	CT2	NW2	SE2
ESTIMATED POPULATION	20.3	34.9	30.6	21.2
ESTIMATED MINIMUM	15.4	28.9	23.9	16.0
ESTIMATED MAXIMUM	29.7	44.1	42.3	36.0
ACTUAL CAPTURES	22	33	34	21

TABLE 6-4

Actual captures of nocturnal mammals in 1991.

	CT1	CT2	NW2	SE2
ORD'S KANGAROO RAT	22	33	34	21
WHITE-FOOTED DEER MOUSE	1	0	0	4
SILKY POCKET MOUSE	9	2	6	8
GRASSHOPPER MOUSE	2	3	6	1
PLAINS WOOD RAT	1	0	1	3

TABLE 6-5
WIPP 1991 FALL VEGETATION REPORT

	* CONTROL 1			* CONTROL 2		
TREE, SHRUB, CACTI, YUCCA	COVER	FREQ	DENS	COVER	FREQ	DENS
WESTERN SOAPBERRY	0.00	0	0.00	0.00	0	0.00
HONEY MESQUITE	0.00	0	0.00	0.06	5	0.00
SHINNERY OAK	10.58	90	0.00	10.98	80	0.00
THREAD-LEAF SAGE WORT	1.43	40	0.00	0.05	5	0.00
SOUTHWEST RABBITBRUSH	0.00	0	0.00	0.00	0	0.00
HARTWEGS EVNG PRIMROSE	0.00	0	0.00	0.00	0	0.00
PLAINS YUCCA	5.94	25	0.00	5.94	15	0.00
PLAINS PRICKLYPEAR	0.00	0	0.00	0.00	0	0.00
PERENNIAL FORBS						
DUNE FLATSEDGE	0.88	45	0.00	0.26	5	0.00
WIDOW'S TEARS, DAY-FLOWER	0.45	10	0.00	0.00	0	0.00
CLIMBING MILKWEED	0.00	0	0.00	0.00	0	0.00
LONGHORN MILKWEED	0.00	0	0.00	0.00	0	0.00
MILKWEED	0.00	0	0.00	0.00	0	0.00
LEATHER-WEED CROTON	1.41	40	0.00	0.00	0	0.00
SMOOTH OXYBAPHUS	0.14	15	0.00	0.00	0	0.00
ARIZONA SNAKECOTTON	0.48	30	0.00	0.00	0	0.00
WOOLLY DALEA	0.48	10	0.00	4.95	55	0.00
INDIAN RUSHPEA	0.00	0	0.00	0.00	0	0.00
WESTERN SENSITIVE BRIER	0.00	0	0.00	0.00	0	0.00
SPECTACLE POD	0.01	5	0.00	0.19	5	0.00
SILVER-LEAF NIGHTSHADE	0.01	5	0.00	0.00	0	0.00
PLAINS BLACKFOOT	0.19	5	0.00	0.00	0	0.00
SLENDER GREENTHREAD	0.31	5	0.00	0.00	0	0.00
THREAD-LEAF BROOMWEED	0.00	0	0.00	0.00	0	0.00
SENECIO, RIDDLE OR THREADLEAF	0.00	0	0.00	0.16	10	0.00
BROOM SNAKEWEED	1.38	5	0.00	0.00	0	0.00
COTYLEDONS	0.00	0	0.00	0.00	0	0.00
SUNFLOWER	0.00	0	0.00	0.00	0	0.00
PERENNIAL GRASSES						
SANDBUR	4.66	85	0.00	5.58	50	0.00
WITCHGRASS	0.00	0	0.00	0.00	0	0.00
FALL WITCHGRASS	1.10	25	0.00	0.84	20	0.00
DROPSEED	0.28	10	0.00	0.06	5	0.00
SAND DROPSEED	0.14	15	0.00	0.14	10	0.00
SPIKE DROPSEED	0.00	0	0.00	0.93	40	0.00
MESA DROPSEED	0.26	15	0.00	0.13	10	0.00
GIANT DROPSEED	0.00	0	0.00	0.00	0	0.00
LITTLE BLUESTEM	0.00	0	0.00	0.00	0	0.00
GIANT BLUESTEM	0.00	0	0.00	0.00	0	0.00
PASPALUM	1.05	5	0.00	0.00	0	0.00
SAND PASPALUM	0.08	10	0.00	0.33	10	0.00
PURPLE THREE-AWN/THREEAWN	4.98	33	0.00	2.51	35	0.00
HAIRY GRAMA	0.75	5	0.00	0.00	0	0.00
SIDEOATS GRAMA	0.00	0	0.00	0.00	0	0.00
BLACK GRAMA	0.19	5	0.00	0.00	0	0.00
LOVEGRASS	0.00	0	0.00	0.04	5	0.00
RED LOVEGRASS	0.00	0	0.00	0.00	0	0.00
ANNUAL FORBS						
TEXAS CROTON	0.00	0	0.00	0.06	5	0.05
PRAIRIE SPURGE	0.31	15	0.35	0.45	15	0.10
RIDGE-SEED SPURGE	0.25	20	0.35	0.09	10	0.25
SAND LEAF-FLOWER	0.59	10	1.85	0.06	5	0.05
MAT BLUETS	0.13	5	0.20	0.00	0	0.00
ANNUAL WILD-BUCKWHEAT	0.40	15	0.20	0.26	5	0.00
SHAGGY PORTULACA	0.06	5	0.05	0.00	0	0.00
ENGLEMANN EVENING-PRIMROSE	0.00	0	0.00	0.00	0	0.00
BEE BLOSSOM	0.00	0	0.00	0.00	0	0.00
PRAIRIE SUNFLOWER	0.00	0	0.00	0.00	0	0.00
RAGWEED	0.63	5	0.30	0.00	0	0.00
ANNUAL SUNFLOWER	0.39	10	0.10	0.53	10	0.05
LIMONCILLO	0.19	5	0.10	1.85	25	1.05
GOLDEN CROWNBEARD	0.00	0	0.00	0.00	0	0.00
ANNUAL GRASS						
FALSE BUFFALO GRASS	0.33	15	0.15	0.08	5	0.00

* **COVER:** Foliar cover in percent; **FREQUENCY:** Percent of sample; **DENSITY:** Annual plants per square meter

TABLE 6-5
(CONTINUED)
WIPP 1991 FALL VEGETATION REPORT

	* NORTHWEST 1			* NORTHWEST 2		
TREE, SHRUB, CACTI, YUCCA	COVER	FREQ	DENS	COVER	FREQ	DENS
WESTERN SOAPBERRY	0.19	5	0.00	0.00	0	0.00
HONEY MESQUITE	0.00	0	0.00	0.00	0	0.00
SHINNERY OAK	10.64	90	0.00	11.46	90	0.00
THREAD-LEAF SAGE WORT	7.34	70	0.00	3.54	50	0.00
SOUTHWEST RABBITBRUSH	0.45	5	0.00	0.19	5	0.00
HARTWEGS EVENING PRIMROSE	0.13	5	0.00	0.00	0	0.00
PLAINS YUCCA	0.00	0	0.00	0.13	5	0.00
PLAINS PRICKLYPEAR	0.00	0	0.00	0.13	10	0.00
PERENNIAL FORBS						
DUNE FLATSEDGE	0.35	20	0.00	0.19	5	0.00
WIDOW'S TEARS, DAY-FLOWER	0.00	0	0.00	0.00	0	0.00
CLIMBING MILKWEED	0.00	0	0.00	0.00	0	0.00
LONGHORN MILKWEED	0.00	0	0.00	0.00	0	0.00
MILKWEED	0.00	0	0.00	0.00	0	0.00
LEATHER-WEED CROTON	0.00	0	0.00	0.00	0	0.00
SMOOTH OXYBAPHUS	0.45	15	0.00	0.38	20	0.00
ARIZONA SNAKECOTTON	0.00	0	0.00	0.00	0	0.00
WOOLLY DALEA	0.48	20	0.00	1.03	20	0.00
INDIAN RUSHPEA	0.00	0	0.00	0.00	0	0.00
WESTERN SENSITIVE BRIER	0.13	5	0.00	0.00	0	0.00
SPECTACLE POD	0.00	0	0.00	0.00	0	0.00
SILVER-LEAF NIGHTSHADE	0.00	0	0.00	0.00	0	0.00
PLAINS BLACKFOOT	0.00	0	0.00	0.00	0	0.00
SLENDER GREENTHREAD	0.00	0	0.00	0.00	0	0.00
THREAD-LEAF BROOMWEED	0.00	0	0.00	0.00	0	0.00
SENECIO, RIDDLE OR THREADLEAF	0.16	10	0.00	0.13	10	0.00
BROOM SNAKEWEED	0.00	0	0.00	0.00	0	0.00
COTYLEDONS	0.06	0	0.00	0.00	0	0.00
SUNFLOWER	1.26	0	0.00	0.59	15	0.00
PERENNIAL GRASSES						
SANDBUR	8.50	85	0.00	3.80	60	0.00
WITCHGRASS	0.00	0	0.00	0.00	0	0.00
FALL WITCHGRASS	4.89	75	0.00	3.39	50	0.00
DROPSEED	0.00	0	0.00	0.00	0	0.00
SAND DROPSEED	0.51	20	0.00	0.70	20	0.00
SPIKE DROPSEED	1.58	40	0.00	1.50	30	0.00
MESA DROPSEED	0.00	0	0.00	0.06	5	0.00
GIANT DROPSEED	0.91	35	0.00	0.85	15	0.00
LITTLE BLUESTEM	0.00	0	0.00	0.00	0	0.00
GIANT BLUESTEM	0.00	0	0.00	0.00	0	0.00
PASPALUM	0.00	0	0.00	0.14	5	0.00
SAND PASPALUM	1.49	50	0.00	0.25	10	0.00
PURPLE THREE-AWN/THREEAWN	1.76	25	0.00	3.68	45	0.00
HAIRY GRAMA	0.00	0	0.00	0.00	0	0.00
SIDEOATS GRAMA	0.00	0	0.00	0.00	0	0.00
BLACK GRAMA	0.00	0	0.00	0.13	5	0.00
LOVEGRASS	0.16	10	0.00	0.13	5	0.00
RED LOVEGRASS	0.00	0	0.00	0.00	0	0.00
ANNUAL FORBS						
TEXAS CROTON	0.00	0	0.00	0.00	0	0.00
PRAIRIE SPURGE	0.40	15	0.05	1.04	30	0.45
RIDGE-SEED SPURGE	0.06	5	0.15	0.00	0	0.00
SAND LEAF-FLOWER	3.04	65	4.20	3.64	80	6.85
MAT BLUETS	0.00	0	0.00	0.00	0	0.00
ANNUAL WILD-BUCKWHEAT	0.41	10	0.20	0.06	5	0.05
SHAGGY PORTULACA	0.00	0	0.00	0.00	0	0.00
ENGLEMANN EVENING-PRIMROSE	0.00	0	0.00	0.06	5	0.05
BEE BLOSSOM	0.00	0	0.00	0.08	10	0.10
PRAIRIE SUNFLOWER	0.00	0	0.00	0.00	0	0.00
RAGWEED	0.00	0	0.00	0.00	0	0.00
ANNUAL SUNFLOWER	0.00	0	0.00	0.00	0	0.00
LIMONCILLO	0.00	0	0.00	0.16	15	0.55
GOLDEN CROWNBEARD	0.00	0	0.00	0.00	0	0.00
ANNUAL GRASS						
FALSE BUFFALO GRASS	0.04	5	0.00	0.03	5	0.00

• **COVER:** Foliar cover in percent; **Frequency:** Percent of sample; **Density:** Annual plants per square meter

TABLE 6-5
(CONTINUED)
WIPP 1991 FALL VEGETATION REPORT

	* SOUTHEAST 1			* SOUTHEAST 2		
TREE, SHRUB, CACTI, YUCCA	COVER	FREQ	DENS	COVER	FREQ	DENS
WESTERN SOAPBERRY	0.00	0	0.00	0.00	0	0.00
HONEY MESQUITE	2.00	10	0.00	0.00	0	0.00
SHINNERY OAK	13.48	75	0.00	15.29	80	0.00
THREAD-LEAF SAGE WORT	9.10	75	0.00	6.40	55	0.00
SOUTHWEST RABBITBRUSH	0.00	0	0.00	0.00	0	0.00
HARTWEGS EVENING PRIMROSE	0.00	0	0.00	0.00	0	0.00
PLAINS YUCCA	0.64	10	0.00	0.00	0	0.00
PLAINS PRICKLYPEAR	0.00	0	0.00	0.00	0	0.00
PERENNIAL FORBS						
DUNE FLATSEDGE	0.23	10	0.00	0.00	0	0.00
WIDOW'S TEARS, DAY-FLOWER	0.00	0	0.00	0.00	0	0.00
CLIMBING MILKWEED	0.25	10	0.00	0.00	0	0.00
LONGHORN MILKWEED	0.00	0	0.00	0.06	5	0.00
MILKWEED	0.00	0	0.00	0.13	5	0.00
LEATHER-WEED CROTON	0.00	0	0.00	0.00	0	0.00
SMOOTH OXYBAPHUS	0.04	5	0.00	0.00	0	0.00
ARIZONA SNAKECOTTON	0.00	0	0.00	0.06	5	0.00
WOOLLY DALEA	1.48	20	0.00	0.00	0	0.00
INDIAN RUSHPEA	0.06	5	0.00	0.00	0	0.00
WESTERN SENSITIVE BRIER	0.00	0	0.00	0.25	5	0.00
SPECTACLE POD	0.31	5	0.00	0.00	0	0.00
SILVER-LEAF NIGHTSHADE	0.29	5	0.00	0.00	0	0.00
PLAINS BLACKFOOT	0.00	0	0.00	0.00	0	0.00
SLENDER GREENTHREAD	0.00	0	0.00	0.00	0	0.00
THREAD-LEAF BROOMWEED	0.00	0	0.00	0.00	0	0.00
SENECIO, RIDDLE OR THREADLEAF	0.10	5	0.00	0.04	5	0.00
BROOM SNAKEWEED	0.00	0	0.00	0.00	0	0.00
COTYLEDONS	0.10	5	0.00	0.13	10	0.00
SUNFLOWER	0.00	0	0.00	0.00	0	0.00
PERENNIAL GRASSES						
SANDBUR	1.59	35	0.00	1.81	35	0.00
WITCHGRASS	0.50	15	0.00	0.50	10	0.00
FALL WITCHGRASS	0.00	0	0.00	2.50	50	0.00
DROPSEED	0.19	5	0.00	0.15	5	0.00
SAND DROPSEED	0.35	20	0.00	0.19	5	0.00
SPIKE DROPSEED	0.16	10	0.00	0.00	0	0.00
MESA DROPSEED	1.58	40	0.00	0.19	5	0.00
GIANT DROPSEED	0.10	10	0.00	0.00	0	0.00
LITTLE BLUESTEM	0.00	0	0.00	0.06	5	0.00
GIANT BLUESTEM	1.56	5	0.00	0.00	0	0.00
PASPALUM	0.00	0	0.00	0.06	5	0.00
SAND PASPALUM	0.21	10	0.00	0.89	15	0.00
PURPLE THREE-AWN/THREEAWN	3.25	50	0.00	4.81	40	0.00
HAIRY GRAMA	0.00	0	0.00	0.00	0	0.00
SIDEOATS GRAMA	0.00	0	0.00	0.00	0	0.00
BLACK GRAMA	0.00	0	0.00	0.00	0	0.00
LOVEGRASS	0.43	15	0.00	1.07	25	0.00
RED LOVEGRASS	0.74	15	0.00	0.00	0	0.00
ANNUAL FORBS						
TEXAS CROTON	0.04	5	0.85	0.00	0	0.00
PRAIRIE SPURGE	1.16	25	0.35	0.21	15	0.10
RIDGE-SEED SPURGE	0.75	10	0.50	0.14	5	0.15
SAND LEAF-FLOWER	1.54	20	1.20	3.10	85	5.40
MAT BLUETS	0.00	0	0.00	0.04	10	0.10
ANNUAL WILD-BUCKWHEAT	0.16	5	0.10	0.05	10	0.05
SHAGGY PORTULACA	0.00	0	0.00	0.00	0	0.00
ENGLEMANN EVENING-PRIMROSE	0.00	0	0.00	0.00	0	0.00
BEE BLOSSOM	0.00	0	0.00	0.00	0	0.00
PRAIRIE SUNFLOWER	0.00	0	0.00	0.00	0	0.00
RAGWEED	0.00	0	0.00	0.00	0	0.00
ANNUAL SUNFLOWER	0.00	0	0.00	0.00	0	0.00
LIMONCILLO	5.69	65	9.75	2.18	40	6.30
GOLDEN CROWNBEARD	0.00	0	0.00	0.00	0	0.00
ANNUAL GRASS						
FALSE BUFFALO GRASS	0.23	15	0.05	0.14	20	0.15

* **COVER:** Foliar cover in percent; **FREQUENCY:** Percent of sample; **DENSITY:** Annual plants per square meter

TABLE 6-5
(CONTINUED)
WIPP 1991 FALL VEGETATION REPORT

		* EAST 1	
TREE, SHRUB, CACTI, YUCCA	COVER	FREQ	DENS
WESTERN SOAPBERRY	0.00	0	0.00
HONEY MESQUITE	2.35	15	0.00
SHINNERY OAK	10.45	80	0.00
THREAD-LEAF SAGE WORT	3.71	45	0.00
SOUTHWEST RABBITBRUSH	0.00	0	0.00
HARTWEGS EVENING PRIMROSE	0.00	0	0.00
PLAINS YUCCA	1.03	15	0.00
PLAINS PRICKLYPEAR	0.00	0	0.00
PERENNIAL FORBS			
DUNE FLATSEDGE	0.10	5	0.00
WIDOW'S TEARS, DAY-FLOWER	0.31	5	0.00
CLIMBING MILKWEED	0.00	0	0.00
LONGHORN MILKWEED	0.00	0	0.00
MILKWEED	1.25	5	0.00
LEATHER-WEED CROTON	1.66	25	0.00
SMOOTH OXYBAPHUS	1.83	40	0.00
ARIZONA SNAKECOTTON	0.00	0	0.00
WOOLLY DALEA	2.04	35	0.00
INDIAN RUSHPEA	0.24	10	0.00
WESTERN SENSITIVE BRIER	0.00	0	0.00
SPECTACLE POD	0.69	10	0.00
SILVER-LEAF NIGHTSHADE	0.00	0	0.00
PLAINS BLACKFOOT	0.60	10	0.00
SLENDER GREENTHREAD	0.00	0	0.00
THREAD-LEAF BROOMWEED	2.98	20	0.00
SENECIO, RIDDLE OR THREADLEAF	0.16	10	0.00
BROOM SNAKEWEED	0.00	0	0.00
COTYLEDONS	0.01	5	0.00
SUNFLOWER	0.00	0	0.00
PERENNIAL GRASSES			
SANDBUR	1.79	30	0.00
WITCHGRASS	0.31	20	0.00
FALL WITCHGRASS	0.10	5	0.00
DROPSEED	0.00	0	0.00
SAND DROPSEED	0.04	5	0.00
SPIKE DROPSEED	0.19	5	0.00
MESA DROPSEED	3.36	55	0.00
GIANT DROPSEED	0.16	5	0.00
LITTLE BLUESTEM	0.25	5	0.00
GIANT BLUESTEM	0.00	0	0.00
PASPALUM	0.00	0	0.00
SAND PASPALUM	0.29	5	0.00
PURPLE THREE-AWN/THREEAWN	4.38	80	0.00
HAIRY GRAMA	0.00	0	0.00
SIDEOATS GRAMA	0.00	0	0.00
BLACK GRAMA	0.00	0	0.00
LOVEGRASS	0.00	0	0.00
RED LOVEGRASS	0.16	5	0.00
ANNUAL FORBS			
TEXAS CROTON	0.00	0	0.00
PRAIRIE SPURGE	0.00	0	0.00
RIDGE-SEED SPURGE	0.00	0	0.00
SAND LEAF-FLOWER	0.00	0	0.00
MAT BLUETS	0.00	0	0.00
ANNUAL WILD-BUCKWHEAT	0.70	25	0.30
SHAGGY PORTULACA	0.00	0	0.00
ENGLEMANN EVENING-PRIMROSE	0.00	0	0.00
BEE BLOSSOM	0.00	0	0.00
PRAIRIE SUNFLOWER	0.00	0	0.00
RAGWEED	0.00	0	0.00
ANNUAL SUNFLOWER	0.00	0	0.00
LIMONCILLO	5.15	50	18.5
GOLDEN CROWNBEARD	0.13	5	0.05
ANNUAL GRASS			
FALSE BUFFALO GRASS	0.23	10	0.10

* **COVER:** Foliar cover in percent; **FREQUENCY:** Percent of sample; **DENSITY:** Annual plants per square meter

CHAPTER 7

GROUND WATER 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). 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 QA 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 evaluating the baseline data from 1985 through the 1990 sampling period is included in this report as Appendix 4. This baseline data will be compared to water quality data collected during the operational phase of the WIPP facility. Pre-operational data will be gathered in the interim period and utilized to strengthen the baseline. 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 OEMP.

The water quality data obtained by the WQSP (Water Quality Sampling Program) in 1991 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. In addition to the characterization of groundwater the WQSP supported radionuclide monitoring for Environmental Analysis and Compliance section of WID. Results of radionuclide sampling are discussed in Chapter 5 of this report. In addition, water samples from each 1991 sampling location were offered to EEG for their independent analysis. However, due to budgetary constraints the EEG declined the 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 (Figure 7-1) make up the stratigraphic column in the vicinity of the WIPP. In ascending order, these units are the Delaware Mountain group (consisting 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 1991 are; the Dewey Lake Redbeds, the Magenta Dolomite, and the Culebra Dolomite, (Figure 7-1). Waters from 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 Dolomite 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 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 silt stone and mud stone 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 investigations at and near the WIPP facility have not identified a continuous zone of saturation within the Dewey Lake Redbeds. Several private wells (located approximately 5 miles south of the WIPP site) are completed in the Dewey Lake Redbeds. These wells appear to be producing from thin lenticular sands that are locally recharged (Mercer, 1983). Five private wells in this area have been sampled by WIPP (Barn Well, Fairview Well, Twin Well (Pasture), Unger Well, and Ranch Well), and the data are reported. (Randall et al., 1988, Lyon 1989 and Broberg et al. 1990). Each of these wells supply water for livestock and one well (Barn Well) provides water for human consumption.

The Rustler formation underlies the Dewey Lake Redbeds and consists of interbedded anhydrite, gypsum, 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 siltstone interbedded with gypsum or anhydrite and halite. The Forty-niner and Tamarisk members are primarily anhydrite and include some halite and potash minerals. Where dissolution has occurred, the anhydrite has altered to gypsum, and halite salts are absent. The Magenta and Culebra Dolomite are aerially extensive and are the most significant water-bearing units in the WIPP vicinity. Water from the Magenta and Culebra have been sampled annually since 1985.

The Magenta dolomite is the uppermost significant water-bearing stratum in the Rustler formation and consists of a clastic carbonate bed with thin laminae of anhydrite. The unit ranges in thickness from 20 to 30 feet in thickness 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 Culebra Dolomite to be a heterogeneous, fractured unit with transmissivity varying locally from 0.07 to greater than 200 square feet per day (Mercer, 1983). The high transmissivity values in the Culebra have been reported from well locations south and west of the WIPP facility. In this area near the WIPP, the Culebra fluids exhibit relatively low concentrations of TDS. South of the WIPP site (Engle, 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, transmissivity in the Culebra is quite low, and fluid samples show high TDS concentrations. Based on actual formation measurements, Crawley, 1988, estimated that regional groundwater flow directions near the WIPP site are towards the south and southwest. It has been suggested, since the water flow in the culebra Dolomite is affected by fractures, variable fluid densities, and heterogeneity of the rock, that regional flow direction may have little, if any, relationship to localized flow paths.

Groundwater surveillance activities during 1991 consisted of two separate programs, groundwater quality sampling and groundwater level measurements. Ground water surveillance programs utilize 57 well bores to gather data. Six of these well 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. Groundwater level measurements are taken at each well location either monthly or quarterly (Tables 7-1 and 7-2) for the measurement frequency of each particular location.

Groundwater Quality data are gathered from 14 well locations. Data are collected at seven locations completed in the Culebra dolomite and four locations completed in the Magenta dolomite. Water quality data are also collected from three privately owned wells in the vicinity of the WIPP that are completed in the Dewey Lake Redbeds. Sampling is performed at each location on an alternating schedule every other year. See Table 7-3 for the sampling frequency of water quality locations.

The water quality sampling process has been developed around the logistics of using groundwater wells that were originally constructed for characterization and not groundwater monitoring activities. The WIPP site has been given a Conditional No-Migration Determination and is not required to have a monitoring program per 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 the geochemistry of the area, anticipated lifetime of the surveillance program nor the chemical parameters to be analyzed. A majority of the wells were drilled using saturated brine water as a drilling fluid which was left standing in the open well bore for various time periods. Many of the wells were cored through the culebra dolomite into the upper part of the Unnamed Member of the Rustler formation leaving halite deposits exposed to the waters of the Culebra. Most of the wells are constructed with J-55 or K-55 iron casing. In order to decrease the sampling bias created by well construction deficiencies and combined with the low transmissivity 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 "sampling rounds". Each yearly sampling round consists of the collection of two types of samples: (1) serial samples and (2) final samples. Serial samples are taken periodically, while the well is being purged. Key physical and chemical parameters (known as field parameters) are analyzed and compared to past serial sampling data until it is determined a chemical steady state has been reached. A chemical steady state is usually defined as +5% of the average of the three to five preceding parameter measurements on the final day of serial sampling from previous rounds. 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 that the pumped groundwater has achieved a representative state, and is sent off site to a contract laboratory for analysis.

Purging systems use gas driven, positive displacement, piston sample pumps. The pumps are constructed of inert materials, the body and piston rods are constructed of 316 stainless steel, check valves are derlin plastic and the piston seals are of teflon impregnated rubber construction. The system is operated by compressed air. Compressed nitrogen may be used in situations where operating pressure requirements are low. However, even under the best operating condition, nitrogen gas is limited to three hours or less. Packers made of stainless steel or brass alloy are used to seal off the production zone just above the pump intake in order to reduce the amount of contamination from stagnant water standing in the well bore.

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. The top of the casing elevation is later referenced to sea level and a groundwater elevation above mean sea level is calculated.

Groundwater surveillance activities during 1991 consisted of water quality sampling of 14 well sites and groundwater level measurements at 57 well locations. The results of the data gathered in each of these subprograms are discussed below. The results of the data gathered in 1991 are presented in appendices at the end of this report.

7.1 GROUNDWATER QUALITY

Sampling for groundwater quality was performed at 14 well locations including 3 privately owned well sites during 1991 (Figure 7-2). With the exception of the three privately owned wells, each of the 11 wells was purged a minimum of 24 hours prior to the commencement of the serial sampling phase. 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 an independent contracted laboratory for analysis. Parameters of analysis by the contracted laboratory are listed in Table 7-4. Splits of samples were also offered to the EEG and Sandia National Laboratories (SNL). Samples were also archived at the WIPP site for future analytical needs.

During the 1991 calendar year 7 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) 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 19,238 gallons through out the year. The total gallons removed from the Magenta Dolomite member of the Rustler formation during the same period was approximately 7,598 gallons of water. The final day average results of final serial analysis show relative consistency when compared to averages of earlier sampling rounds. Appendices 8 through 10 contain detailed results of data for each individual well sampled. Data in these appendices are presented in summary discussion, tabulated and graphic form.

Water quality of the Magenta and Culebra in the vicinity of the WIPP are naturally poor and the waters are not usable for human consumption or for agricultural purposes. The waters contain high concentrations of total dissolved solids (TDS) 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 or inductively coupled plasma, causing detection limits to be inconsistent. No other inconsistencies of general chemistry parameters were noted in either the Magenta or Culebra during the 1991 sampling period.

The only usable waters 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 sands that are believed to be locally recharged (Mercer 1983). Three wells were sampled in the Dewey Lake Redbeds. These were; Ranch well located approximately 3.2 miles south of the WIPP site, Barn Well located approximately 3.4 miles south of the WIPP site and Twin well and Pasture well located approximately 10 miles south of the WIPP site. Each of these wells showed elevated levels of nitrate in the groundwater analysis. Ranch well showed the highest concentration with 50 mg/l followed by Twin well and Barn well with concentrations of 9.29 mg/l and 9.5 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

During the course of a sampling season it is not uncommon for the contracted laboratory to report 4 to 6 analytical values which appear to be anomalous or suspect of outside contamination such as constituents of organic compounds used in the cleaning of labware. During the 1991 sampling season no volatile or semi-volatile analyses were requested. Only general chemical and trace metal analysis were requested. In spite of the relatively standard analytical suite requested for 1991, the number of anomalous values reported by the contracted laboratory were abnormally high on just the major cation and major anion analysis (27).

An investigation into these anomalous values revealed that for analyses having a hold time of seven days or less, analysis were delayed beyond maximum hold time 107 out of 126 requested analysis. Charge balance spreadsheets were compiled for each of the 14 wells sampled during 1991 from the values reported by the contracted laboratory. Nine of the charge balance worksheets for major cation and major anion constituents were out of balance by more than 10%. Trace metals analysis had no violations of holding time (6 months), however the values for trace metal analysis were reported for unfiltered samples at the request of the Department of Energy. In the past, trace metal analysis were reported for filtered samples. Because the filter used in the past may have removed some of the larger metal particulates from the water prior to analysis, the values reported from 1991 may not be comparable to values from prior years. Therefore, it would be inappropriate to assume suspect values from the metals analysis. However, based on the poor performance of the contracted laboratory with regard to general chemical analysis, caution should be used when considering any data obtained during 1991 in

the general characterization of WIPP ground water. The analytical laboratory contract has been renegotiated and thus, 1992 groundwater data, and subsequent years should provide greater confidence in analytical results than what was produced in CY 1991.

7.2 GROUND WATER LEVEL SURVEILLANCE

In October 1988, the WID was tasked with conducting a ground water level surveillance program in the area of the WIPP Site. In this area 5% well bores are utilized to perform surveillance of six water bearing zones in the WIPP area. The two zones of primary interest are the Culebra Dolomite and Magenta Dolomite members of the Rustler formation, Forty-six measurements are taken in the Culebra Dolomite and eleven measurements are taken in the Magenta dolomite. Two measurements are taken in the Rustler/Salado contact and one measurement each are taken in the 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.

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 7-5). Of the surveillance locations, 39 of the 46 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 8.64 feet of ground water level elevation at Cabin Baby (CB-1) well site located approximately 2.5 miles south of the WIPP site from January through December 1991, and the second was a gain of 24.77 feet of ground water 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. The suspected cause of the loss of water level elevation at Cabin Baby is a bridge plug located between the Culebra Dolomite and the Rustler/Salado contact zone. The anomalous water level elevation increase at P-18 is gradually decreasing from year to year. In 1989, P-18 increased approximately 45 feet while in 1990 and 1991 the increase was approximately 33 and 25 feet respectively. The decrease from year to year indicate that P-18 is trending toward an equilibrium state, however the magnitude of elevation gains indicate that years may pass before equilibrium is achieved.

Groundwater elevation measurements in the Culebra Dolomite indicate that the generalized directional flow of groundwater is north to south. However, caution should be used when making assumptions based on ground water 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 7-6). No anomalous losses or gains were noted within the Magenta Dolomite. Seven of eleven Magenta surveillance locations show a gain in the elevation of ground water levels from January to December 1991. Four wells showed lower ground water level elevations in December than in January of 1991. All 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, H-05c, and H-06c. Recovery from these pumping events may have influenced the water level data collected at these locations. Groundwater flow directions in the magenta dolomite appear to be generally from an 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 special 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 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 1991 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 in 1991 is a natural trend for the formations to recover to groundwater elevations near those of 1983 potentiometric elevations.

Detailed tables and graphic presentation of water elevation data collected in 1991 are available in Appendix 11. Historical data from October 1988 through December 1990 is presented in graphic form in Appendix 12.

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

1292B:0199K

TABLE 7-1
MONTHLY GROUNDWATER 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-16DL	DEWEY LAKE	
H-16ULM	UNNAMED LOWER MEMBER	
H-08c	RUSTLER/SALADO	
WIPP-28	RUSTLER/SALADO	

TABLE 7-2
QUARTERLY GROUNDWATER-LEVEL MEASUREMENTS
CULEBRA

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

TABLE 7-3
WATER QUALITY SAMPLING PROGRAM
MONITORING LOCATIONS
LOCATIONS MONITORED EACH YEAR

1.	H-02c	CULEBRA
2.	H-03b3	CULEBRA
3.	H-04b	CULEBRA
4.	H-05b	CULEBRA
5.	H-06bc	CULEBRA
6.	H-011b3	CULEBRA
7.	H-14	CULEBRA
8.	WIPP-19	CULEBRA
9.	RANCH WELL	DEWEY LAKE
10.	BARN WELL	DEWEY LAKE
11.	TWIN WELL (PASTURE)	DEWEY LAKE

WELLS MONITORED EVERY THREE YEARS

1.	H-03b1	MAGENTA
2.	H-04c	MAGENTA
3.	H-05c	MAGENTA
4.	H-06c	MAGENTA
5.	H-03b3	CULEBRA
6.	H-18	CULEBRA
7.	WIPP-19	CULEBRA
8.	H-15	CULEBRA
9.	RANCH WELL	DEWEY LAKE
10.	BARN WELL	DEWEY LAKE
11.	TWIN WELL (PASTURE)	DEWEY LAKE

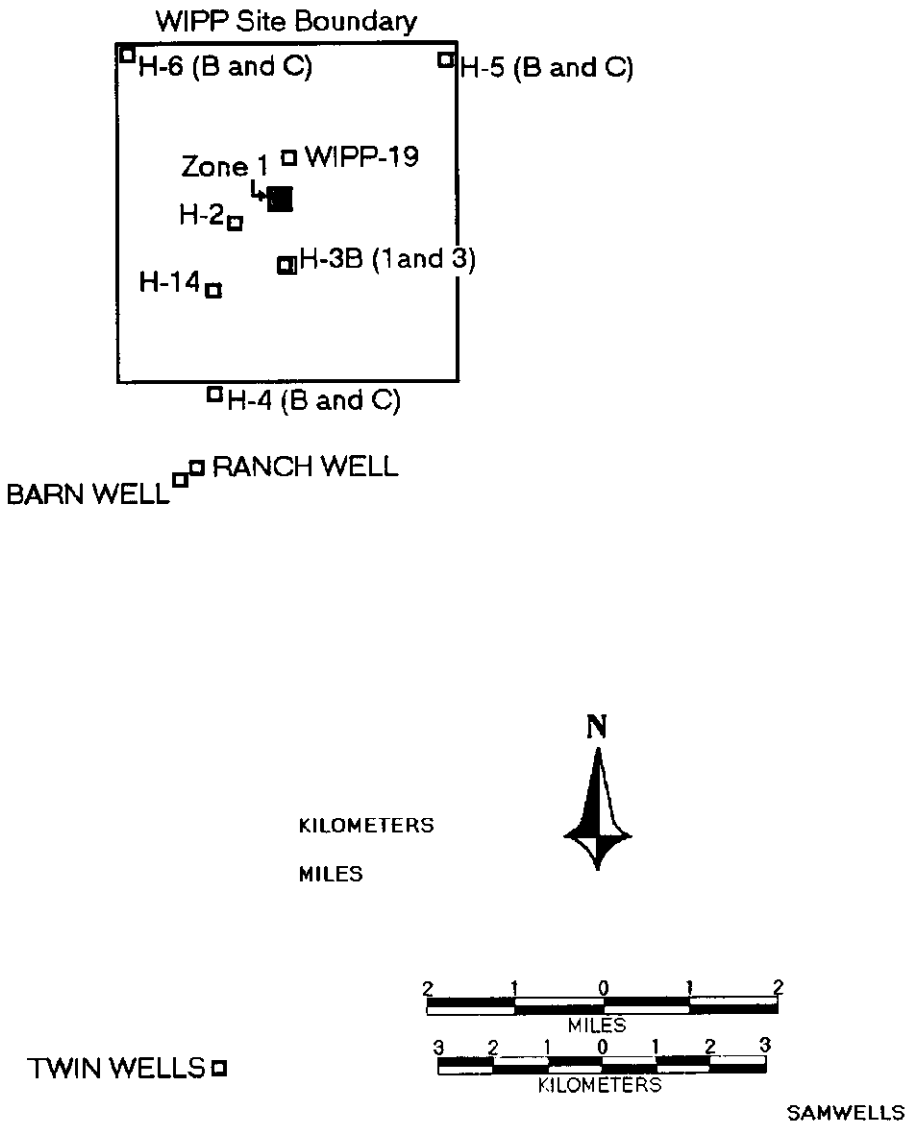

Figure 7-2
Water Quality Sampling Program
Sample Wells 1991

193B:0199d

TABLE 7-4

GROUNDWATER MONITORING

CHEMICAL PARAMETERS

1991

GENERAL CHEMISTRY	METALS (CATIONS)TOTAL METALS
pH	CalciumAluminum
Specific Conductance	MagnesiumAntimony
Bicarbonate	PotassiumArsenic
Bromide	SodiumBarium
Carbonate	Beryllium
Chloride	Boron
Cyanide, Total	Cadmium
Fluoride	Cesium
Iodide	Chromium
Nitrate	Cobalt
Total Phenolics	Copper
Total Phosphorus	Iron
Total Dissolved Solids	Lead
Total Suspended Solids	Lithium
Silica	Manganese
Sulfate	Mercury
Total organic Carbon	Molybdenum
Total organic Halides	Nickel
	Selenium
	Silver
	Strontium
	Thallium
	Vanadium
	Zinc

TABLE 7-5

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	-0.21	3035.79	01/91	3035.06	10/91	0.73
CABIN BABY	-8.64	2980.84	01/91	2972.20	12/91	8.64
DOE-01	+0.69	2977.15	05/91	2975.85	09/91	1.30
DOE-02	+0.90	3055.93	10/91	3054.75	01/91	1.18
D-268	+0.06	3003.94	02/91	3003.35	07/91	0.59
ERDA-09	+0.30	2949.05	11/91	2947.56	01/91	1.49
H-01	+0.76	2976.53	11/91	2974.94	01/91	1.59
H-02a (Q)*	-1.02	3006.98	06/91	3001.43	09/91	5.55
H-02b2	+1.22	3008.38	12/91	2988.88	08/91	19.50
H-02c (Q)	+1.93	3006.40	12/91	3004.47	03/91	1.93
H-03b2	+1.39	2985.90	12/91	2984.45	06/91	1.45
H-03b3 (Q)	+1.00	2986.14	12/91	2984.65	06/91	1.49
H-04b	+0.53	2999.69	12/91	2999.12	09/91	0.57
H-05a (Q)	-0.01	3025.50	01/91	3024.11	09/91	1.39
H-05b	+0.70	3021.07	12/91	3005.08	06/91	15.99
H-06a (Q)	+0.96	3047.47	12/91	3046.51	03/91	0.96
H-06b	+1.17	3046.94	12/91	3045.77	01/91	1.17
H-07b1	-0.10	2995.93	03/91	2995.32	11/91	0.61
H-07b2 (Q)	-1.18	2995.70	03/91	2994.52	12/91	1.18
H-09a (Q)	+0.51	2991.52	06/91	2990.65	03/91	0.87
H-09b	+0.22	2991.81	05/91	2990.91	03/91	0.90
H-09c (Q)	+0.43	2991.70	06/91	2990.84	03/91	0.86
H-10b	+0.10	2989.67	11/91	2989.30	02/91	0.37
H-11B1 (Q)	+0.58	2978.22	12/91	2977.60	09/91	0.62
H-11B2	+0.90	2977.66	12/91	2976.76	01/91	0.90
H-11B3 (Q)	+0.58	2977.39	12/91	2976.81	03/91	0.58
H-12	+0.67	2968.51	11/91	2967.64	02/91	0.87
H-14	+1.28	3003.03	12/91	3001.20	08/91	1.83
H-15	+1.04	2955.80	11/91	2954.67	02/91	1.13
H-17	+1.46	2953.53	12/91	2952.07	01/91	1.46
H-18	+1.87	3050.67	12/91	3048.80	01/91	1.87
P-14	+1.07	3040.18	12/91	3039.11	01/91	1.07
P-15	+0.66	3010.96	12/91	3010.30	01/91	0.66
P-17	+0.58	2984.79	12/91	2984.21	01/91	0.58
P-18	+24.77	3067.20	12/91	3042.43	01/91	24.77
WIPP-12	+0.99	3025.76	11/91	3024.76	01/91	1.00
WIPP-13	+0.59	3054.78	11/91	3053.80	01/91	0.98
WIPP-18	+1.92	3014.60	11/91	3012.15	08/91	2.45
WIPP-19	+2.28	3005.69	11/91	3001.39	08/91	4.30
WIPP-21	-0.89	2946.16	11/91	2943.92	12/91	2.24
WIPP-22	+1.50	2980.82	11/91	2976.77	08/91	4.05
WIPP-25	+1.53	3053.30	09/91	3051.74	01/91	1.56
WIPP-26	+0.78	3018.15	09/91	3016.82	06/91	1.33
WIPP-27	+2.28	3077.65	12/91	3075.34	02/91	2.31
WIPP-29	+0.18	2968.82	09/91	2967.75	03/91	1.07
WIPP-30	+1.01	3063.19	10/91	3061.91	01/91	1.28

:: * Q= QUARTERLY MEASUREMENT

TABLE 7-6

VARIATION TABLE WATER LEVELS
MAGENTA DOLOMITE

WELL#	FEET GAIN/LOSS JAN-DEC	FEET AMSL HIGH	MONTH	FEET AMSL LOW	MONTH	FEET TOTAL VARIATION
H-01	+0.20	3121.76	12/91	3121.11	08/91	0.65
H-02b1	+0.02	3125.60	06/91	3125.20	01/91	0.40
H-03b1	-0.01	3138.21	04/91	3134.41	06/91	3.80
H-04c	-1.57	3141.66	09/91	3126.04	10/91	15.62
H-05c	-0.42	3153.87	05/91	3146.08	08/91	7.79
H-06c	-0.30	3059.08	04/91	3049.97	05/91	9.11
H-08a	+0.12	3027.42	06/91	3027.18	02/91	0.24
H-10a	+0.18	3159.06	10/91	3158.57	02/91	0.49
WIPP-25	+1.29	3054.34	12/91	3053.05	01/91	1.29
WIPP-27	+1.79	3072.35	12/91	3070.56	01/91	1.79
WIPP-30	+0.44	3125.55	12/91	3124.05	03/91	1.50

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, and NMED 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, 1990d), 5400.3 (DOE, 1989), and the Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance (DOE/EH-0173T, Jan. 1991).

8.1 BASELINE DATA

There are four environmental programs currently in place at the WIPP: the NES, the 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. Appendices 1-4 provide a data base spanning several years of preoperation data for the WIPP.

Preliminary studies are important when considering the 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, vegetation, arthropods, and vertebrates (Best, 1980)

- Investigations of the site geohydrology - conducted by the U.S. Geological Survey (USGS) at the request of the DOE. In addition, the NRC issued a contract to Columbia University to perform a study of radionuclide mobility in the highly saline groundwaters of the Delaware Basin (U.S. Geological Survey, 1983)

- Radiological monitoring of air, water, and biological media - conducted by the Atomic Energy Commission before and after the Project Gnome nuclear detonation (USAEC, 1962a,b,c,d)

8.2 SAMPLE COLLECTION METHODOLOGIES

Written procedures provide guidance to field personnel for every sample taken and form the basis of an auditable program. The QA Department periodically conducts surveillance reports, inspection reports, and internal audits to ensure compliance with established procedures. An inspection report surveys personnel performance in one activity. A surveillance report assesses a procedure from data collection through data management. Surveillances are conducted according to WP 13-011. An internal audit, a 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. There were a total of 3 QA inspections performed on the Environmental Monitoring Section in 1991 with no major finding and all appropriate recommendations incorporated into existing programs.

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)

- Radiation Safety Manual (WP 12-5)

- WID Quality Assurance Program Description (WP 13-1, Rev. 14)

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-0173T (DOE, 1991). 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 and the NMED act as a check that procedures are adequate and that data results are comparable between the WIPP and EEG and the NMED 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 for analysis. 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 report makes no reference to the cross-check data from the comparison program, as the WIPP was just beginning participation in this program. It is anticipated that cross-check data results will be presented in the ASER for 1992 and analytical schedules met.

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); United Nuclear Corporation Grand Junction, Colorado; and Controls for Environmental Pollution, Inc., Santa Fe, New Mexico.

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, and blank analyses to check precision
- Analyses of reagents to ensure chemical purity that could affect the results of the analytical process
- Each laboratory will have a written and implemented QA program that utilizes standard analysis methods for each parameter studied.
- Participation in interlaboratory cross-checks can reveal outdated, previously acceptable lab procedures that are currently unsuitable or inadequate. Steps are then taken to find

updated methodologies. The 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 DOE Order 1324.2A, Records Description (DOE, 1992), WIPP Records Management Procedures (WP 15-030). All original records are maintained in a fire resistant file cabinet at the WIPP until they are transmitted to the WIPP Master Records Center for permanent filing (WP 15-030). All records, including raw data, calculations, computer programs or other data manipulation, are subject to review and verification under the WIPP Quality Assurance Program. The 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/QC Implementation Procedures (WP 02-302). Specific record and data management procedures including the recording and referencing of data manipulations are implemented according to the WIPP Groundwater Monitoring Program Plan and Procedures Manual, RES Data Management Procedure (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, Subpart H (EPA, 1985B), which pertain to atmospheric radionuclide emissions (WP 02-301). In addition, unless regulations are amended in the future, records development pursuant to these criteria will be maintained at least 30 years, as specified in DOE 1324.2A (DOE, 1992), 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 QA requirements. Section 10 of the OEMP includes a listing of the required records and 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-1-1989.

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.

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.

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

Hart, J. S., and L. M. Brausch, 1980, Plan to Mitigate Effects on Archeological Resources; Site and Preliminary Design Validation (SPDV), Waste Isolation Pilot Plant, Eddy County, New Mexico, *International Technology Corporation, Albuquerque, New Mexico.*

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.

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, Report No. 50, Washington, D.C., 1976.

New Mexico Tech., A. Sanford, R. Bulch, L. Jaksha, Rattlesnake Canyon Earthquake Southeastern New Mexico, January 2, 1992, January 23, 1992

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

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

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

Reith, C. C. and G. Daer, Radiological Baseline Program for the Waste Isolation Pilot Plant: Program Plan, 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 Report: July-December 1984, WTSD-TME-058, Waste Isolation Pilot Plant, Carlsbad, New Mexico., 1985.

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

U. S. Department of Energy, DOE/WIPP 87-002, Annual Site Environmental Monitoring Report for the Waste Isolation Pilot Plant, Calendar Year 1986, 1987.

U. S. Department of Energy, DOE/WIPP 87-004, Compilation of Historical Radiological Data Collected in the Vicinity of the WIPP Site, 1987.

U. S. Department of Energy, DOE/WIPP 91-025, "1990 Annual Water Quality Data Report for the Waste Isolation Pilot Plant", WIPP Project, Carlsbad, New Mexico., 1991.

U. S. Department of Energy, DOE/WIPP 90-003, Waste Isolation Pilot Plant Site Environmental Report for Calendar Year 1989, 1990.

U. S. Department of Energy, DOE/WIPP 91-008, Waste Isolation Pilot Plant Site Environmental Report for Calendar Year 1990, 1991.

U. S. Department of Energy, DOE/WIPP-89-001, Annual Water Quality Data Report for the Waste Isolation Pilot Plant, 1989.

U. S. Department of Energy, DOE/WIPP-86-002, Annual Site Environmental Report for the Waste Isolation Pilot Plant, 1986.

U.S. Department of Energy, WIPP-DOE-215, Water Quality Sampling Plan, 1985.

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

U.S. Department of Energy, DOE/WIPP 88-030, Hydrostatic Pressure and Fluid Density Distribution of the Culebra Dolomite Member of the Rustler Formation near the Waste Isolation Pilot Plant, Southeastern New Mexico, 1988.

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

U.S. Department of Energy, Implementation of the National Environmental Policy Act (NEPA), DOE Order AL 5440.1D, Albuquerque Operations Office, Albuquerque, New Mexico.

U. S. Department of Energy, Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance, DOE/EH-0173T, January 1991.

U. S. Department of Energy, Records Description, DOE Order 1324.2A, Washington D.C., 1992

U. S. Department of Energy, Quality Assurance, DOE Order 5700.6B, Washington, D.C., 1986.

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

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

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

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

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

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

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

U. S. Department of Energy, DOE/WIPP 85-002, Ecological Monitoring Program, Second Semi-Annual Report, 1985.

U. S. Department of Energy, DOE/WIPP 86-006, Annual Water Quality Data Report, 1986.

U. S. Department of Energy, DOE/WIPP 87-003, Ecological Monitoring Program, Annual Report, Fiscal Year 1986, 1987.

U. S. Department of Energy, DOE/WIPP 87-007, Annual Water Quality Data Report, 1987.

U. S. Department of Energy, DOE/WIPP 88-008, Ecological Monitoring Program at the Waste Isolation Pilot Plant, Annual Report, CY 1987, 1988.

U. S. Department of Energy, DOE/WIPP 88-009, Annual Site Environmental Monitoring Report for the Waste Isolation Pilot Plant, Calendar Year 1987, 1988.

U. S. Department of Energy, DOE/WIPP 89-005, Annual Site Environmental Report For the Waste Isolation Pilot Plant, CY 1988.

U.S. Department of Energy, 1981, Department of Energy/Waste Isolation Pilot Plant, Record of Decision, *Federal Register*, Vol. 46, No. 18, pp. 9162-9164.

U.S. Department of Energy and U.S. Department of the Interior, Bureau of Land Management (BLM), 1983, Archaeological Resources Protection Plan, Waste Isolation Pilot Plant U.S. Department of Energy, Carlsbad, New Mexico.

U.S. Department of Energy, 1987, 10 CFR Part 962, Radioactive Waste, By-Product Material, *Federal Register*, Vol. 52, No. 84, pp. 15937-15941.

U.S. Department of Energy and U.S. Department of Labor (DOL), 1987, Memorandum of Understanding Between the U.S. Department of Energy and the U.S. Department of Labor, signed June 1987 by Roy L. Bernard, Administrator for Metal and Nonmetal Mine Safety and Health, U.S. Department of Labor, and R. G. Romotowski, Manager, Albuquerque Operations Office, U.S. Department of Energy.

U.S. Department of Energy 1990a, Final Supplement Environmental Impact Statement, Waste Isolation Pilot Plant, DOE/EIS-0026-FS, U.S. Department of Energy, Office of Environmental Restoration and Waste Management, Washington, D.C.

U.S. Department of Energy, 1990c, Record of Decision, Waste Isolation Pilot Plant, *Federal Register*, Vol. 55, No. 121, pp. 25689-25692.

U.S. Department of Energy, DOE/WIPP 89-003, DOE, Waste Isolation Pilot Plant No-Migration Variance Petition, Revision 1, 1990d.

U. S. Department of Energy, DOE/WIPP 89-011, DOE, WIPP Test Phase Plan: Performance Assessment, Revision 0, 1990e.

U.S. Department of Energy, 1991a, Final Safety Analysis Report Addendum, Dry Bin Scale Test, WP 02-9, Revision 0, Waste Isolation Pilot Plant, Carlsbad, NM.

U.S. Department of Energy, 1991b, Waste Isolation Pilot Plant RCRA Part A Permit Application, Waste Isolation Pilot Plant, Carlsbad, NM.

U.S. Department of Energy, 1991, Waste Isolation Pilot Plant No-Migration Determination Annual Report for the Period November 1990 through September 1991, DOE/WIPP 91-059, Waste Isolation Pilot Plant, Carlsbad, New Mexico.

U.S. Department of Energy, 1992, Resource Conservation and Recovery Act Part B Permit Application, DOE/WIPP 91-005, Revision 1.0, Waste Isolation Pilot Plant, Carlsbad, NM.

U.S. Department of Energy, Environmental Measurements Laboratory, HASL-300, Environmental Measurement Laboratory Procedures Manual, (revised annually).

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

U.S. Department of the Interior, Bureau of Land Management (BLM), 1991, Modification of Public Land Order 6826, *Federal Register*, Vol. 56, No. 18, pp. 3038-3039.

U.S. Environmental Protection Agency, 1986, State Authorization to Regulate the Hazardous Components of Radioactive Mixed Wastes Under the Resource Conservation and Recovery Act, *Federal Register*, Vol. 51, No. 128, pp. 24504-24505.

U.S. Environmental Protection Agency, 1990a, State of New Mexico: Final Authorization for State Hazardous Waste Management Program, *Federal Register*, Vol. 55, No. 133, pp. 28397-28398.

U.S. Environmental Protection Agency, 1990b, Notice Proposing to Grant a Conditional Variance to the Department of Energy Waste Isolation Pilot Plant (WIPP) from Land Disposal Restrictions, *Federal Register*, Vol. 55, No. 67, pp. 13068-13094.

U.S. Environmental Protection Agency 1990c, Conditional No-Migration Determination for the Department of Energy Waste Isolation Pilot Plant (WIPP), *Federal Register*, Vol. 55, No. 220, pp. 47700-47721.

U.S. Nuclear Regulatory Commission, 1990, Certificate of Compliance for Radioactive Materials Packaging, No. 9218, U.S. Nuclear Regulatory Commission, Washington, D.C.

U. S. Department of Energy, DOE/WIPP 91-054, Environmental Protection Implementation Plan for the Waste Isolation Pilot Plant, 1991.

Westinghouse Electric Corporation, 1991, VOC Monitoring Plan for Bin-Room Tests, WD 12-6, Waste Isolation Pilot Plant, Carlsbad, New Mexico.

Westinghouse Electric Corporation, 1992, Volatile Organic Compounds Monitoring Quality Assurance Program Plan, Revision 1, WP 12-7, Waste Isolation Pilot Plant, Carlsbad, New Mexico.

Westinghouse Electric Corporation, WID Quality Assurance Program Discription, WP 13, Rev 14, 1992.

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National Center - 950
Reston, VA 22092-0950

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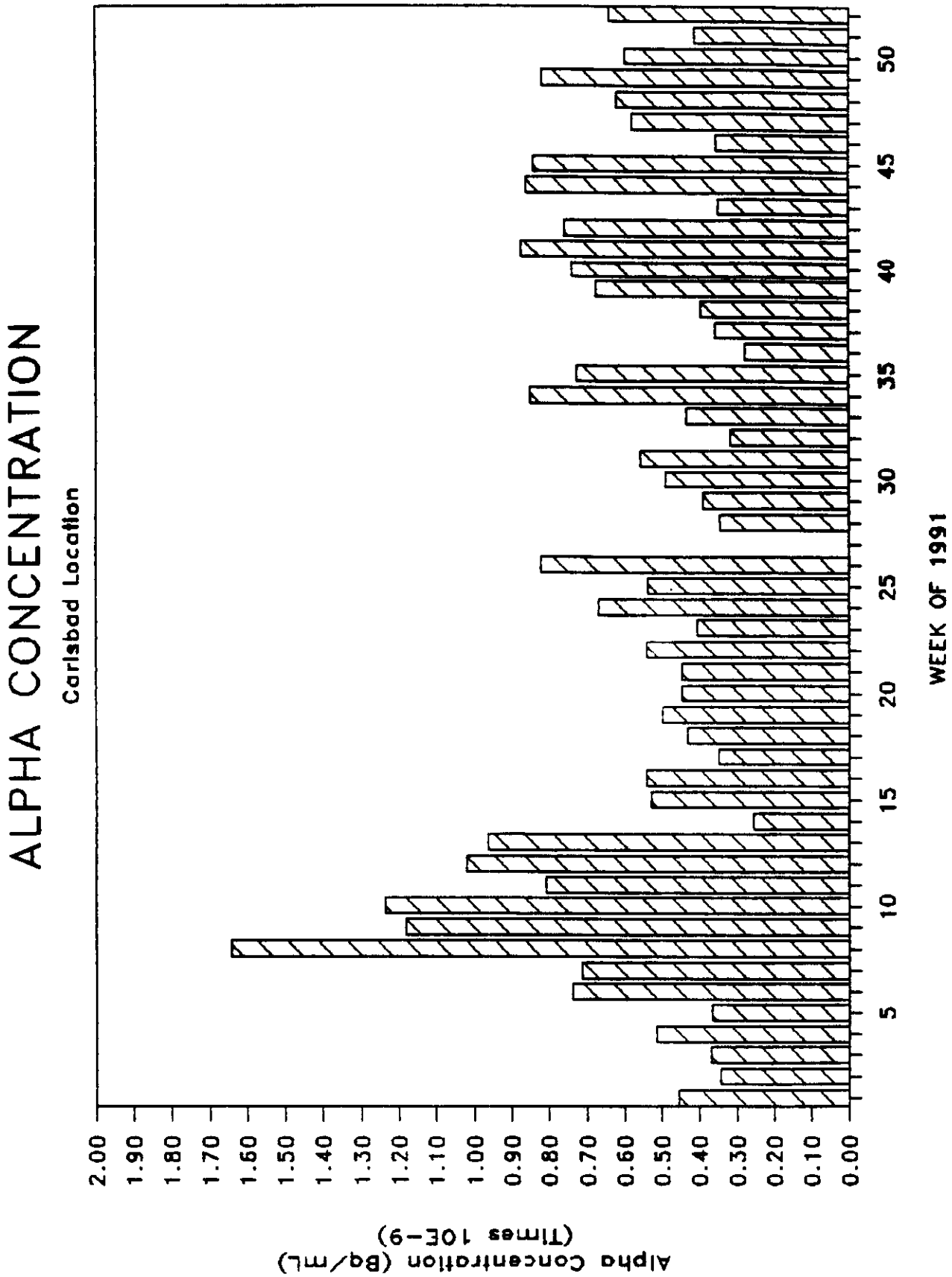
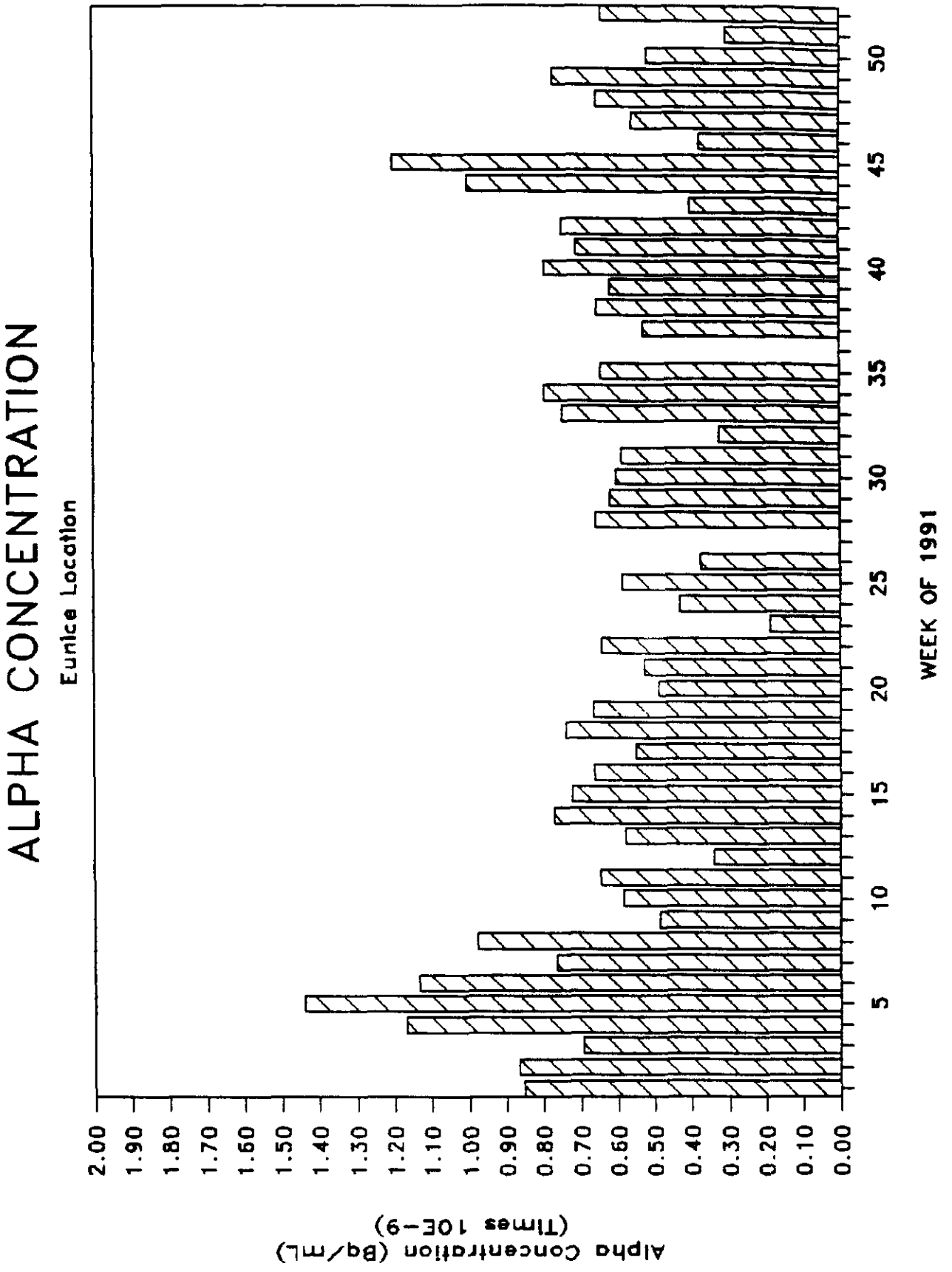
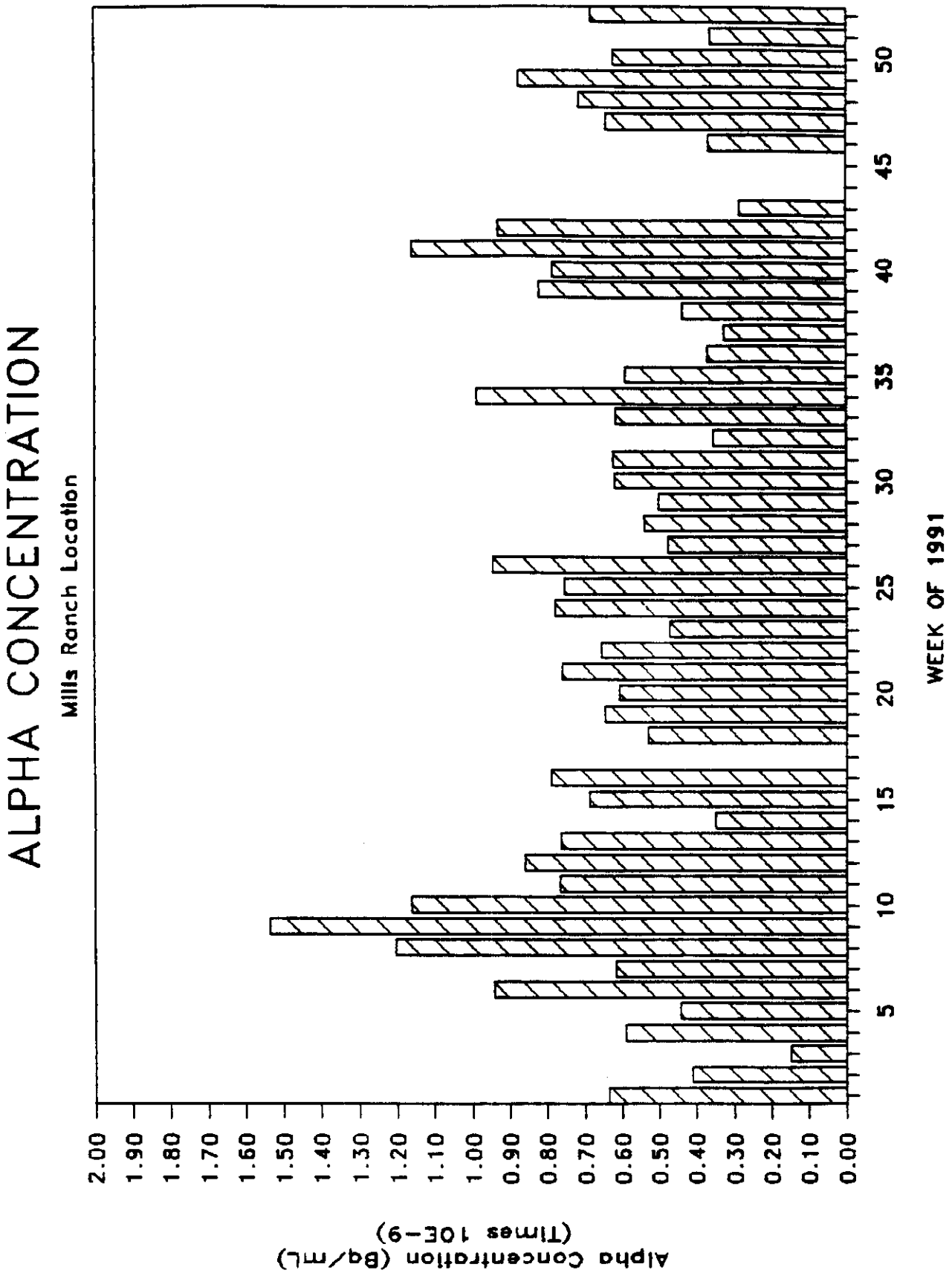
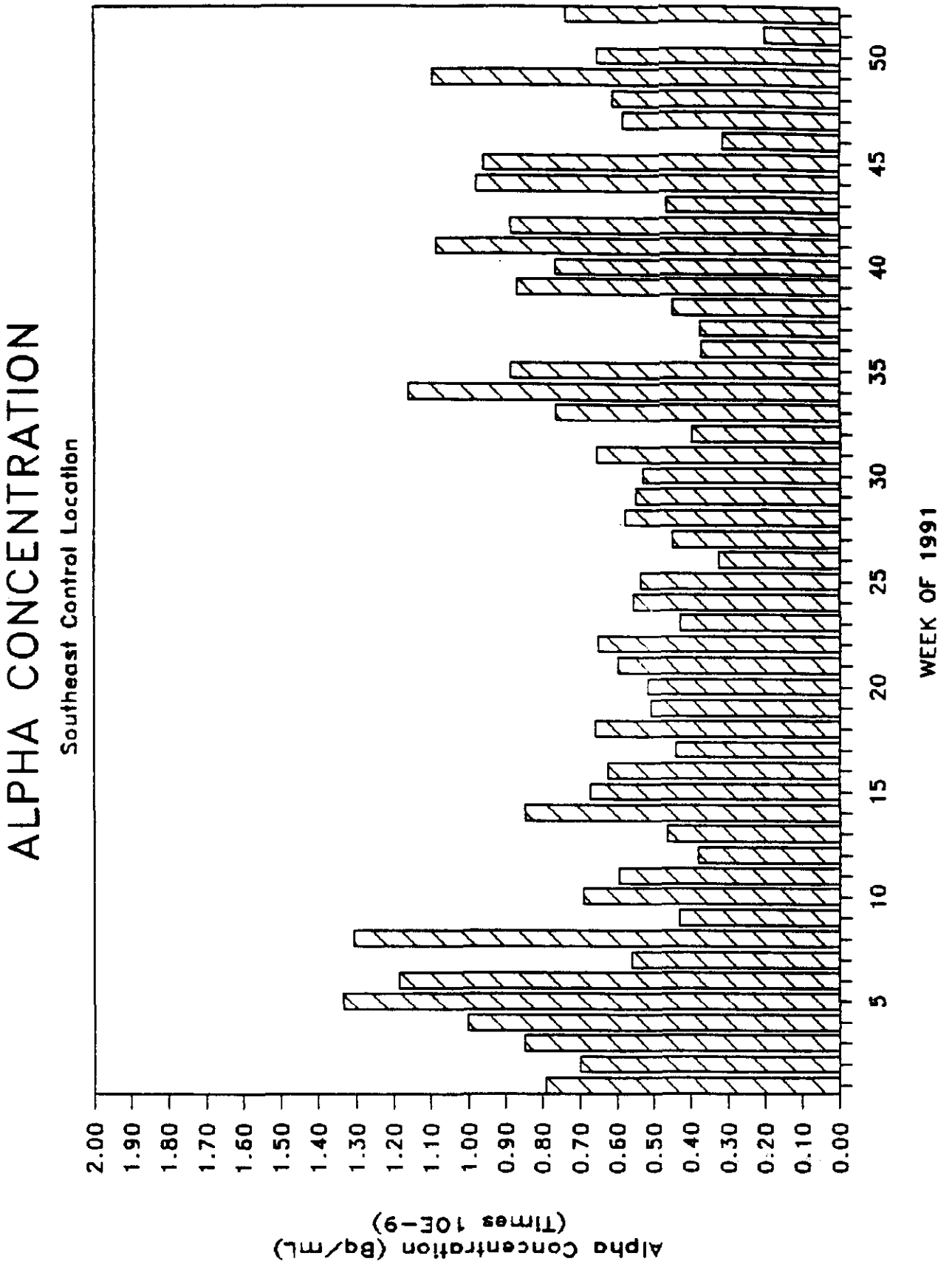
Argonne National Laboratory
Argonne, IL 60439

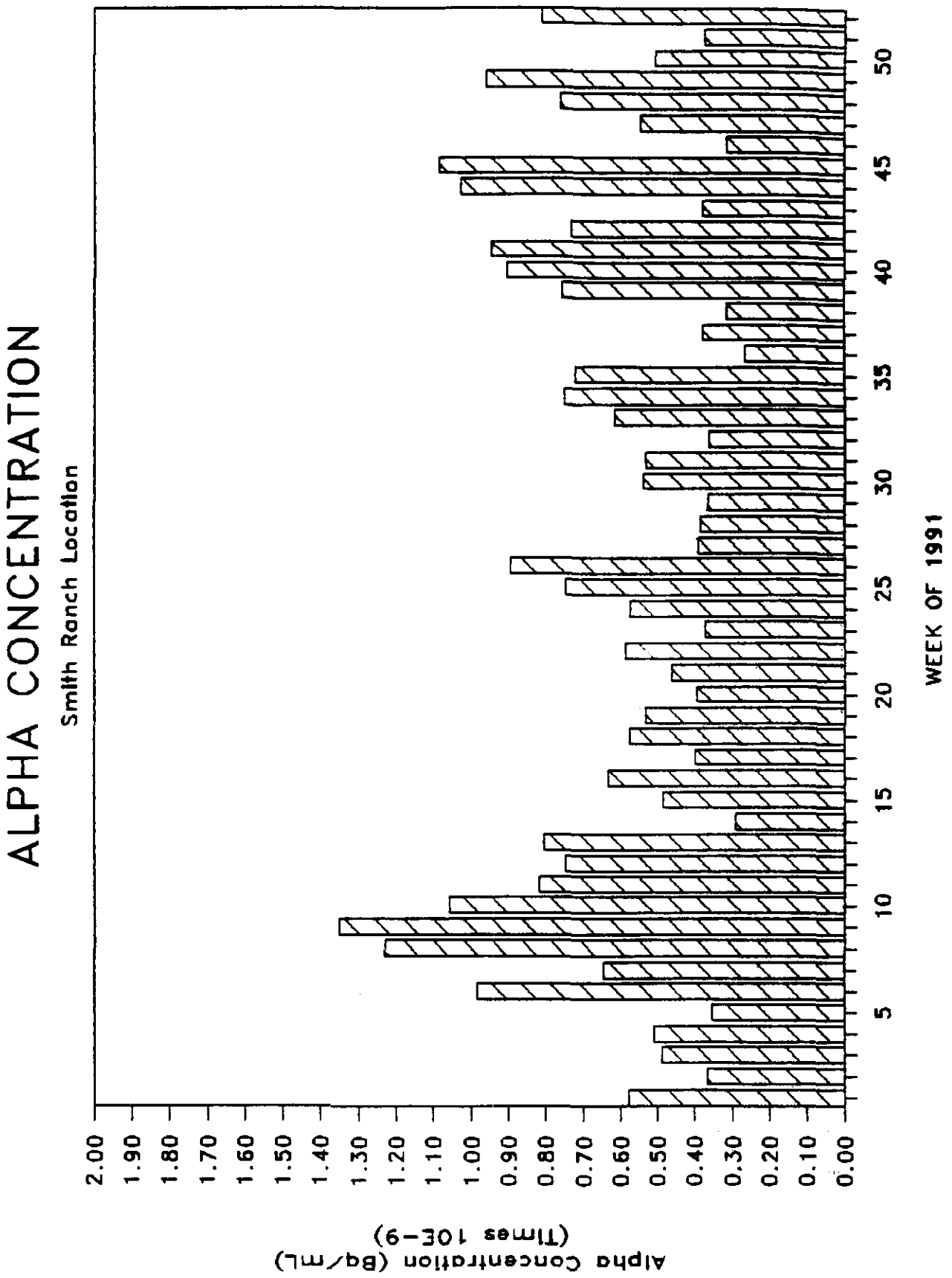
Appendix 5
Gross Alpha and Beta Concentrations

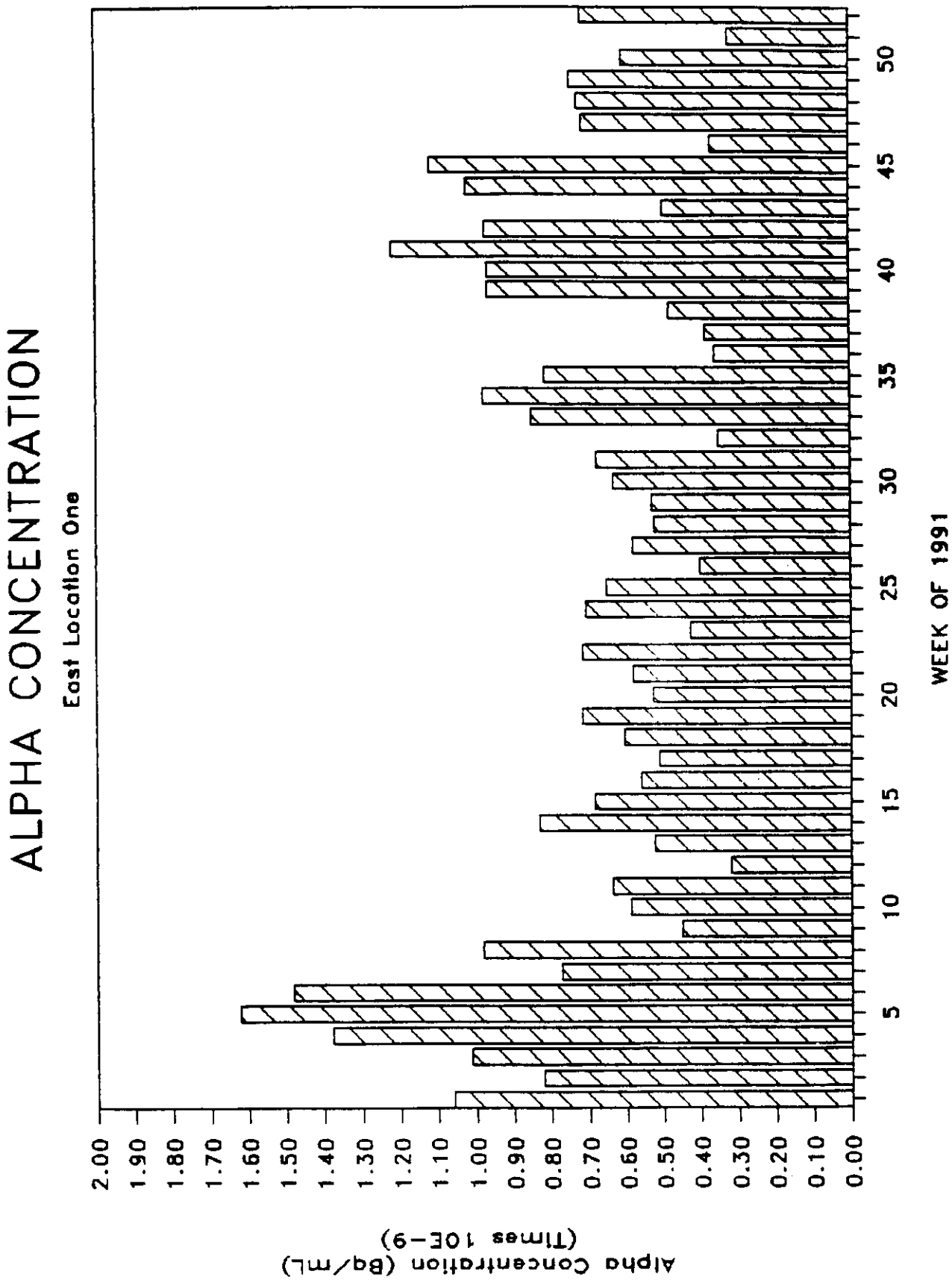

ALPHA CONCENTRATION
Carlsbad Location
Alpha Concentration (Bq/mL)
(Times 10E-9)
2.00
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
5
10
15
20
25
30
35
40
45
50
WEEK OF 1991

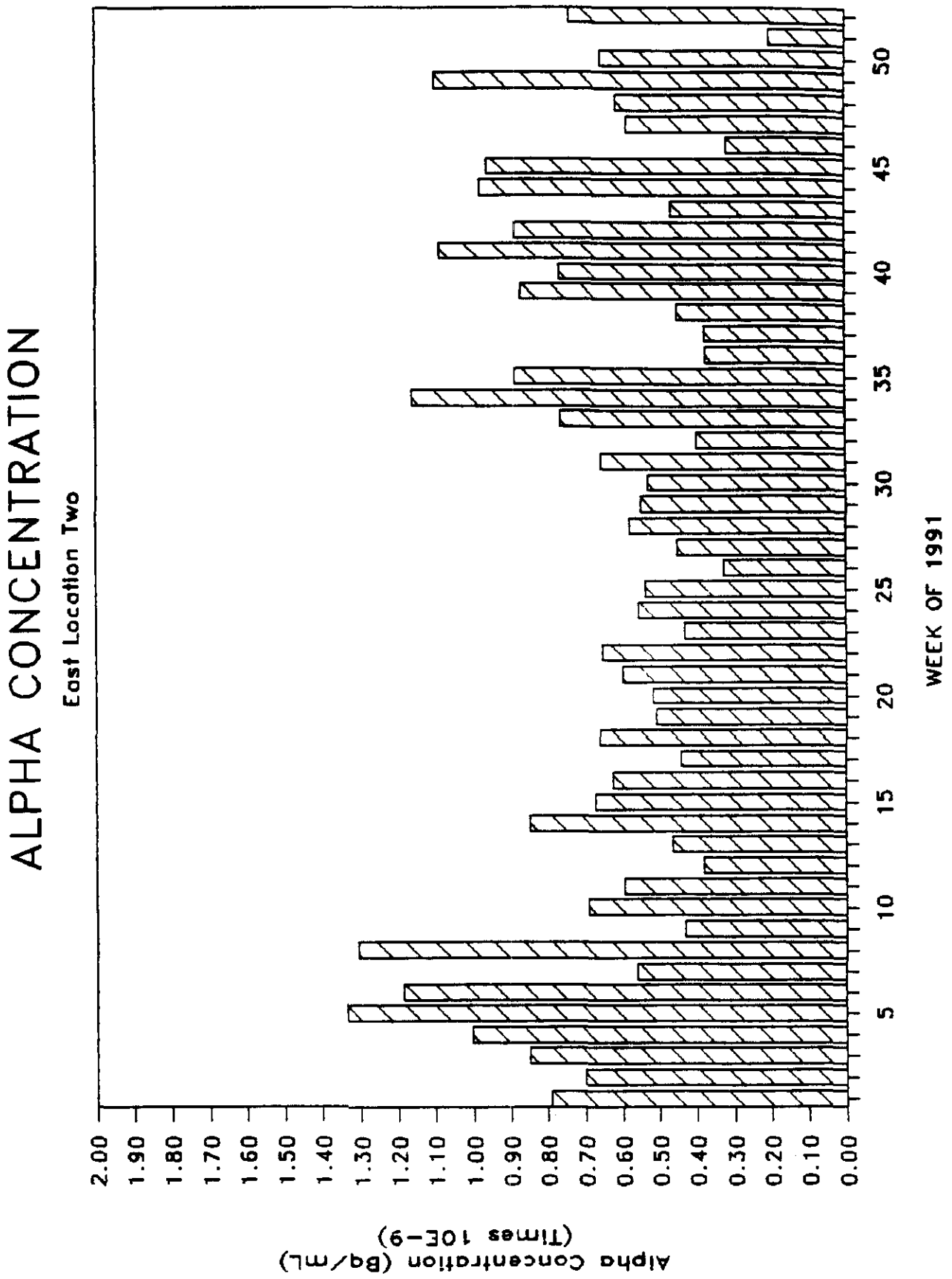

ALPHA CONCENTRATION
Eunice Location
Alpha Concentration (Bq/mL)
(Times 10E-9)
2.00
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
5
10
15
20
25
30
35
40
45
50
WEEK OF 1991

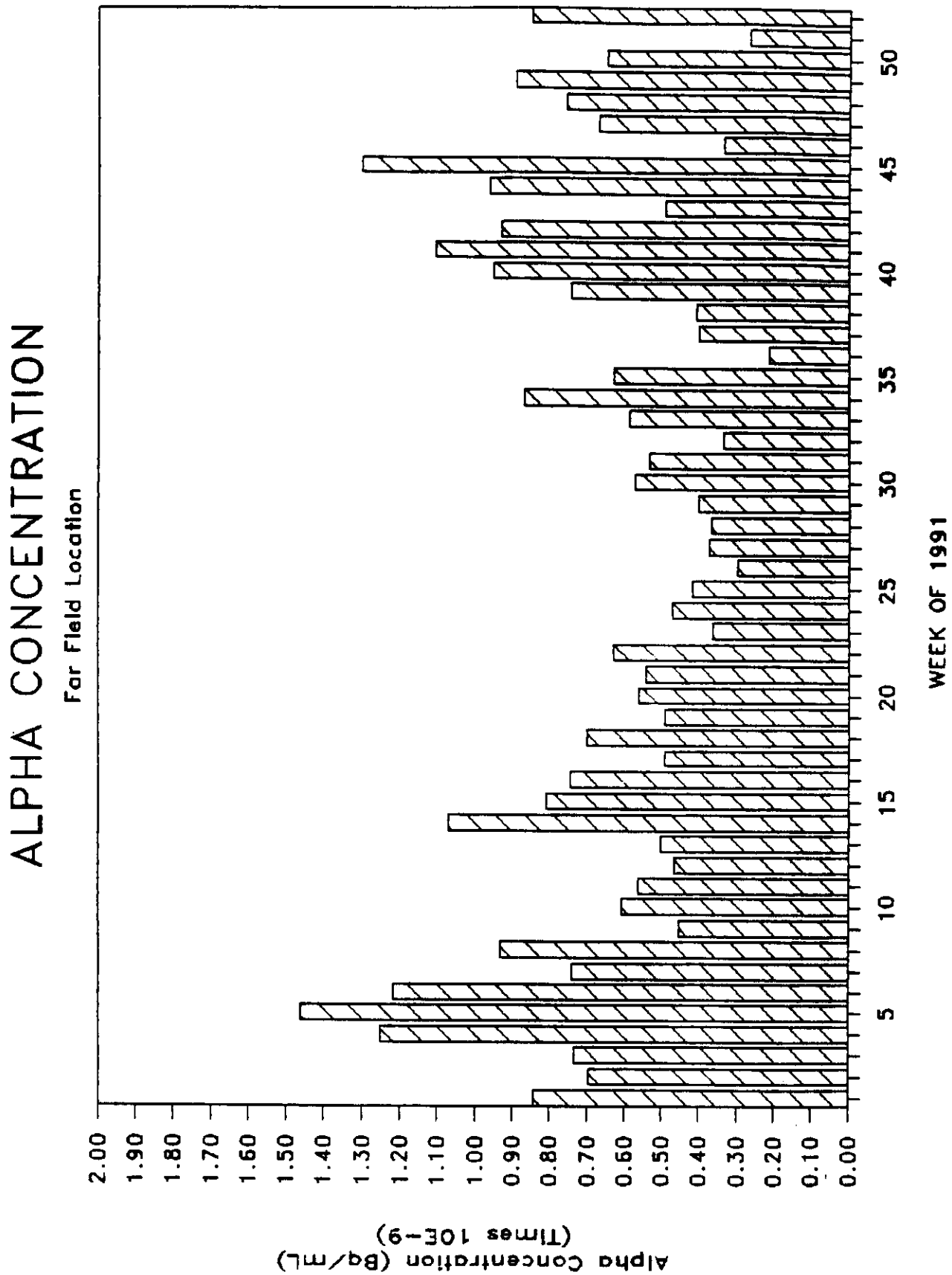

ALPHA CONCENTRATION
Mills Ranch Location
Alpha Concentration (Bq/mL)
(Times 10E-9)
2.00
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
5
10
15
20
25
30
35
40
45
50
WEEK OF 1991

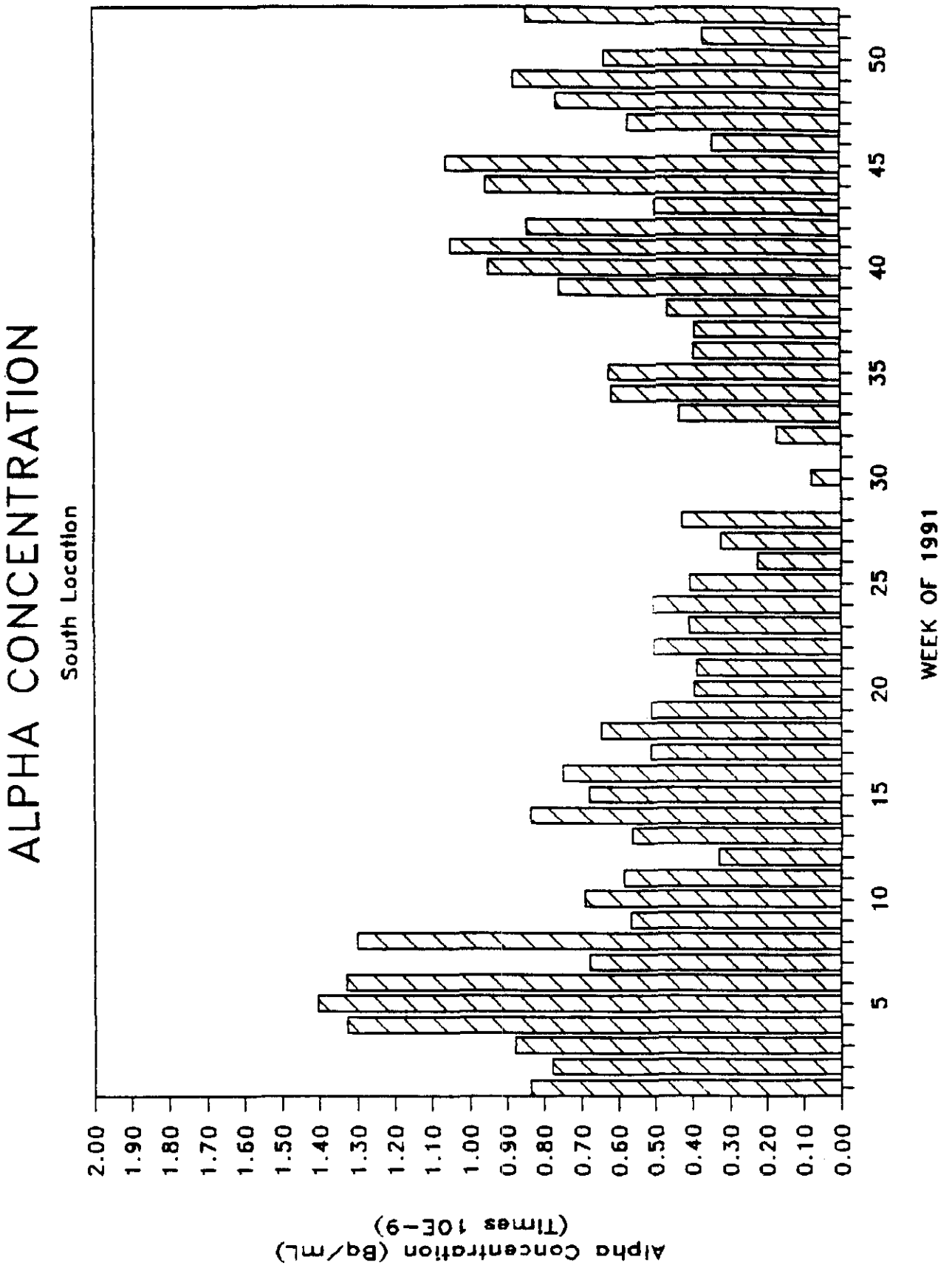

ALPHA CONCENTRATION
Southeast Control Location
Alpha Concentration (Bq/mL)
(Times 10E-9)
2.00
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
5
10
15
20
25
30
35
40
45
50
WEEK OF 1991

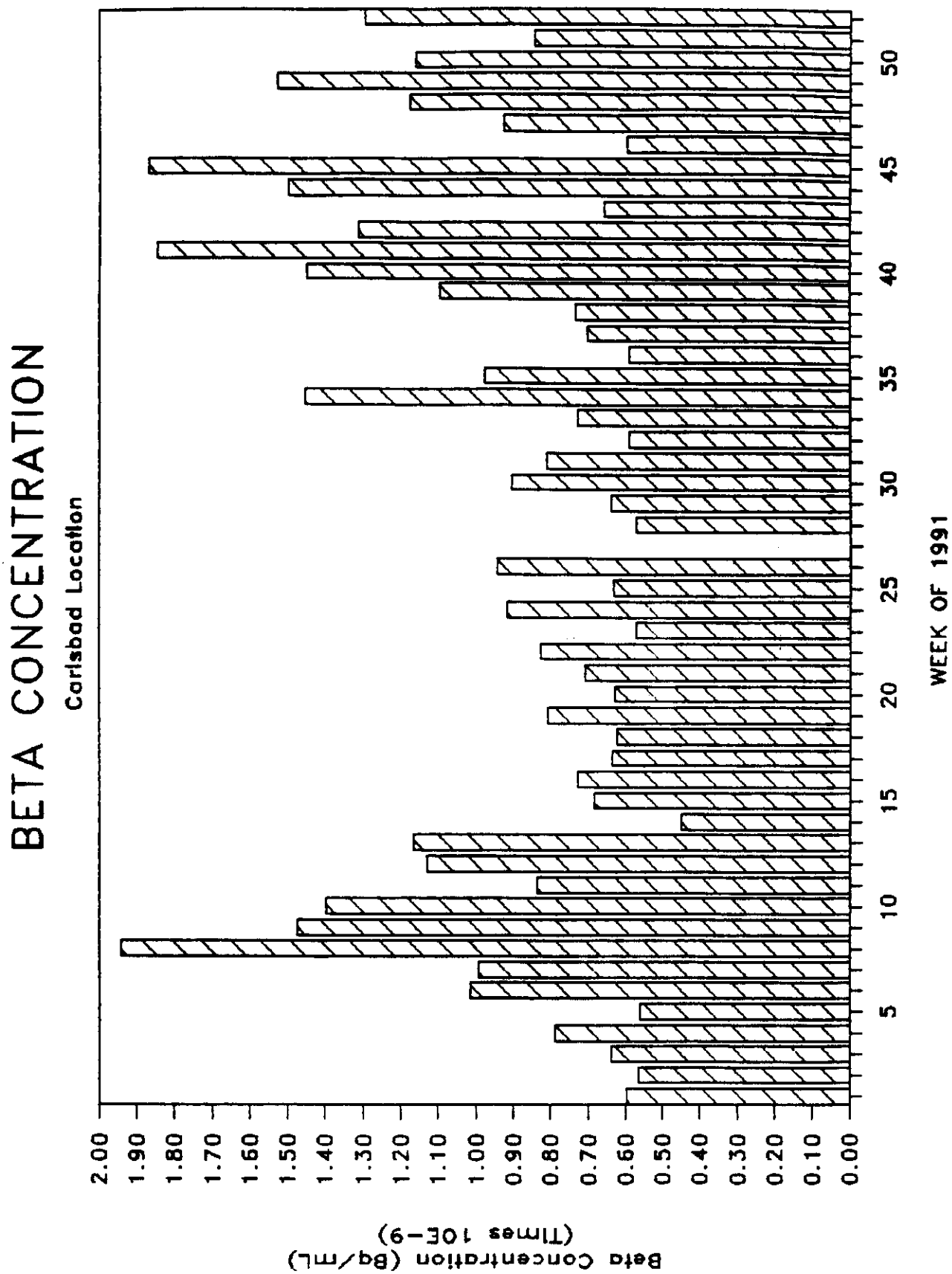

ALPHA CONCENTRATION
Smith Ranch Location
Alpha Concentration (Bq/mL)
(Times 10E-9)
2.00
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
5
10
15
20
25
30
35
40
45
50
WEEK OF 1991

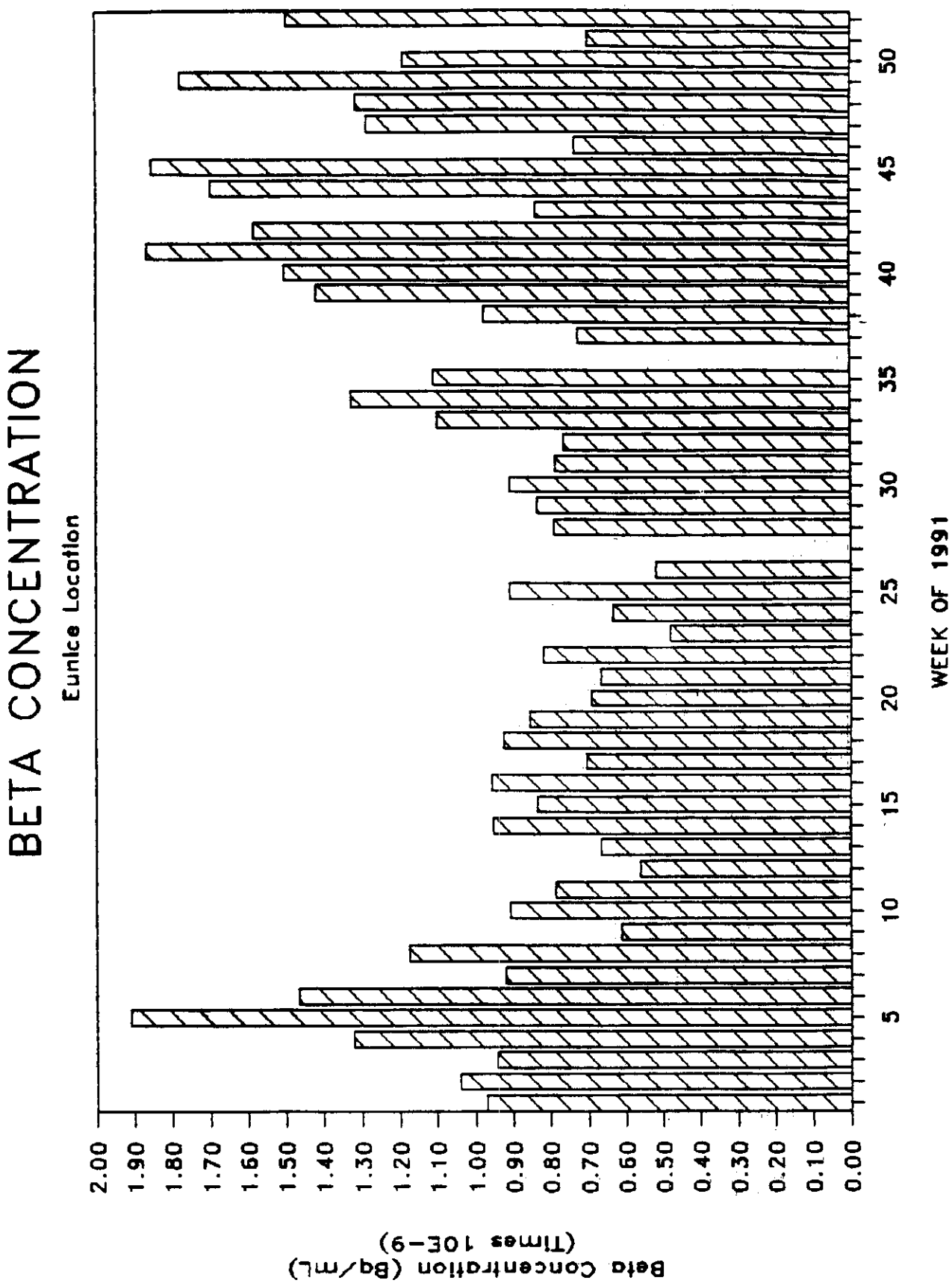

ALPHA CONCENTRATION
East Location One
Alpha Concentration (Bq/mL)
(Times 10E-9)
2.00
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
5
10
15
20
25
30
35
40
45
50
WEEK OF 1991


ALPHA CONCENTRATION
East Location Two
Alpha Concentration (Bq/mL)
(Times 10E-9)
2.00
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
5
10
15
20
25
30
35
40
45
50
WEEK OF 1991


ALPHA CONCENTRATION
Far Field Location
Alpha Concentration (Bq/mL)
(Times 10E-9)
2.00
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
5
10
15
20
25
30
35
40
45
50
WEEK OF 1991


ALPHA CONCENTRATION
South Location
Alpha Concentration (Bq/mL)
(Times 10E-9)
2.00
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
5
10
15
20
25
30
35
40
45
50
WEEK OF 1991


BETA CONCENTRATION
Carlsbad Location
Beta Concentration (Bq/mL)
(Times 10E-9)
2.00
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
5
10
15
20
25
30
35
40
45
50
WEEK OF 1991


BETA CONCENTRATION
Eunice Location
Beta Concentration (Bq/mL)
(Times 10E-9)
2.00
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
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0.10
0.00
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10
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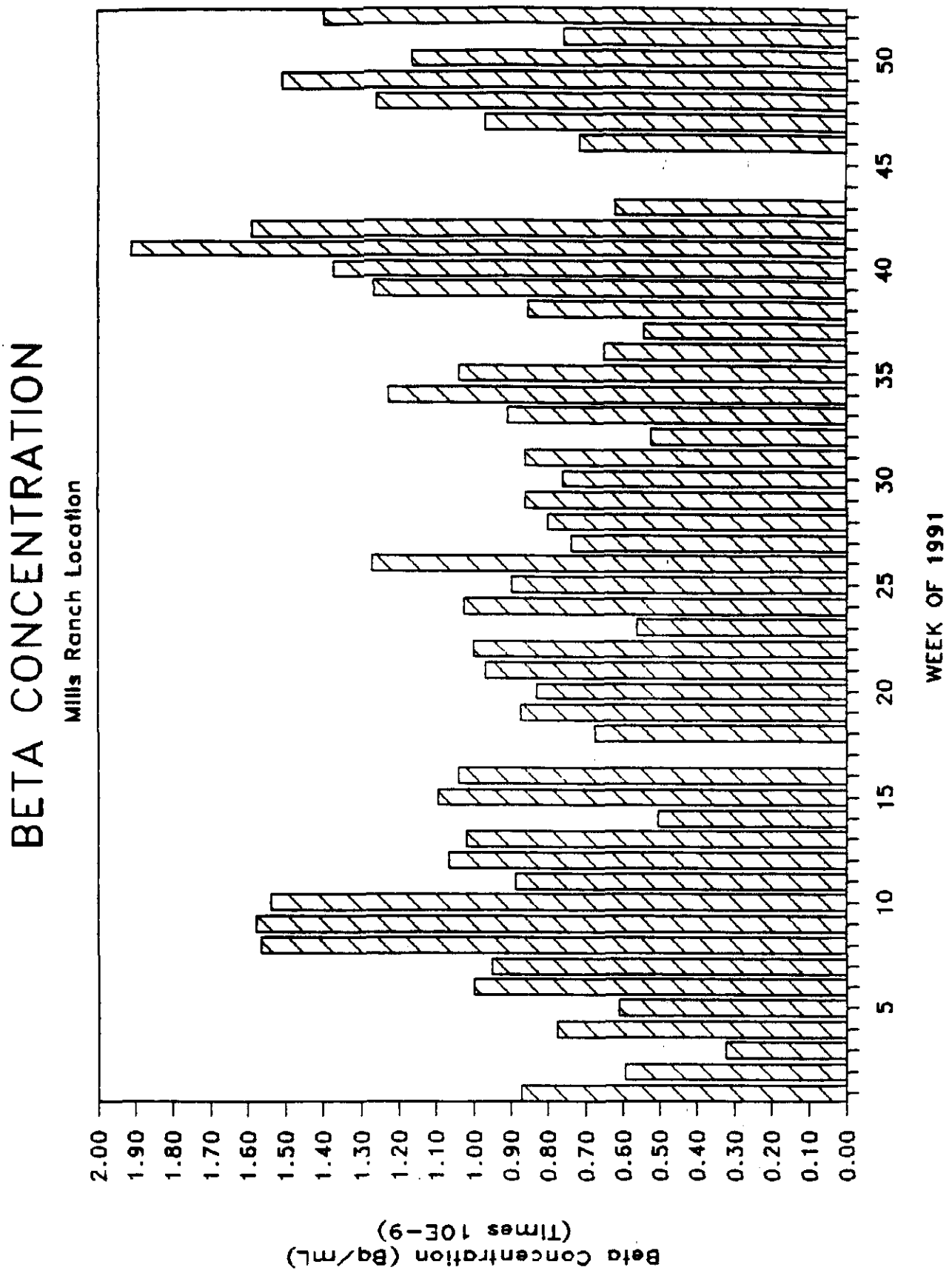
20
25
30
35
40
45
50
WEEK OF 1991


BETA CONCENTRATION
Mills Ranch Location
Beta Concentration (Bq/mL)
(Times 10E-9)
2.00
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
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0.00
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25
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35
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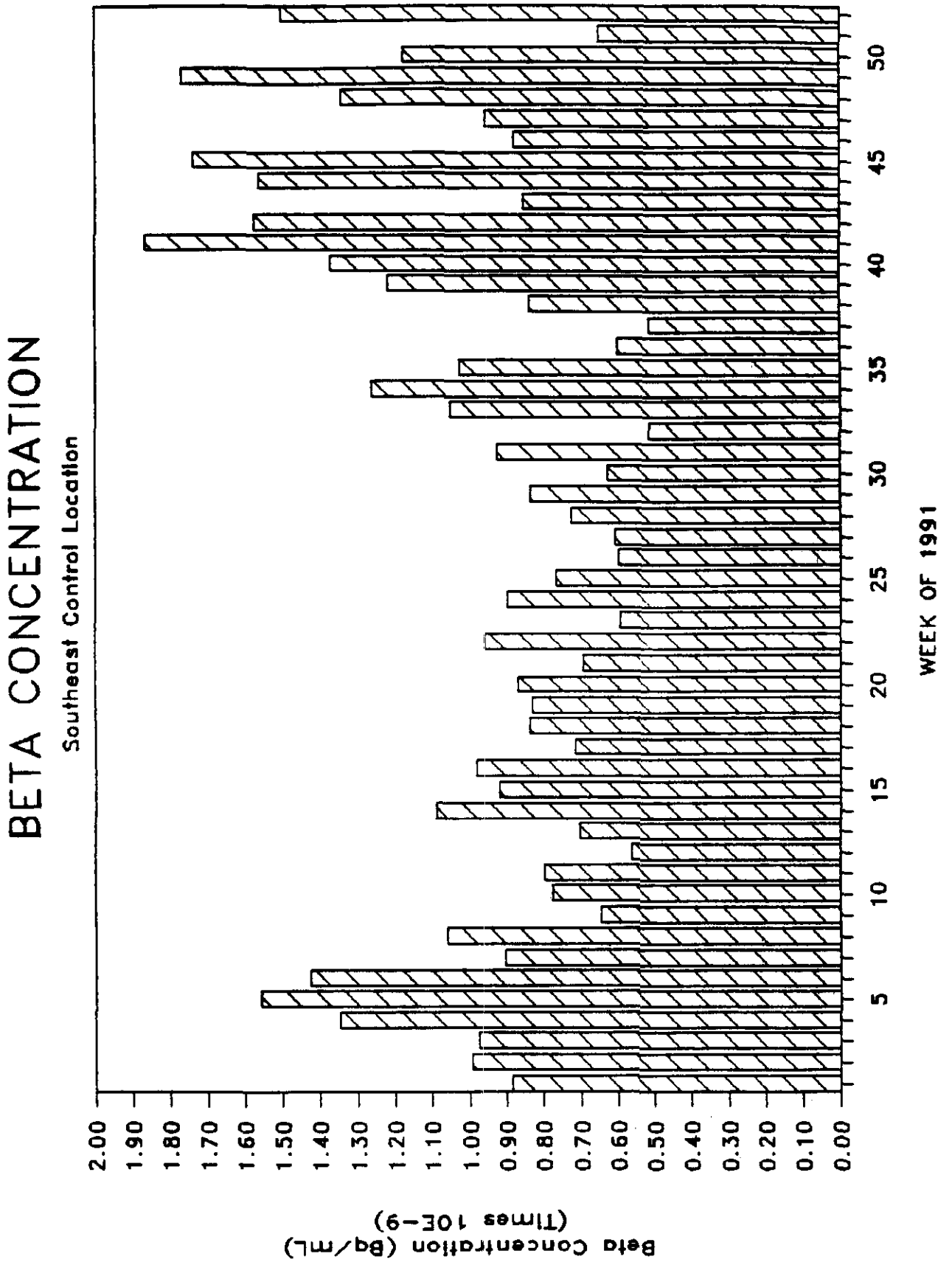
45
50
WEEK OF 1991


BETA CONCENTRATION
Southeast Control Location
Beta Concentration (Bq/mL)
(Times 10E-9)
2.00
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
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0.10
0.00
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35
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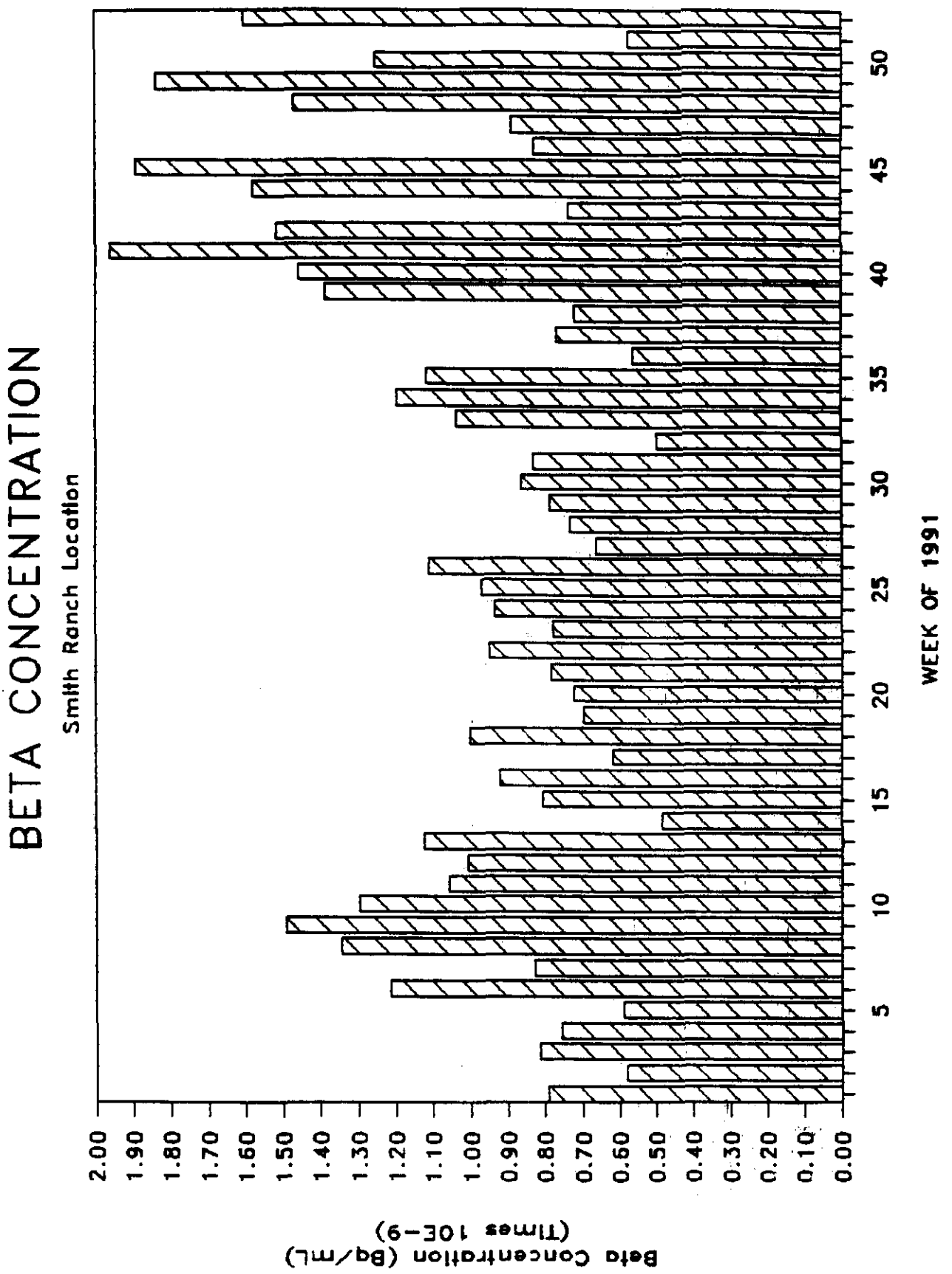
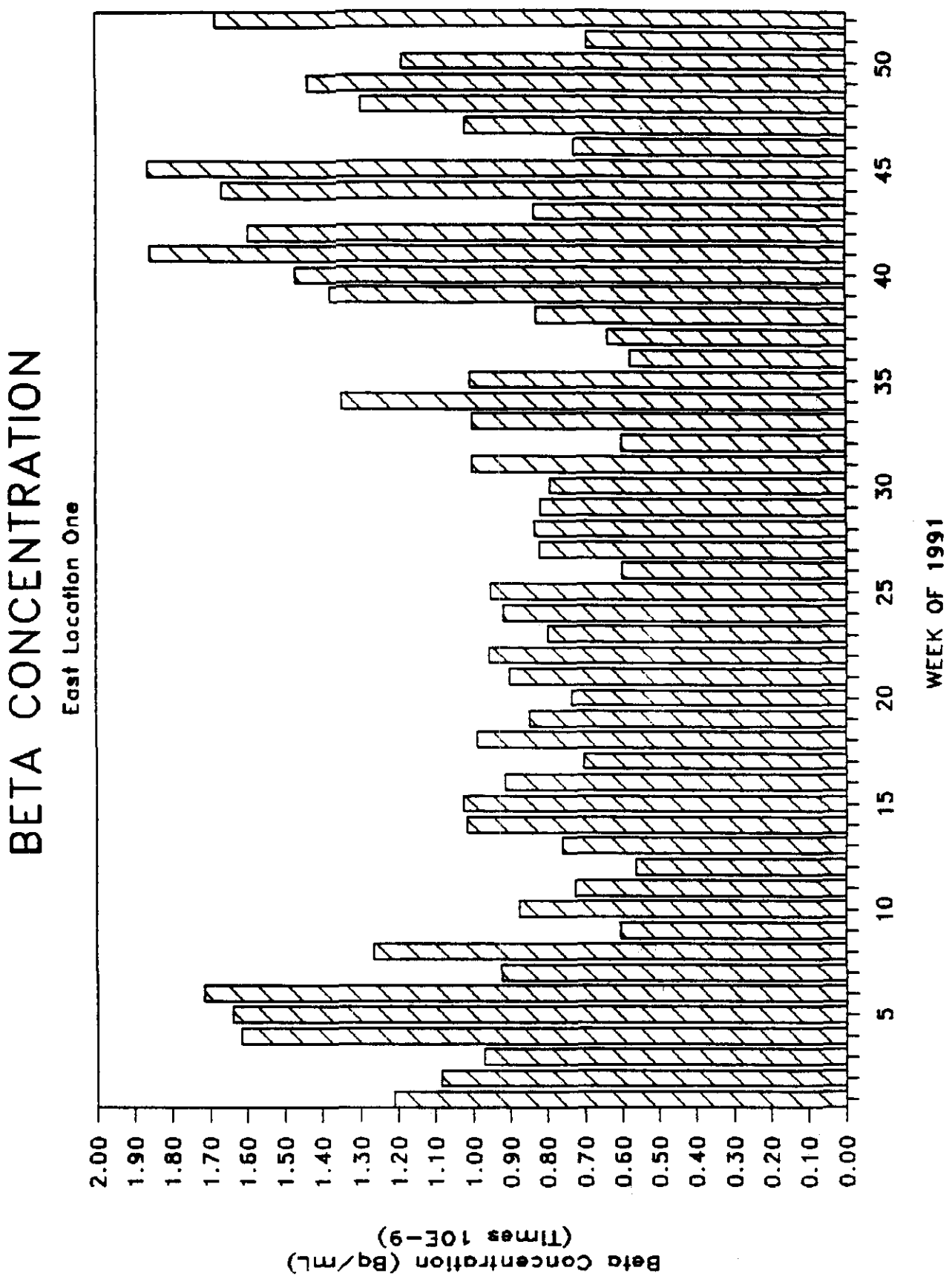
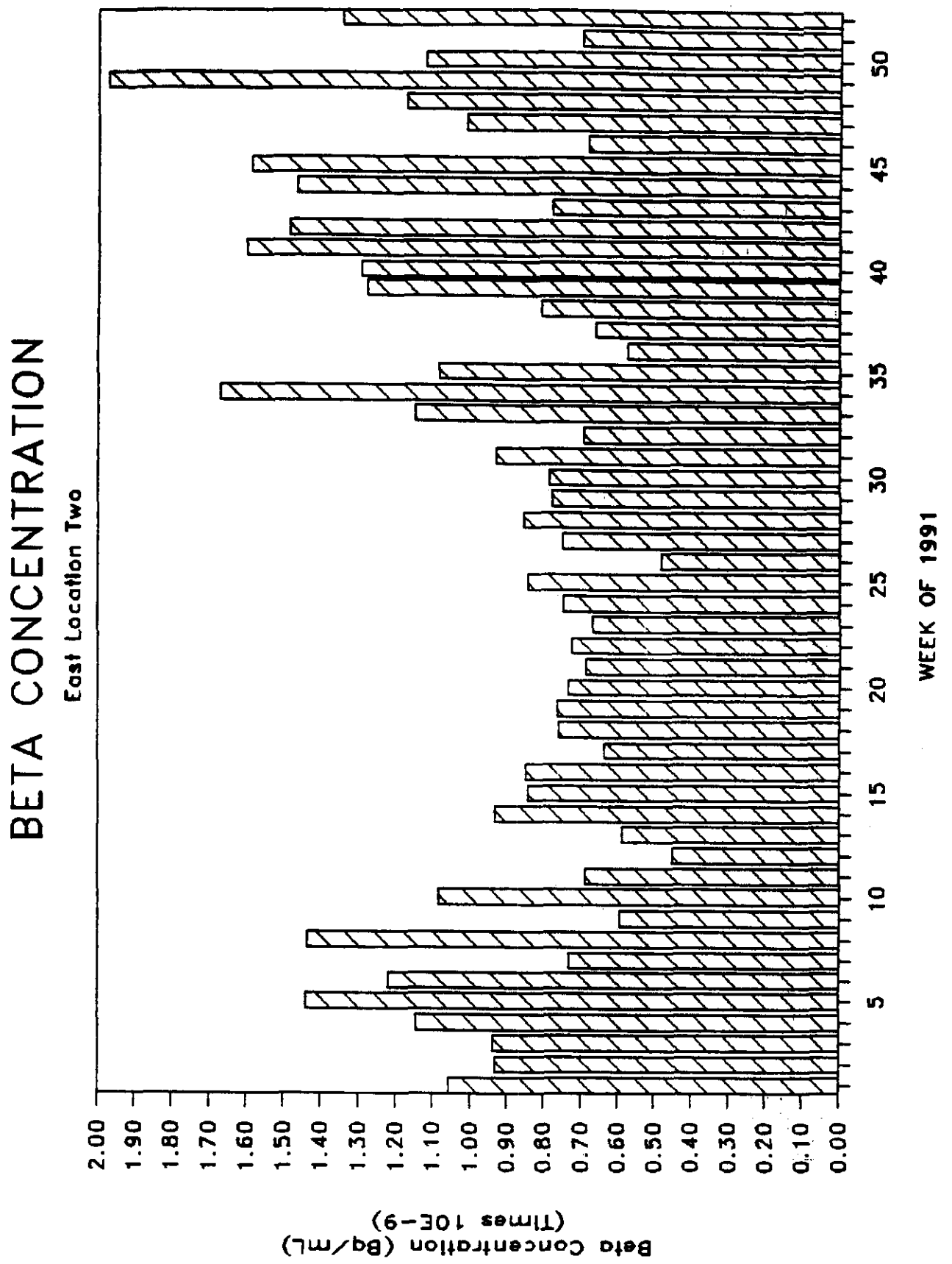
45
50
WEEK OF 1991


BETA CONCENTRATION
Smith Ranch Location
Beta Concentration (Bq/mL)
(Times 10E-9)
2.00
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
5
10
15
20
25
30
35
40
45
50
WEEK OF 1991


BETA CONCENTRATION
East Location One
Beta Concentration (Bq/mL)
(Times 10E-9)
2.00
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
5
10
15
20
25
30
35
40
45
50
WEEK OF 1991


BETA CONCENTRATION
East Location Two
Beta Concentration (Bq/mL)
(Times 10E-9)
2.00
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
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5
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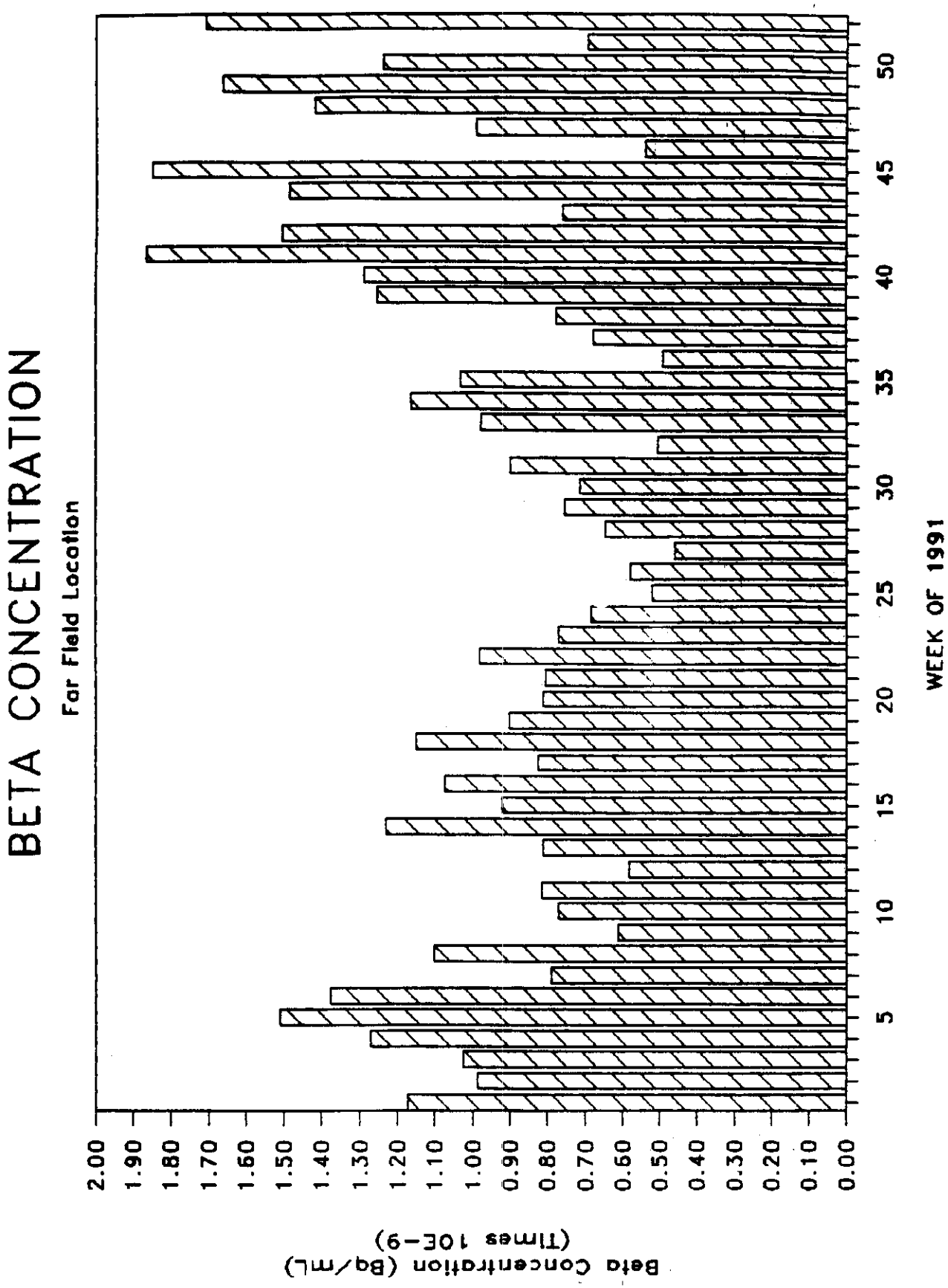
35
40
45
50
WEEK OF 1991


BETA CONCENTRATION
Far Field Location
Beta Concentration (Bq/mL)
(Times 10E-9)
2.00
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
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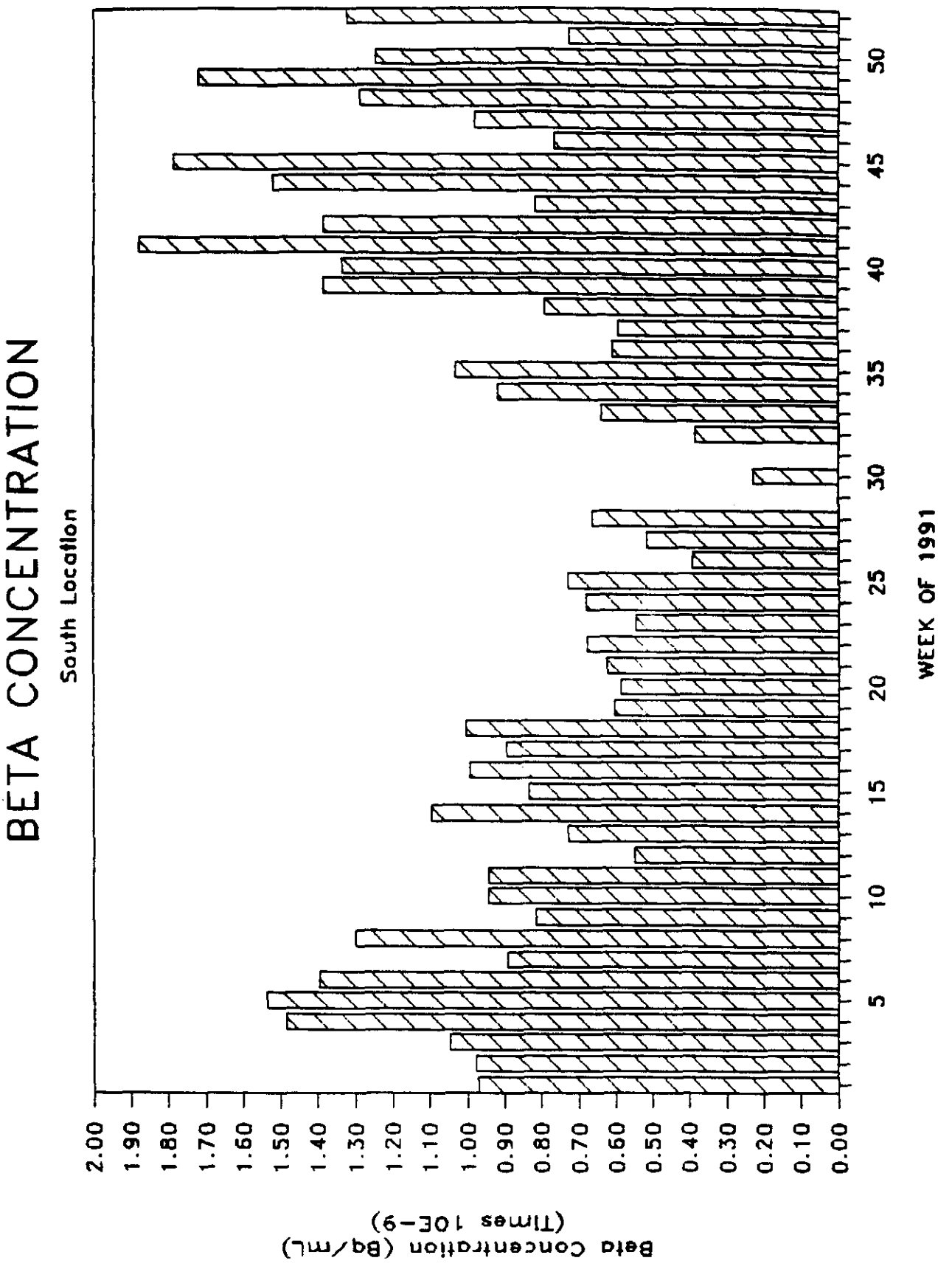
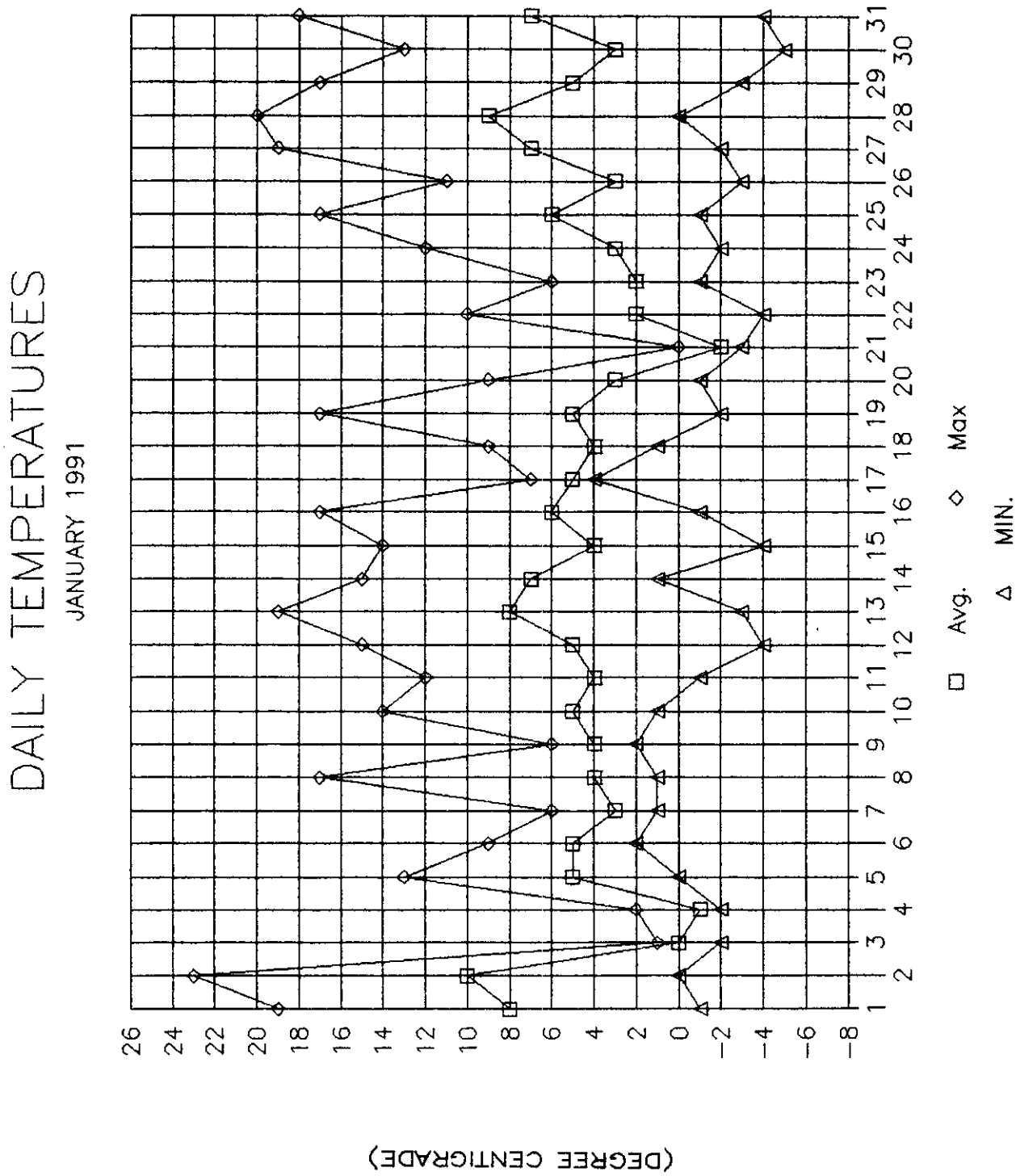
0.10
0.00
5
10
15
20
25
30
35
40
45
50
WEEK OF 1991

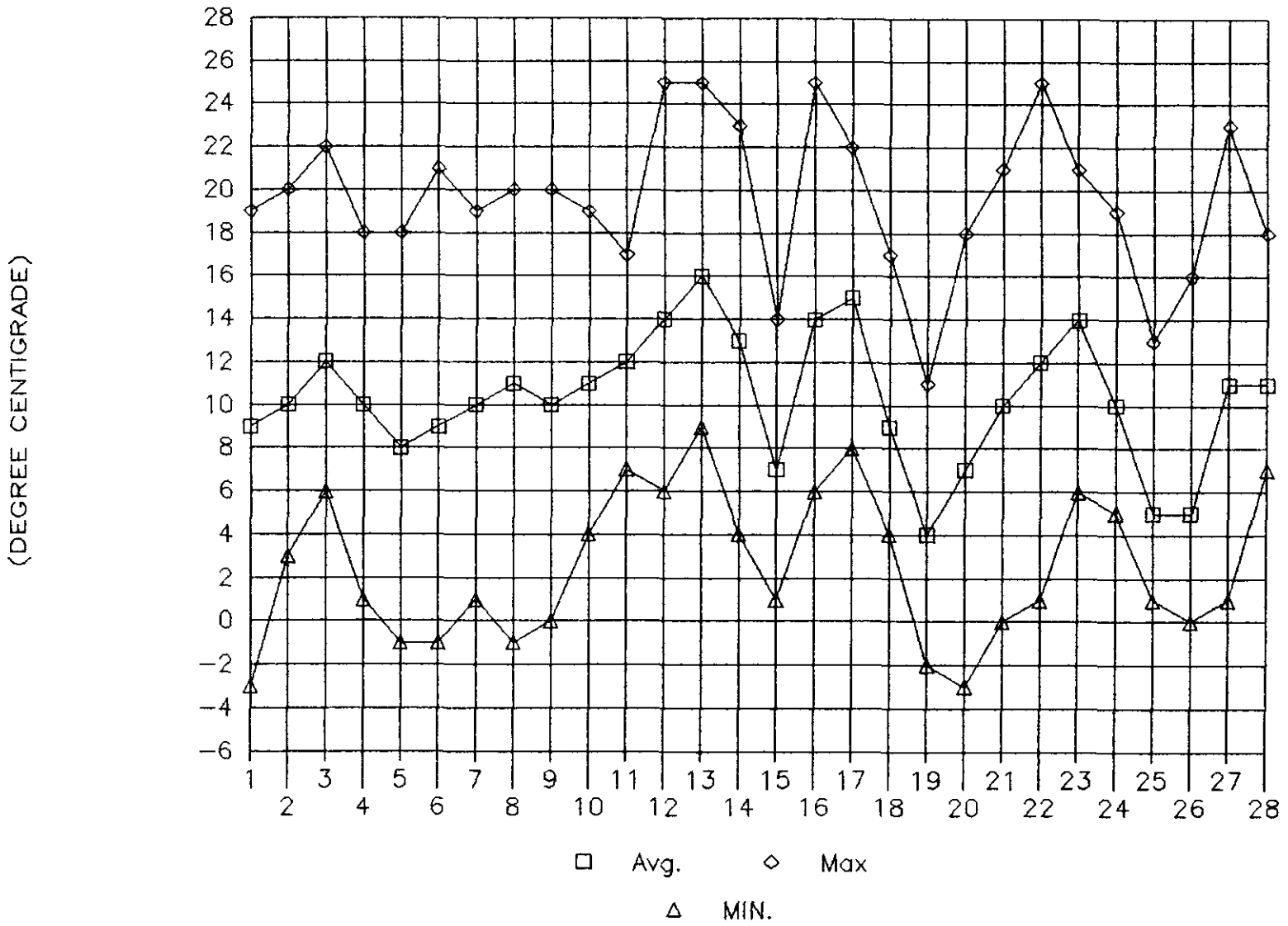

BETA CONCENTRATION
South Location
Beta Concentration (Bq/mL)
(Times 10E-9)
2.00
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
5
10
15
20
25
30
35
40
45
50
WEEK OF 1991

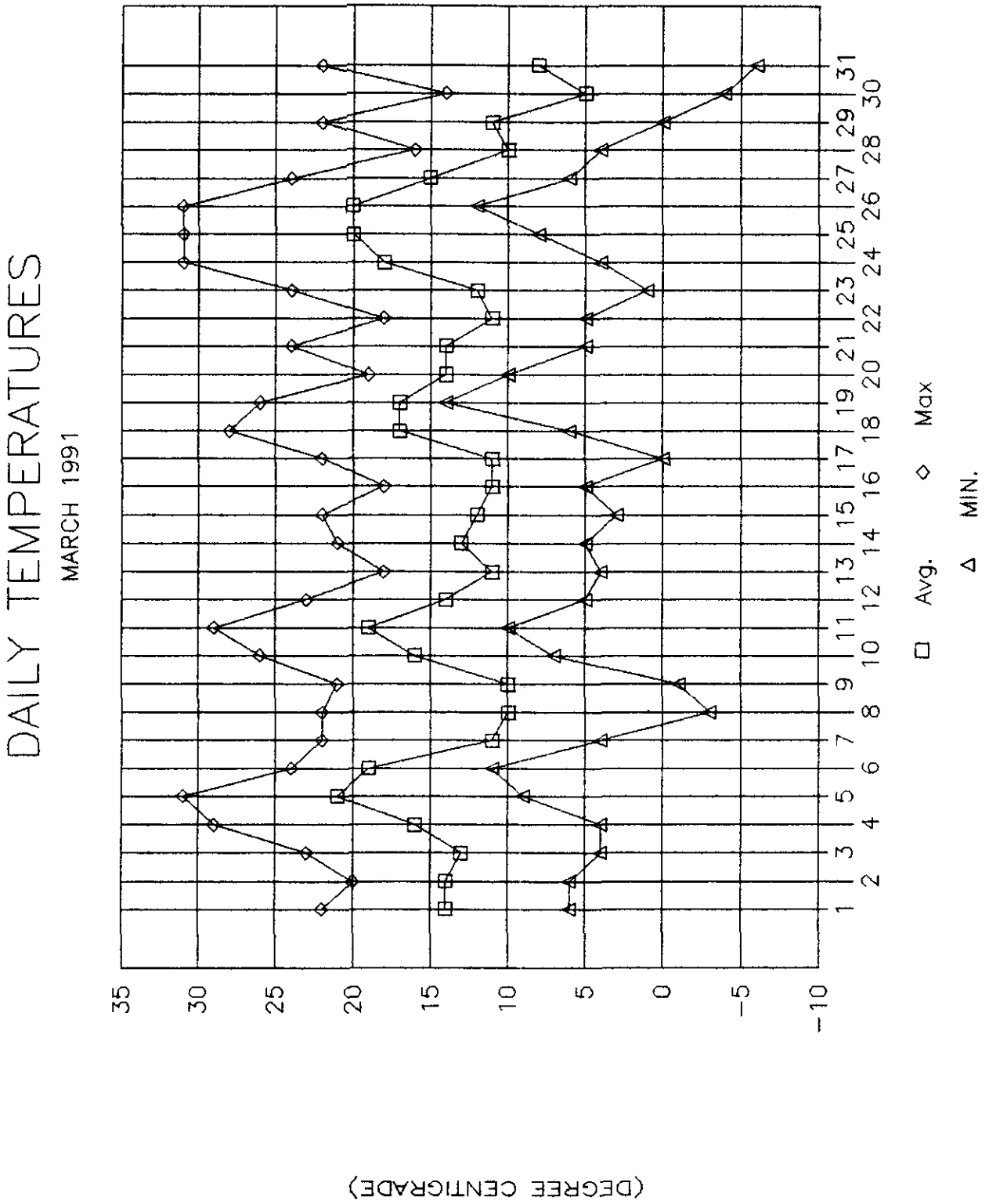
Appendix 6
Daily Maximum, Minimum, and Average Temperatures

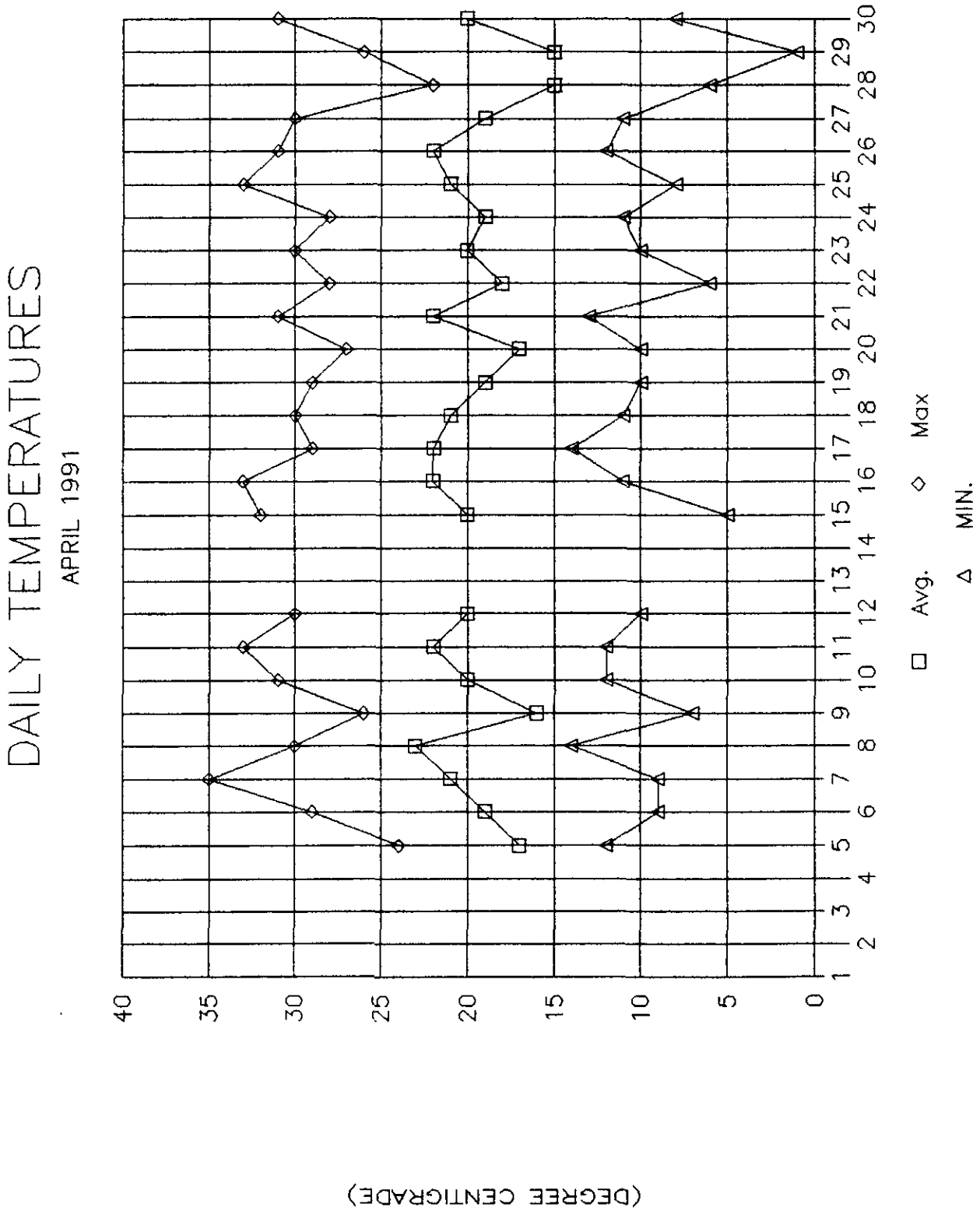

DAILY TEMPERATURES
JANUARY 1991
26
24
22
20
18
16
14
12
10
8
6
4
2
0
−2
−4
−6
−8
(DEGREE CENTIGRADE)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
Avg.
Max
MIN.

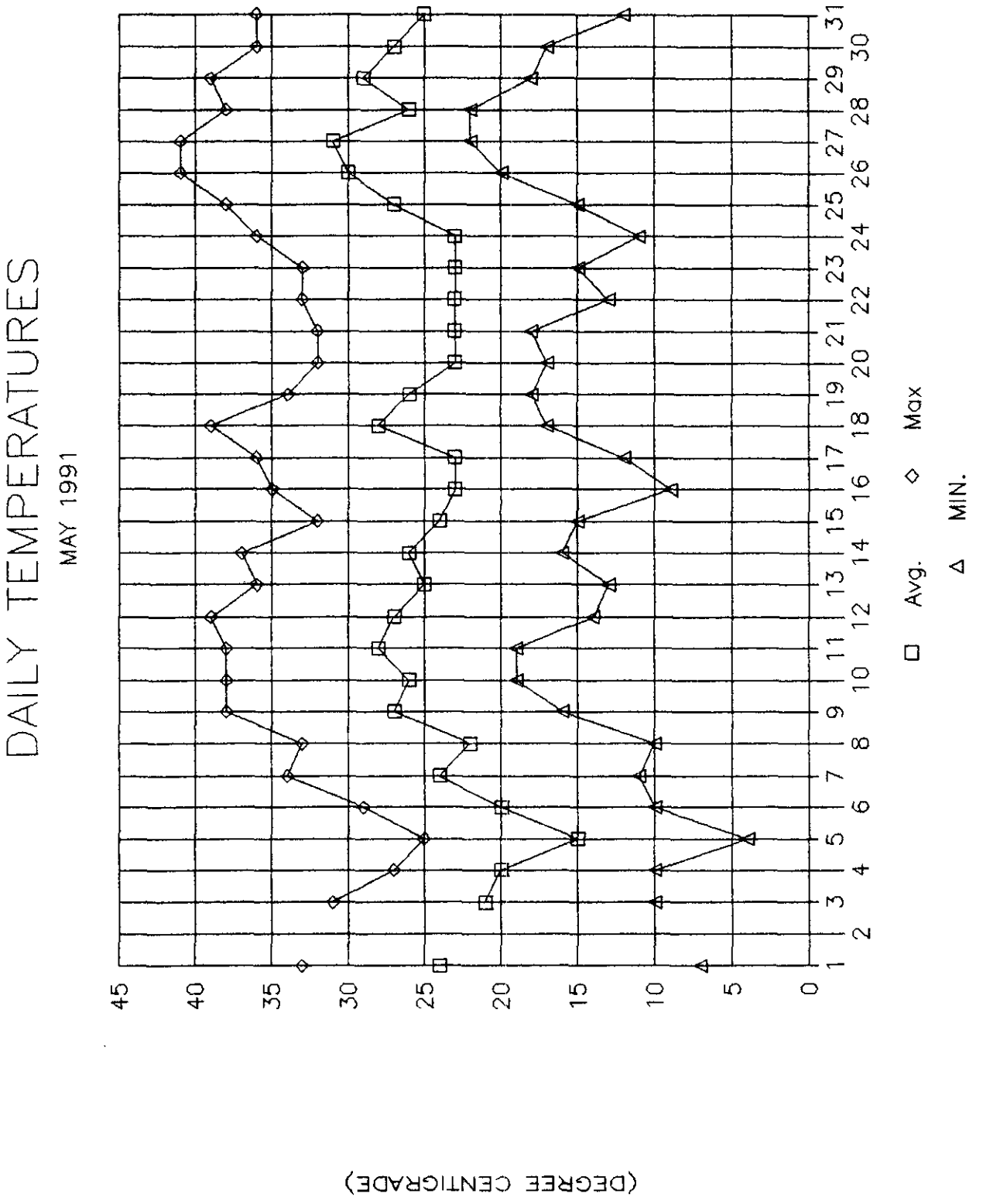
DAILY TEMPERATURES

FEBRUARY 1991




DAILY TEMPERATURES
MARCH 1991
35
30
25
20
15
10
5
0
-5
-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
Avg.
Max
MIN.
(DEGREE CENTIGRADE)


DAILY TEMPERATURES
APRIL 1991
(DEGREE CENTIGRADE)
40
35
30
25
20
15
10
5
0
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
Avg.
Max
MIN.


DAILY TEMPERATURES
MAY 1991
(DEGREE CENTIGRADE)
45
40
35
30
25
20
15
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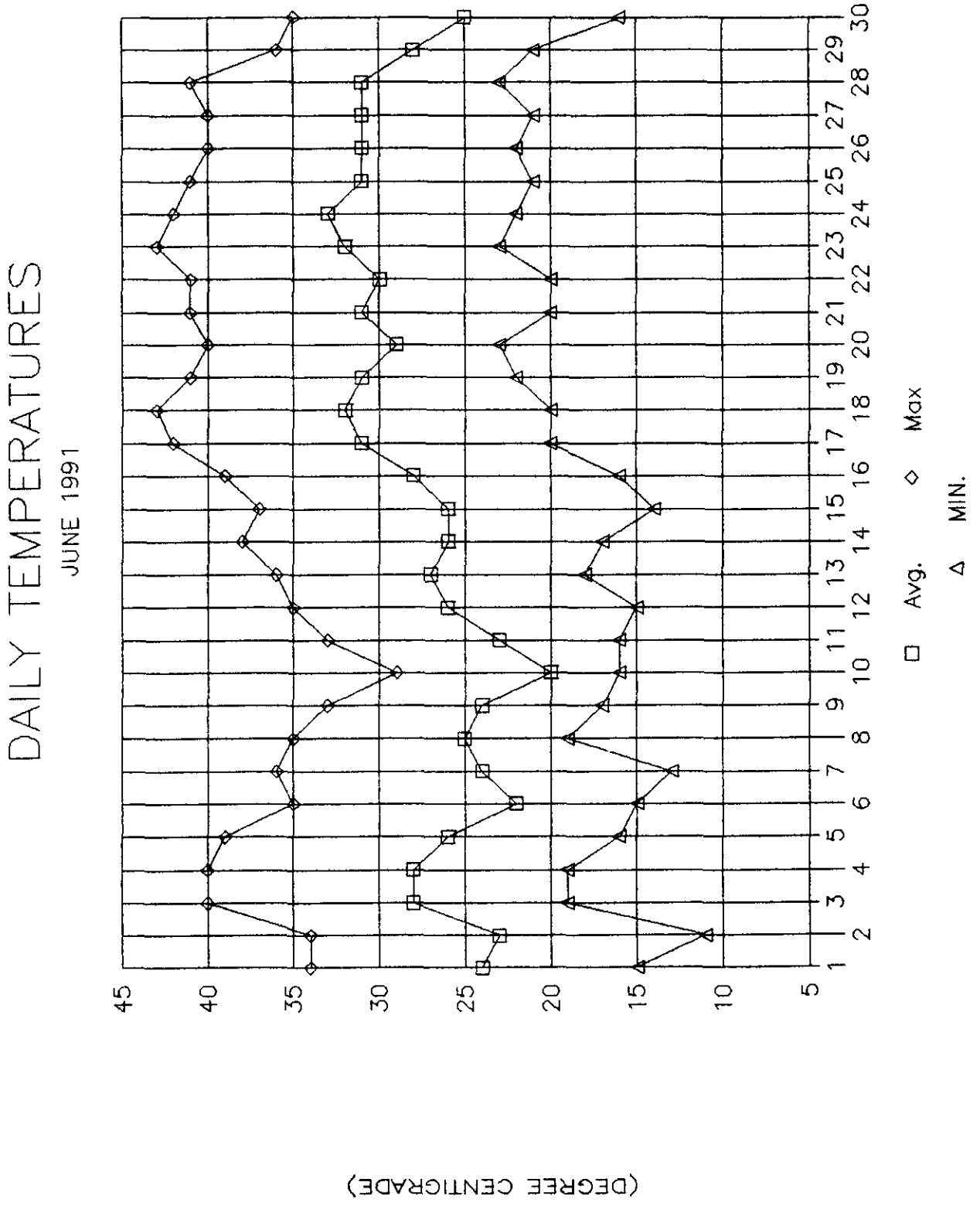
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Avg.
Max
MIN.


DAILY TEMPERATURES
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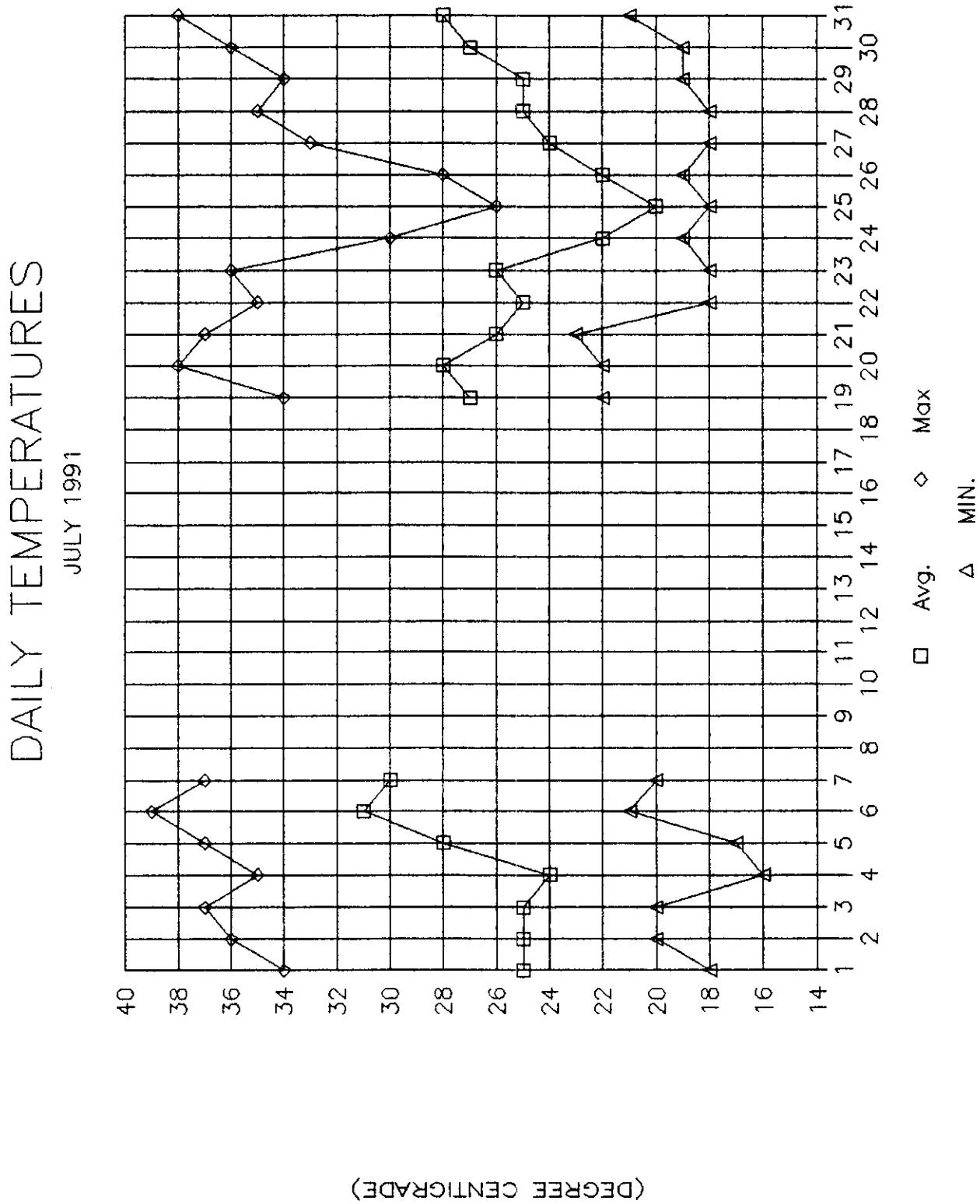
Avg.
Max
MIN.
(DEGREE CENTIGRADE)


DAILY TEMPERATURES
JULY 1991
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26
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22
20
18
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14
(DEGREE CENTIGRADE)
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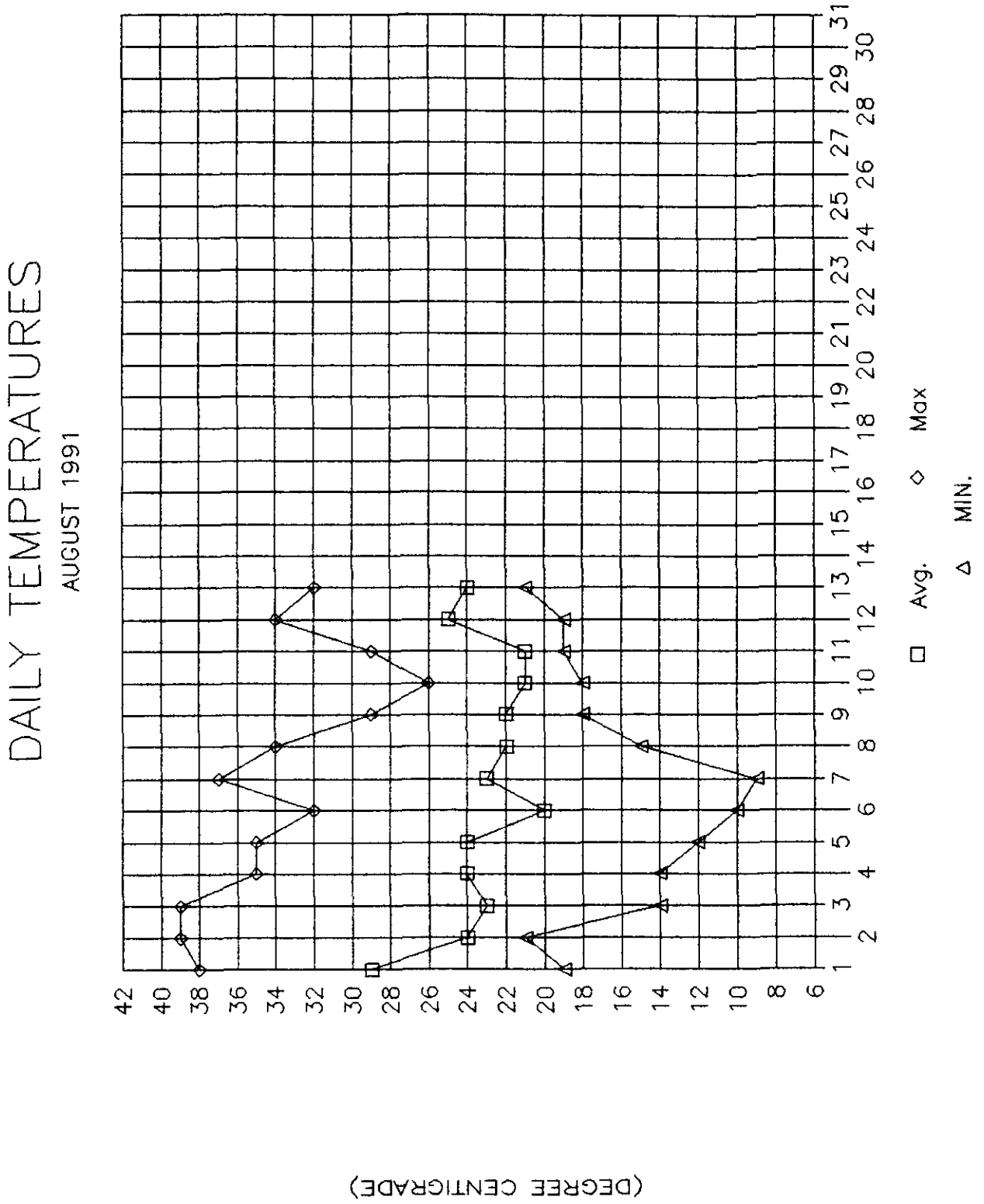
Avg.
Max
MIN.


DAILY TEMPERATURES
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32
30
28
26
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22
20
18
16
14
12
10
8
6
(DEGREE CENTIGRADE)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
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16
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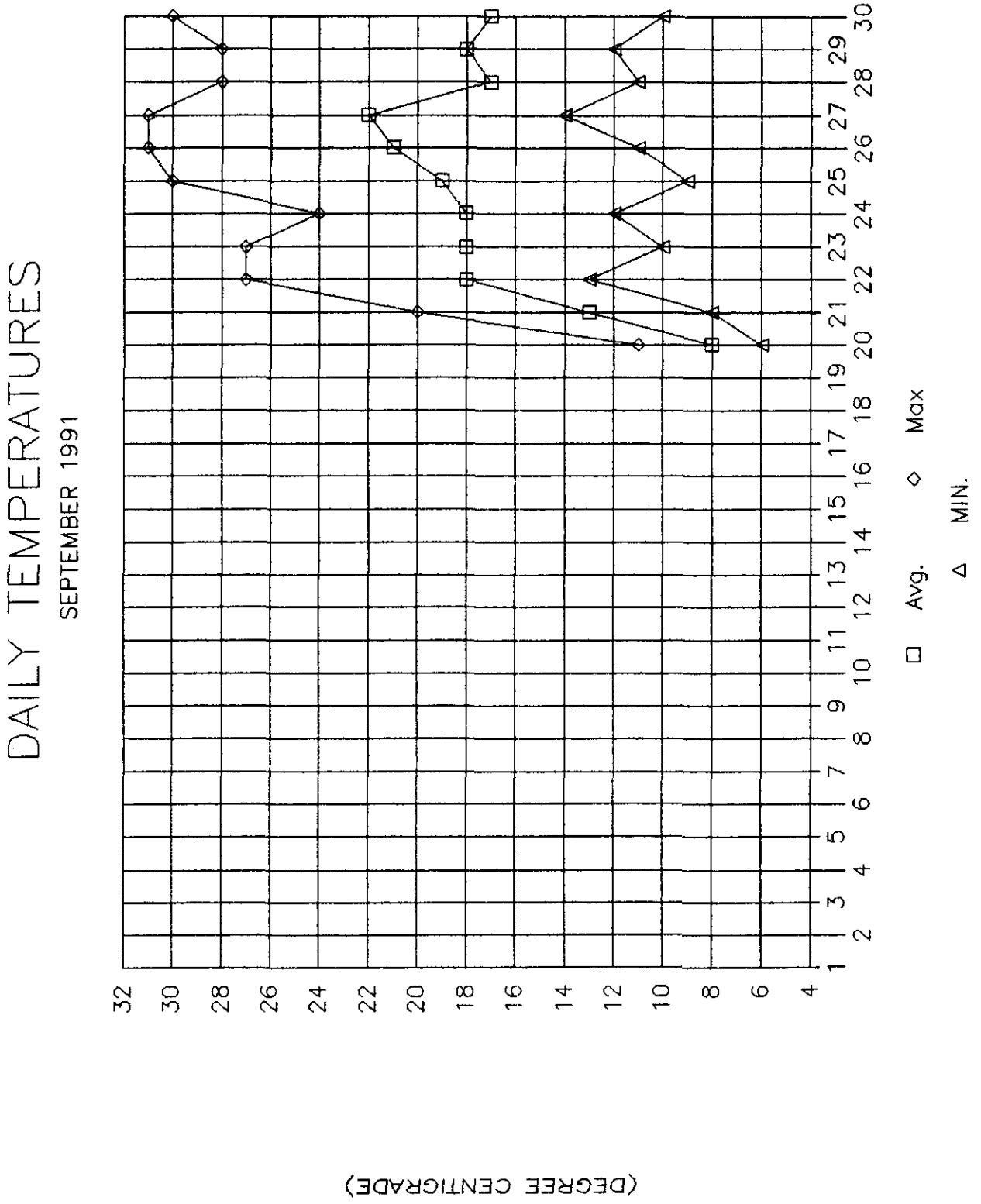
28
29
30
31
Avg.
Max
MIN.


DAILY TEMPERATURES
SEPTEMBER 1991
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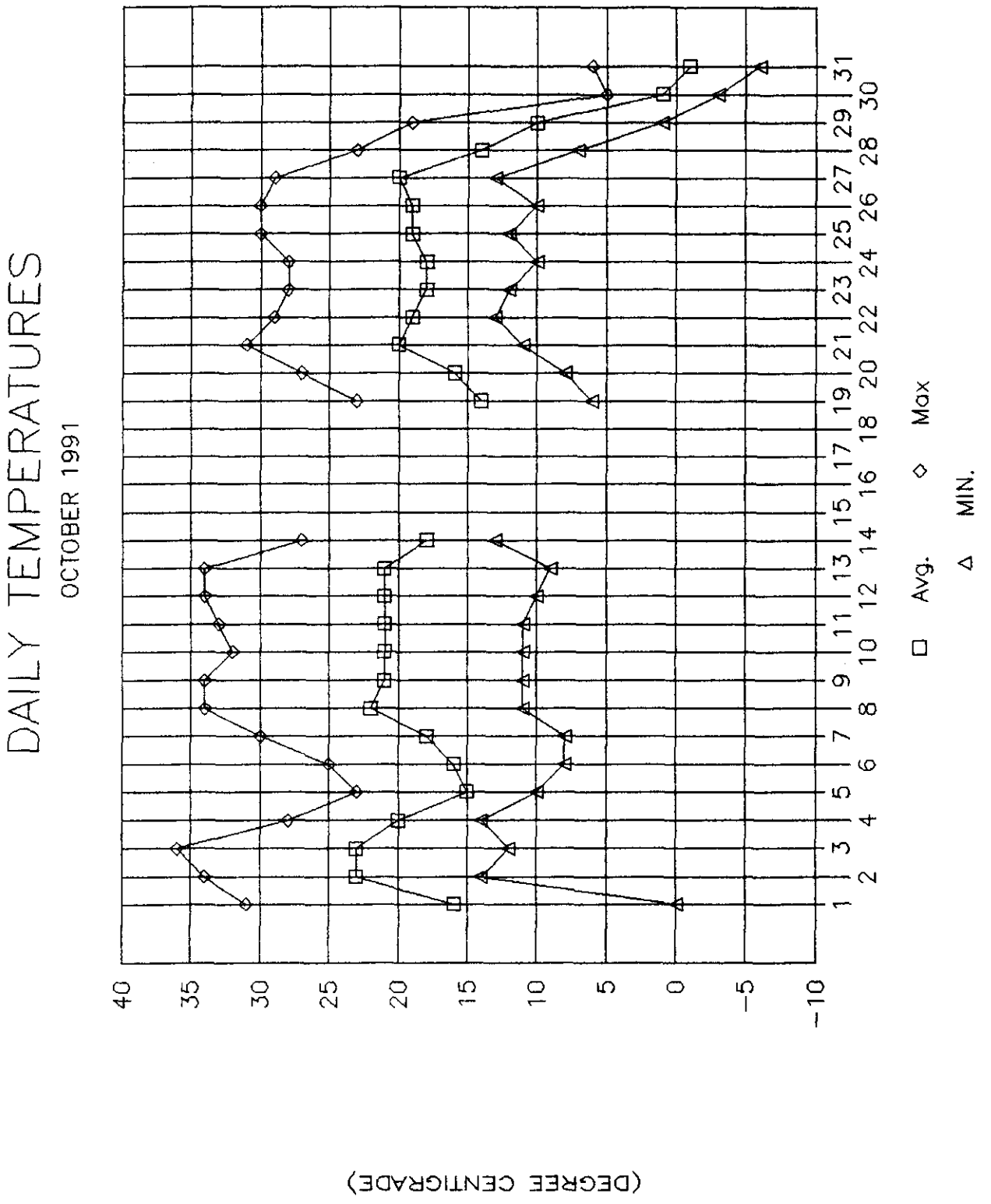
Avg.
Max
MIN.
(DEGREE CENTIGRADE)


DAILY TEMPERATURES
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35
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25
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15
10
5
0
-5
-10
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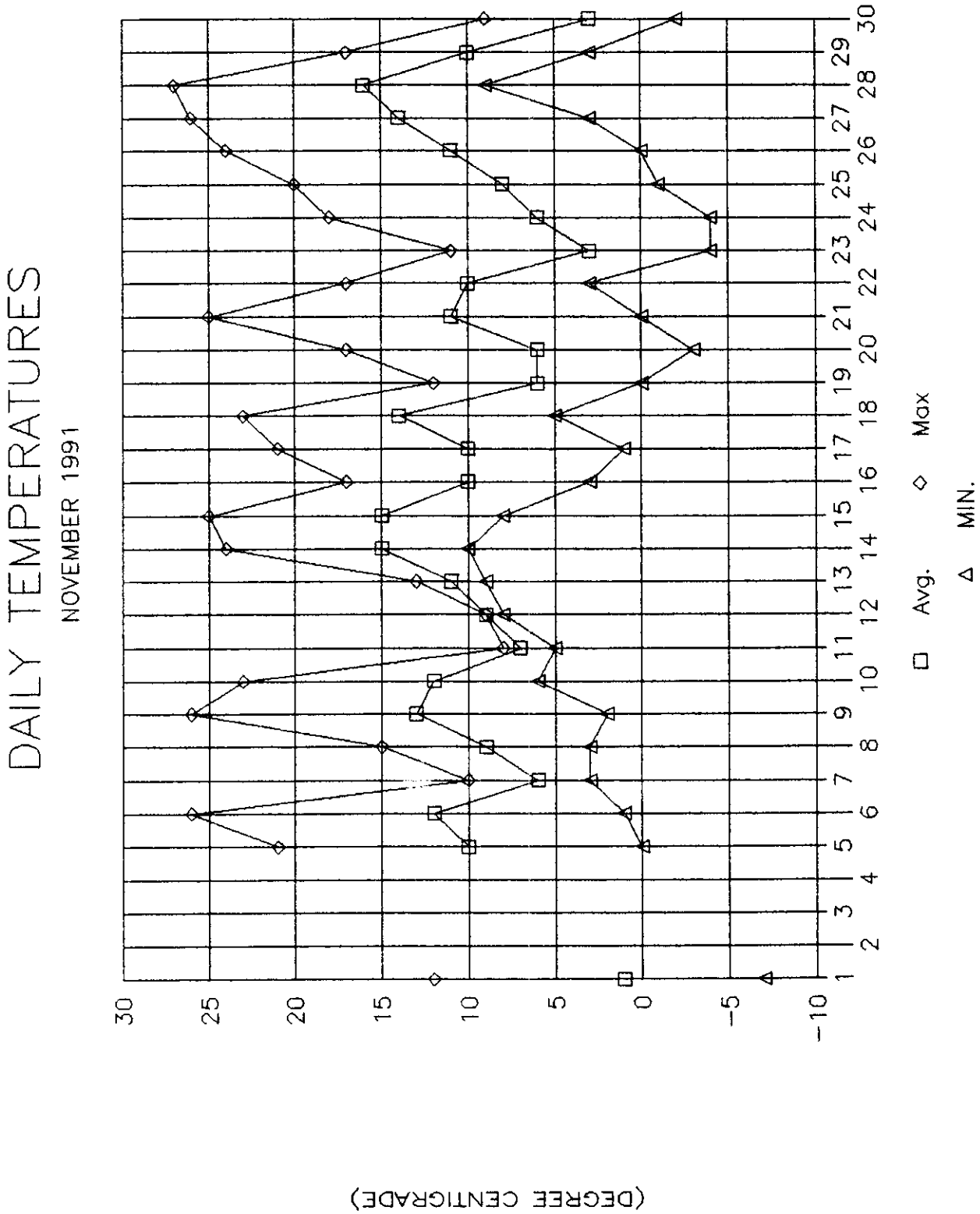
Avg.
Max
MIN.
(DEGREE CENTIGRADE)


DAILY TEMPERATURES
NOVEMBER 1991
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5
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-5
-10
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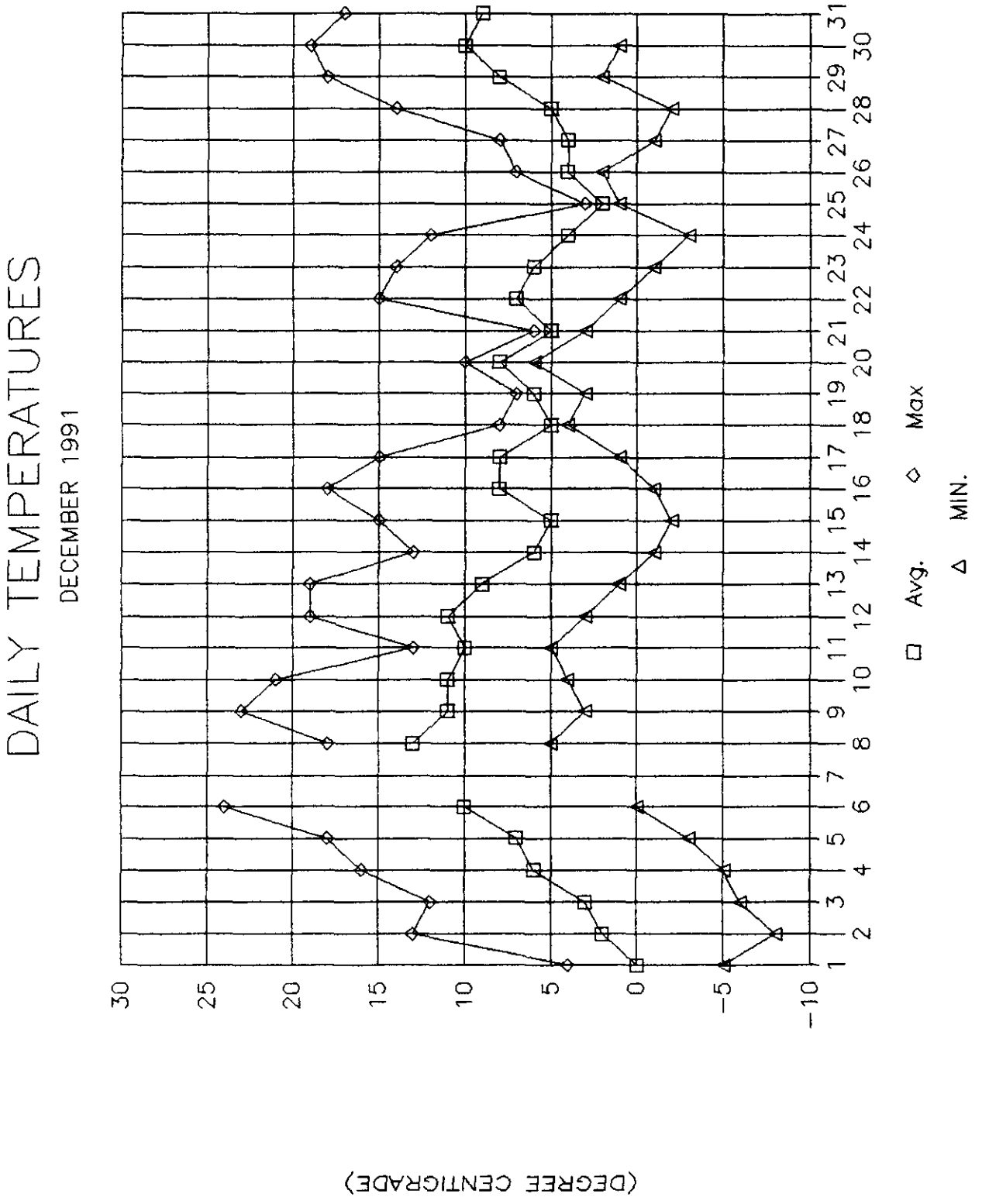
Avg.
Max
MIN.
(DEGREE CENTIGRADE)


DAILY TEMPERATURES
DECEMBER 1991
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25
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-5
-10
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8
9
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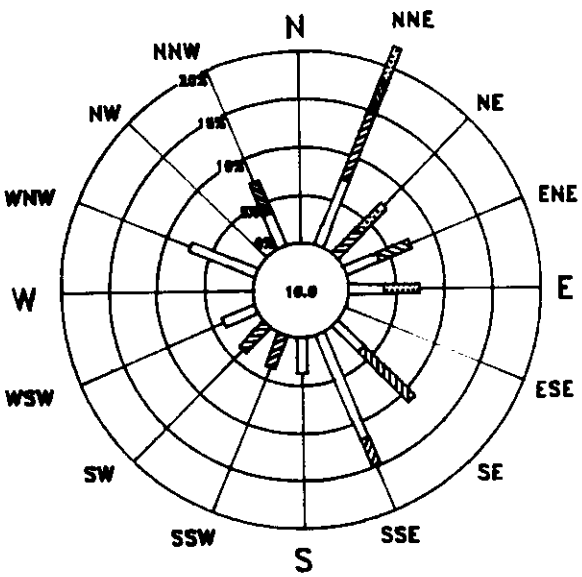
31
Avg.
Max
MIN.
(DEGREE CENTIGRADE)

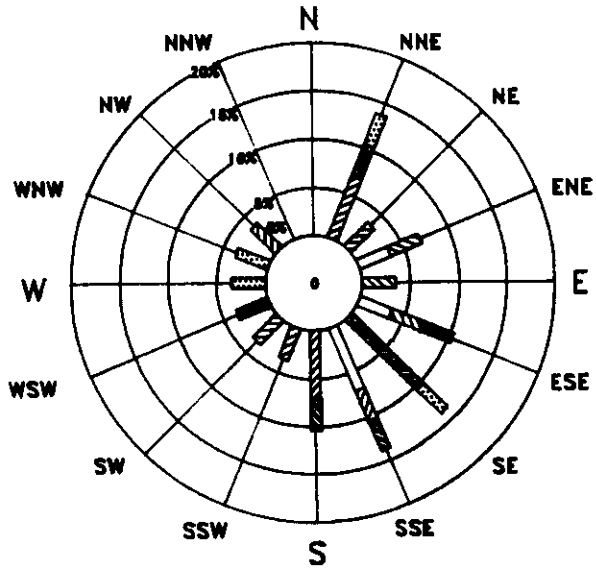
Appendix 7
Monthly Windroses

WINDROSES FOR JANUARY-APRIL 1991

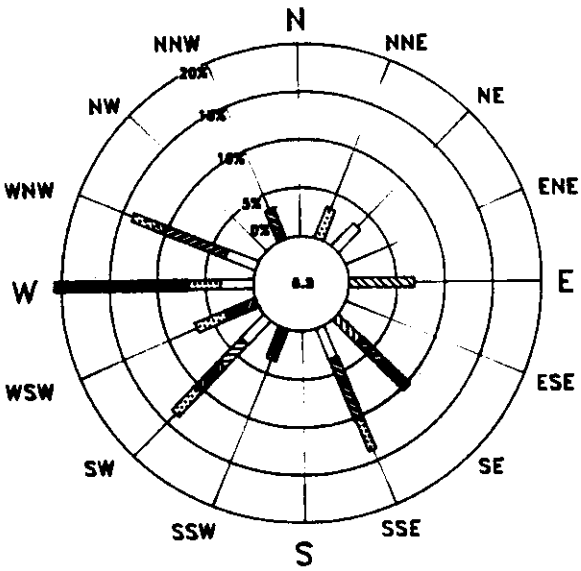
JANUARY



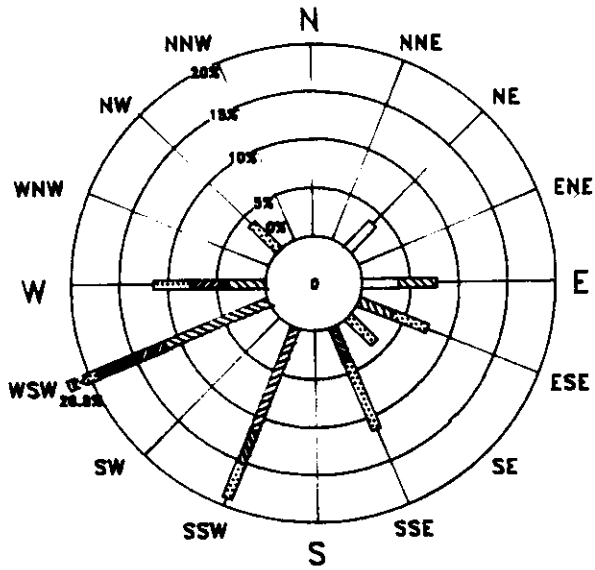
FEBRUARY



MARCH



APRIL

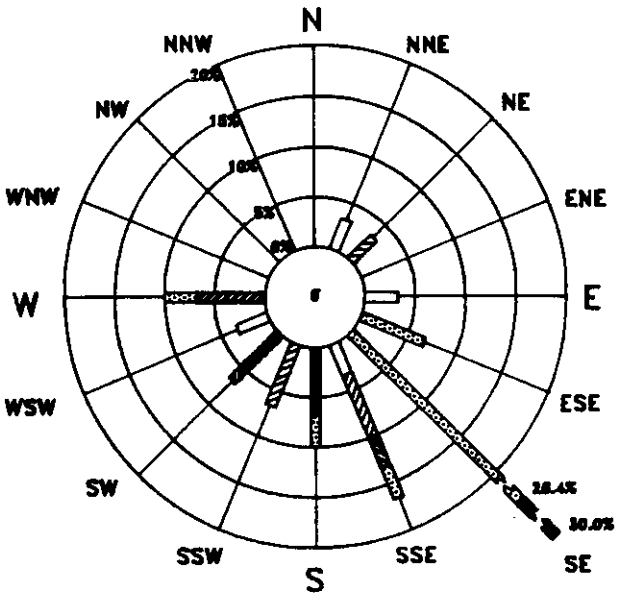


LEGEND

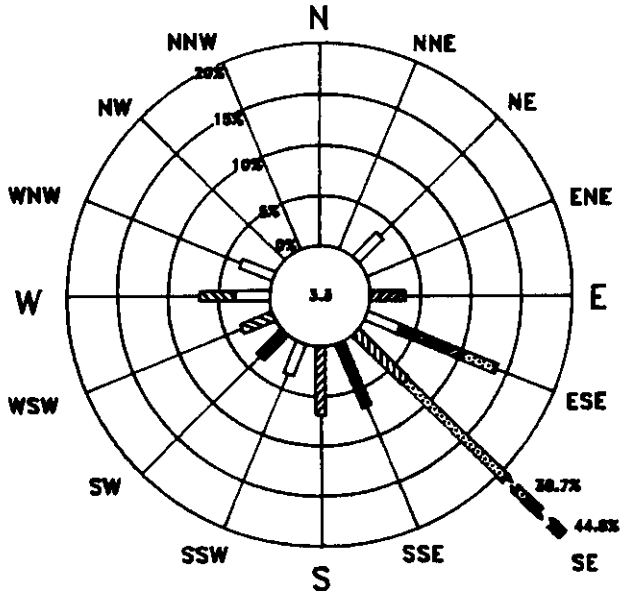
WIND VELOCITY IN METERS PER SECOND

WINDROSES FOR MAY-AUGUST 1991

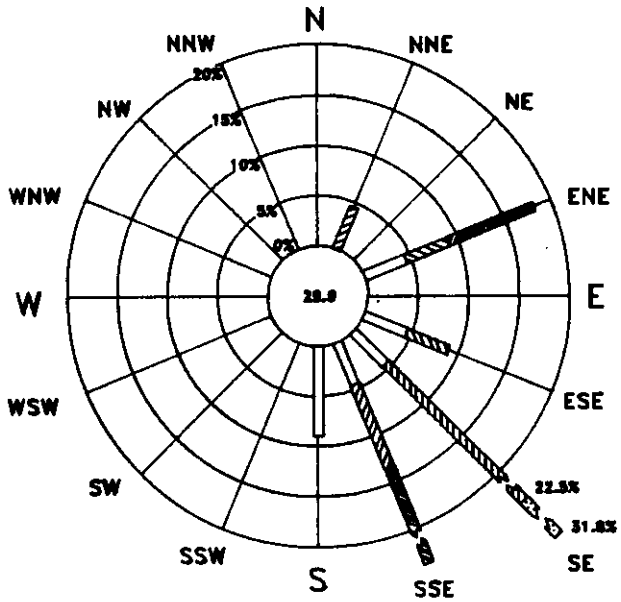
MAY



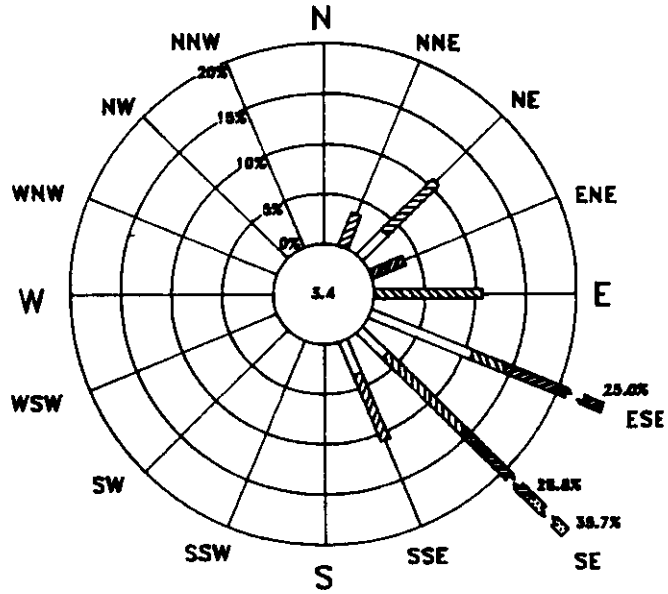
JUNE



JULY



AUGUST

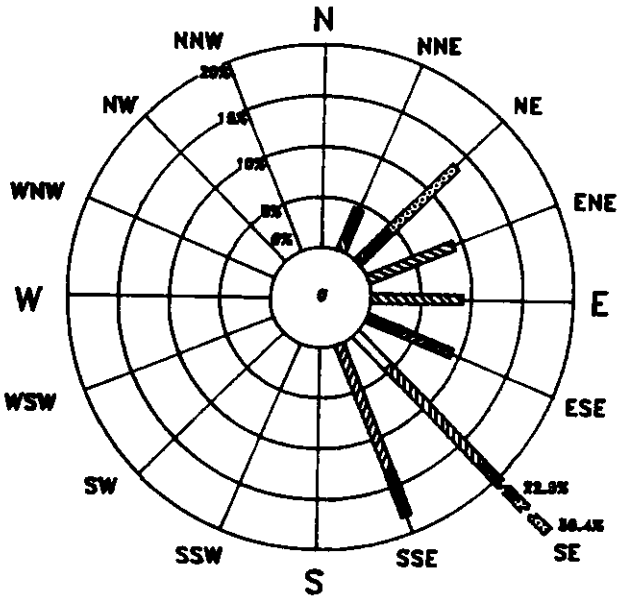


LEGEND

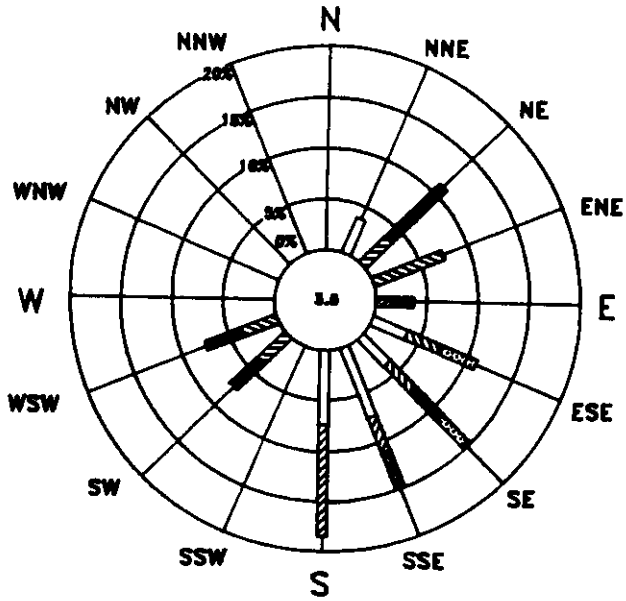
WIND VELOCITY IN METERS PER SECOND

WINDROSES FOR SEPTEMBER-DECEMBER 1991

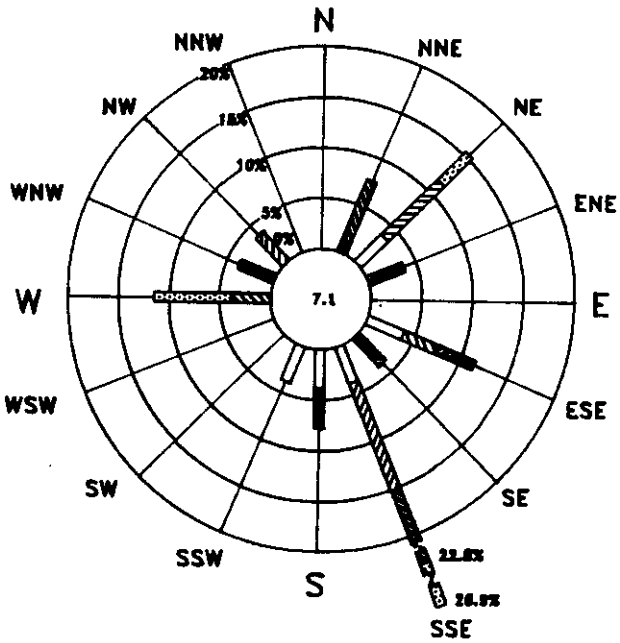
SEPTEMBER



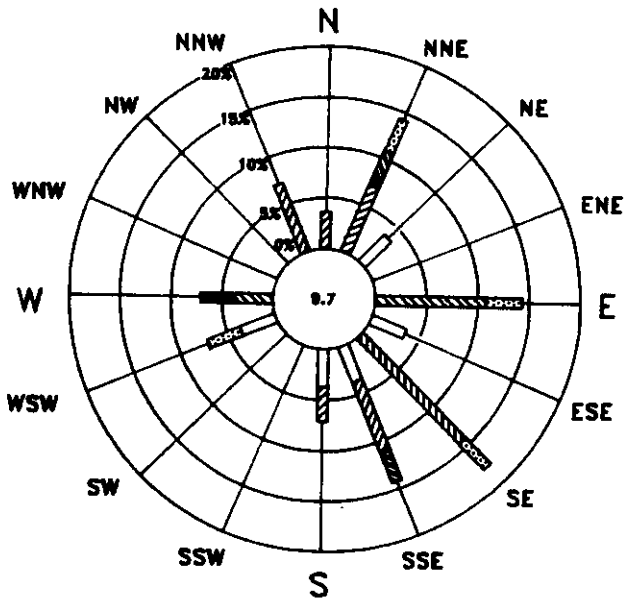
OCTOBER



NOVEMBER



DECEMBER



LEGEND

WIND VELOCITY IN METERS PER SECOND

Appendix 8
Summaries of Each Well Sampled in 1991

SUMMARY OF BARN WELL, DEWEY LAKE, ROUND FIVE

WELL CHARACTERISTICS

Barn Well is located approximately three and four tenths miles 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) (Cooperand Glanzman, 1971). Water is pumped using an electric submersible pump.

SAMPLING PROCESS

Water samples were collected on 07-18-91 from a running stream of water from a spigot located in the owner's yard. Samples were filtered through a 0.45 micron filter with a portable peristaltic pump. Samples were collected for Controls for Environmental Pollution for analysis and for the WIPP project archive. Samples were provided to Sandia National Laboratories and the New Mexico Environmental Evaluation Group. Samples were also collected for radionuclide analysis at a later date pending the issuance of a contract for analysis.

FIELD ANALYTICAL RESULTS

Round five analytical results for Barn Well were as follows: pH 7.52, Specific Gravity 1.0010 @ 21.6 C, Specific Conductivity 1004 umhos/cm @ 25.0 C. Average readings for Alkalinity, Chlorides and Divalent Cations were 285.0 mg/l, 60.0 mg/l and 5.0 meq/l respectively.

COMPARISON OF ROUND FIVE RESULTS WITH PREVIOUS ROUNDS

Round five results compare favorably with results obtained from the previous four sampling rounds. This comparison was made by comparing chemical parameter averages for round five 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 FIVE
Alkalinity 282.3 mg/l	Alkalinity 285.0 mg/l
Chlorides 49.4 mg/l	Chlorides 60.0 mg/l
Di-Cats 6.4 meq/l	Di-Cats 5.0 meq/l

SUMMARY OF H-05c, MAGENTA, ROUND-6

WELL CHARACTERISTICS

H-05c is located 2.7 miles northeast of the center of the WIPP site, (1005.55 FNL, 134.95 FEL, Section 15, Township 22S, Range 31 E). Ground monument elevation is 3505.78 ft. amsl, and top of casing (TOC) is at an elevation of 3506.04 feet amsl (SAND88-1065).

H-05c was completed on 06-03-78 to a total depth of 1076 ft. below ground surface (BGS). Well casing (J-55, 15.5#/ft.) is installed to a depth of 1024 feet. The well was originally completed open hole in the Rustler/Salado Contact, 1041 to 1076 ft. (BGS). After testing of the Rustler/Salado Contact was completed, a bridge plug was installed at a depth of 935 ft. BTOC. The well was re-completed in the Culebra from 899 to 924 ft BGS. The Culebra at this location is situated at a depth from 895 to 925 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 to 812 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 1806-25) and a 2.8 inch Ardvark sliding end packer (SN 3690-435). A 3" X 1-1/2" packer feed through nipple was used to facilitate monitoring of formation pressures. The total length of the assembly was approximately 7.55 feet.

Two geokon 4500H vibrating wire transducers were utilized to monitor formation pressures. A 0-150 psi pressure range (SN 3427) transducer was attached to the tubing bundle and installed at a depth of 675 feet BTOC to monitor the integrity of the packer seal. A second transducer (0-250 psi, SN 11871) 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 07-11-91 the pump/packer assembly was installed in the well. The bottom of the assembly was positioned at a depth of 783 feet BTOC. Static water level just prior to installation measured 352.98 feet BTOC (Solinst probe 75-CG-0053). The well was pumped for a total of 7 days at an average rate of 11.53 gallons per hour.

Three serial samples were collected; the first on 07-12-91 after approximately 238 gallons of water had been pumped from the well. Final samples were collected on 07-17-91 after approximately 1606 gallons of water (approximately 3-1/2 well bore volumes) had been pumped from the well.

Final samples were sent to Controls for Environmental Pollution. Samples were also provided to Sandia National Laboratories. The New Mexico Environmental Evaluation Group were offered samples for independent analysis but declined the samples. Archival samples were collected for the WIPP Project.

ROUND-6 SERIAL SAMPLING RESULTS

Eh fluctuated during the 3 days of sampling measuring 101 mv, 197 mv, and 77 mv respectively.

pH remained fairly stable during the 3 days of sampling measuring 7.99 S.U., 8.00 S.U. and 7.97 S.U. respectively.

Temperature measured 21.8 C. on day 1, 22.2 C. on day 2 and 22.6 C. on day 3 .

Specific Gravity measured 1.0050 @ 21.5 C. on day 1, and 1.0060 @ 23.6 C. on day 3.

Specific Conductance measured 8600 on day 1, and 8460 on day 3.

Alkalinity, chlorides and divalent cations remained fairly stable throughout the 3 day sampling period. Alkalinity averaged 54.0 mg/l, 54.0 mg/l and 53.9 mg/l respectively. Chlorides averaged 1171 mg/l, 1046 mg/l and 1045 mg/l respectively. Divalent cations averaged 42.0 meq/l, 41.9 meq/l and 42.0 meq/l respectively.

Both iron parameters, (total-iron and ferrous-iron) increased from sample one to sample two then remained stable for the remainder of the sampling period. Total-iron averaged 0.14 mg/l, 0.21 mg/l and 0.22 mg/l respectively. Ferrous iron averaged 0.13 mg/l, 0.19 mg/l and 0.19 mg/l respectively.

COMPARISON OF ROUND-6 RESULTS WITH PREVIOUS ROUNDS

The amount of water pumped prior to final sampling for each of the six rounds is as follows; 5,800 gallons, 1,900 gallons, 2,500 gallons, 1,997 gallons, 1940 gallons, and 1606 gallons respectively. Comparison of round 6 results with results obtained from the first five rounds, indicate that a representative sample was obtained. This comparison was made by comparing chemical parameter averages for the final day of round-6 sampling with the average of the chemical parameter values obtained for the last day of sampling for each of the previous five rounds. The results are presented below.

AVG. OF FINAL DAY RESULTS FOR LAST FIVE ROUNDS	AVG. OF FINAL DAY FOR ROUND-6
Alkalinity 57.7 mg/l	Alkalinity 53.9 mg/l
Chlorides 1033 mg/l	Chlorides 1045 mg/l
Di-Cats 42.2 meq/l	Di-Cats 42.0 meq/l
Total Iron 0.73 mg/l	Total Iron 0.22 mg/l

The averages for Total iron from the first five rounds is misleading because the first round averages are much higher than the other four rounds.

SUMMARY FOR H-06c, MAGENTA, ROUND SIX

WELL CHARACTERISTICS

H-06c drill hole is located 2.6 miles northwest of the WIPP site at T22S R31E Section 18 281.06FNL and 374.47FWL in southeastern Eddy County New Mexico. H-06c was completed to a depth of 741 feet BGS on 06-26-78. Casing, 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 Salado interval open from 700 to 741 ft. BGS. After hydrologic testing of the Rustler formation was completed a bridge plug was set below the Culebra Dolomite, 641 ft. BTOC. The Culebra interval was then perforated from 604 to 627 ft. BTOC. The well bore was left undisturbed until 8-20-86 when a second bridge plug was installed 534 ft. BTOC and the casing was again perforated from 490 to 514 ft. BTOC exposing the Magenta Dolomite to facilitate water quality sampling for the WIPP site.

SAMPLING PROCESS

The sampling configuration for H-06c consisted of a model 1800 Bennett sample pump (SN 1806-11) and a 2.8" sliding end packer (SN 3690-435). The pump and packer were attached by a specially fabricated packer feed through nipple. The total length of the assembly was 7.5 feet. Two Geokon transducers were utilized to monitor the pressures in the well bore during testing. The first (SN 3432) was placed at a depth of 450 feet BTOC to monitor the integrity of the packer seal. The second (SN 9077) was attached to the packer feed through nipple and utilized to monitor pressures in the formation. 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 04-25-91 to a depth of 483 feet BTOC to the bottom of the pump intake. Static water level was measured just prior to the start of pumping at 289.47 feet BTOC. Actual downhole working pressure prior to the start of pumping was 81.11 psi at the pump intake. During the testing period 3139 gallons of water were pumped from the well bore at an average pumping rate of 19 gallons per hour.

Four serial samples were collected; the first sample was collected on 04-29-91 after approximately 1813 gallons of water were pumped and final samples were collected on 05-02-91 after approximately 3021 gallons of water (roughly 16 well bore volumes) had been pumped from the well. Samples were collected for CEP and SNL. An offer was extended to the NMEEG to collect samples for them, however NMEEG declined the samples. Archival samples were collected for the WIPP project. Samples were also collected for radionuclide analysis at a future date pending the issuance of a contract for analysis.

ROUND SIX SERIAL SAMPLING RESULTS

Eh fluctuated moderately during the four days of sampling measuring
+155 mv, +281 mv, +177 mv, +235 mv respectively.

pH measured 7.78 S.U., 7.77 S.U., 7.76 S.U., 7.80 S.U. respectively.

Temperature measured 21.8 C, 21.8 C, 21.7 C, 21.9 C respectively.

Specific Gravity was measured on the first and fourth days of testing and Specific Conductivity was measured on the first and fourth days of testing. Specific gravity measured 1.003 @ 20.8 C, and 1.002 @ 22.2 C. Specific conductivity measured 5,320 uMhos/cm @ 25 C on the first and fourth days of testing.

Alkalinity measurements averaged, 51.4 mg/l, 51.0 mg/l, 51.4 mg/l, 50.9 mg/l respectively.

Chlorides averaged 416 mg/l, 418 mg/l, 415 mg/l, and 417 mg/l respectively.

Divalent cations averaged 40.1 meq/l, 40.3 meq/l, 40.9 meq/l, 40.6 meq/l consecutively from day one through day four of testing.

Total iron and ferrous iron decreased with only slight fluctuations over the sampling period. Total iron averaged 0.24 mg/l, 0.23 mg/l, 0.19 mg/l, and 0.21 mg/l. Ferrous iron averaged 0.20 mg/l, 0.21 mg/l, 0.17 mg/l, and 0.19 mg/l respectively.

COMPARISON OF ROUND SIX RESULTS WITH PREVIOUS ROUNDS

The amount of water pumped prior to final sampling for the five previous rounds is 7,000 gallons, 4,800 gallons, 1,700 gallons, 2,200 gallons and 2,391 gallons respectively. Approximately 3021 gallons were pumped prior to final sampling during round six. A comparison of the average final day data for the five previous rounds and final day data for round six is described in the following table for alkalinity, chlorides, dications and total iron.

AVG. OF FINAL DAY RESULTS FOR LAST FIVE ROUNDS	AVG. OF FINAL DAY RESULTS FOR ROUND SIX
Alkalinity 51.40 mg/l	Alkalinity 50.90 mg/l
Chlorides 408.00 mg/l	Chlorides 417.00 mg/l
Dications 41.30 meq/l	Dications 40.60 meq/l
Total iron 0.20 mg/l	Total iron 0.21 mg/l

SUMMARY OF H-02c, CULEBRA, ROUND-3

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 TOC is at an elevation of 3378.41 feet amsl.

H-02c was completed on 02-05-77 to a total depth of 795 feet 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 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.

SAMPLING PROCESS

A Bennett pump/packer assembly was used for this sampling round. The assembly consisted of a model 1800 Bennett Sample Pump (SN 1806-25) 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 7.67 feet.

Two Geokon 4500H vibrating wire transducers were utilized to monitor formation pressures. A 0-150 psi pressure range transducer (SN 3427) was attached to the tubing bundle and installed at a depth of 575 feet BTOC in order to monitor the integrity of the packer seal. A 0-250 psi transducer (SN 11871) 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 08-06-91 the pump/packer assembly was installed in H-02c. The bottom of the assembly was positioned at a depth of 608 feet BTOC. Static water level just prior to installation measured 373.31 feet BTOC (Solinst probe 75-CG-0053). This pump operated for eight days and pumped approximately 2048 gallons of water.

Final samples were sent to CEP and SNL. Samples were also collected for the WIPP project archive. Samples were collected for radionuclide analysis at a future date pending

the issuance of a contract for analysis. The NMEEG declined a sample.

ROUND-3 SERIAL SAMPLING RESULTS

Four serial samples were collected from 08-09-91 to 08-14-91. The first sample was collected after approximately 673 gallons of water had been pumped. The final sample was collected after approximately 1957 gallons (five well bore volumes) of water had been pumped.

Eh declined slightly during the sampling period. From 08-09-91 to 08-14-91 four measurements were taken. The measurements were +205 mv, +195 mv, +193 mv, and +190 mv, respectively.

pH measurements declined slightly during the sampling period. The measurements were 8.05 S.U., 8.02 S.U., 7.97 S.U., and 7.94 S.U., respectively.

Temperature fluctuated during the sampling period. From 08-09-91 to 08-14-91 four measurements were taken. The measurements were 20.6 C., 22.3 C., 22.3 C., and 21.6 C respectively.

Specific Gravity measured 1.008 @ 21.3 C. on 08-09-91, and 1.008 @ 21.8 C. on 08-14-91.

Specific Conductance measured 13,580 umhos/cm @ 25.0 C on 08-09-91, and 12,700 umhos/cm @ 25.0 C on 08-14-91.

Alkalinity, chlorides and divalent cations fluctuated slightly throughout the sampling period. For the four samples collected alkalinity averaged 59.6 mg/l, 60.7 mg/l, 56.8 mg/l, and 54.8 mg/l, respectively. Chlorides averaged 3,290 mg/l, 3,091 mg/l, 3,038 mg/l, and 2,953 mg/l, respectively. Divalent cations averaged 47.9 meq/l, 46.7 meq/l, 47.3 meq/l, and 46.9 meq/l respectively.

Both iron parameters, (total-iron and ferrous-iron) fluctuated moderately during the sampling period. Total iron averaged 1.53 mg/l, 1.49 mg/l, 1.62 mg/l, and 1.29 mg/l, respectively. Ferrous iron averaged 0.84 mg/l, 1.00 mg/l, 1.23 mg/l, and 0.93 mg/l respectively.

COMPARISON OF PREVIOUS ROUNDS WITH ROUND THREE RESULTS

The amount of water pumped prior to final sampling during the first two rounds was 6,660 gallons and 4,294 gallons respectively compared to 1957 gallons for round three. Alkalinity, Chlorides and Divalent Cations results were slightly lower than the average of the two previous rounds. Total and ferrous iron were somewhat higher, probably the result of an incomplete packer seal.

AVERAGE OF FINAL DAY RESULTS FOR TWO PREVIOUS ROUNDS	AVERAGE OF FINAL DAY FOR ROUND THREE
Alkalinity 59.6 mg/l	Alkalinity 54.8 mg/l
Chlorides 3418 mg/l	Chlorides 2953 mg/l
Di-cats 50.6 meq/l	Di-cats 46.9 meq/l
Total Iron 0.99 mg/l	Total Iron 1.29 mg/l

SUMMARY FOR H-03b1, MAGENTA, ROUND SIX

WELL CHARACTERISTICS

H-03b1 drill hole is located 0.8 miles south of the WIPP site at T22S, R31E, Section 29, 2085.31 FSL and 138.10 FEL in southeastern Eddy County New Mexico. H-03b1 was completed to a depth of 902 feet BGS on 08-12-76. Casing, 6.625 inch O.D. type J-55, 24.0 lb/ft., was set in the borehole to a depth of 891 ft. BGS leaving the Rustler Salado interval open from 813 to 837 ft. BGS. The well was next completed in the Culebra and Magenta. A bridge packer was installed at approximately 795 ft. BGS. The casing was perforated in the Magenta (562 to 590 ft. BGS) and in the Culebra (675 to 703 ft. BGS). A PIP was installed at a depth of approximately 562 ft. 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

The sampling configuration for H-03b1 consisted of a model 1800 Bennett sample pump (SN 1802) and a 3.5" 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 7.71 feet. Two Geokon 4500-H vibrating wire transducers were utilized to monitor formation pressures. The first transducer (SN 3432) was attached to the tubing bundle 25 feet above the pump/packer assembly at a depth of 500 ft. BTOC. A second transducer (SN 9077) was attached to the packer feed through assembly in order to monitor pressures below the packer. Data from the transducers was collected and stored continuously utilizing a Micro-10 datalogger (Sn 20).

The pump/packer assembly was installed on 05-13-91 to a depth of 533 feet BTOC to the bottom of the pump intake. Static water level was measured just prior to the start of pumping at 252.49 feet BTOC. Actual downhole working pressure prior to the start of pumping was 119.40 psi at the pump intake. During the testing period 1781 gallons of water were pumped from the well bore at an average pumping rate of 9 gallons per hour.

Four serial samples were collected. The first sample was collected on 05-16-91 after approximately 604 gallons of water were pumped and final samples were collected on 05-21-91 after approximately 1702 gallons of water (4+ well bore volumes) had been pumped from the well. Samples were collected for CEP and SNL. An offer was extended to the NMEEG to collect samples for them, however NMEEG declined

the samples. Archival samples were collected for the WIPP project.

ROUND SIX SERIAL SAMPLING RESULTS

Eh increased moderately during the four days of sampling measuring
-41 mv, -30 mv, -23 mv, +9 mv respectively.

pH measured 7.86 S.U., 7.86 S.U., 7.82 S.U., 7.84 S.U. respectively.

Temperature measured 22.3 C, 22.2 C, 23.3 C, 22.1 C respectively.

Specific Gravity was measured on the first and fourth days of testing and Specific Conductivity was measured on the first and fourth days of testing. Specific gravity measured 1.006 @ 22.7 C, and 1.007 @ 22.0 C. Specific conductivity measured 12,500 umhos/cm @ 25.0 C on the first day and 12,420 umhos/cm @ 25.0 C on the fourth day of testing.

Alkalinity measurements averaged, 47.3 mg/l, 47.7 mg/l, 47.5 mg/l, 46.6 mg/l respectively.

Chlorides averaged 3,413 mg/l, 3,410 mg/l, 3,395 mg/l, and 3,413 mg/l respectively.

Divalent cations averaged 73.2 meq/l, 73.4 meq/l, 72.1 meq/l, 73.1 meq/l consecutively from day one through day four of testing.

Total iron and ferrous iron were low and fluctuated slightly over the sampling period. Total iron averaged 0.04 mg/l, 0.05 mg/l, 0.05 mg/l, and 0.05 mg/l. Ferrous iron averaged 0.03 mg/l, 0.05 mg/l, 0.04 mg/l, and 0.05 mg/l respectively.

COMPARISON OF ROUND SIX RESULTS WITH PREVIOUS ROUNDS

The amount of water pumped prior to final sampling for the five previous rounds is 3,800 gallons, 1,500 gallons, 1,700 gallons, 2,280 gallons and 1,795 gallons respectively. Approximately 1,702 gallons were pumped prior to final sampling during round six. A comparison of the average final day data for the five previous rounds and final day data for round six is described in the following table for alkalinity, chlorides, dications and total iron.

AVG. OF FINAL DAY RESULTS FOR LAST FIVE ROUNDS	AVG. OF FINAL DAY RESULTS FOR ROUND SIX
Alkalinity 46.1 mg/l	Alkalinity 46.6 mg/l
Chloride 3,344 mg/l	Chloride 3,413 mg/l
Di-cats 73.6 meq/l	Di-cats 73.1 meq/l
Total iron 0.26 mg/l	Total iron 0.05 mg/l

SUMMARY OF WELL H-04b CULEBRA, ROUND-6

WELL CHARACTERISTICS

Well H-04b is 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 amsl, and the 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 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. The culebra lies from 498-522 feet BGS at this location.

SAMPLING PROCESS

A pump/packer assembly was used to sample H-04b. 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 7.52 feet.

Two Geokon 4500H vibrating wire transducers were used to monitor formation pressures. A 0-150 psi pressure range (SN 3427) 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 (0-250 psi, SN 11871) was attached to the packer feed through assembly 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 09-12-91 the pump/packer assembly was installed in the well. The bottom of the assembly was positioned at a depth of 457.52 feet BTOC. Static water level just prior to installation measured 333.93 feet BTOC, (Solinst probe 75-CG-0102). The well was pumped for a total of 6 days at an average rate of 12.63 gallons per hour.

Three serial samples were collected; the first on 09-16-91 after approximately 1135 gallons of water had been pumped and final samples were collected on 09-18-91 after approximately 1715 gallons (approximately 9-1/2 well bore volumes) of water had been pumped from the well. Final samples were sent to CEP for independent analysis. Samples were also collected for SNL. The NMEEG was informed of the sampling activity but declined to collect samples. Archival samples were collected for the WIPP Project.

ROUND-6 SERIAL SAMPLING RESULTS

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

Turbidity measured 1.1 NTU, 1.4 NTU and 1.1 NTU.

Eh measured +135 mv, +123 mv and +115 mv.

pH measured 7.69 S.U. , 7.72 S.U. and 7.74 S.U. respectively.

Temperature measured 21.7 C, 21.3 C and 20.6 C.

Specific gravity measured 1.016 @ 22.0 C on day one and 1.016 @ 20.1 C on day three.

Specific conductivity measured 26,500 umhos @25 C. on day one and 26,800 umhos @ 25 C. on day three.

Alkalinity measurements averages for each of the three days were 65.6 mg/l, 65.8 mg/l and 64.8 mg/l respectively.

Chlorides averaged 7,586 mg/l, 7,586 mg/l and 7,599 mg/l respectively.

Divalent cations from day one to day three averaged 72.0 meq/l, 71.6 meq/l and 70.9 meq/l respectively.

Both Iron parameters decreased steadily over the three day period. Total Iron averaged 0.92 mg/l, 0.90 mg/l and 0.83 mg/l. Ferrous Iron Averaged 0.83 mg/l 0.84 mg/l and 0.78 mg/l respectively.

COMPARISON OF ROUND-6 RESULTS WITH PREVIOUS ROUNDS

The amount of water pumped prior to final sampling for each of the six rounds is as follows; 4700 gallons, 2450 gallons, 2500 gallons, 1048 gallons, 1286 and 1715 gallons respectively. Round-6 parameters compare favorably to all of the previous rounds of testing. This comparison was made by comparing chemical parameter averages for the final day of sampling for rounds 1-5 with the average of the chemical parameter values obtained for the last day of sampling for round 6. The results are presented below.

AVG. OF FINAL DAY RESULTS FOR LAST FIVE ROUNDS	AVG. OF FINAL DAY FOR ROUND-6
Alkalinity 68.9 mg/l	Alkalinity 64.8 mg/l
Chlorides 7472 mg/l	Chlorides 7599 mg/l
Di-Cats 71.5 meq/l	Di-Cats 70.9 meq/l
Total iron 0.87 mg/l	Total Iron 0.83 mg/l

SUMMARY OF RANCH WELL, DEWEY LAKE, ROUND-SIX

WELL CHARACTERISTICS

Ranch Well is located approximately three and two tenths miles south-southeast of the center of the WIPP site. Surface elevation is 3,310 ft. amsl. The total depth of the well is 156 feet BGS. Water is pumped to the surface by an electric submersible pump.

SAMPLING PROCESS

Samples were collected on 07-16-91, from a discharge pipe above a storage tank located approximately twenty feet north of the well. Samples were filtered with a portable peristaltic pump. Samples were collected for CEP and SNL. Archival samples were collected for the WIPP project. NMEEG was present at the sampling and collected samples for independent analysis. Samples were also collected for Radionuclide analysis at a future date pending the issuance of a contract for analysis.

FIELD ANALYTICAL RESULTS

Round six analytical results for Ranch Well were as follows; pH 7.05 SU, Specific Gravity 1.0042 @ 22.2 degrees C, Specific Conductivity 3418 @ 25 degrees C. Average readings for Alkalinity, Chlorides and Divalent Cations were; 250.0 mg/l, 362 mg/l, and 33.0 meq/l respectively.

COMPARISON OF ROUND SIX RESULTS WITH PREVIOUS ROUNDS

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

AVERAGE OF PREVIOUS FIVE ROUNDS	AVERAGE OF ROUND SIX
Alkalinity 243.0 mg/l	Alkalinity 250.0 mg/l
Chlorides 378.6mg/l	Chlorides 362.0 mg/l
Di-Cats 35.9 meq/l	Di-cats 33.0 meq/l

Round two 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.

SUMMARY OF WIPP-19, CULEBRA, ROUND-6

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, TOC is at an elevation of 3435.14 feet amsl.

WIPP-19 was drilled in May of 1978 to a total depth of 1038 feet 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.

SAMPLING PROCESS

A Bennett pump/packer assembly was used for this sampling round. The assembly consisted of a model 1800 Bennett Sample Pump (SN 1806-11) 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 7.48 feet.

Two Geokon 4500H vibrating wire transducers were utilized to monitor formation pressures. A 0-150 psi pressure range (SN 3427) transducer was attached to the tubing bundle 25 ft above the top of the pump at a depth of 700 feet BTOC in order to monitor the integrity of the packer seal. A second transducer (0-250 psi, SN 11871) 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 07-24-91 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 431.02 feet BTOC, (Solinst probe 75-CG-0054). The well was pumped for a total of 7 days at an average rate of approximately 10.58 gallons per hour.

Three serial samples were collected; the first on 07-29-91 after approximately 1738 gallons of water had been pumped from the well. Final samples were collected on 07-31-91 after approximately 2417 gallons (approximately 7 well-bore

volumes) of water had been pumped from the well. Final samples were sent to CEP and SNL.

An offer was extended to the EEG to collect samples for them, however EEG declined the samples. Archival samples were collected for the WIPP Project. Samples were also collected for radionuclide analysis at a future date pending the issuance of a contract for analysis.

ROUND SIX SERIAL SAMPLING RESULTS

Eh fluctuated slightly throughout the sampling period measuring +109, +118, and +108 respectively.

pH measured 7.47 S.U., 7.38 S.U., and 7.42 S.U. respectively.

Temperature measured 22.1 C., 23.2 C., 23.2 C. respectively.

Specific Gravity measured 1.0550 @ 22.3 C. for sample 1, and 1.0530 @ 23.8 C. for sample 3.

Specific Conductance measured 92,100 @ 25 C. for sample 1, and 92,600 @ 25 C. for sample 3.

Alkalinity, chlorides and divalent cations fluctuated only slightly during the sampling period. Alkalinity averaged 61.3 mg/l, 57.6 mg/l and 58.2 mg/l respectively. Chlorides averaged 41583 mg/l, 39875 mg/l and 40818 mg/l respectively. Divalent cations averaged 165.6 meq/l, 165.6 meq/l and 165.9 meq/l respectively.

Both iron parameters, (total-iron and ferrous-iron) fluctuated moderately from sample 1 to sample 3. Total-iron averaged 2.27 mg/l, 2.48 mg/l, and 2.43 mg/l respectively. Ferrous iron averaged 1.45 mg/l, 1.36 mg/l, and 2.06 mg/l respectively.

COMPARISON OF ROUND-6 RESULTS WITH PREVIOUS ROUNDS

The amount of water pumped prior to final sampling for each of the five previous rounds is as follows; 2,400 gallons, 3,050 gallons, 5,300 gallons, 6,292 gallons and 5,516 gallons respectively. Approximately 2,417 gallons were pumped prior to final sampling during round six. A comparison of the average final day data for the five previous rounds and the final day data for round six is presented in the following table for alkalinity, chlorides, di-cats and total iron.

AVG. OF FINAL DAY RESULTS FOR LAST FIVE ROUNDS	AVG. OF FINAL DAY FOR ROUND-6
Alkalinity 66.7 mg/l	Alkalinity 58.2 mg/l
Chlorides 47,180 mg/l	Chlorides 40,818 mg/l
Di-Cats 220.3 meq/l	Di-Cats 165.9 meq/l
Total Iron 1.29 mg/l	Total Iron 2.43 mg/l

SUMMARY OF H-05b, CULEBRA, ROUND-6

WELL CHARACTERISTICS

H-05b is located approximately 2.7 miles northeast of the center of the WIPP site (1008.30 FNL and 236.22 FEL, Section 15, Township 22S, Range 31E). The ground monument elevation is 3505.38 feet amsl, and 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 installed to a depth of 881 feet BGS. The well is completed open hole in the Culebra which lies at a 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 1800 Bennett Sample Pump (SN 1806-11) 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 3432) transducer was attached to the tubing bundle 100 ft above the top of the pump at a depth of 740 feet below top of casing (BTOC) in order to monitor the integrity of the packer seal. A second transducer (0-250 psi, SN 9077) 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 06-12-91 the pump/packer assembly was installed in H-05b. The bottom of the assembly was positioned at a depth of 848 feet BTOC. Static water level just prior to installation measured 484.95 feet BTOC (Solinst probe 75-CG-0102). The well was pumped for a total of 10 days in two intervals at an average rate of approximately 11.36 gallons per hour. It was determined that three wellbore volumes was equivalent to approximately 1100 gallons of water.

Four serial samples were collected; the first on 06-14-91 after approximately 473 gallons of water had been pumped from the well. Final samples were collected on 06-25-91 after approximately 2,311 gallons (approximately 6 well bore volumes) of water had been pumped from the well. Final samples were sent to CEP for analysis. Samples were also provided to SNL and the NMEEG were offered samples for independent analysis. Archival samples were collected for

the WIPP Project.

ROUND-6 SERIAL SAMPLING RESULTS

Eh fluctuated during the 4 days of sampling measuring +81 mv, +85 mv, +103 mv, +102 mv, respectively.

pH remained fairly stable during the 4 days of sampling measuring 7.30 S.U., 7.24 S.U., 7.22 S.U., and 7.24 S.U., respectively.

Temperature measured 21.7 C., 22.6 C., 22.6 C., and 22.4 C. respectively.

Specific Gravity measured 1.1040 @ 23.4 C. for sample 1, and 1.104 @ 21.9 for sample 4.

Specific Conductance measured 154,300 umhos/cm @ 25.0 C for sample 1, and 152,300 umhos/cm @ 25.0 C for sample 4.

Alkalinity, chlorides and divalent cations fluctuated slightly from sample 1 to sample 4. Alkalinity averaged 49.8 mg/l, 47.8 mg/l, 47.4 mg/l,and 49.1 mg/l respectively.

Chlorides averaged 86,838 mg/l, 86,927 mg/l, 86,794 mg/l,and 87,105 mg/l respectively.

Divalent cations averaged 255.5 meq/l, 253.0 meq/l, 257.0 meq/l and 255.8 meq/l respectively.

Both iron parameters, (total-iron and ferrous-iron) decreased from sample one through sample three increasing slightly in sample four. Total-iron averaged 5.52 mg/l, 3.64 mg/l, 3.47 mg/l and 4.14 mg/l respectively. Ferrous iron averaged 5.30 mg/l, 3.57 mg/l, 3.44 mg/l,and 4.08 mg/l respectively.

COMPARISON OF ROUND-6 RESULTS WITH PREVIOUS ROUNDS

The amount of water pumped prior to final sampling for each of the six rounds is as follows; 1,100 gallons, 2,000 gallons, 1,450 gallons, 1,996, 2,253 and 2,407 gallons respectively. Round 6 results are in good agreement with results obtained from the first five sampling rounds. This comparison was made by comparing chemical parameter averages for the final day of round-6 sampling with the average of the chemical parameter values obtained for the last day of sampling for each of the previous five rounds. The results are presented below.

AVG. OF FINAL DAY RESULTS FOR LAST FIVE ROUNDS	AVG. OF FINAL DAY FOR ROUND-6
Alkalinity 50.0 mg/l	Alkalinity 49.1 mg/l
Chlorides 84,571 mg/l	Chlorides 87,105 mg/l
Di-Cats 256.8 meq/l	Di-Cats 255.8 meq/l
Total Iron 3.01 mg/l	Total Iron 4.14 mg/l

SUMMARY FOR H-06b, CULEBRA, ROUND SIX

WELL CHARACTERISTICS

H-06b drill hole is located 2.6 miles north west of the WIPP site at T22S R31E Section 18 196.34FNL and 322.96FWL in southeastern Eddy County New Mexico. H-06b was completed to a depth of 640 feet BGS on 07-05-78. A 5 in. ID well casing was installed to a depth of 590 feet BGS leaving the Culebra dolomite (604-627 feet BGS) and the remaining portion of the bore hole open (SAND85-7206). Ground elevation at H-06b is 3347.57 ft amsl and TOC elevation is 3348.25 ft amsl (SAND88-1065).

SAMPLING PROCESS

The sampling configuration for H-06b consisted of a Model 1800 Bennett sample pump (SN 1806-25) and a 2.8" sliding end packer (SN 3690-435). The pump and packer were attached by a specially fabricated packer feed through nipple. The total length of the assembly was 7.5 feet. Two geokon transducers were utilized to monitor the pressures in the well bore during testing. The first Sn 3432 was placed at a depth of 550 feet BTOC to monitor the integrity of the packer seal. The second (SN 9077) was attached to the packer feed through nipple and utilized to monitor pressures in the formation. 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 04-15-91 to a depth of 583 feet BTOC to the bottom of the pump intake. Static water level was measured just prior to the start of pumping at 302.29 feet BTOC. Actual downhole working pressure prior to the start of pumping was 118.67 psi at the pump intake. During the testing period 4631 gallons of water were pumped from the well bore at an average pumping rate of 25 gallons per hour.

Seven serial samples were collected; the first sample was collected on 04-16-91 after approximately 240 gallons of water were pumped and final samples were collected on 04-23-91 after approximately 4549 gallons of water (roughly 16 well bore volumes) had been pumped from the well. Samples were collected for CEP and SNL. An offer was extended to the NMEEG to collect samples for them, however NMEEG declined the samples. Archival samples were collected for the WIPP project. Samples were also collected for Radionuclide analysis at a future date pending the issuance of a contract for analysis.

ROUND SIX SERIAL SAMPLING RESULTS

Eh fluctuated only slightly during the seven day sampling period measuring +290 mv, +285 mv, +283 mv, +289 mv, +292 mv, +296 mv and +291 mv.

pH measured 6.98 S.U., 6.95 S.U., 6.97 S.U., 6.96 S.U., 6.94 S.U., 6.94 S.U. and 6.99 S.U. respectively.

Temperature measured 22.3 C, 21.4 C, 21.9 C, 21.2 C, 21.3 C, 21.7 C and 21.1 C respectively.

Specific gravity was measured on the first, sixth and seventh day of testing and Specific conductivity was measured on the first and seventh day of testing. Specific gravity measured 1.0440 @ 23.2 C, 1.0410 @21.7 C and 1.0410 @ 21.6 C. Specific conductivity measured 77,200 umhos/cm @ 25 C and 76,800 umhos/cm @ 25 C respectively.

Alkalinity measurements averaged, 96.8 mg/l, 95.3 mg/l, 94.2 mg/l, 93.6 mg/l, 94.7 mg/l, 94.5 mg/l and 95.3 mg/l consecutively.

Chlorides averaged 32,726 mg/l, 32,637 mg/l, 32,726 mg/l, 31,712 mg/l, 32,423 mg/l, 32,405 mg/l and 32,138 mg/l over the seven days of testing.

Divalent cations averaged 223.4 mg/l, 218.7 mg/l, 219.4 mg/l, 222.8 mg/l, 226.0 mg/l, 221.8 mg/l and 219.1 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 0.62 mg/l, 0.41 mg/l, 0.35 mg/l, 0.27 mg/l, 0.33 mg/l, 0.34 mg/l and 0.38 mg/l. Ferrous iron averaged 0.41 mg/l, 0.33 mg/l, 0.31 mg/l, 0.26 mg/l, 0.31 mg/l, 0.29 mg/l and 0.29 mg/l respectively.

COMPARISON OF ROUND SIX RESULTS WITH PREVIOUS ROUNDS

The amount of water pumped prior to final sampling for the five previous rounds is 79,744 gallons, 126,100 gallons, 87,500 gallons, 5142 gallons and 6127 gallons respectively, approximately 4549 gallons were pumped prior to final sampling during round six. A comparison of the average final day data for the five previous rounds and final day data for round six is described in the following table for alkalinity, chlorides, dications and total iron.

AVG. OF FINAL DAY RESULTS FOR LAST FIVE ROUNDS	AVG. OF FINAL DAY RESULTS FOR ROUND SIX
Alkalinity 94.3mg/l	Alkalinity 95.3 mg/l
Chlorides 32,071 mg/l	Chlorides 32,138 mg/l
Di-cats 191.7 meq/l	Di-cats 219.1 meq/l
Total Iron 0.23 mg/l	Total Iron 0.38 mg/l

SUMMARY OF WELL H-14, CULEBRA, ROUND-4

WELL CHARACTERISTICS

Well H-14 is located approximately two miles south-southwest of the WIPP site, (372.2 FSL, 562.4 FWL, Section 29, Township 22 South, Range 31 East). Surface elevation is 3345.48 feet amsl, and TOC is at an elevation of 3347.11 feet amsl. The well was completed in October of 1986 to a total depth of 589 feet BGS. The wellbore is cased with 5 inch ID (15.5 lb/ft) well casing to a depth of 532 feet BGS. From 532 to 589 feet BGS the well is open hole with a diameter of 4.75 inches. The Culebra Dolomite is located from 545 to 572 feet BGS.

SAMPLING PROCESS

A Bennett pump/packer assembly was used to sample H-14 during round four. The assembly was installed on 8-20-91 to a depth of 533 feet BTOC. Static water level just prior to installation measured 344.94 feet BTOC (Solinst Probe 75-CG-0053). This assembly consisted of a 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 7.50 feet. Two Geokon model 4500H vibrating wire transducers were utilized to monitor formation pressures. The first (SN 3427) was positioned 25 feet above the top of the pump assembly to monitor the integrity of the packer seal. The second (SN 11-871) was attached to the pump assembly to monitor formation pressures. Data was collected and stored on a continuous basis using a Micro-10 Geokon data logger (SN 20).

The well was pumped for a total of eight days at an average rate of 9.41 gallons per hour. Pumping was interrupted on one occasion from approximately 07:00 on 8-24-91 to 09:00 on 8-25-91. The pressure above the pump/packer assembly dropped from approximately 72 p.s.i. to 62 p.s.i. over the eight day sampling period, indicating that a complete packer seal had not been achieved.

Four serial samples were collected during round-4 testing. The first serial sample was collected on 8-23-91 after 768 gallons of water had been pumped from the well. Final samples were collected on 8-28-91 after 1747 gallons of water (8+ well bore volumes) had been pumped from the well. Final samples were sent to CEP and SNL for analysis. Final samples were collected for the WIPP project archive and for radionuclide analysis at a future date pending the issuance of a contract for analysis. The NMEEG was notified of the date of collection of final samples for this well, however they declined to take a sample.

ROUND FOUR SERIAL SAMPLING RESULTS

Four serial samples were collected during round four. They were collected on 8-23-91, 8-26-91, 8-27-91, and 8-28-91. The total amount of water pumped from the well prior to each sample was 768, 1237, 1459, and 1747 gallons respectively.

For serial samples one, two, and three Eh measured 359mv, 295mv, and 297mv respectively. No Eh measurement was taken during the fourth serial sample because of equipment failure.

Values for pH declined slightly over the sampling period. Values for serial samples one through four were 7.78 S.U., 7.75 S.U., 7.74 S.U., and 7.71 S.U. respectively.

Temperature values for serial samples one through four were 22.8 C., 22.7 C., 22.8 C., and 22.8 C. respectively.

Specific gravity measured 1.015 @ 21.5 C. on 8-23-91 and 1.014 @ 22.0 C. on 8-28-91.

Specific conductance measured 28,200 umhos/cm @25.0 C. on 8-23-91 and 25,200 umhos/cm @ 25.0 C on 8-28-91.

Alkalinity averaged 39.3 mg/l, 37.8 mg/l, 38.1 mg/l, and 38.1 mg/l for serial samples one through four respectively.

Chlorides averaged 10,267 mg/l, 9,320 mg/l, 9,226 mg/l, and 9,102 mg/l respectively for the four serial samples.

Divalent cations declined moderately over the sampling period averaging 152.0 meq/l, 140.0 meq/l, 139.1 meq/l, and 134.9 meq/l respectively.

Values for total iron for the four serial samples were 0.60 mg/l, 0.57 mg/l, 0.54 mg/l, and 0.46 mg/l respectively.

Values for ferrous iron for the four serial samples were 0.55 mg/l, 0.53 mg/l, 0.47 mg/l, and 0.39 mg/l respectively.

COMPARISON OF ROUND-FOUR RESULTS WITH PREVIOUS ROUNDS

The amount of water pumped prior to final sampling for the four rounds was 2,600, 3,000, 5,580 and 1,747 gallons respectively. The average final day results for alkalinity during round-four compare favorably with the results from the three previous rounds. The values for chlorides, di-cats and total iron are somewhat higher. Data for sampling round averages for alkalinity, chlorides, di-valent cations and total iron is presented in the following table.

AVERAGE OF FINAL DAY RESULTS FOR THREE PREVIOUS ROUNDS	AVERAGE OF FINAL DAY RESULTS FOR ROUND FOUR
Alkalinity 38.5 mg/l	Alkalinity 38.1 mg/l
Chlorides 8,504 mg/l	Chlorides 9,102 mg/l
Di-cats 129.7 meq/l	Di-cats 134.9 meq/l
Total iron 0.38 mg/l	Total iron 0.46 mg/l

SUMMARY FOR H03b1, MAGENTA, ROUND SIX

WELL CHARACTERISTICS

H-03b1 drill hole is located 0.8 miles south of the WIPP site at T22S, R31E,Section 29, 2085.31 FSL and 138.10 FEL in southeastern Eddy County New Mexico. H-03b1 was completed to a depth of 902 feet BGS (Below Ground Surface) on 08-12-76. Casing, 6.625 inch O.D. type J-55, 24.0 lb/ft., was set in the borehole to a depth of 891 ft. BGS leaving the Rustler Salado interval open from 813 to 837 ft. BGS. The well was next completed in the Culebra and Magenta. A bridge packer was installed at approximately 795 ft. BGS. The casing was perforated in the Magenta (562 to 590 ft. BGS) and in the Culebra (675 to 703 ft. BGS). A Production Inflation Packer (PIP) was installed at a depth of approximately 562 ft. 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

The sampling configuration for H-03b1 consisted of a model 1800 Bennett sample pump (SN 1802) and a 3.5" 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 7.71 feet. Two Geokon 4500-H vibrating wire transducers were utilized to monitor formation pressures. The first transducer (SN 3432) was attached to the tubing bundle 25 feet above the pump/packer assembly at a depth of 500 ft. BTOC. A second transducer (SN 9077) was attached to the packer feed through assembly in order to monitor pressures below the packer. Data from the transducers was collected and stored continuously utilizing a Micro-10 datalogger (Sn 20).

The pump/packer assembly was installed on 05-13-91 to a depth of 533 feet BTOC to the bottom of the pump intake. Static water level was measured just prior to the start of pumping at 252.49 feet BTOC. Actual downhole working pressure prior to the start of pumping was 119.40 psi at the pump intake. During the testing period 1781 gallons of water were pumped from the well bore at an average pumping rate of 9 gallons per hour.

Four serial samples were collected. The first sample was collected on 05-16-91 after approximately 604 gallons of water were pumped and final samples were collected on 05-21-91 after approximately 1702 gallons of water (4+ well bore volumes) had been pumped from the well. Samples were collected for Controls for Environmental Pollution Laboratory (CEP) and Sandia National Laboratory (SNL). An offer was extended to the New Mexico Environmental Evaluation Group

(EEG) to collect samples for them, however EEG declined the samples. Archival samples were collected for the WIPP project.

ROUND SIX SERIAL SAMPLING RESULTS

Eh increased moderately during the four days of sampling measuring
-41 mv, -30 mv, -23 mv, +9 mv respectively.

pH measured 7.86 S.U., 7.86 S.U., 7.82 S.U., 7.84 S.U. respectively.

Temperature measured 22.3 C, 22.2 C, 23.3 C, 22.1 C respectively.

Specific Gravity was measured on the first and fourth days of testing and Specific Conductivity was measured on the first and fourth days of testing. Specific gravity measured 1.006 @ 22.7 C, and 1.007 @ 22.0 C. Specific conductivity measured 12,500 umhos/cm @ 25.0 C on the first day and 12,420 umhos/cm @ 25.0 C on the fourth day of testing.

Alkalinity measurements averaged, 47.3 mg/l, 47.7 mg/l, 47.5 mg/l, 46.6 mg/l respectively.

Chlorides averaged 3,413 mg/l, 3,410 mg/l, 3,395 mg/l, and 3,413 mg/l respectively.

Divalent cations averaged 73.2 mg/l, 73.4 mg/l, 72.1 mg/l, 73.1 mg/l consecutively from day one through day four of testing.

Total iron and ferrous iron were low and fluctuated slightly over the sampling period. Total iron averaged 0.04 mg/l, 0.05 mg/l, 0.05 mg/l, and 0.05 mg/l. Ferrous iron averaged 0.03 mg/l, 0.05 mg/l, 0.04 mg/l, and 0.05 mg/l respectively.

COMPARISON OF ROUND SIX RESULTS WITH PREVIOUS ROUNDS

The amount of water pumped prior to final sampling for the five previous rounds is 3,800 gallons, 1,500 gallons, 1,700 gallons, 2,280 gallons and 1,795 gallons respectively. Approximately 1,702 gallons were pumped prior to final sampling during round six. A comparison of the average final day data for the five previous rounds and final day data for round six is described in the following table for alkalinity, chlorides, dications and total iron.

AVG. OF FINAL DAY RESULTS FOR PREVIOUS FIVE ROUNDS	AVG. OF FINAL DAY RESULTS FOR ROUND SIX
Alkalinity 46.1 mg/l	Alkalinity 46.6 mg/l
Chloride 3,344 mg/l	Chloride 3,413 mg/l
Di-cats 73.6 meq/l	Di-cats 73.1 meq/l
Total iron 0.26 mg/l	Total iron 0.05 mg/l

GENERAL OBSERVATIONS/COMMENTS

Formation water from the Magenta at this location is slightly effervescent and has a strong sulfurous odor. The water contains a small amount of dark colored particulate mattter that can be observed on a 0.45 um filter.

SUMMARY OF WELL H-03b3, CULEBRA, ROUND-6

WELL CHARACTERISTICS

Well H-03b3 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 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 BGS. J-55, (15.5 lb/ft, 5 inch ID) 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

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 an Aardvark 2.8 inch sliding end inflatable packer (SN 3690-435). 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 transducer (SN 3432) was attached to the tubing bundle 25 feet above the top of the pump/packer assembly. A second 0-250 psi transducer (SN 9077) 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 05-29-91 the pump/packer assembly was installed in the well. The bottom of the assembly was positioned at a depth of 653 feet BTOC. Static water level just prior to installation measured 403.10 feet BTOC. The well was pumped for a total of 7 days at an average rate of 29.37 gallons per hour.

Three serial samples were collected; the first on 05-31-91 after approximately 1120 gallons of water had been pumped from the well. Final samples were collected on 06-04-91 after approximately 3989 gallons of water (approximately 14 well bore volumes) had been pumped from the well. Final samples were sent to CEP for analysis. Samples were also provided to SNL for independent analysis. The New Mexico Environmental Evaluation Group were offered samples but declined to accept them. Archival samples were collected for the WIPP Project.

ROUND-6 SERIAL SAMPLING RESULTS

From day 1 to day 3 Eh measured 317 mv, 329 mv, and 308 mv, respectively.

From day 1 to day 3 pH measured 7.48 S.U., 7.46 S.U., and 7.45 S.U., respectively.

From day 1 to day 3, temperature measured 22.5 C., 22.6 C., and 22.3 C. respectively.

Specific Gravity measured 1.0390 @ 22.7 C. on day 1, and 1.0390 @ 23.5 C. on day 3.

Specific Conductance measured 68,300 umhos/cm @ 25.0 C on day 1, and 70,200 umhos/cm @ 25.0 C on day 4.

Alkalinity remained fairly stable throughout round-6. From day 1 to day 3, alkalinity averaged 51.4 mg/l, 51.0 mg/l, and 50.8 mg/l, respectively.

Chlorides fluctuated slightly. From day 1 to day 3 chlorides averaged 28,315 mg/l, 28,457 mg/l, and 28,635 mg/l respectively.

Divalent Cations remained fairly stable throughout round-5. From day 1 to day 3 divalent cations averaged 135.3 meq/l, 135.2 meq/l, and 135.6 meq/l respectively.

For the three days of sampling total iron averaged 0.27 mg/l, 0.25 mg/l, and 0.22 mg/l respectively.

From day 1 to day 3 ferrous iron averaged 0.24 mg/l, 0.22 mg/l, and 0.19 mg/l respectively.

COMPARISON OF ROUND-6 RESULTS WITH PREVIOUS ROUNDS

The amount of water pumped prior to final sampling for each of the six rounds is as follows; 16,300 gallons, 40,000 gallons, 94,000 gallons, 101,919, 5,466 and 4046 gallons respectively. Round six parameters compare favorably to all of the previous rounds. This comparison was made by comparing chemical parameter averages for the final day of round-6 sampling with the average of the chemical parameter values obtained for the last day of sampling for each of the previous five rounds. The results are presented below.

AVG. OF FINAL DAY RESULTS FOR LAST FIVE ROUNDS	AVG. OF FINAL DAY RESULTS FOR ROUND-6
Alkalinity 50.8 mg/l	Alkalinity 50.8mg/l
Chlorides 28,005 mg/l	Chlorides 28,635 mg/l
Di-Cats 143.6 meq/l	Di-Cats 135.6 meq/l
Total Iron 0.19 mg/l	Total Iron 0.22 mg/l

SUMMARY OF WELL H-04c, MAGENTA, ROUND-6

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 amsl and 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 BGS, (Winstanley/Carrasco, 1986). J-55, (15.5 lb/ft, 5 inch ID) well casing is installed to a depth of 610 feet BGS. Initial completion was in the Culebra dolomite. 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 dolomite. 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 1806-21) and a 2.8 inch Aardvark sliding end packer (SN 3690-435). The total length of the assembly was 7.50 feet.

Two Geokon 4500H vibrating wire transducers were utilized to monitor formation pressures. A 0-150 psi pressure range (SN 3427) transducer was attached to the tubing bundle 25 feet above the top of the pump/packer assembly at a depth of 325 feet BTOC. A second transducer (0-250 psi, SN 11871) 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 09-23-91 the pump/packer assembly was installed in the well. The bottom of the assembly was positioned at a depth of 357.50 feet BTOC. Static water level just prior to installation measured 192.38 feet BTOC, (Solinst probe 75-CG-0054). The well was pumped for a total of 246.7 hours at an average rate of 3.99 gallons per hour.

Three serial samples were collected; the first on 09-30-91 after approximately 720 gallons of water had been pumped and final samples were collected on 10-09-91 after approximately 955 gallons of water had been pumped from the well. Approximately 5 well bore volumes were pumped prior to the collection of final samples. Final samples were sent to CEP. Samples were also provided to SNL. The NMEEG was notified of sampling and elected not to take a sample for

analysis. Archival samples were collected for the WIPP Project.

ROUND-6 SERIAL SAMPLING RESULTS

Turbidity measured 1.5 NTU for each of the three serial samples taken.

Eh measured -116 mv, -47 mv, and +264 mv respectively.

pH measured 8.10 S.U., 8.08 S.U. and 8.17 S.U.

Temperature measured form day one to day three 23.8 C, 23.5 C and 23.5 C.

Specific gravity and Specific Conductivity were measured on the first and third serial sample. Specific gravity measured 1.018 @ 23.3 C. and 1.018 @ 23.6 C respectively. Specific conductivity measured 30,900 umhos/cm @25.0 C and 30,700 umhos/cm @25.0 C respectively.

Alkalinity averaged 77.7 mg/l, 74.7 mg/l and 80.9 mg/l respectively.

Chlorides averaged 8,466 mg/l, 8,226 mg/l and 8,364 mg/l respectively.

Divalent Cations remained relatively stable measuring 68.1 meq/l, 67.4 meq/l and 67.2 meq/l daily average readings.

Both iron parameters fluctuated throughout the sampling period. Total iron averaged 0.07 mg/l, 0.67 mg/l and 0.17 mg/l. Ferrous iron averaged 0.07 mg/l, 0.25 mg/l and 0.10 mg/l respectively.

COMPARISON OF ROUND-6 RESULTS WITH PREVIOUS ROUNDS

The amount of water pumped prior to final sampling for each of the six rounds is as follows; 700 gallons, 1,100 gallons, 700 gallons, 450 gallons, 585 gallons and 955 gallons respectively. Round-6 parameters compare favorably to all of the previous rounds. This comparison was made by comparing chemical parameter averages for the final day of round-6 sampling with the average of the chemical parameter values obtained for the last day of sampling for each of the previous five rounds. The results are presented below.

AVG. OF FINAL DAY RESULTS FOR LAST FIVE ROUNDS	AVG. OF FINAL DAY FOR ROUND-6
Alkalinity 80.8 mg/l	Alkalinity 77.0 mg/l
Chlorides 8393 mg/l	Chlorides 8364 mg/l
Di-Cats 68.9 meq/l	Di-Cats 67.2 meq/l
Total Iron 0.52 mg/l	Total Iron 0.17 mg/l

CONTRACT LABORATORY ANALYSIS

RESULTS

H-04c, MAGENTA

ROUND SIX

(GENERAL CHEMISTRY)

PARAMETER	VALUE	VALUE DUPLICATE	UNITS	MINIMUM DETECTION LIMIT	LEVEL CONTAMINATE LEVEL	ACID BLANK	WATER BLANK	ROUND #	DATE SAMPLED
SPECIFIC CONDUCTANCE	35600.0000	35600.0000	units	0.2000	0.0000			6	10-09-91
SULFATE	6740.0000	6980.0000	mg/l	1.0000	600.0000			6	10-09-91
TOTAL DISSOLVED SOLIDS	24270.0000	23650.0000	mg/l	1.0000	1000.0000			6	10-09-91
TOTAL SUSPENDED SOLIDS	193.0000	147.0000	mg/l	1.0000	0.0000			6	10-09-91
TURBIDITY	10.6000	9.6500	NTU	0.0010	0.0000			6	10-09-91
pH	8.2800	8.2900	SU	N/A	6-9			6	10-09-91
ALKALINITY	120.0000	120.0000	mg/l	1.0000	0.0000			6	10-09-91
BROMIDE	59.8100	57.4900	mg/l	0.0100	0.0000			6	10-09-91
CHLORIDE	8812.0000	8820.0000	mg/l	1.0000	250.0000			6	10-09-91
CYANIDE	< 0.0100	< 0.0100	mg/l	0.0100	0.2000			6	10-09-91
FLOURIDE	2.5300	2.5400	mg/l	0.0100	1.6000			6	10-09-91
IODIDE	0.3300	0.3300	mg/l	0.1000	0.0000			6	10-09-91
NITROGEN, NITRATE (AS N)	< 0.1000	< 0.1000	mg/l	0.1000	10.0000			6	10-09-91
TOTAL ORGANIC CARBON	1.3000	< 1.0000	mg/l	1.0000	0.0000			6	10-09-91
TOTAL ORGANIC HALOGENS	250.0000	240.0000	mg/l	5.0000	0.0000			6	10-09-91
PHENOL, TOTAL	0.0080	0.0100	mg/l	0.0050	0.0050			6	10-09-91
PHOSPHATE, TOTAL (AS P)	0.0700	0.0600	mg/l	0.1500	0.0000			6	10-09-91

Appendix 9
Tabulated Results of
Contract Laboratory Analysis

CONTRACT LABORATORY ANALYSIS
RESULTS
H-02c, CULEBRA
ROUND THREE
(GENERAL CHEMISTRY)

PARAMETER	VALUE	VALUE DUPLICATE	UNITS	MINIMUM DETECTION LIMIT	MAXIMUM CONTAMINANT LEVEL	ACID BLANK	WATER BLANK	ROUND #	DATE SAMPLED
SPECIFIC CONDUCTANCE	12010.0000	12670.0000	units	0.2000	0.0000			3	08-14-91
SULFATE	2320.0000	2640.0000	mg/l	1.0000	600.0000			3	08-14-91
TOTAL DISSOLVED SOLIDS	9410.0000	9300.0000	mg/l	1.0000	1000.0000			3	08-14-91
TOTAL SUSPENDED SOLIDS	20.0000	12.0000	mg/l	1.0000	0.0000			3	08-14-91
TURBIDITY	16.8200	15.5400	NTU	0.0010	0.0000			3	08-14-91
pH	7.9300	7.8900	SU	N/A	6-9			3	08-14-91
ALKALINITY	59.8000	58.8000	mg/l	1.0000	0.0000			3	08-14-91
BROMIDE	6.1000	5.9300	mg/l	0.0100	0.0000			3	08-14-91
CHLORIDE	3330.0000	3020.0000	mg/l	1.0000	250.0000			3	08-14-91
CYANIDE	0.2400	0.2500	mg/l	0.0100	0.2000			3	08-14-91
FLOURIDE	1.8500	1.8800	mg/l	0.0100	1.6000			3	08-14-91
IODIDE	0.1200	0.1200	mg/l	0.1000	0.0000			3	08-14-91
NITROGEN, NITRATE (AS N)	< 0.1000	< 0.1000	mg/l	0.1000	10.0000			3	08-14-91
TOTAL ORGANIC CARBON	4.1000	4.5000	mg/l	1.0000	0.0000			3	08-14-91
TOTAL ORGANIC HALOGENS	110.0000	126.0000	mg/l	5.0000	0.0000			3	08-14-91
PHENOL, TOTAL	0.0090	0.0060	mg/l	0.0050	0.0050			3	08-14-91
PHOSPHATE, TOTAL (AS P)	0.0300	0.0200	mg/l	0.1500	0.0000			3	08-14-91

CONTRACT LABORATORY ANALYSIS
RESULTS
H-02c, CULEBRA
ROUND THREE
(TRACE METALS)

PARAMETER		VALUE		VALUE DUPLICATE	UNITS	MINIMUM DETECTION LIMIT	MAXIMUM CONTAMINANT LEVEL	ACID BLANK	WATER BLANK	ROUND #	DATE SAMPLED
ALUMINUM		0.6200		0.6600	mg/l	0.0300	5.0000			3	08-14-91
ANTIMONY		0.1000		0.1000	mg/l	0.0500	0.0000			3	08-14-91
ARSENIC	<	0.0100	<	0.0100	mg/l	0.0100	0.1000			3	08-14-91
BARIUM	<	0.0500		0.0500	mg/l	0.0500	1.0000			3	08-14-91
BERYLLIUM	<	0.0010	<	0.0010	mg/l	0.0010	0.0000			3	08-14-91
BORON		14.4000		14.5000	mg/l	0.1000	0.7500			3	08-14-91
CADMIUM		0.0200		0.0300	mg/l	0.0010	0.0100			3	08-14-91
CALCIUM		772.0000		814.0000	mg/l	0.1000	0.0000			3	08-14-91
CESIUM	<	0.1000	<	0.1000	mg/l	5.0000	0.0000			3	08-14-91
IRON, TOTAL		1.6100		1.7100	mg/l	0.0300	1.0000			3	08-14-91
MAGNESIUM		165.0000		168.0000	mg/l	0.0500	0.0000			3	08-14-91
MANGANESE		0.1300		0.1400	mg/l	0.0500	0.2000			3	08-14-91
MERCURY	<	0.0002	<	0.0002	mg/l	0.0002	0.0020			3	08-14-91
MOLYBDENUM		0.0700		0.0700	mg/l	0.0500	1.0000			3	08-14-91
NICKEL		0.0600		0.0800	mg/l	0.0500	0.2000			3	08-14-91
POTASSIUM		105.0000		113.0000	mg/l	0.1000	0.0000			3	08-14-91
SELENIUM		N/A		N/A	mg/l	0.0050	0.0500			3	08-14-91
SILICA		0.5000		0.5000	mg/l	1.0000	0.0000			3	08-14-91
SILVER	<	0.0500		0.0500	mg/l	0.0500	0.0500			3	08-14-91
SODIUM		2590.0000		2840.0000	mg/l	0.0100	0.0000			3	08-14-91
STRONTIUM		20.5000		19.6000	mg/l	0.0100	0.0000			3	08-14-91
THALLIUM		0.1200		0.1100	mg/l	0.0500	0.0000			3	08-14-91
TIN		0.3100		0.3100	mg/l	0.0500	0.0000			3	08-14-91
TITANIUM		0.0600		0.0700	mg/l	0.0500	0.0000			3	08-14-91
ZINC		0.0800		0.0900	mg/l	0.0300	10.0000			3	08-14-91

CONTRACT LABORATORY ANALYSIS

RESULTS

H-03b1, MAGENTA

ROUND SIX

(GENERAL CHEMISTRY)

PARAMETER		VALUE		VALUE DUPLICATE	UNITS	MINIMUM DETECTION LIMIT	LEVEL CONTAMINANT LEVEL	ACID BLANK	WATER BLANK	ROUND #	DATE SAMPLED
SPECIFIC CONDUCTANCE		11200.0000		10200.0000	units	0.2000	0.0000			6	05-21-91
SULFATE		2400.0000		2310.0000	mg/l	1.0000	600.0000			6	05-21-91
TOTAL DISSOLVED SOLIDS		9020.0000		9680.0000	mg/l	1.0000	1000.0000			6	05-21-91
TOTAL SUSPENDED SOLIDS		16.0000		17.0000	mg/l	1.0000	0.0000			6	05-21-91
TURBIDITY		0.6710		0.6480	NTU	0.0010	0.0000			6	05-21-91
pH		7.6400		7.6400	SU	N/A	6-9			6	05-21-91
ALKALINITY		79.1000		89.0000	mg/l	1.0000	0.0000			6	05-21-91
BROMIDE		5.4500		5.5100	mg/l	0.0100	0.0000			6	05-21-91
CHLORIDE		3700.0000		3710.0000	mg/l	1.0000	250.0000			6	05-21-91
CYANIDE	<	0.0100	<	0.0100	mg/l	0.0100	0.2000			6	05-21-91
FLOURIDE	<	10.0000	<	10.0000	mg/l	0.0100	1.6000			6	05-21-91
IODIDE		1.1200		1.0800	mg/l	0.1000	0.0000			6	05-21-91
NITROGEN, NITRATE (AS N)	<	0.1000	<	0.1000	mg/l	0.1000	10.0000			6	05-21-91
TOTAL ORGANIC CARBON	<	1.0000	<	1.0000	mg/l	1.0000	0.0000			6	05-21-91
TOTAL ORGANIC HALOGENS		130.0000		120.0000	mg/l	5.0000	0.0000			6	05-21-91
PHENOL, TOTAL		0.0100		0.0100	mg/l	0.0050	0.0050			6	05-21-91
PHOSPHATE, TOTAL (AS P)	<	0.1500	<	0.1500	mg/l	0.1500	0.0000			6	05-21-91

CONTRACT LABORATORY ANALYSIS

RESULTS

H-03b1, MAGENTA

ROUND SIX

(GENERAL CHEMISTRY)

PARAMETER		VALUE		VALUE DUPLICATE	UNITS	MINIMUM DETECTION LIMIT	LEVEL CONTAMINANT LEVEL	ACID BLANK	WATER BLANK	ROUND #	DATE SAMPLED
ALUMINUM		0.5900		0.5900	mg/l	0.0300	5.0000			6	05-21-91
ANTIMONY	<	0.0500	<	0.0500	mg/l	0.0500	0.0000			6	05-21-91
ARSENIC	<	0.0100	NA	0.0000	mg/l	0.0100	0.1000			6	05-21-91
BARIUM	<	0.0500	<	0.0500	mg/l	0.0500	1.0000			6	05-21-91
BERYLLIUM	<	0.0010	<	0.0010	mg/l	0.0010	0.0000			6	05-21-91
BORON		3.6000		3.6000	mg/l	0.1000	0.7500			6	05-21-91
CADMIUM		0.0120		0.0090	mg/l	0.0010	0.0100			6	05-21-91
CALCIUM		373.0000		374.0000	mg/l	0.1000	0.0000			6	05-21-91
CESIUM	<	10.0000	<	10.0000	mg/l	5.0000	0.0000			6	05-21-91
MAGNESIUM		304.0000		299.0000	mg/l	0.0500	0.0000			6	05-21-91
MANGANESE	<	0.0500	<	0.0500	mg/l	0.0500	0.2000			6	05-21-91
MERCURY		0.0004		0.0005	mg/l	0.0002	0.0020			6	05-21-91
MOLYBDENUM	<	0.0500	<	0.0500	mg/l	0.0500	1.0000			6	05-21-91
NICKEL	<	0.0500	<	0.0500	mg/l	0.0500	0.2000			6	05-21-91
POTASSIUM		30.2000		29.4000	mg/l	0.1000	0.0000			6	05-21-91
SELENIUM	<	0.0050	<	0.0050	mg/l	0.0050	0.0500			6	05-21-91
SILICA		11.1000		10.8000	mg/l	1.0000	0.0000			6	05-21-91
SILVER	<	0.0500	<	0.0500	mg/l	0.0500	0.0500			6	05-21-91
SODIUM		1260.0000		1270.0000	mg/l	0.0100	0.0000			6	05-21-91
STRONTIUM		0.0160		0.0110	mg/l	0.0100	0.0000			6	05-21-91
THALLIUM	<	0.0500	<	0.0500	mg/l	0.0500	0.0000			6	05-21-91
TIN		0.2500		0.2900	mg/l	0.0500	0.0000			6	05-21-91
TITANIUM	<	0.0500	<	0.0500	mg/l	0.0500	0.0000			6	05-21-91
ZINC		0.0500		0.0500	mg/l	0.0300	10.0000			6	05-21-91

CONTRACT LABORATORY ANALYSIS
RESULTS
H-03b3, CULEBRA
ROUND SIX
(GENERAL CHEMISTRY)

PARAMETER	VALUE	VALUE DUPLICATE	UNITS	MINIMUM DETECTION LIMIT	MAXIMUM CONTAMINANT LEVEL	ACID BLANK	WATER BLANK	ROUND #	DATE SAMPLED
SPECIFIC CONDUCTANCE	145844.0000	151000.0000	units	0.2000	0.0000			6	06-04-91
SULFATE	5730.0000	5630.0000	mg/l	1.0000	600.0000			6	06-04-91
TOTAL DISSOLVED SOLIDS	54000.0000	48600.0000	mg/l	1.0000	1000.0000			6	06-04-91
TOTAL SUSPENDED SOLIDS	271.0000	283.0000	mg/l	1.0000	0.0000			6	06-04-91
TURBIDITY	3.3000	3.7000	NTU	0.0010	0.0000			6	06-04-91
pH	7.4600	7.4700	SU	N/A	6-9			6	06-04-91
ALKALINITY	48.5000	49.1000	mg/l	1.0000	0.0000			6	06-04-91
BROMIDE	207.0000	206.0000	mg/l	0.0100	0.0000			6	06-04-91
CHLORIDE	30700.0000	28900.0000	mg/l	1.0000	250.0000			6	06-04-91
CYANIDE	< 0.0100	< 0.0100	mg/l	0.0100	0.2000			6	06-04-91
FLOURIDE	0.9900	1.0100	mg/l	0.0100	1.6000			6	06-04-91
IODIDE	0.6500	0.6600	mg/l	0.1000	0.0000			6	06-04-91
NITROGEN, NITRATE (AS N)	< 0.1000	< 0.1000	mg/l	0.1000	10.0000			6	06-04-91
TOTAL ORGANIC CARBON	< 1.0000	< 1.0000	mg/l	1.0000	0.0000			6	06-04-91
TOTAL ORGANIC HALOGENS	70.0000	80.0000	mg/l	5.0000	0.0000			6	06-04-91
PHENOL, TOTAL	0.0200	0.0200	mg/l	0.0050	0.0050			6	06-04-91
PHOSPHATE, TOTAL (AS P)	0.1100	0.1000	mg/l	0.1500	0.0000			6	06-04-91

CONTRACT LABORATORY ANALYSIS
RESULTS
H-03b3, CULEBRA
ROUND SIX
(TRACE METALS)

PARAMETER		VALUE		VALUE DUPLICATE	UNITS	MINIMUM DETECTION LIMIT	MAXIMUM CONTAMINANT LEVEL	ACID BLANK	WATER BLANK	ROUND #	DATE SAMPLED
ALUMINUM		0.2600		0.2800	mg/l	0.0300	5.0000			6	06-04-91
ANTIMONY	<	0.0500	<	0.0500	mg/l	0.0500	0.0000			6	06-04-91
ARSENIC	<	0.0100	NA	0.0000	mg/l	0.0100	0.1000			6	06-04-91
BARIUM		0.1300		0.1300	mg/l	0.0500	1.0000			6	06-04-91
BERYLLIUM		0.0030		0.0040	mg/l	0.0010	0.0000			6	06-04-91
BORON		31.6000		34.5000	mg/l	0.1000	0.7500			6	06-04-91
CADMIUM		0.0370		0.0330	mg/l	0.0010	0.0100			6	06-04-91
CALCIUM		1360.0000		1420.0000	mg/l	0.1000	0.0000			6	06-04-91
CESIUM	<	10.0000	<	10.0000	mg/l	5.0000	0.0000			6	06-04-91
MAGNESIUM		726.0000		736.0000	mg/l	0.0500	0.0000			6	06-04-91
MANGANESE		0.1600		0.1600	mg/l	0.0500	0.2000			6	06-04-91
MERCURY		0.0005		0.0007	mg/l	0.0002	0.0020			6	06-04-91
MOLYBDENUM	<	0.0500	<	0.0500	mg/l	0.0500	1.0000			6	06-04-91
NICKEL		0.1200		0.1200	mg/l	0.0500	0.2000			6	06-04-91
POTASSIUM		431.0000		442.0000	mg/l	0.1000	0.0000			6	06-04-91
SELENIUM		0.0300		0.0300	mg/l	0.0050	0.0500			6	06-04-91
SILICA		47.7000		51.1000	mg/l	1.0000	0.0000			6	06-04-91
SILVER		0.0700		0.0800	mg/l	0.0500	0.0500			6	06-04-91
SODIUM		15200.0000		14900.0000	mg/l	0.0100	0.0000			6	06-04-91
STRONTIUM		209.0000		216.0000	mg/l	0.0100	0.0000			6	06-04-91
THALLIUM		0.0700		0.0900	mg/l	0.0500	0.0000			6	06-04-91
TIN		0.6600		0.7600	mg/l	0.0500	0.0000			6	06-04-91
TITANIUM	<	0.0500	<	0.0500	mg/l	0.0500	0.0000			6	06-04-91
ZINC		0.0600		0.0600	mg/l	0.0300	10.0000			6	06-04-91

CONTRACT LABORATORY ANALYSIS
WORKSHEET
H-04b, CULEBRA
ROUND SIX
(GENERAL CHEMISTRY)

PARAMETER		VALUE		VALUE DUPLICATE	UNITS	MINIUM DETECTION LIMIT	MAXIMUM CONTAMINANT LEVEL	ACID BLANK	WATER BLANK	ROUND #	DATE SAMPLED
SPECIFIC CONDUCTANCE		29310.0000		31860.0000	units	0.2000	0.0000			6	09-18-91
SULFATE		5570.0000		5490.0000	mg/l	1.0000	600.0000			6	09-18-91
TOTAL DISSOLVED SOLIDS		20500.0000		20700.0000	mg/l	1.0000	1000.0000			6	09-18-91
TOTAL SUSPENDED SOLIDS		71.0000		77.0000	mg/l	1.0000	0.0000			6	09-18-91
TURBIDITY		13.3100		13.0000	NTU	0.0010	0.0000			6	09-18-91
pH		7.6000		7.5900	SU	N/A	6-9			6	09-18-91
ALKALINITY		16.8000		19.4000	mg/l	1.0000	0.0000			6	09-18-91
BROMIDE		41.7000		39.6000	mg/l	0.0100	0.0000			6	09-18-91
CHLORIDE		7990.0000		8010.0000	mg/l	1.0000	250.0000			6	09-18-91
CYANIDE		0.1700		0.1800	mg/l	0.0100	0.2000			6	09-18-91
FLOURIDE		33.7000		32.4000	mg/l	0.0100	1.6000			6	09-18-91
IODIDE	<	20.0000	<	20.0000	mg/l	0.1000	0.0000			6	09-18-91
NITROGEN, NITRATE (AS N)	<	0.1000	<	0.1000	mg/l	0.1000	10.0000			6	09-18-91
TOTAL ORGANIC CARBON		2.0000		2.2000	mg/l	1.0000	0.0000			6	09-18-91
TOTAL ORGANIC HALOGENS		250.0000		210.0000	mg/l	5.0000	0.0000			6	09-18-91
PHENOL, TOTAL		0.0100		0.0090	mg/l	0.0050	0.0050			6	09-18-91
PHOSPHATE, TOTAL (AS P)		0.1200		0.0900	mg/l	0.1500	0.0000			6	09-18-91

CONTRACT LABORATORY ANALYSIS
WORKSHEET
H-04b, CULEBRA
ROUND SIX
(TRACE METALS)

PARAMETER		VALUE		VALUE DUPLICATE	UNITS	MINIUM DETECTION LIMIT	MAXIMUM CONTAMINANT LEVEL	ACID BLANK	WATER BLANK	ROUND #	DATE SAMPLED
ALUMINUM		1.1900		1.1700	mg/l	0.0300	5.0000			6	09-18-91
ANTIMONY		0.1100		0.1100	mg/l	0.0500	0.0000			6	09-18-91
ARSENIC	<	0.0100	<	0.0100	mg/l	0.0100	0.1000			6	09-18-91
BARIUM		0.0600		0.0600	mg/l	0.0500	1.0000			6	09-18-91
BERYLLIUM	<	0.0010	<	0.0010	mg/l	0.0010	0.0000			6	09-18-91
BORON		20.9000		21.5000	mg/l	0.1000	0.7500			6	09-18-91
CADMIUM		0.0200		0.0300	mg/l	0.0010	0.0100			6	09-18-91
CALCIUM		813.0000		818.0000	mg/l	0.1000	0.0000			6	09-18-91
CESIUM	<	1.0000	<	1.0000	mg/l	5.0000	0.0000			6	09-18-91
IRON, TOTAL		1.1400		1.1500	mg/l	0.0300	1.0000			6	09-18-91
MAGNESIUM		436.0000		435.0000	mg/l	0.0500	0.0000			6	09-18-91
MANGANESE		0.1800		0.1800	mg/l	0.0500	0.2000			6	09-18-91
MERCURY	<	0.0002	<	0.0002	mg/l	0.0002	0.0020			6	09-18-91
MOLYBDENUM		0.1200		0.1200	mg/l	0.0500	1.0000			6	09-18-91
NICKEL		0.1000		0.1000	mg/l	0.0500	0.2000			6	09-18-91
POTASSIUM		182.0000		191.0000	mg/l	0.1000	0.0000			6	09-18-91
SELENIUM	<	0.0050	<	0.0050	mg/l	0.0050	0.0500			6	09-18-91
SILICA		7.1000		5.6000	mg/l	1.0000	0.0000			6	09-18-91
SILVER		0.0700		0.0700	mg/l	0.0500	0.0500			6	09-18-91
SODIUM		4150.0000		4030.0000	mg/l	0.0100	0.0000			6	09-18-91
STRONTIUM		36.4000		36.4000	mg/l	0.0100	0.0000			6	09-18-91
THALLIUM		0.1500		0.1500	mg/l	0.0500	0.0000			6	09-18-91
TIN		0.5600		0.5400	mg/l	0.0500	0.0000			6	09-18-91
TITANIUM		0.0600		0.0600	mg/l	0.0500	0.0000			6	09-18-91
ZINC		0.2800		0.2800	mg/l	0.0300	10.0000			6	09-18-91

CONTRACT LABORATORY ANALYSIS

RESULTS

H-04c, MAGENTA

ROUND SIX

(GENERAL CHEMISTRY)

PARAMETER	VALUE	VALUE DUPLICATE	UNITS	MINIMUM DETECTION LIMIT	LEVEL CONTAMINATE LEVEL	ACID BLANK	WATER BLANK	ROUND #	DATE SAMPLED
SPECIFIC CONDUCTANCE	35600.0000	35600.0000	units	0.2000	0.0000			6	10-09-91
SULFATE	6740.0000	6980.0000	mg/l	1.0000	600.0000			6	10-09-91
TOTAL DISSOLVED SOLIDS	24270.0000	23650.0000	mg/l	1.0000	1000.0000			6	10-09-91
TOTAL SUSPENDED SOLIDS	193.0000	147.0000	mg/l	1.0000	0.0000			6	10-09-91
TURBIDITY	10.6000	9.6500	NTU	0.0010	0.0000			6	10-09-91
pH	8.2800	8.2900	SU	N/A	6-9			6	10-09-91
ALKALINITY	120.0000	120.0000	mg/l	1.0000	0.0000			6	10-09-91
BROMIDE	59.8100	57.4900	mg/l	0.0100	0.0000			6	10-09-91
CHLORIDE	8812.0000	8820.0000	mg/l	1.0000	250.0000			6	10-09-91
CYANIDE	< 0.0100	< 0.0100	mg/l	0.0100	0.2000			6	10-09-91
FLOURIDE	2.5300	2.5400	mg/l	0.0100	1.6000			6	10-09-91
IODIDE	0.3300	0.3300	mg/l	0.1000	0.0000			6	10-09-91
NITROGEN, NITRATE (AS N)	< 0.1000	< 0.1000	mg/l	0.1000	10.0000			6	10-09-91
TOTAL ORGANIC CARBON	1.3000	< 1.0000	mg/l	1.0000	0.0000			6	10-09-91
TOTAL ORGANIC HALOGENS	250.0000	240.0000	mg/l	5.0000	0.0000			6	10-09-91
PHENOL, TOTAL	0.0080	0.0100	mg/l	0.0050	0.0050			6	10-09-91
PHOSPHATE, TOTAL (AS P)	0.0700	0.0600	mg/l	0.1500	0.0000			6	10-09-91

CONTRACT LABORATORY ANALYSIS
RESULTS
H-04c, MAGENTA
ROUND SIX
(TRACE METALS)

PARAMETER		VALUE		VALUE DUPLICATE	UNITS	MINIMUM DETECTION LIMIT	LEVEL CONTAMINATE LEVEL	ACID BLANK	WATER BLANK	ROUND #	DATE SAMPLED
ALUMINUM		0.4200		0.4600	mg/l	0.0500	5.0000			6	10-09-91
ANTIMONY		0.0800		0.0800	mg/l	0.0500	0.0000			6	10-09-91
ARSENIC	<	0.0100	<	0.0100	mg/l	0.0100	0.1000			6	10-09-91
BARIUM	<	0.0500	<	0.0500	mg/l	0.0500	1.0000			6	10-09-91
BERYLLIUM		0.0010		0.0020	mg/l	0.0010	0.0000			6	10-09-91
BORON		15.0000		15.0000	mg/l	0.1000	0.7500			6	10-09-91
CADMIUM		0.0060		0.0070	mg/l	0.0010	0.0100			6	10-09-91
CALCIUM		734.0000		743.0000	mg/l	0.1000	0.0000			6	10-09-91
CESIUM	<	1.0000	<	1.0000	mg/l	5.0000	0.0000			6	10-09-91
IRON		2.2900		2.3500	mg/l	0.0300	0.3000			6	10-09-91
MAGNESIUM		456.0000		452.0000	mg/l	0.0500	0.0000			6	10-09-91
MANGANESE		0.4500		0.4700	mg/l	0.0500	0.2000			6	10-09-91
MERCURY	<	0.0002	<	0.0002	mg/l	0.0002	0.0020			6	10-09-91
MOLYBDENUM	<	0.0500	<	0.0500	mg/l	0.0500	1.0000			6	10-09-91
NICKEL		0.1100		0.1100	mg/l	0.0500	0.2000			6	10-09-91
POTASSIUM		65.0000		68.2000	mg/l	0.1000	0.0000			6	10-09-91
SELENIUM		N/A		N/A	mg/l	0.0050	0.0500			6	10-09-91
SILICA		4.9000		4.9000	mg/l	1.0000	0.0000			6	10-09-91
SILVER		0.0500		0.0500	mg/l	0.0500	0.0500			6	10-09-91
SODIUM		6480.0000		7240.0000	mg/l	0.0100	0.0000			6	10-09-91
STRONTIUM		42.3000		42.4000	mg/l	0.0100	0.0000			6	10-09-91
THALLIUM		0.1400		0.1500	mg/l	0.0500	0.0000			6	10-09-91
TIN		0.5400		0.5400	mg/l	0.0500	0.0000			6	10-09-91
TITANIUM	<	0.0500		0.0500	mg/l	0.0500	0.0000			6	10-09-91
ZINC		0.0600		0.0600	mg/l	0.0300	10.0000			6	10-09-91

CONTRACT LABORATORY ANALYSIS
RESULT
H-05b, CULEBRA
ROUND SIX
(GENERAL CHEMISTRY)

PARAMETER	VALUE	VALUE DUPLICATE	UNITS	MINIMUM DETECTION LIMIT	MAXIMUM CONTAMINATE LEVEL	ACID BLANK	WATER BLANK	ROUND #	DATE SAMPLED
SPECIFIC CONDUCTANCE	0.0000	0.0000	units	0.2000	0.0000			6	06-25-91
SULFATE	185000.0000	183000.0000	mg/l	1.0000	600.0000			6	06-25-91
TOTAL DISSOLVED SOLIDS	262000.0000	260000.0000	mg/l	1.0000	1000.0000			6	06-25-91
TOTAL SUSPENDED SOLIDS	370.0000	357.0000	mg/l	1.0000	0.0000			6	06-25-91
TURBIDITY	61.2000	63.4000	NTU	0.0010	0.0000			6	06-25-91
pH	7.0900	7.0800	SU	N/A	6-9			6	06-25-91
ALKALINITY	36.4000	37.2000	mg/l	1.0000	0.0000			6	06-25-91
BROMIDE	2120.0000	1880.0000	mg/l	0.0100	0.0000			6	06-25-91
CHLORIDE	86500.0000	89600.0000	mg/l	1.0000	250.0000			6	06-25-91
CYANIDE	0.1000	0.0900	mg/l	0.0100	0.2000			6	06-25-91
FLOURIDE	0.4100	0.4400	mg/l	0.0100	1.6000			6	06-25-91
IODIDE	5.5700	5.7300	mg/l	0.1000	0.0000			6	06-25-91
NITROGEN, NITRATE (AS N)	< 0.1000	< 0.1000	mg/l	0.1000	10.0000			6	06-25-91
TOTAL ORGANIC CARBON	< 1.0000	< 1.0000	mg/l	1.0000	0.0000			6	06-25-91
TOTAL ORGANIC HALOGENS	360.0000	360.0000	mg/l	5.0000	0.0000			6	06-25-91
PHENOL, TOTAL	0.0070	0.0080	mg/l	0.0050	0.0050			6	06-25-91
PHOSPHATE, TOTAL (AS P)	0.0500	0.0500	mg/l	0.1500	0.0000			6	06-25-91

CONTRACT LABORATORY ANALYSIS
RESULT
H-05b, CULEBRA
ROUND SIX
(TRACE METALS)

PARAMETER		VALUE		VALUE DUPLICATE	UNITS	MINIMUM DETECTION LIMIT	MAXIMUM CONTAMINATE LEVEL	ACID BLANK	WATER BLANK	ROUND #	DATE SAMPLED
ALUMINUM	<	0.0300	<	0.0300	mg/l	0.0300	5.0000			6	06-25-91
ANTIMONY		0.2500		0.2900	mg/l	0.0500	0.0000			6	06-25-91
ARSENIC		0.0000		0.0000	mg/l	0.0100	0.1000			6	06-25-91
BARIUM	<	0.0300	<	0.0300	mg/l	0.0500	1.0000			6	06-25-91
BERYLLIUM	<	0.0010	<	0.0010	mg/l	0.0010	0.0000			6	06-25-91
BORON		48.8000		50.0000	mg/l	0.1000	0.7500			6	06-25-91
CADMIUM		0.0800		0.0700	mg/l	0.0010	0.0100			6	06-25-91
CALCIUM		1520.0000		1570.0000	mg/l	0.1000	0.0000			6	06-25-91
CESIUM	<	0.1000	<	0.1000	mg/l	5.0000	0.0000			6	06-25-91
IRON, TOTAL		0.0900		0.1200	mg/l	0.0300	1.0000			6	06-25-91
MAGNESIUM		2000.0000		2030.0000	mg/l	0.0500	0.0000			6	06-25-91
MANGANESE	<	0.0300	<	0.0300	mg/l	0.0500	0.2000			6	06-25-91
MERCURY		0.0007		0.0005	mg/l	0.0002	0.0020			6	06-25-91
MOLYBDENUM		0.1500		0.1500	mg/l	0.0500	1.0000			6	06-25-91
NICKEL	<	0.0300	<	0.0300	mg/l	0.0500	0.2000			6	06-25-91
POTASSIUM		1180.0000		1130.0000	mg/l	0.1000	0.0000			6	06-25-91
SELENIUM		0.0000		0.0000	mg/l	0.0050	0.0500			6	06-25-91
SILICA		16.8000		16.7000	mg/l	1.0000	0.0000			6	06-25-91
SILVER	<	0.0300	<	0.0300	mg/l	0.0500	0.0500			6	06-25-91
SODIUM		48000.0000		46600.0000	mg/l	0.0100	0.0000			6	06-25-91
STRONTIUM		128.0000		127.0000	mg/l	0.0100	0.0000			6	06-25-91
THALLIUM		44.0000		49.0000	mg/l	0.0500	0.0000			6	06-25-91
TIN		2.3500		2.6100	mg/l	0.0500	0.0000			6	06-25-91
TITANIUM		0.1900		0.2200	mg/l	0.0500	0.0000			6	06-25-91
ZINC	<	0.0300	<	0.0300	mg/l	0.0300	10.0000			6	06-25-91

CONTRACT LABORATORY ANALYSIS
RESULTS
H-05c, MAGENTA
ROUND SIX
(GENERAL CHEMISTRY)

PARAMETER	VALUE	VALUE DUPLICATE	UNITS	MINIMUM DETECTION LIMIT	MAXIMUM CONTAMINATE LEVEL	ACID BLANK	WATER BLANK	ROUND #	DATE SAMPLED
SPECIFIC CONDUCTANCE	8819.2000	8819.2000	units	0.2000	0.0000			6	07-17-91
SULFATE	365.1000	35.6900	mg/l	1.0000	600.0000			6	07-17-91
TOTAL DISSOLVED SOLIDS	7231.0000	7225.0000	mg/l	1.0000	1000.0000			6	07-17-91
TOTAL SUSPENDED SOLIDS	17.0000	8.0000	mg/l	1.0000	0.0000			6	07-17-91
TURBIDITY	3.3100	3.5500	NTU	0.0010	0.0000			6	07-17-91
pH	7.9500	7.9300	SU	N/A	6-9			6	07-17-91
ALKALINITY	62.4000	61.4400	mg/l	1.0000	0.0000			6	07-17-91
BROMIDE	11.4000	11.5600	mg/l	0.0100	0.0000			6	07-17-91
CHLORIDE	1126.3000	1122.4000	mg/l	1.0000	250.0000			6	07-17-91
CYANIDE	0.1100	0.1300	mg/l	0.0100	0.2000			6	07-17-91
FLOURIDE	2.0700	2.0400	mg/l	0.0100	1.6000			6	07-17-91
IODIDE	0.2500	0.2500	mg/l	0.1000	0.0000			6	07-17-91
NITROGEN, NITRATE (AS N)	< 0.1000	< 0.1000	mg/l	0.1000	10.0000			6	07-17-91
TOTAL ORGANIC CARBON	< 1.0000	< 1.0000	mg/l	1.0000	0.0000			6	07-17-91
TOTAL ORGANIC HALOGENS	110.0000	130.0000	mg/l	5.0000	0.0000			6	07-17-91
PHENOL, TOTAL	< 0.0050	< 0.0050	mg/l	0.0050	0.0050			6	07-17-91
PHOSPHATE, TOTAL (AS P)	0.0900	0.0800	mg/l	0.1500	0.0000			6	07-17-91

CONTRACT LABORATORY ANALYSIS

RESULTS

H-05c, MAGENTA

ROUND SIX

(GENERAL CHEMISTRY)

PARAMETER	VALUE	VALUE DUPLICATE	UNITS	MINIMUM DETECTION LIMIT	MAXIMUM CONTAMINATE LEVEL	ACID BLANK	WATER BLANK	ROUND #	DATE SAMPLED
ALUMINUM	1.4000	1.2800	mg/l	0.0300	5.0000	1.3100	1.6900	6	07-17-91
ANTIMONY	0.0700	0.0500	mg/l	0.0500	0.0000 <	0.0500 <	0.0500	6	07-17-91
ARSENIC	< 0.0100 <	0.0100	mg/l	0.0100	0.1000 <	0.0100 <	0.0100	6	07-17-91
BARIUM	0.0500	0.0400	mg/l	0.0500	1.0000	0.0700	0.0600	6	07-17-91
BERYLLIUM	0.0010	0.0010	mg/l	0.0010	0.0000 <	0.0010 <	0.0010	6	07-17-91
BORON	9.9000	10.0000	mg/l	0.1000	0.7500 <	0.1000 <	0.1000	6	07-17-91
CADMIUM	0.0100	0.0100	mg/l	0.0010	0.0100 <	0.0100 <	0.0100	6	07-17-91
CALCIUM	591.1600	559.5200	mg/l	0.1000	0.0000	0.9500	0.9100	6	07-17-91
CESIUM	< 0.1000 <	0.1000	mg/l	5.0000	0.0000 <	0.1000 <	0.1000	6	07-17-91
IRON, TOTAL	0.4100	0.3900	mg/l	0.0300	1.0000	0.1900	0.3100	6	07-17-91
MAGNESIUM	173.1600	171.3900	mg/l	0.0500	0.0000	0.0900	0.0900	6	07-17-91
MANGANESE	0.0500	0.0400	mg/l	0.0500	0.2000 <	0.0300 <	0.0300	6	07-17-91
MERCURY	0.0003 <	0.0002	mg/l	0.0002	0.0020 <	0.0002 <	0.0002	6	07-17-91
MOLYBDENUM	< 0.0500 <	0.0500	mg/l	0.0500	1.0000 <	0.0500 <	0.0500	6	07-17-91
NICKEL	0.2100	0.1900	mg/l	0.0500	0.2000	0.2300	0.2700	6	07-17-91
POTASSIUM	3.5000	3.5000	mg/l	0.1000	0.0000	0.1000	0.1000	6	07-17-91
SELENIUM	< 0.0100 <	0.0100	mg/l	0.0050	0.0500 <	0.0100 <	0.0100	6	07-17-91
SILICA	6.7000	6.4000	mg/l	1.0000	0.0000	1.1000	0.4000	6	07-17-91
SILVER	0.1400	0.1200	mg/l	0.0500	0.0500	0.1600	0.1900	6	07-17-91
SODIUM	1197.0000	1035.0000	mg/l	0.0100	0.0000	0.2750	141.0000	6	07-17-91
STRONTIUM	33.1800	32.1800	mg/l	0.0100	0.0000 <	0.0100	0.0100	6	07-17-91
THALLIUM	0.0800	0.0700	mg/l	0.0500	0.0000 <	0.0500 <	0.0500	6	07-17-91
TIN	0.2600	0.2200	mg/l	0.0500	0.0000 <	0.0500 <	0.0500	6	07-17-91
TITANIUM	< 0.0500 <	0.0500	mg/l	0.0500	0.0000 <	0.0500 <	0.0500	6	07-17-91
ZINC	0.0500	0.0500	mg/l	0.0300	10.0000	0.1000	0.0400	6	07-17-91

CONTRACT LABORATORY ANALYSIS
RESULTS
H-06b, CULEBRA
ROUND SIX
(GENERAL CHEMISTRY)

PARAMETER	VALUE	VALUE DUPLICATE	UNITS	MINIMUM DETECTION LIMITS	MAXIMUM CONTAMINATE LEVEL	ACID BLANK	WATER BLANK	ROUND #	DATE SAMPLED
SPECIFIC CONDUCTANCE	78400.0000	78400.0000	units	0.2000	0.0000			6	04-23-91
SULFATE	4430.0000	4310.0000	mg/l	1.0000	600.0000			6	04-23-91
TOTAL DISSOLVED SOLIDS	57000.0000	54500.0000	mg/l	1.0000	1000.0000			6	04-23-91
TOTAL SUSPENDED SOLIDS	65.0000	67.0000	mg/l	1.0000	0.0000			6	04-23-91
TURBIDITY	1.0890	1.1120	NTU	0.0010	0.0000			6	04-23-91
pH	7.0400	7.0500	SU	N/A	6-9			6	04-23-91
ALKALINITY	103.0000	103.0000	mg/l	1.0000	0.0000			6	04-23-91
BROMIDE	3.5100	3.8400	mg/l	0.0100	0.0000			6	04-23-91
CHLORIDE	33700.0000	33100.0000	mg/l	1.0000	250.0000			6	04-23-91
CYANIDE	< 0.0100	< 0.0100	mg/l	0.0100	0.2000			6	04-23-91
FLOURIDE	0.7300	0.6700	mg/l	0.0100	1.6000			6	04-23-91
IODIDE	0.7000	0.7000	mg/l	0.1000	0.0000			6	04-23-91
NITROGEN, NITRATE (AS N)	< 0.1000	< 0.1000	mg/l	0.1000	10.0000			6	04-23-91
TOTAL ORGANIC CARBON	< 1.0000	< 1.0000	mg/l	1.0000	0.0000			6	04-23-91
TOTAL ORGANIC HALOGENS	250.0000	320.0000	mg/l	5.0000	0.0000			6	04-23-91
PHENOL, TOTAL	0.0200	0.0200	mg/l	0.0050	0.0050			6	04-23-91
PHOSPHATE, TOTAL (AS P)	< 0.1500	< 0.1500	mg/l	0.1500	0.0000			6	04-23-91

CONTRACT LABORATORY ANALYSIS
RESULTS
H-06b, CULEBRA
ROUND SIX
(TRACE METALS)

PARAMETER	VALUE	VALUE DUPLICATE	UNITS	MINIMUM DETECTION LIMITS	MAXIMUM CONTAMINATE LEVEL	ACID BLANK	WATER BLANK	ROUND #	DATE SAMPLED
ALUMINUM	0.8000	0.7000	mg/l	0.0300	5.0000	0.0750	0.1900	6	04-23-91
ANTIMONY	0.6700	0.6800	mg/l	0.0500	0.0000 <	0.0100 <	0.0100	6	04-23-91
ARSENIC	0.0300	0.0300	mg/l	0.0100	0.1000 <	0.0100	0.0300	6	04-23-91
BARIUM	0.2600	0.1600	mg/l	0.0500	1.0000	0.1100 <	0.0500	6	04-23-91
BERYLLIUM	0.0040	0.0040	mg/l	0.0010	0.0000 <	0.0010 <	0.0010	6	04-23-91
BORON	9.6000	9.3000	mg/l	0.1000	0.7500	0.2000 <	0.1000	6	04-23-91
CADMIUM	0.1840	0.2400	mg/l	0.0010	0.0100 <	0.0010 <	0.0010	6	04-23-91
CALCIUM	1160.0000	1190.0000	mg/l	0.1000	0.0000	2.7450	0.0500	6	04-23-91
CESIUM	< 5.0000	< 5.0000	mg/l	5.0000	0.0000 <	5.0000 <	5.0000	6	04-23-91
MAGNESIUM	775.0000	791.0000	mg/l	0.0500	0.0000	0.9500 <	0.0500	6	04-23-91
MANGANESE	7.3900	7.4300	mg/l	0.0500	0.2000 <	0.0500 <	0.0500	6	04-23-91
MERCURY	0.0032	0.0018	mg/l	0.0002	0.0020	0.0003	0.0007	6	04-23-91
MOLYBDENUM	11.8000	15.3000	mg/l	0.0500	1.0000 <	0.0500 <	0.0500	6	04-23-91
NICKEL	77.5000	78.8000	mg/l	0.0500	0.2000	0.0900 <	0.0500	6	04-23-91
POTASSIUM	374.0000	370.0000	mg/l	0.1000	0.0000 <	0.1000 <	0.1000	6	04-23-91
SELENIUM	0.0200 <	0.0050	mg/l	0.0050	0.0500 <	0.0050 <	0.0100	6	04-23-91
SILICA	32.2000	35.7000	mg/l	1.0000	0.0000 <	1.0000 <	1.0000	6	04-23-91
SILVER	0.0600	0.0600	mg/l	0.0500	0.0500 <	0.0500 <	0.0500	6	04-23-91
SODIUM	6110.0000	6110.0000	mg/l	0.0100	0.0000	0.5000	0.0400	6	04-23-91
STRONTIUM	197.0000	205.0000	mg/l	0.0100	0.0000	0.0200	0.0200	6	04-23-91
THALLIUM	0.2700	0.2600	mg/l	0.0500	0.0000 <	0.0100 <	0.0100	6	04-23-91
TIN	1.5300	1.8400	mg/l	0.0500	0.0000 <	0.0500 <	0.0500	6	04-23-91
TITANIUM	0.0500	0.0600	mg/l	0.0500	0.0000 <	0.0500 <	0.0500	6	04-23-91
ZINC	0.9500	0.8800	mg/l	0.0300	10.0000	0.1050	0.0800	6	04-23-91

CONTRACT LABORATORY ANALYSIS
RESULTS
H-06c, MAGENTA
ROUND SIX
(GENERAL CHEMISTRY)

PARAMETER		VALUE		VALUE DUPLICATE	UNITS	MINIMUM DETECTION LIMIT	MAXIMUM CONTAMINATE LEVEL	ACID BLANK	WATER BLANK	ROUND #	DATE SAMPLED
SPECIFIC CONDUCTANCE		5410.0000		5410.0000	units	0.2000	0.0000			6	05-02-91
SULFATE		3180.0000		3160.0000	mg/l	1.0000	600.0000			6	05-02-91
TOTAL DISSOLVED SOLIDS		4790.0000		4870.0000	mg/l	1.0000	1000.0000			6	05-02-91
TOTAL SUSPENDED SOLIDS		9.0000		10.0000	mg/l	1.0000	0.0000			6	05-02-91
TURBIDITY		1.7800		1.7500	NTU	0.0010	0.0000			6	05-02-91
pH		7.7600		7.7500	SU	N/A	6-9			6	05-02-91
ALKALINITY		53.5000		51.5000	mg/l	1.0000	0.0000			6	05-02-91
BROMIDE		3.3200		3.2500	mg/l	0.0100	0.0000			6	05-02-91
CHLORIDE		466.0000		466.0000	mg/l	1.0000	250.0000			6	05-02-91
CYANIDE	<	0.0100	<	0.0100	mg/l	0.0100	0.2000			6	05-02-91
FLOURIDE		1.5500		1.5400	mg/l	0.0100	1.6000			6	05-02-91
IODIDE		0.1000		0.1000	mg/l	0.1000	0.0000			6	05-02-91
NITROGEN, NITRATE (AS N)	<	0.1000	<	0.1000	mg/l	0.1000	10.0000			6	05-02-91
TOTAL ORGANIC CARBON	<	1.0000	<	1.0000	mg/l	1.0000	0.0000			6	05-02-91
TOTAL ORGANIC HALOGENS		360.0000		340.0000	mg/l	5.0000	0.0000			6	05-02-91
PHENOL, TOTAL	<	0.0050	<	0.0050	mg/l	0.0050	0.0050			6	05-02-91
PHOSPHATE, TOTAL (AS P)	<	0.1500	<	0.1500	mg/l	0.1500	0.0000			6	05-02-91

CONTRACT LABORATORY ANALYSIS
RESULTS
H-06c, MAGENTA
ROUND SIX
(TRACE METALS)

PARAMETER		VALUE		VALUE DUPLICATE	UNITS	MINIMUM DETECTION LIMIT	MAXIMUM CONTAMINATE LEVEL		ACID BLANK		WATER BLANK	ROUND #	DATE SAMPLED
ALUMINUM		0.0600		0.0700	mg/l	0.0300	5.0000		0.0600	<	0.0500	6	05-02-91
ANTIMONY	<	0.0100	<	0.0100	mg/l	0.0500	0.0000	<	0.0100	<	0.0100	6	05-02-91
ARSENIC	<	0.0100	<	0.0100	mg/l	0.0100	0.1000	<	0.0100	<	0.0100	6	05-02-91
BARIUM		0.0800		0.0800	mg/l	0.0500	1.0000	<	0.0500	<	0.0500	6	05-02-91
BERYLLIUM	<	0.0010	<	0.0010	mg/l	0.0010	0.0000		0.0010		0.0010	6	05-02-91
BORON		2.3000		2.0000	mg/l	0.1000	0.7500	<	0.1000	<	0.1000	6	05-02-91
CADMIUM		0.0040		0.0030	mg/l	0.0010	0.0100		0.0025	<	0.0010	6	05-02-91
CALCIUM		487.0000		492.0000	mg/l	0.1000	0.0000		0.5500		0.4200	6	05-02-91
CESIUM	<	5.0000	<	5.0000	mg/l	5.0000	0.0000	<	5.0000	<	5.0000	6	05-02-91
MAGNESIUM		159.0000		160.0000	mg/l	0.0500	0.0000		0.1100		0.0600	6	05-02-91
MANGANESE	<	0.0500	<	0.0500	mg/l	0.0500	0.2000	<	0.0500	<	0.0500	6	05-02-91
MERCURY		0.0004		0.0002	mg/l	0.0002	0.0020		0.0002	<	0.0002	6	05-02-91
MOLYBDENUM		0.0500	<	0.0500	mg/l	0.0500	1.0000	<	0.0500	<	0.0500	6	05-02-91
NICKEL	<	0.0500	<	0.0500	mg/l	0.0500	0.2000	<	0.0500	<	0.0500	6	05-02-91
POTASSIUM		15.7000		15.7000	mg/l	0.1000	0.0000	<	0.1000	<	0.1000	6	05-02-91
SELENIUM	<	0.0050	<	0.0050	mg/l	0.0050	0.0500	<	0.0050	<	0.0050	6	05-02-91
SILICA		5.9000		5.4000	mg/l	1.0000	0.0000	<	1.0000	<	1.0000	6	05-02-91
SILVER	<	0.0500	<	0.0500	mg/l	0.0500	0.0500	<	0.0500	<	0.0500	6	05-02-91
SODIUM		535.0000		520.0000	mg/l	0.0100	0.0000		0.4000		0.4000	6	05-02-91
STRONTIUM		14.5000		17.4000	mg/l	0.0100	0.0000		0.0200		0.0200	6	05-02-91
THALLIUM	<	0.0100	<	0.0100	mg/l	0.0500	0.0000	<	0.0100	<	0.0100	6	05-02-91
TIN		0.2500		0.2400	mg/l	0.0500	0.0000	<	0.0500	<	0.0500	6	05-02-91
TITANIUM	<	0.0500	<	0.0500	mg/l	0.0500	0.0000	<	0.0500	<	0.0500	6	05-02-91
ZINC		0.0700		0.0800	mg/l	0.0300	10.0000		0.1400		0.0550	6	05-02-91

CONTRACT LABORATORY ANALYSIS
RESULTS
H-14, CULEBRA
ROUND FOUR
(GENERAL CHEMISTRY)

PARAMETER	VALUE	VALUE DUPLICATE	UNITS	MINIMUM DETECTION LIMIT	MAXIMUM CONTAMINATE LEVEL	ACID BLANK	WATER BLANK	ROUND #	DATE SAMPLED
SPECIFIC CONDUCTANCE	37020.0000	34960.0000	units	0.2000	0.0000			4	08-28-91
SULFATE	1920.0000	1799.0000	mg/l	1.0000	600.0000			4	08-28-91
TOTAL DISSOLVED SOLIDS	21800.0000	22200.0000	mg/l	1.0000	1000.0000			4	08-28-91
TOTAL SUSPENDED SOLIDS	146.0000	155.0000	mg/l	1.0000	0.0000			4	08-28-91
TURBIDITY	6.4600	6.4200	NTU	0.0010	0.0000			4	08-28-91
pH	7.6000	7.6200	SU	N/A	6-9			4	08-28-91
ALKALINITY	40.1000	37.6000	mg/l	1.0000	0.0000			4	08-28-91
BROMIDE	14.9000	15.2000	mg/l	0.0100	0.0000			4	08-28-91
CHLORIDE	9740.0000	9030.0000	mg/l	1.0000	250.0000			4	08-28-91
CYANIDE	< 0.0100	< 0.0100	mg/l	0.0100	0.2000			4	08-28-91
FLOURIDE	24.1000	27.6000	mg/l	0.0100	1.6000			4	08-28-91
IODIDE	0.1300	0.1200	mg/l	0.1000	0.0000			4	08-28-91
NITROGEN, NITRATE (AS N)	< 0.1000	< 0.1000	mg/l	0.1000	10.0000			4	08-28-91
TOTAL ORGANIC CARBON	1.6000	1.3000	mg/l	1.0000	0.0000			4	08-28-91
TOTAL ORGANIC HALOGENS	115.0000	139.0000	mg/l	5.0000	0.0000			4	08-28-91
PHENOL, TOTAL	0.0070	0.0070	mg/l	0.0050	0.0050			4	08-28-91
PHOSPHATE, TOTAL (AS P)	< 0.0100	< 0.0100	mg/l	0.1500	0.0000			4	08-28-91

CONTRACT LABORATORY ANALYSIS
RESULTS
H-14, CULEBRA
ROUND FOUR
(TRACE METALS)

PARAMETER		VALUE		VALUE DUPLICATE	UNITS	MINIMUM DETECTION LIMIT	MAXIMUM CONTAMINATE LEVEL		ACID BLANK		WATER BLANK	ROUND #	DATE SAMPLED
ALUMINUM		0.4700		0.4800	mg/l	0.0300	5.0000		0.1300	<	0.0500	4	08-28-91
ANTIMONY		0.1600		0.1600	mg/l	0.0500	0.0000	<	0.0500	<	0.0500	4	08-28-91
ARSENIC	<	0.0100	<	0.0100	mg/l	0.0100	0.1000	<	0.0100	<	0.0100	4	08-28-91
BARIUM		0.0500		0.0500	mg/l	0.0500	1.0000	<	0.0500	<	0.0500	4	08-28-91
BERYLLIUM	<	0.0010	<	0.0010	mg/l	0.0010	0.0000	<	0.0010	<	0.0010	4	08-28-91
BORON		13.0000		12.0000	mg/l	0.1000	0.7500		0.3000		0.1500	4	08-28-91
CADMIUM		0.0300		0.0300	mg/l	0.0010	0.0100	<	0.0100	<	0.0100	4	08-28-91
CALCIUM		2110.0000		2100.0000	mg/l	0.1000	0.0000		0.6900		0.1700	4	08-28-91
IRON, TOTAL		0.7700		0.7800	mg/l	0.0300	1.0000		0.0700		0.0700	4	08-28-91
CESIUM	<	1.0000	<	1.0000	mg/l	5.0000	0.0000	<	1.0000	<	1.0000	4	08-28-91
MAGNESIUM		612.0000		598.0000	mg/l	0.0500	0.0000		0.1900	<	0.0500	4	08-28-91
MANGANESE		0.1300		0.1300	mg/l	0.0500	0.2000	<	0.0500	<	0.0500	4	08-28-91
MERCURY	<	0.0002	<	0.0002	mg/l	0.0002	0.0020		0.0002		0.0003	4	08-28-91
MOLYBDENUM		0.0800		0.0800	mg/l	0.0500	1.0000	<	0.0500	<	0.0500	4	08-28-91
NICKEL		0.1100		0.1200	mg/l	0.0500	0.2000	<	0.0500	<	0.0500	4	08-28-91
POTASSIUM		239.0000		228.0000	mg/l	0.1000	0.0000	<	0.5000	<	0.5000	4	08-28-91
SELENIUM	<	0.0050	<	0.0050	mg/l	0.0050	0.0500	<	0.0050	<	0.0050	4	08-28-91
SILICA		7.0000		7.1000	mg/l	1.0000	0.0000	<	1.0000	<	1.0000	4	08-28-91
SILVER		0.0600		0.0600	mg/l	0.0500	0.0500	<	0.0500	<	0.0500	4	08-28-91
SODIUM		2460.0000		3340.0000	mg/l	0.0100	0.0000		0.4700		0.1300	4	08-28-91
STRONTIUM		36.9000		38.1000	mg/l	0.0100	0.0000	<	0.0100	<	0.0100	4	08-28-91
THALLIUM		0.2100		0.2000	mg/l	0.0500	0.0000	<	0.0500	<	0.0500	4	08-28-91
TIN		0.7300		0.7200	mg/l	0.0500	0.0000	<	0.0500	<	0.0500	4	08-28-91
TITANIUM		0.0700		0.0700	mg/l	0.0500	0.0000	<	0.0500	<	0.0500	4	08-28-91
ZINC		0.0500		0.0500	mg/l	0.0300	10.0000		0.0600		0.0500	4	08-28-91

CONTRACT LABORATORY ANALYSIS
RESULTS
WIPP-19, CULEBRA
ROUND SIX
(GENERAL CHEMISTRY)

PARAMETER		VALUE		VALUE DUPLICATE	UNITS	MINIMUM DETECTION LIMIT	MAXIMUM CONTAMINATE LEVEL	ACID BLANK	WATER BLANK	ROUND #	DATE SAMPLED
SPECIFIC CONDUCTANCE		63460.0000		63460.0000	units	0.2000	0.0000			6	07-31-91
SULFATE		6610.0000		6090.0000	mg/l	1.0000	600.0000			6	07-31-91
TOTAL DISSOLVED SOLIDS		76020.0000		75200.0000	mg/l	1.0000	1000.0000			6	07-31-91
TOTAL SUSPENDED SOLIDS		17.0000		5.0000	mg/l	1.0000	0.0000			6	07-31-91
TURBIDITY		29.5000		29.2000	NTU	0.0010	0.0000			6	07-31-91
pH		7.2900		7.3000	SU	N/A	6-9			6	07-31-91
ALKALINITY		61.2000		59.7000	mg/l	1.0000	0.0000			6	07-31-91
BROMIDE		47.7000		47.6000	mg/l	0.0100	0.0000			6	07-31-91
CHLORIDE		52600.0000		42000.0000	mg/l	1.0000	250.0000			6	07-31-91
CYANIDE		0.0100		0.0100	mg/l	0.0100	0.2000			6	07-31-91
FLOURIDE		0.6500		0.6400	mg/l	0.0100	1.6000			6	07-31-91
IODIDE		1.0000		1.0500	mg/l	0.1000	0.0000			6	07-31-91
NITROGEN, NITRATE (AS N)	<	0.1000	<	0.1000	mg/l	0.1000	10.0000			6	07-31-91
TOTAL ORGANIC CARBON	<	1.0000	<	1.0000	mg/l	1.0000	0.0000			6	07-31-91
TOTAL ORGANIC HALOGENS		580.0000		580.0000	mg/l	5.0000	0.0000			6	07-31-91
PHENOL, TOTAL	<	0.0050	<	0.0050	mg/l	0.0050	0.0050			6	07-31-91
PHOSPHATE, TOTAL (AS P)		0.0200		0.0200	mg/l	0.1500	0.0000			6	07-31-91

CONTRACT LABORATORY ANALYSIS
RESULTS
WIPP-19, CULEBRA
ROUND SIX
(TRACE METALS)

PARAMETER		VALUE		VALUE DUPLICATE	UNITS	MINIMUM DETECTION LIMIT	MAXIMUM CONTAMINATE LEVEL	ACID BLANK	WATER BLANK	ROUND #	DATE SAMPLED
ALUMINUM		0.3200		0.3300	mg/l	0.0300	5.0000			6	07-31-91
ANTIMONY		0.1400		0.1400	mg/l	0.0500	0.0000			6	07-31-91
ARSENIC		N/A		N/A	mg/l	0.0100	0.1000			6	07-31-91
BARIUM		0.0500	<	0.0500	mg/l	0.0500	1.0000			6	07-31-91
BERYLLIUM	<	0.0010	<	0.0010	mg/l	0.0010	0.0000			6	07-31-91
BORON		72.0000		73.0000	mg/l	0.1000	0.7500			6	07-31-91
CADMIUM		0.0600		0.0500	mg/l	0.0010	0.0100			6	07-31-91
CALCIUM		1640.0000		1650.0000	mg/l	0.1000	0.0000			6	07-31-91
CESIUM	<	0.1000	<	0.1000	mg/l	5.0000	0.0000			6	07-31-91
IRON, TOTAL		2.1300		2.0900	mg/l	0.0300	1.0000			6	07-31-91
MAGNESIUM		1120.0000		1130.0000	mg/l	0.0500	0.0000			6	07-31-91
MANGANESE		0.7200		0.7000	mg/l	0.0500	0.2000			6	07-31-91
MERCURY		0.0003		0.0003	mg/l	0.0002	0.0020			6	07-31-91
MOLYBDENUM		0.0800		0.0800	mg/l	0.0500	1.0000			6	07-31-91
NICKEL		0.1400		0.1400	mg/l	0.0500	0.2000			6	07-31-91
POTASSIUM		707.0000		640.0000	mg/l	0.1000	0.0000			6	07-31-91
SELENIUM		N/A		N/A	mg/l	0.0050	0.0500			6	07-31-91
SILICA		12.4000		11.6000	mg/l	1.0000	0.0000			6	07-31-91
SILVER		0.0800		0.0800	mg/l	0.0500	0.0500			6	07-31-91
SODIUM		24100.0000		26700.0000	mg/l	0.0100	0.0000			6	07-31-91
STRONTIUM		66.0000		66.0000	mg/l	0.0100	0.0000			6	07-31-91
THALLIUM		0.2300		0.2400	mg/l	0.0500	0.0000			6	07-31-91
TIN		1.1400		1.1100	mg/l	0.0500	0.0000			6	07-31-91
TITANIUM		0.0600		0.0700	mg/l	0.0500	0.0000			6	07-31-91
ZINC	<	0.0500	<	0.0500	mg/l	0.0300	10.0000			6	07-31-91

CONTRACT LABORATORY ANALYSIS
RESULTS
BARN WELL, DEWEY LAKE REDBEDS
ROUND FIVE
(GENERAL CHEMISTRY)

PARAMETER	VALUE	VALUE DUPLICATE	UNITS	MINIMUM DETECTION LIMIT	MAXIMUM CONTAMINANT LEVEL	ACID BLANK	WATER BLANK	ROUND #	DATE SAMPLED
SPECIFIC CONDUCTANCE	940.0000	1034.0000	units	0.2000	0.0000			5	07-18-91
SULFATE	156.0000	160.0000	mg/l	1.0000	600.0000			5	07-18-91
TOTAL DISSOLVED SOLIDS	704.0000	684.0000	mg/l	1.0000	1000.0000			5	07-18-91
TOTAL SUSPENDED SOLIDS	1.0000	3.0000	mg/l	1.0000	0.0000			5	07-18-91
TURBIDITY	0.0540	0.0800	NTU	0.0010	0.0000			5	07-18-91
pH	7.9300	7.9700	SU	N/A	6-9			5	07-18-91
ALKALINITY	217.0000	219.0000	mg/l	1.0000	0.0000			5	07-18-91
BROMIDE	0.7400	0.7400	mg/l	0.0100	0.0000			5	07-18-91
CHLORIDE	39.1000	39.0000	mg/l	1.0000	250.0000			5	07-18-91
CYANIDE	0.1700	0.1700	mg/l	0.0100	0.2000			5	07-18-91
FLOURIDE	2.3700	2.3900	mg/l	0.0100	1.6000			5	07-18-91
IODIDE	< 0.0100	< 0.0100	mg/l	0.1000	0.0000			5	07-18-91
NITROGEN, NITRATE (AS N)	7.8000	9.5000	mg/l	0.1000	10.0000			5	07-18-91
TOTAL ORGANIC CARBON	1.5000	1.4000	mg/l	1.0000	0.0000			5	07-18-91
TOTAL ORGANIC HALOGENS	600.0000	530.0000	mg/l	5.0000	0.0000			5	07-18-91
PHENOL, TOTAL	0.0070	0.0040	mg/l	0.0050	0.0050			5	07-18-91
PHOSPHATE, TOTAL (AS P)	0.2000	0.1700	mg/l	0.1500	0.0000			5	07-18-91

CONTRACT LABORATORY ANALYSIS
RESULTS
BARN WELL, DEWEY LAKE REDBEDS
ROUND FIVE
(TRACE METALS)

PARAMETER		VALUE		VALUE DUPLICATE	UNITS	MINIMUM DETECTION LIMIT	MAXIMUM CONTAMINANT LEVEL	ACID BLANK	WATER BLANK	ROUND #	DATE SAMPLED
ALUMINUM		1.5700		1.5600	mg/l	0.0300	5.0000			5	07-18-91
ANTIMONY	<	0.0500	<	0.0500	mg/l	0.0500	0.0000			5	07-18-91
ARSENIC	<	0.0100	<	0.0100	mg/l	0.0100	0.1000			5	07-18-91
BARIUM		0.0800		0.0800	mg/l	0.0500	1.0000			5	07-18-91
BERYLLIUM	<	0.0010	<	0.0010	mg/l	0.0010	0.0000			5	07-18-91
BORON		0.4000		0.5000	mg/l	0.1000	0.7500			5	07-18-91
CADMIUM	<	0.0100	<	0.0100	mg/l	0.0010	0.0100			5	07-18-91
CALCIUM		53.6000		55.3000	mg/l	0.1000	0.0000			5	07-18-91
CESIUM	<	0.1000	<	0.1000	mg/l	5.0000	0.0000			5	07-18-91
IRON, TOTAL		0.2000		0.1800	mg/l	0.0300	1.0000			5	07-18-91
MAGNESIUM		28.7000		29.3000	mg/l	0.0500	0.0000			5	07-18-91
MANGANESE	<	0.0300	<	0.0300	mg/l	0.0500	0.2000			5	07-18-91
MERCURY	<	0.0002	<	0.0002	mg/l	0.0002	0.0020			5	07-18-91
MOLYBDENUM	<	0.0500	<	0.0500	mg/l	0.0500	1.0000			5	07-18-91
NICKEL		0.2700		0.3400	mg/l	0.0500	0.2000			5	07-18-91
POTASSIUM		2.0000		2.0000	mg/l	0.1000	0.0000			5	07-18-91
SELENIUM		0.0200		0.0200	mg/l	0.0050	0.0500			5	07-18-91
SILICA		21.1000		21.6000	mg/l	1.0000	0.0000			5	07-18-91
SILVER		0.1800		0.2200	mg/l	0.0500	0.0500			5	07-18-91
SODIUM		73.0000		58.0000	mg/l	0.0100	0.0000			5	07-18-91
STRONTIUM		1.0300		1.0500	mg/l	0.0100	0.0000			5	07-18-91
THALLIUM	<	0.0500	<	0.0500	mg/l	0.0500	0.0000			5	07-18-91
TIN	<	0.0500		0.0500	mg/l	0.0500	0.0000			5	07-18-91
TITANIUM	<	0.0500	<	0.0500	mg/l	0.0500	0.0000			5	07-18-91
ZINC		0.0700		0.0700	mg/l	0.0300	10.0000			5	07-18-91

CONTRACT LABORATORY ANALYSIS
RESULTS
RANCH WELL, DEWEY LAKE REDBEDS
ROUND SIX
(GENERAL CHEMISTRY)

PARAMETER	VALUE	VALUE DUPLICATE	UNITS	MINIMUM DETECTION LIMIT	MAXIMIUM CONTAMINATE LEVEL	ACID BLANK	WATER BLANK	ROUND #	DATE SAMPLED
SPECIFIC CONDUCTANCE	3858.0000	3748.0000	units	0.2000	0.0000			6	07-21-91
SULFATE	1250.0000	1220.0000	mg/l	1.0000	600.0000			6	07-21-91
TOTAL DISSOLVED SOLIDS	3220.0000	3210.0000	mg/l	1.0000	1000.0000			6	07-21-91
TOTAL SUSPENDED SOLIDS	6.0000	5.0000	mg/l	1.0000	0.0000			6	07-21-91
TURBIDITY	0.0950	0.1020	NTU	0.0010	0.0000			6	07-21-91
pH	7.3500	7.3300	SU	N/A	6-9			6	07-21-91
ALKALINITY	166.6000	169.0000	mg/l	1.0000	0.0000			6	07-21-91
BROMIDE	2.7600	2.7500	mg/l	0.0100	0.0000			6	07-21-91
CHLORIDE	256.0000	293.0000	mg/l	1.0000	250.0000			6	07-21-91
CYANIDE	0.0400	0.0500	mg/l	0.0100	0.2000			6	07-21-91
FLOURIDE	0.8400	0.8600	mg/l	0.0100	1.6000			6	07-21-91
IODIDE	0.0100	0.0100	mg/l	0.1000	0.0000			6	07-21-91
NITROGEN, NITRATE (AS N)	50.3000	45.7000	mg/l	0.1000	10.0000			6	07-21-91
TOTAL ORGANIC CARBON	2.9000	2.9000	mg/l	1.0000	0.0000			6	07-21-91
TOTAL ORGANIC HALOGENS	95.0000	110.0000	mg/l	5.0000	0.0000			6	07-21-91
PHENOL, TOTAL	< 0.0050	< 0.0050	mg/l	0.0050	0.0050			6	07-21-91
PHOSPHATE, TOTAL (AS P)	0.4000	0.4000	mg/l	0.1500	0.0000			6	07-21-91

CONTRACT LABORATORY ANALYSIS
RESULTS
RANCH WELL, DEWEY LAKE REDBEDS
ROUND SIX
(TRACE METALS)

PARAMETER		VALUE		VALUE DUPLICATE	UNITS	MINIMUM DETECTION LIMIT	MAXIMIUM CONTAMINATE LEVEL	ACID BLANK	WATER BLANK	ROUND #	DATE SAMPLED
ALUMINUM		0.3100		0.9200	mg/l	0.0300	5.0000			6	07-21-91
ANTIMONY	<	0.0500		0.0500	mg/l	0.0500	0.0000			6	07-21-91
ARSENIC	<	0.0100	<	0.0100	mg/l	0.0100	0.1000			6	07-21-91
BARIUM		0.0700		0.1000	mg/l	0.0500	1.0000			6	07-21-91
BERYLLIUM	<	0.0010	<	0.0010	mg/l	0.0010	0.0000			6	07-21-91
BORON		0.3000		0.3000	mg/l	0.1000	0.7500			6	07-21-91
CADMIUM		0.0200		0.0200	mg/l	0.0010	0.0100			6	07-21-91
CALCIUM		501.0000		526.0000	mg/l	0.1000	0.0000			6	07-21-91
CESIUM	<	0.1000	<	0.1000	mg/l	5.0000	0.0000			6	07-21-91
IRON, TOTAL		0.0700		0.1300	mg/l	0.0300	1.0000			6	07-21-91
MAGNESIUM		151.0000		155.0000	mg/l	0.0500	0.0000			6	07-21-91
MANGANESE	<	0.0300	<	0.0300	mg/l	0.0500	0.2000			6	07-21-91
MERCURY	<	0.0002	<	0.0002	mg/l	0.0002	0.0020			6	07-21-91
MOLYBDENUM	<	0.0500	<	0.0500	mg/l	0.0500	1.0000			6	07-21-91
NICKEL		0.0500		0.1800	mg/l	0.0500	0.2000			6	07-21-91
POTASSIUM		4.1000		4.0000	mg/l	0.1000	0.0000			6	07-21-91
SELENIUM		0.0200		0.0100	mg/l	0.0050	0.0500			6	07-21-91
SILICA		14.5000		14.7000	mg/l	1.0000	0.0000			6	07-21-91
SILVER		0.0400		0.1400	mg/l	0.0500	0.0500			6	07-21-91
SODIUM		165.0000		168.0000	mg/l	0.0100	0.0000			6	07-21-91
STRONTIUM		11.6000		11.5000	mg/l	0.0100	0.0000			6	07-21-91
THALLIUM	<	0.0500		0.0600	mg/l	0.0500	0.0000			6	07-21-91
TIN		0.1800		0.2000	mg/l	0.0500	0.0000			6	07-21-91
TITANIUM	<	0.0500	<	0.0500	mg/l	0.0500	0.0000			6	07-21-91
ZINC		0.0600		0.0800	mg/l	0.0300	10.0000			6	07-21-91

CONTRACT LABORATORY ANALYSIS
RESULTS
TWIN WELL, DEWEY LAKE REDBED
ROUND FIVE
(GENERAL CHEMISTRY)

PARAMETER		VALUE		VALUE DUPLICATE	UNITS	MINIMUM DETECTION LIMIT	MAXIMUM CONTAMINATE LEVEL	ACID BLANK	WATER BLANK	ROUND #	DATE SAMPLED
SPECIFIC CONDUCTANCE		556.4000		556.4000	units	0.2000	0.0000			5	08-07-91
SULFATE		51.7000		55.2000	mg/l	1.0000	600.0000			5	08-07-91
TOTAL DISSOLVED SOLIDS		408.0000		418.0000	mg/l	1.0000	1000.0000			5	08-07-91
TOTAL SUSPENDED SOLIDS		2.0000		3.0000	mg/l	1.0000	0.0000			5	08-07-91
TURBIDITY		3.1300		2.6500	NTU	0.0010	0.0000			5	08-07-91
pH		7.9400		7.9400	SU	N/A	6-9			5	08-07-91
ALKALINITY		165.0000		164.0000	mg/l	1.0000	0.0000			5	08-07-91
BROMIDE	<	0.5000	<	0.5000	mg/l	0.0100	0.0000			5	08-07-91
CHLORIDE		36.0000		38.4000	mg/l	1.0000	250.0000			5	08-07-91
CYANIDE		0.0200		0.0200	mg/l	0.0100	0.2000			5	08-07-91
FLOURIDE		0.5200		0.5100	mg/l	0.0100	1.6000			5	08-07-91
IODIDE	<	0.0100	<	0.0100	mg/l	0.1000	0.0000			5	08-07-91
NITROGEN, NITRATE (AS N)		9.0800		9.2900	mg/l	0.1000	10.0000			5	08-07-91
TOTAL ORGANIC CARBON	<	1.0000	<	1.0000	mg/l	1.0000	0.0000			5	08-07-91
TOTAL ORGANIC HALOGENS		14.0000		5.2000	mg/l	5.0000	0.0000			5	08-07-91
PHENOL, TOTAL		0.0080		0.0080	mg/l	0.0050	0.0050			5	08-07-91
PHOSPHATE, TOTAL (AS P)		0.0400		0.0400	mg/l	0.1500	0.0000			5	08-07-91

CONTRACT LABORATORY ANALYSIS
RESULTS
TWIN WELL, DEWEY LAKE REDBED
ROUND FIVE
(TRACE METALS)

PARAMETER		VALUE		VALUE DUPLICATE	UNITS	MINIMUM DETECTION LIMIT	MAXIMUM CONTAMINATE LEVEL	ACID BLANK	WATER BLANK	ROUND #	DATE SAMPLED
ALUMINUM		0.1500		0.1400	mg/l	0.0300	5.0000			5	08-07-91
ANTIMONY	<	0.0500	<	0.0500	mg/l	0.0500	0.0000			5	08-07-91
ARSENIC		0.0100		0.0100	mg/l	0.0100	0.1000			5	08-07-91
BARIUM		0.1300		0.1300	mg/l	0.0500	1.0000			5	08-07-91
BERYLLIUM	<	0.0010	<	0.0010	mg/l	0.0010	0.0000			5	08-07-91
BORON		0.4000		0.4000	mg/l	0.1000	0.7500			5	08-07-91
CADMIUM	<	0.0100	<	0.0100	mg/l	0.0010	0.0100			5	08-07-91
CALCIUM		64.6000		68.3000	mg/l	0.1000	0.0000			5	08-07-91
CESIUM	<	0.1000	<	0.1000	mg/l	5.0000	0.0000			5	08-07-91
IRON, TOTAL		0.5400		0.5200	mg/l	0.0300	1.0000			5	08-07-91
MAGNESIUM		22.7000		22.5000	mg/l	0.0500	0.0000			5	08-07-91
MANGANESE	<	0.0500	<	0.0500	mg/l	0.0500	0.2000			5	08-07-91
MERCURY	<	0.0002	<	0.0002	mg/l	0.0002	0.0020			5	08-07-91
MOLYBDENUM	<	0.0500	<	0.0500	mg/l	0.0500	1.0000			5	08-07-91
NICKEL	<	0.0500	<	0.0500	mg/l	0.0500	0.2000			5	08-07-91
POTASSIUM		5.0600		5.2500	mg/l	0.1000	0.0000			5	08-07-91
SELENIUM	<	0.0050	<	0.0050	mg/l	0.0050	0.0500			5	08-07-91
SILICA		4.1000		4.2000	mg/l	1.0000	0.0000			5	08-07-91
SILVER	<	0.0500	<	0.0500	mg/l	0.0500	0.0500			5	08-07-91
SODIUM		28.3000		5.8000	mg/l	0.0100	0.0000			5	08-07-91
STRONTIUM		1.1400		1.2100	mg/l	0.0100	0.0000			5	08-07-91
THALLIUM	<	0.0500	<	0.0500	mg/l	0.0500	0.0000			5	08-07-91
TIN	<	0.0500		0.0500	mg/l	0.0500	0.0000			5	08-07-91
TITANIUM	<	0.0500	<	0.0500	mg/l	0.0500	0.0000			5	08-07-91
ZINC		0.1600		0.1500	mg/l	0.0300	10.0000			5	08-07-91

Appendix 10
Charge Balance of Major Cations and Anions Based on Contract Laboratory Analysis

WQSP: H-06c
ORIGINATOR: R. G. R.
DATE PRINTED: 11-12-92

CHARGE BALANCE FORMULAS
& TDS CALCULATIONS
H-06c, MAGENTA, ROUND SIX
(CEP ANALYSIS)

	VALUE mg/l	ATOMIC/MOLE WEIGHT	CHARGE UNITS	meq/l
CATIONS				
SODIUM (AA)	527.50	22.99	1	22.94
POTASSIUM (AA)	15.70	39.10	1	0.40
MAGNESIUM (ICP)	159.50	24.31	2	13.12
CALCIUM (ICP)	489.50	40.08	2	24.43
BORON	2.15	10.81	3	0.60
SILICA	5.65	28.81	2	0.39
		SUM OF CATION CHARGES		61.88
SUM OF CATIONS	1200.00			
ANIONS				
CHLORIDE	466.00	35.45	1	13.14
SULFATE	3170.00	96.05	2	66.01
IODIDE	0.10	126.90	1	0.00
BROMIDE	3.29	79.91	1	0.04
FLUORIDE	1.55	19.00	1	0.08
ALKALINITY (HCO3)	52.50	61.01	1	0.86
HCO3 CONVERT TO CO3**	25.82			
		SUM OF ANION CHARGES		80.14
SUM OF ANIONS	3666.76			
TOTAL DISSOLVED SOLIDS	4830.00	CHARGE DIFFERENCE		18.25
FIELD CONDUCTIVITY	5320.00	% CHARGE DIFFERENCE		12.85
FIELD COND./TDS	1.10			

*FIELD HCO3 UTILIZED FOR CHARGE BALANCE CALCULATION
**FIELD HCO3 CONVERTED TO EQUIVALENT CO3 FOR SUMMATION OF ANIONS AND TDS

WQSP: H-06b
ORIGINATOR: R. G. R.
DATE PRINTED: 11-12-92

CHARGE BALANCE FORMULAS
& TDS CALCULATIONS
H-06b, CULEBRA, ROUND SIX
(CEP ANALYSIS)

	VALUE mg/l	ATOMIC/MOLE WEIGHT	CHARGE UNITS	meq/l
CATIONS				
SODIUM (AA)	6110.00	22.99	1	265.77
POTASSIUM (AA)	372.00	39.10	1	9.51
MAGNESIUM (ICP)	783.00	24.31	2	64.41
CALCIUM (ICP)	1175.00	40.08	2	58.63
BORON	9.45	10.81	3	2.62
SILICA	33.95	28.81	2	2.36
		SUM OF CATION CHARGES		403.31
SUM OF CATIONS	8483.40			
ANIONS				
CHLORIDE	33400.00	35.45	1	942.09
SULFATE	4370.00	96.05	2	90.99
IODIDE	0.70	126.90	1	0.01
BROMIDE	3.68	79.91	1	0.05
FLUORIDE	0.70	19.00	1	0.04
ALKALINITY (HCO3)	103.00	61.01	1	1.69
HCO3 CONVERT TO CO3**	50.66			
		SUM OF ANION CHARGES		1034.86
SUM OF ANIONS	37825.74			
TOTAL DISSOLVED SOLIDS	55750.00	CHARGE DIFFERENCE		631.55
FIELD CONDUCTIVITY	76800.00	% CHARGE DIFFERENCE		43.91
FIELD COND./TDS	1.38			

*FIELD HCO3 UTILIZED FOR CHARGE BALANCE CALCULATION
**FIELD HCO3 CONVERTED TO EQUIVALENT CO3 FOR SUMMATION OF ANIONS AND TDS

WQSP: H-03b1
ORIGINATOR: R. G. R.
DATE PRINTED: 11-13-92

CHARGE BALANCE FORMULAS
& TDS CALCULATIONS
H-03b1, MAGENTA, ROUND SIX
(CEP ANALYSIS)

	VALUE mg/l	ATOMIC/MOLE WEIGHT	CHARGE UNITS	meq/l
CATIONS				
SODIUM (AA)	1265.00	22.99	1	55.02
POTASSIUM (AA)	29.80	39.10	1	0.76
MAGNESIUM (ICP)	301.50	24.31	2	24.80
CALCIUM (ICP)	373.50	40.08	2	18.64
BORON	3.60	10.81	3	1.00
SILICA	10.95	28.81	2	0.76
		SUM OF CATION CHARGES		100.99
SUM OF CATIONS	1984.35			
ANIONS				
CHLORIDE	3705.00	35.45	1	104.50
SULFATE	2360.48	96.05	2	49.15
IODIDE	1.10	126.90	1	0.01
BROMIDE	5.48	79.91	1	0.07
FLUORIDE	0.00	19.00	1	0.00
ALKALINITY (HCO3)	84.05	61.01	1	1.38
HCO3 CONVERT TO CO3**	41.34			
		SUM OF ANION CHARGES		155.11
SUM OF ANIONS	6113.40			
TOTAL DISSOLVED SOLIDS	9350.00	CHARGE DIFFERENCE		54.12
FIELD CONDUCTIVITY	12420.00	% CHARGE DIFFERENCE		21.13
FIELD COND./TDS	1.33			

*FIELD HCO3 UTILIZED FOR CHARGE BALANCE CALCULATION
**FIELD HCO3 CONVERTED TO EQUIVALENT CO3 FOR SUMMATION OF ANIONS AND TDS

WQSP: H-03b3
ORIGINATOR: R. G. R.
DATE PRINTED: 11-13-92

CHARGE BALANCE FORMULAS
& TDS CALCULATIONS
H-03b3, CULEBRA, ROUND SIX
(ITAS ANALYSIS)

	VALUE mg/l	ATOMIC/MOLE WEIGHT	CHARGE UNITS	meq/l
CATIONS				
SODIUM (AA)	15050.00	22.99	1	654.64
POTASSIUM (AA)	436.50	39.10	1	11.16
MAGNESIUM (ICP)	731.00	24.31	2	60.13
CALCIUM (ICP)	1390.00	40.08	2	69.36
BORON	33.05	10.81	3	9.17
SILICA	49.40	28.81	2	3.43
		SUM OF CATION CHARGES		807.90
SUM OF CATIONS	17689.95			
ANIONS				
CHLORIDE	29800.00	35.45	1	840.55
SULFATE	5680.00	96.05	2	118.27
IODIDE	0.66	126.90	1	0.01
BROMIDE	206.50	79.91	1	2.58
FLUORIDE	1.00	19.00	1	0.05
ALKALINITY (HCO3)	48.80	61.01	1	0.80
HCO3 CONVERT TO CO3**	24.00			
		SUM OF ANION CHARGES		962.26
SUM OF ANIONS	35712.16			
TOTAL DISSOLVED SOLIDS	51300.00	CHARGE DIFFERENCE		154.36
FIELD CONDUCTIVITY	70200.00	% CHARGE DIFFERENCE		8.72
FIELD COND./TDS	1.37			

*FIELD HCO3 UTILIZED FOR CHARGE BALANCE CALCULATION
**FIELD HCO3 CONVERTED TO EQUIVALENT CO3 FOR SUMMATION OF ANIONS AND TDS

WQSP: H-05b
ORIGINATOR: R. G. R.
DATE PRINTED: 11-12-92

CHARGE BALANCE FORMULAS
& TDS CALCULATIONS
H-05b, CULEBRA, ROUND SIX
(CEP ANALYSIS)

	VALUE mg/l	ATOMIC/MOLE WEIGHT	CHARGE UNITS	meq/l
CATIONS				
SODIUM (AA)	47300.00	22.99	1	2057.43
POTASSIUM (AA)	1155.00	39.10	1	29.54
MAGNESIUM (ICP)	2015.00	24.31	2	165.76
CALCIUM (ICP)	1545.00	40.08	2	77.10
BORON	49.40	10.81	3	13.71
SILICA	16.80	28.81	2	1.17
		SUM OF CATION CHARGES		2344.70
SUM OF CATIONS	52081.20			
ANIONS				
CHLORIDE	88050.00	35.45	1	2483.57
SULFATE	184000.00	96.05	2	3831.34
IODIDE	5.65	126.90	1	0.04
BROMIDE	2000.00	79.91	1	25.03
FLUORIDE	0.43	19.00	1	0.02
ALKALINITY (HCO3)	36.80	61.01	1	0.60
HCO3 CONVERT TO CO3**	18.10			
		SUM OF ANION CHARGES		6340.61
SUM OF ANIONS	274074.18			
TOTAL DISSOLVED SOLIDS	261000.00	CHARGE DIFFERENCE		3995.90
FIELD CONDUCTIVITY	152300.00	% CHARGE DIFFERENCE		46.01
FIELD COND./TDS	0.58			

*FIELD HCO3 UTILIZED FOR CHARGE BALANCE CALCULATION
**FIELD HCO3 CONVERTED TO EQUIVALENT CO3 FOR SUMMATION OF ANIONS AND TDS

WQSP: RANCH WELL
ORIGINATOR: R. G. R.
DATE PRINTED: 11-12-92

CHARGE BALANCE FORMULAS
& TDS CALCULATIONS
RANCH WELL,DEWEY LAKE, ROUND SIX
(CEP ANALYSIS)

	VALUE mg/l	ATOMIC/MOLE WEIGHT	CHARGE UNITS	meq/l
CATIONS				
SODIUM (AA)	167.00	22.99	1	7.26
POTASSIUM (AA)	4.10	39.10	1	0.10
MAGNESIUM (ICP)	153.00	24.31	2	12.59
CALCIUM (ICP)	514.00	40.08	2	25.65
BORON	0.30	10.81	3	0.08
SILICA	14.60	28.81	2	1.01
		SUM OF CATION CHARGES		46.70
SUM OF CATIONS	853.00			
ANIONS				
CHLORIDE	275.00	35.45	1	7.76
SULFATE	1235.00	96.05	2	25.72
IODIDE	0.01	126.90	1	0.00
BROMIDE	2.76	79.91	1	0.03
FLUORIDE	0.85	19.00	1	0.04
ALKALINITY (HCO3)	167.80	61.01	1	2.75
HCO3 CONVERT TO CO3**	82.52			
		SUM OF ANION CHARGES		36.30
SUM OF ANIONS	1596.14			
TOTAL DISSOLVED SOLIDS	3215.00	CHARGE DIFFERENCE		10.40
FIELD CONDUCTIVITY	3418.00	% CHARGE DIFFERENCE		12.53
FIELD COND./TDS	1.06			

*FIELD HCO3 UTILIZED FOR CHARGE BALANCE CALCULATION
**FIELD HCO3 CONVERTED TO EQUIVALENT CO3 FOR SUMMATION OF ANIONS AND TDS

WQSP: H-05c
ORIGINATOR: R. G. R.
DATE PRINTED: 11-12-92

CHARGE BALANCE FORMULAS
& TDS CALCULATIONS
H-05c, MAGENTA, ROUND SIX
(CEP ANALYSIS)

	VALUE mg/l	ATOMIC/MOLE WEIGHT	CHARGE UNITS	meq/l
CATIONS				
SODIUM (AA)	1116.00	22.99	1	48.54
POTASSIUM (AA)	3.50	39.10	1	0.09
MAGNESIUM (ICP)	172.28	24.31	2	14.17
CALCIUM (ICP)	575.34	40.08	2	28.71
BORON	10.00	10.81	3	2.77
SILICA	6.60	28.81	2	0.46
		SUM OF CATION CHARGES		94.75
SUM OF CATIONS	1883.72			
ANIONS				
CHLORIDE	1124.40	35.45	1	31.72
SULFATE	365.10	96.05	2	7.60
IODIDE	0.25	126.90	1	0.00
BROMIDE	11.48	79.91	1	0.14
FLUORIDE	2.06	19.00	1	0.11
ALKALINITY (HCO3)	61.92	61.01	1	1.01
HCO3 CONVERT TO CO3**	30.45			
		SUM OF ANION CHARGES		40.59
SUM OF ANIONS	1533.74			
TOTAL DISSOLVED SOLIDS	7228.00	CHARGE DIFFERENCE		54.16
FIELD CONDUCTIVITY	8460.00	% CHARGE DIFFERENCE		40.02
FIELD COND./TDS	1.17			

*FIELD HCO3 UTILIZED FOR CHARGE BALANCE CALCULATION
**FIELD HCO3 CONVERTED TO EQUIVALENT CO3 FOR SUMMATION OF ANIONS AND TDS

WQSP: BARN WELL
ORIGINATOR: R. G. R.
DATE PRINTED: 11-12-92

CHARGE BALANCE FORMULAS
& TDS CALCULATIONS
BARN WELL, DEWEY LAKE, ROUND FIVE
(CEP ANALYSIS)

	VALUE mg/l	ATOMIC/MOLE WEIGHT	CHARGE UNITS	meq/l
CATIONS				
SODIUM (AA)	66.00	22.99	1	2.87
POTASSIUM (AA)	2.00	39.10	1	0.05
MAGNESIUM (ICP)	29.00	24.31	2	2.39
CALCIUM (ICP)	54.50	40.08	2	2.72
BORON	0.45	10.81	3	0.12
SILICA	21.40	28.81	2	1.49
		SUM OF CATION CHARGES		9.64
SUM OF CATIONS	173.35			
ANIONS				
CHLORIDE	39.10	35.45	1	1.10
SULFATE	158.00	96.05	2	3.29
IODIDE	0.00	126.90	1	0.00
BROMIDE	0.74	79.91	1	0.01
FLUORIDE	2.38	19.00	1	0.13
ALKALINITY (HCO3)	218.00	61.01	1	3.57
HCO3 CONVERT TO CO3**	107.21			
		SUM OF ANION CHARGES		8.10
SUM OF ANIONS	307.43			
TOTAL DISSOLVED SOLIDS	694.00	CHARGE DIFFERENCE		1.54
FIELD CONDUCTIVITY	1004.00	% CHARGE DIFFERENCE		8.67
FIELD COND./TDS	1.45			

*FIELD HCO3 UTILIZED FOR CHARGE BALANCE CALCULATION
**FIELD HCO3 CONVERTED TO EQUIVALENT CO3 FOR SUMMATION OF ANIONS AND TDS

WQSP: TWIN WELL
ORIGINATOR: R. G. R.
DATE PRINTED: 11-12-92

CHARGE BALANCE FORMULAS
& TDS CALCULATIONS
TWIN WELLS - PASTURE, DEWEY LAKE ROUND 5
(CEP ANALYSIS)

	VALUE mg/l	ATOMIC/MOLE WEIGHT	CHARGE UNITS	meq/l
CATIONS				
SODIUM (AA)	28.30	22.99	1	1.23
POTASSIUM (AA)	5.16	39.10	1	0.13
MAGNESIUM (ICP)	22.60	24.31	2	1.86
CALCIUM (ICP)	66.50	40.08	2	3.32
BORON	0.40	10.81	3	0.11
SILICA	4.15	28.81	2	0.29
		SUM OF CATION CHARGES		6.94
SUM OF CATIONS	127.11			
ANIONS				
CHLORIDE	37.20	35.45	1	1.05
SULFATE	53.50	96.05	2	1.11
IODIDE	0.00	126.90	1	0.00
BROMIDE	0.00	79.91	1	0.00
FLUORIDE	0.52	19.00	1	0.03
ALKALINITY (HCO3)	164.50	61.01	1	2.70
HCO3 CONVERT TO CO3**	80.90			
		SUM OF ANION CHARGES		4.89
SUM OF ANIONS	172.12			
TOTAL DISSOLVED SOLIDS	413.00	CHARGE DIFFERENCE		2.05
FIELD CONDUCTIVITY	587.00	% CHARGE DIFFERENCE		17.36
FIELD COND./TDS	1.42			

*FIELD HCO3 UTILIZED FOR CHARGE BALANCE CALCULATION
**FIELD HCO3 CONVERTED TO EQUIVALENT CO3 FOR SUMMATION OF ANIONS AND TDS

WQSP: WIPP-19
ORIGINATOR: R. G. R.
DATE PRINTED: 11-12-92

CHARGE BALANCE FORMULAS
& TDS CALCULATIONS
WIPP-19, CULEBRA, ROUND SIX
(CEP ANALYSIS)

	VALUE mg/l	ATOMIC/MOLE WEIGHT	CHARGE UNITS	meq/l
CATIONS				
SODIUM (AA)	25400.00	22.99	1	1104.84
POTASSIUM (AA)	673.50	39.10	1	17.22
MAGNESIUM (ICP)	1125.00	24.31	2	92.55
CALCIUM (ICP)	1645.00	40.08	2	82.09
BORON	72.50	10.81	3	20.12
SILICA	12.00	28.81	2	0.83
		SUM OF CATION CHARGES		1317.65
SUM OF CATIONS	28928.00			
ANIONS				
CHLORIDE	47300.00	35.45	1	1334.16
SULFATE	6350.00	96.05	2	132.22
IODIDE	1.03	126.90	1	0.01
BROMIDE	47.70	79.91	1	0.60
FLUORIDE	0.65	19.00	1	0.03
ALKALINITY (HCO3)	60.45	61.01	1	0.99
HCO3 CONVERT TO CO3**	29.73			
		SUM OF ANION CHARGES		1468.01
SUM OF ANIONS	53729.11			
TOTAL DISSOLVED SOLIDS	75610.00	CHARGE DIFFERENCE		150.37
FIELD CONDUCTIVITY	92600.00	% CHARGE DIFFERENCE		5.40
FIELD COND./TDS	1.22			

*FIELD HCO3 UTILIZED FOR CHARGE BALANCE CALCULATION
**FIELD HCO3 CONVERTED TO EQUIVALENT CO3 FOR SUMMATION OF ANIONS AND TDS

WQSP: H-02c
ORIGINATOR: R. G. R.
DATE PRINTED: 11-12-92

CHARGE BALANCE FORMULAS
& TDS CALCULATIONS
H-02c, CULEBRA, ROUND THREE
(CEP ANALYSIS)

	VALUE mg/l	ATOMIC/MOLE WEIGHT	CHARGE UNITS	meq/l
CATIONS				
SODIUM (AA)	2715.00	22.99	1	118.10
POTASSIUM (AA)	109.00	39.10	1	2.79
MAGNESIUM (ICP)	167.00	24.31	2	13.74
CALCIUM (ICP)	793.00	40.08	2	39.57
BORON	14.50	10.81	3	4.02
SILICA	0.50	28.81	2	0.03
		SUM OF CATION CHARGES		178.25
SUM OF CATIONS	3799.00			
ANIONS				
CHLORIDE	3175.00	35.45	1	89.56
SULFATE	2480.00	96.05	2	51.64
IODIDE	0.12	126.90	1	0.00
BROMIDE	6.02	79.91	1	0.08
FLUORIDE	1.87	19.00	1	0.10
ALKALINITY (HCO3)	59.30	61.01	1	0.97
HCO3 CONVERT TO CO3**	29.16			
		SUM OF ANION CHARGES		142.34
SUM OF ANIONS	5692.17			
TOTAL DISSOLVED SOLIDS	9355.00	CHARGE DIFFERENCE		35.91
FIELD CONDUCTIVITY	12700.00	% CHARGE DIFFERENCE		11.20
FIELD COND./TDS	1.36			

*FIELD HCO3 UTILIZED FOR CHARGE BALANCE CALCULATION
**FIELD HCO3 CONVERTED TO EQUIVALENT CO3 FOR SUMMATION OF ANIONS AND TDS

WQSP: H-14
ORIGINATOR: R. G. R.
DATE PRINTED: 11-12-92

CHARGE BALANCE FORMULAS
& TDS CALCULATIONS
H-14, CULEBRA, ROUND SIX
(CEP ANALYSIS)

	VALUE mg/l	ATOMIC/MOLE WEIGHT	CHARGE UNITS	meq/l
CATIONS				
SODIUM (AA)	2900.00	22.99	1	126.14
POTASSIUM (AA)	234.00	39.10	1	5.98
MAGNESIUM (ICP)	605.00	24.31	2	49.77
CALCIUM (ICP)	2105.00	40.08	2	105.04
BORON	12.50	10.81	3	3.47
SILICA	7.10	28.81	2	0.49
		SUM OF CATION CHARGES		290.90
SUM OF CATIONS	5863.60			
ANIONS				
CHLORIDE	9385.00	35.45	1	264.72
SULFATE	1860.00	96.05	2	38.73
IODIDE	0.13	126.90	1	0.00
BROMIDE	15.10	79.91	1	0.19
FLUORIDE	25.90	19.00	1	1.36
ALKALINITY (HCO3)	38.85	61.01	1	0.64
HCO3 CONVERT TO CO3**	19.11			
		SUM OF ANION CHARGES		305.64
SUM OF ANIONS	11305.24			
TOTAL DISSOLVED SOLIDS	22000.00	CHARGE DIFFERENCE		14.74
FIELD CONDUCTIVITY	25200.00	% CHARGE DIFFERENCE		2.47
FIELD COND./TDS	1.15			

*FIELD HCO3 UTILIZED FOR CHARGE BALANCE CALCULATION
**FIELD HCO3 CONVERTED TO EQUIVALENT CO3 FOR SUMMATION OF ANIONS AND TDS

WQSP: H-04b
ORIGINATOR: R. G. R.
DATE PRINTED: 11-12-92

CHARGE BALANCE FORMULAS
& TDS CALCULATIONS
H-04b, CULEBRA, ROUND SIX
(CEP ANALYSIS)

	VALUE mg/l	ATOMIC/MOLE WEIGHT	CHARGE UNITS	meq/l
CATIONS				
SODIUM (AA)	4090.00	22.99	1	177.90
POTASSIUM (AA)	186.50	39.10	1	4.77
MAGNESIUM (ICP)	435.50	24.31	2	35.83
CALCIUM (ICP)	815.50	40.08	2	40.69
BORON	21.20	10.81	3	5.88
SILICA	6.35	28.81	2	0.44
		SUM OF CATION CHARGES		265.52
SUM OF CATIONS	5555.05			
ANIONS				
CHLORIDE	8000.00	35.45	1	225.65
SULFATE	5530.00	96.05	2	115.15
IODIDE	0.00	126.90	1	0.00
BROMIDE	40.65	79.91	1	0.51
FLUORIDE	33.05	19.00	1	1.74
ALKALINITY (HCO3)	18.10	61.01	1	0.30
HCO3 CONVERT TO CO3**	8.90			
		SUM OF ANION CHARGES		343.34
SUM OF ANIONS	13612.60			
TOTAL DISSOLVED SOLIDS	20500.00	CHARGE DIFFERENCE		77.83
FIELD CONDUCTIVITY	26800.00	% CHARGE DIFFERENCE		12.78
FIELD COND./TDS	1.31			

*FIELD HCO3 UTILIZED FOR CHARGE BALANCE CALCULATION
**FIELD HCO3 CONVERTED TO EQUIVALENT CO3 FOR SUMMATION OF ANIONS AND TDS

WQSP: H-04c
ORIGINATOR: R. G. R.
DATE PRINTED: 02-07-92

CHARGE BALANCE FORMULAS
& TDS CALCULATIONS
H-04c, MAGENTA, ROUND SIX
(CONTRACT LABORATORY)

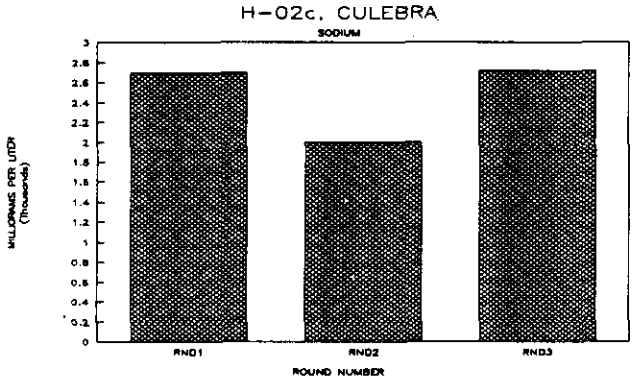
	VALUE mg/l	ATOMIC/MOLE WEIGHT	CHARGE UNITS	meq/l
CATIONS				
SODIUM (AA)	6860.00	22.99	1	298.39
POTASSIUM (AA)	66.60	39.10	1	1.70
MAGNESIUM (ICP)	454.00	24.31	2	37.35
CALCIUM (ICP)	738.50	40.08	2	36.85
BORON	15.00	10.81		
SILICA	4.90	28.81		
		SUM OF CATION CHARGES		374.30
SUM OF CATIONS	8139.00			
ANIONS				
CHLORIDE	8816.00	35.45	1	248.67
SULFATE	6860.00	96.05	2	142.84
IODIDE	0.33	126.90	1	0.00
BROMIDE	58.65	79.91	1	0.73
FLUORIDE	2.54	19.00	1	0.13
ALKALINITY (HCO3)	120.00	61.01	1	1.97
HCO3 CONVERT TO CO3**	59.02			
		SUM OF ANION CHARGES		394.35
SUM OF ANIONS	15796.54			
TOTAL DISSOLVED SOLIDS	24270.00	CHARGE DIFFERENCE		20.05
FIELD CONDUCTIVITY	35600.00	% CHARGE DIFFERENCE		2.61
FIELD COND./TDS	1.47			

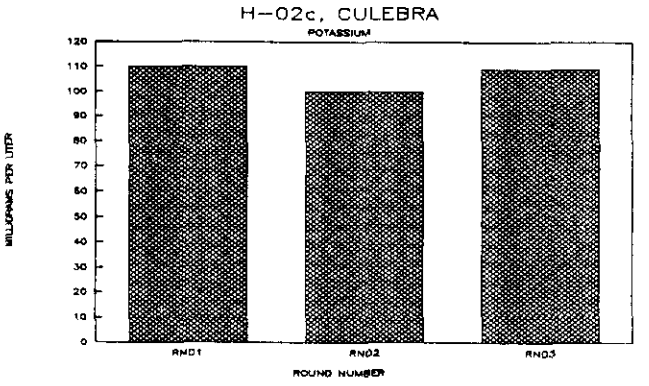
**FIELD HCO3 CONVERTED TO EQUIVALENT CO3 FOR SUMMATION OF ANIONS AND TDS

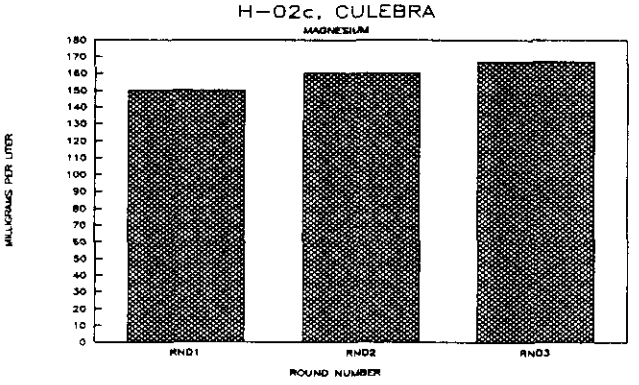
Appendix 11
Major Cation and Anion Graphs

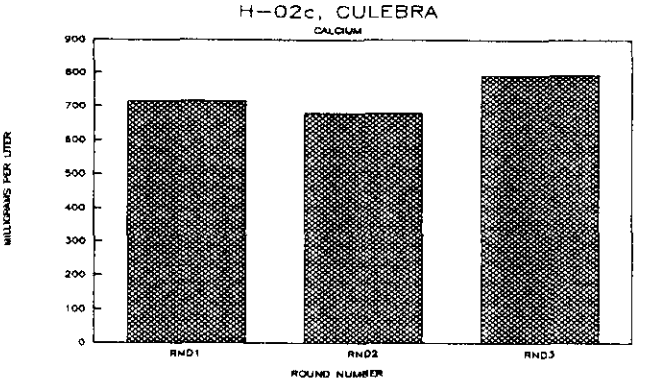
H-02c, CULEBRA
HISTORY
MAJOR CATIONS

ROUND	SODIUM	POTASSIUM	MAGNESIUM	CALCIUM
RND1	2700.00	110.00	150.00	715.00
RND2	2000.00	100.00	160.00	680.00
RND3	2715.00	109.00	167.00	793.00



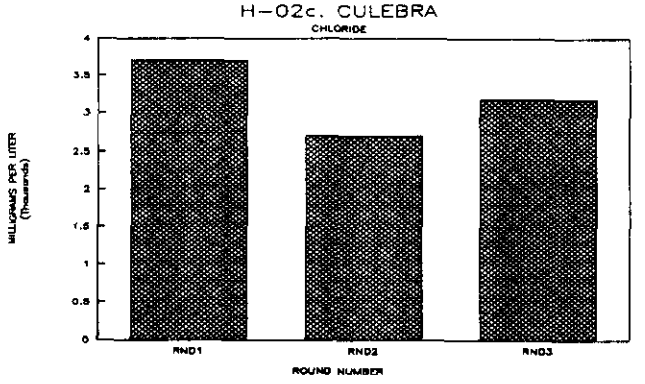


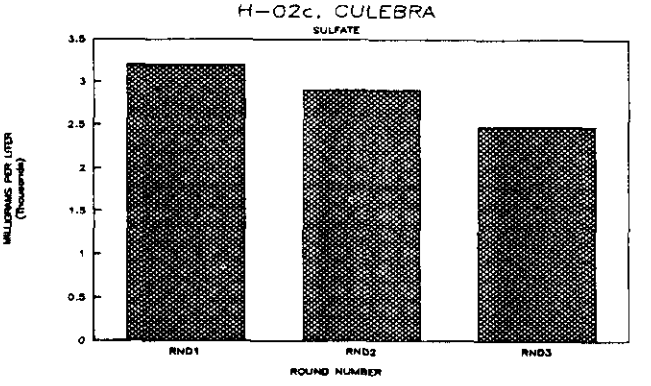


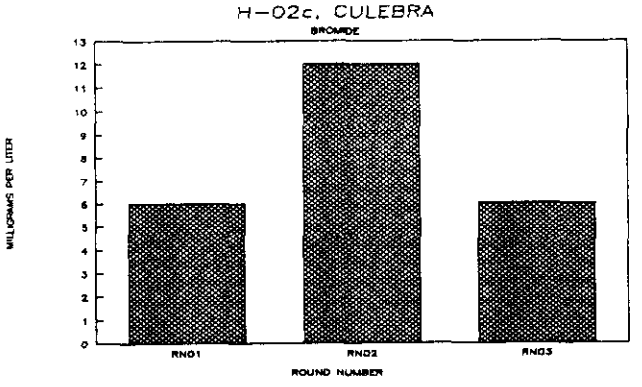


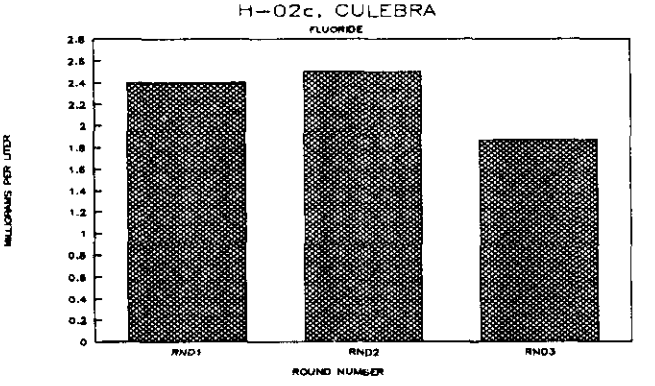
H-02c, CULEBRA
HISTORY
MAJOR ANIONS

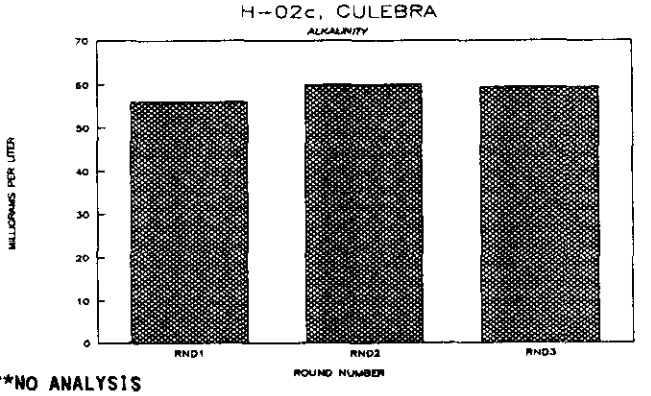
ROUND	CHLORIDE	SULFATE	BROMIDE	FLUORIDE	ALKALINITY
RND1	3700.00	3200.00	6.00	2.40	56.00
RND2	2700.00	2900.00	12.00 **	2.50	60.00
RND3	3175.00	2480.00	6.02	1.87	59.30







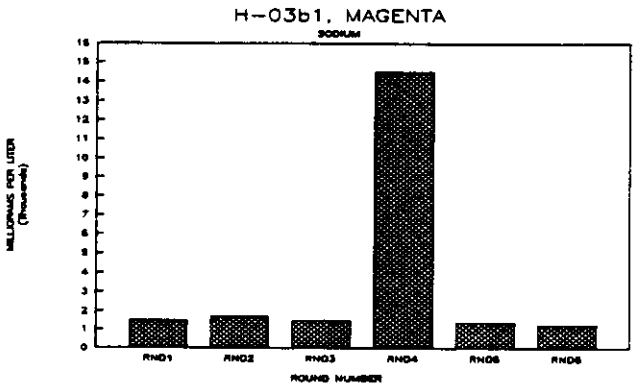


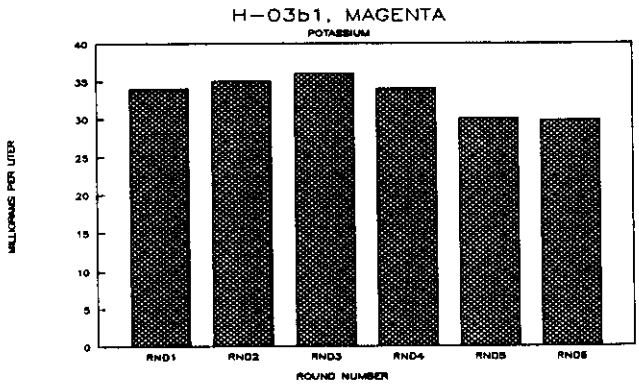


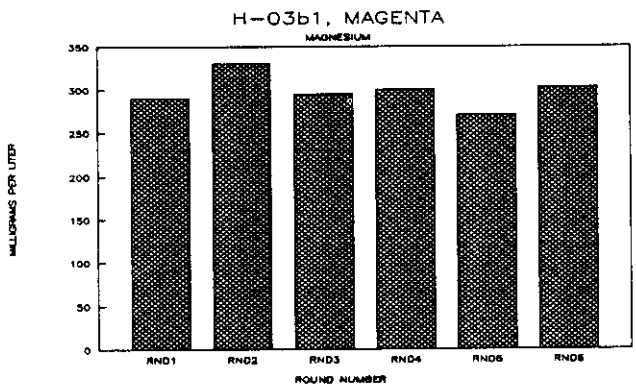
*FIELD VALUE **SUSPECT VALUE ***NO ANALYSIS

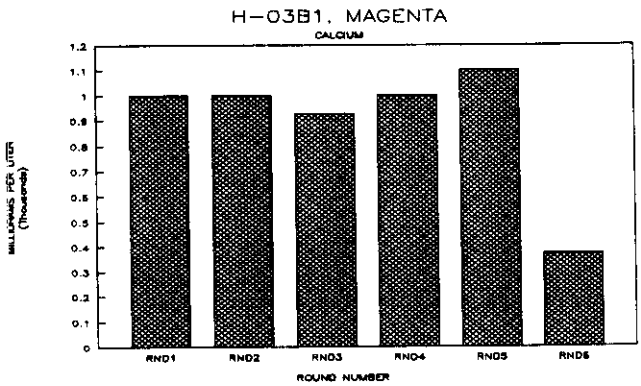
H-03b1, MAGENTA
HISTORY
MAJOR CATIONS

ROUND	SODIUM	POTASSIUM	MAGNESIUM	CALCIUM
RND1	1500.00	34.00	290.00	1000.00
RND2	1700.00	35.00	330.00	1000.00
RND3	1500.00	36.00	295.00	925.00
RND4	14500.00 **	34.00	300.00	1000.00
RND5	1400.00	30.00	270.00	1100.00
RND6	1265.00	29.80	302.00	374.00 **





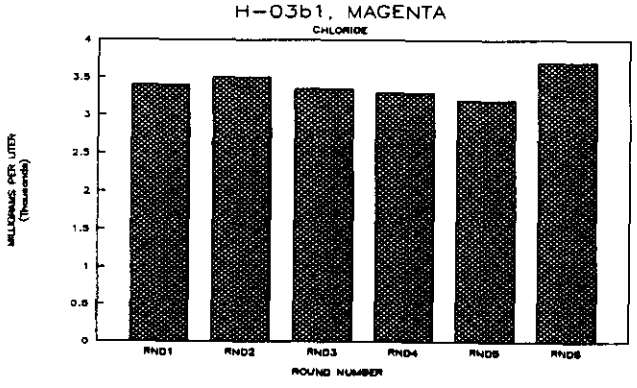


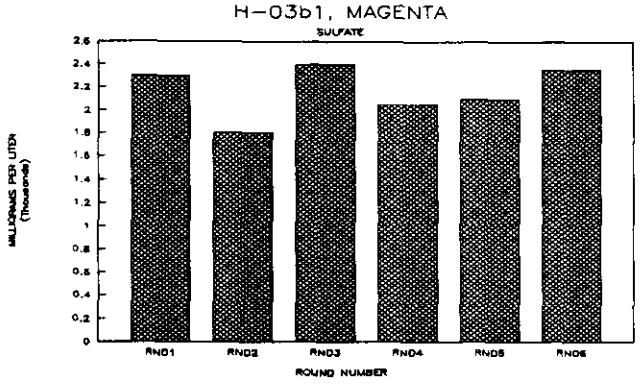


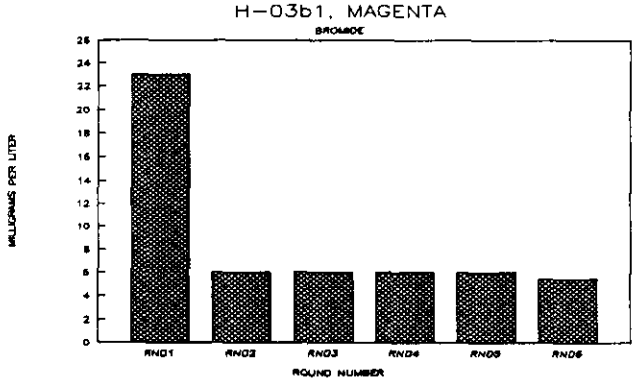
*FIELD VALUE **SUSPECT VALUE ***NO ANALYSIS

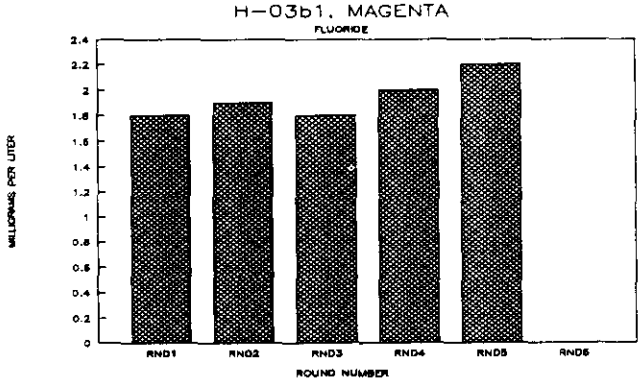
H-03b1, MAGENTA
HISTORY
MAJOR ANIONS

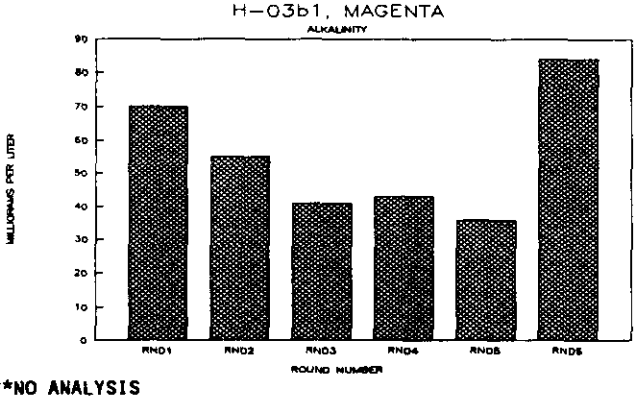
ROUND	CHLORIDE	SULFATE	BROMIDE	FLUORIDE	ALKALINITY
RND1	3400.00	2300.00	23.00	1.80	70.00
RND2	3500.00	1800.00	6.00	1.90	55.00
RND3	3350.00	2400.00	6.00	1.80	41.00
RND4	3300.00	2050.00	6.00	2.00	43.00
RND5	3200.00	2100.00	6.00	2.20	36.00
RND6	3705.00	2355.00	5.48	0.00 **	84.10 **







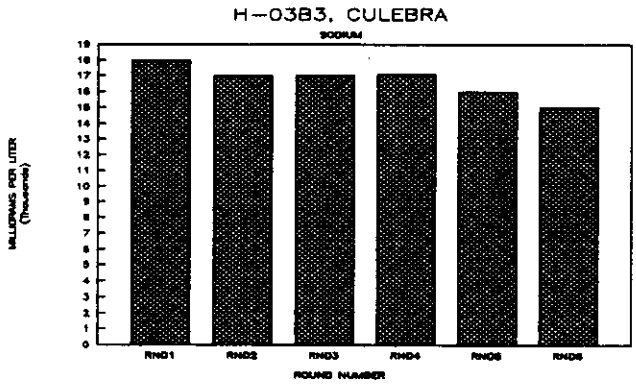


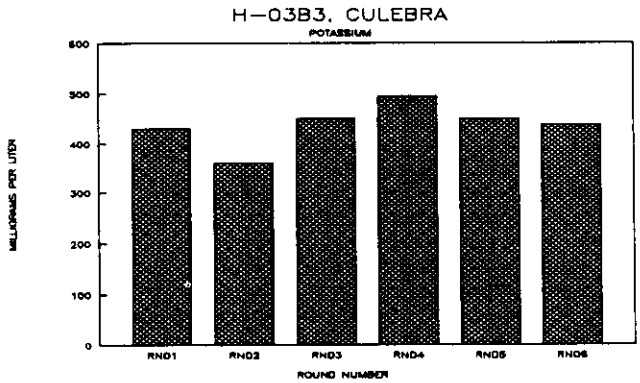


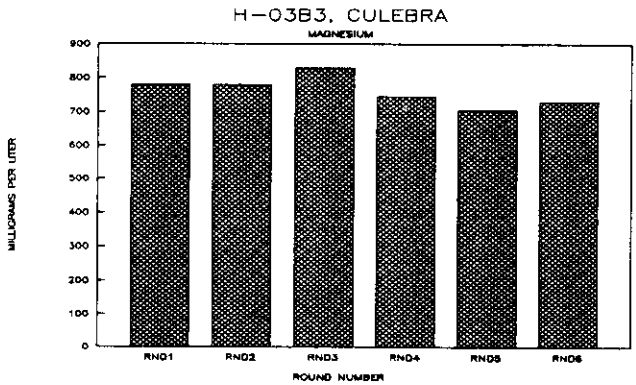
*FIELD VALUE **SUSPECT VALUE ***NO ANALYSIS

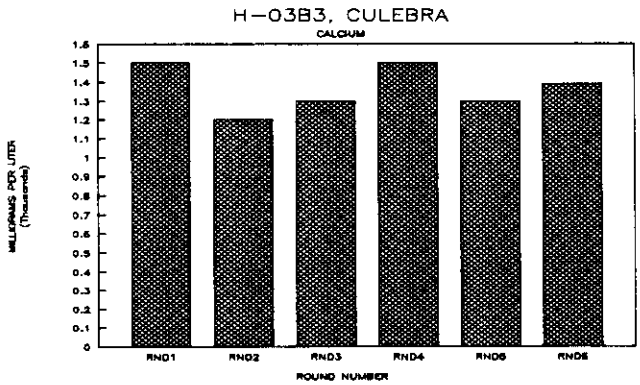
H-03b3, CULEBRA
HISTORY
MAJOR CATIONS

ROUND	SODIUM	POTASSIUM	MAGNESIUM	CALCIUM
RND1	18000.00	430.00	780.00	1500.00
RND2	17000.00	360.00	780.00	1200.00
RND3	17000.00	450.00	830.00	1300.00
RND4	17100.00	495.00	745.00	1500.00
RND5	16000.00	450.00	705.00	1300.00
RND6	15050.00	437.00	731.00	1390.00





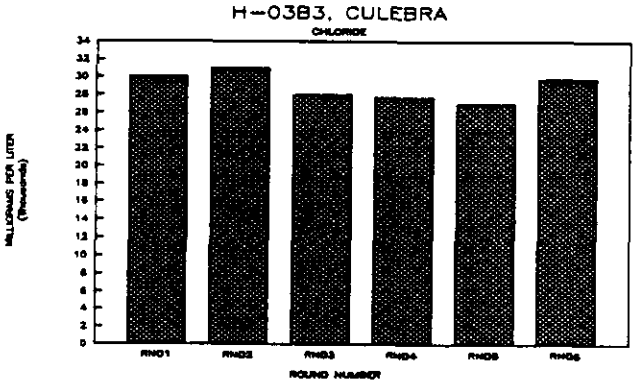


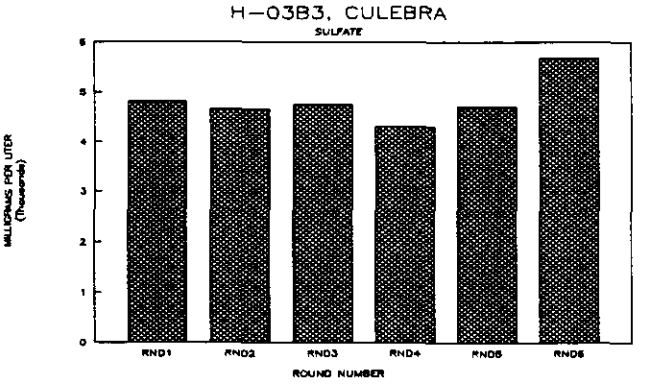


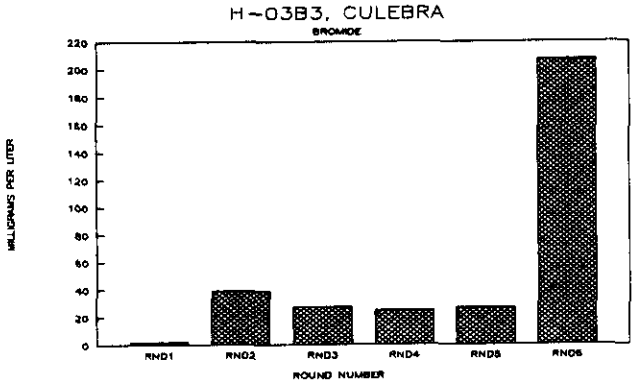
*FIELD VALUE **SUSPECT VALUE ***NO ANALYSIS

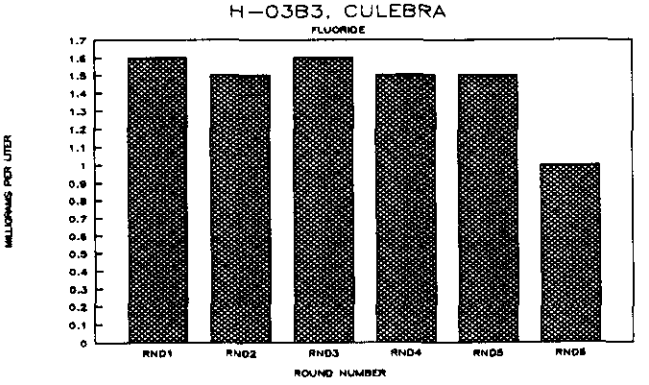
H-03b3, CULEBRA
HISTORY
MAJOR ANIONS

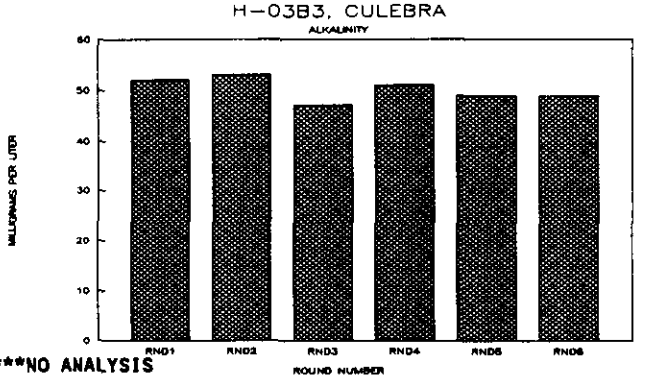
ROUND	CHLORIDE	SULFATE	BROMIDE	FLUORIDE	ALKALINITY
RND1	30000.00	4800.00	1.90 **	1.60	52.00 *
RND2	31000.00	4650.00	39.00	1.50	53.00
RND3	28000.00	4750.00	27.50	1.60	47.00
RND4	27700.00	4300.00	25.00	1.50	51.00
RND5	27000.00	4700.00	27.00	1.50	49.00
RND6	29800.00	5680.00	207.00 **	1.00	48.80







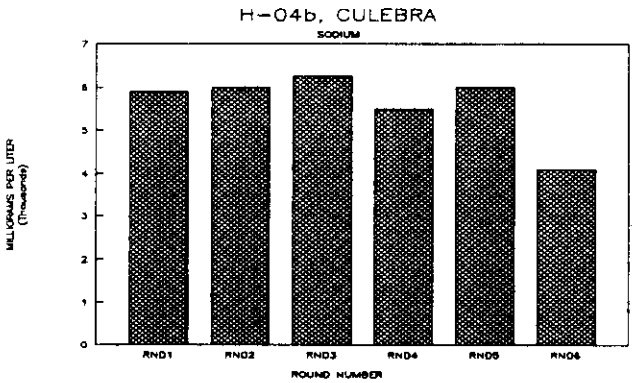


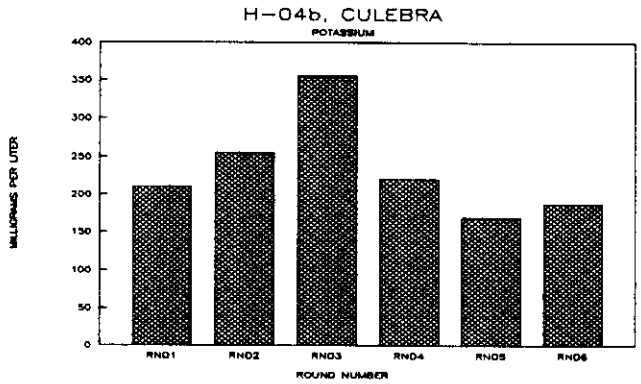


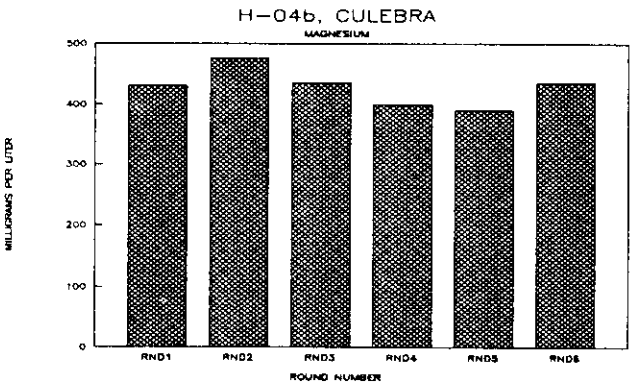
*FIELD VALUE **SUSPECT VALUE ***NO ANALYSIS

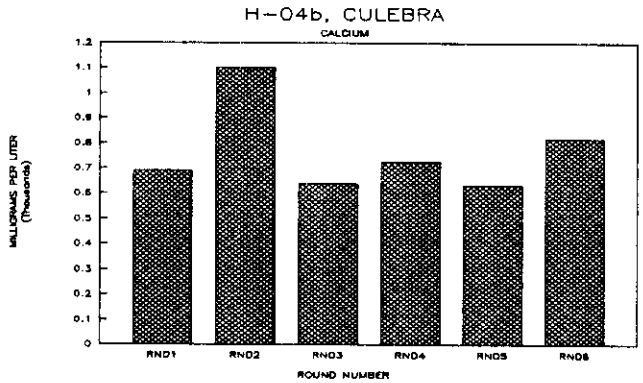
H-04b, CULEBRA
HISTORY
MAJOR CATIONS

ROUND	SODIUM	POTASSIUM	MAGNESIUM	CALCIUM
RND1	5900.00	210.00	430.00	690.00
RND2	6000.00	255.00	475.00	1100.00
RND3	6250.00	356.00	435.00	640.00
RND4	5500.00	220.00	400.00	725.00
RND5	6000.00	170.00	390.00	635.00
RND6	4090.00	187.00	436.00	816.00





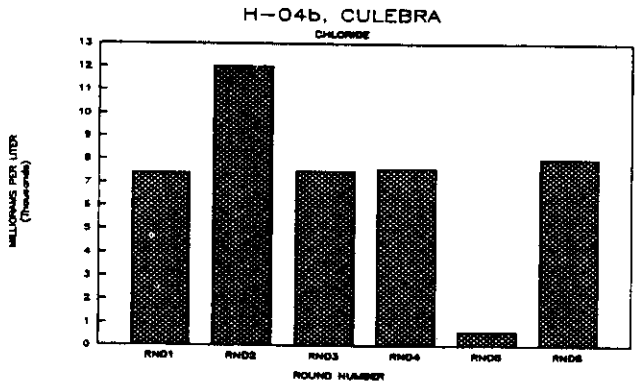


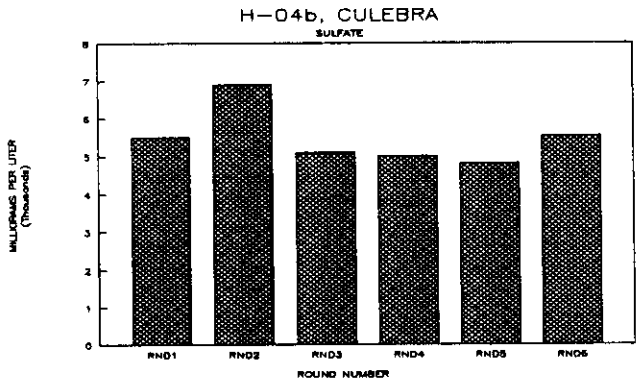


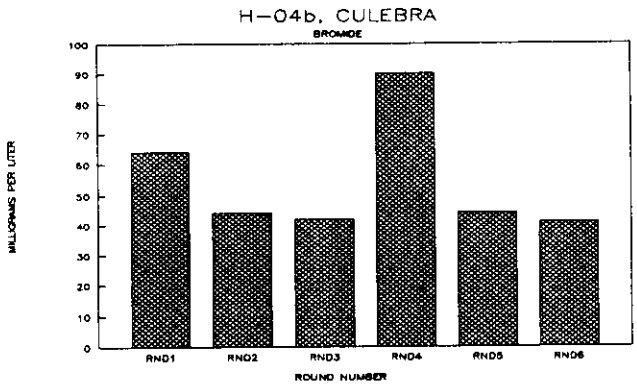
*FIELD VALUE **SUSPECT VALUE ***NO ANALYSIS

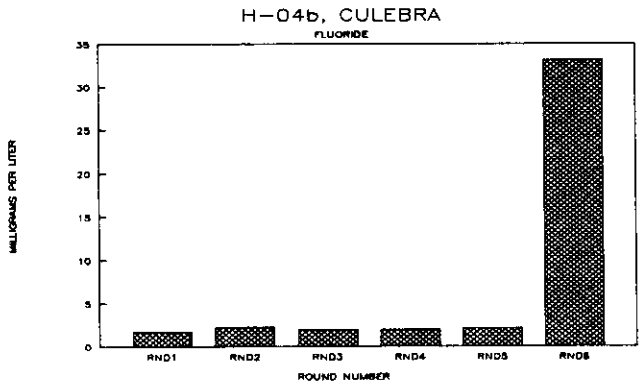
H-04b, CULEBRA
HISTORY
MAJOR ANIONS

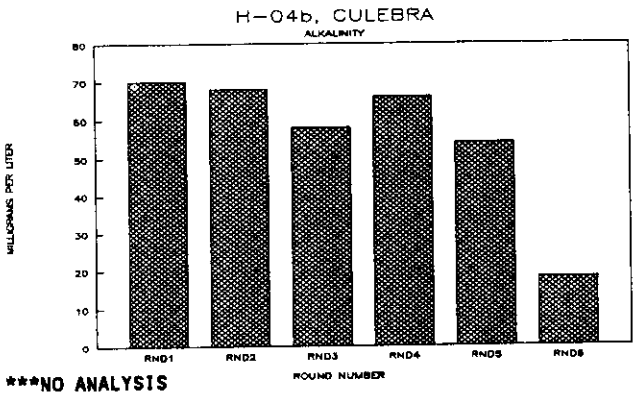
ROUND	CHLORIDE	SULFATE	BROMIDE	FLUORIDE	ALKALINITY
RND1	7400.00	5500.00	64.00	1.70	70.00 *
RND2	12000.00	6900.00	44.00	2.20	68.00
RND3	7500.00	5100.00	42.00	1.90	58.00
RND4	7600.00	5000.00	90.00	1.90	66.00
RND5	615.00 **	4800.00	44.00	2.10	54.00
RND6	8000.00	5530.00	41.00	33.10 **	18.00 **







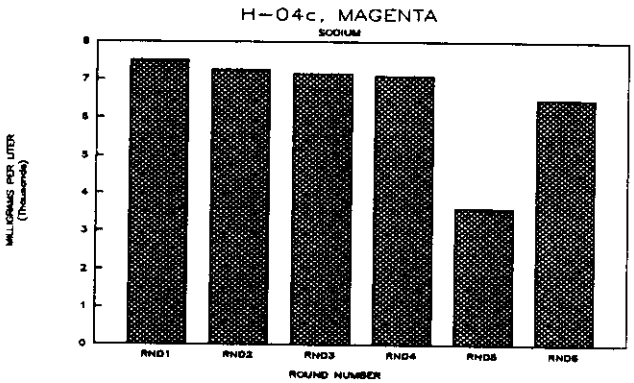


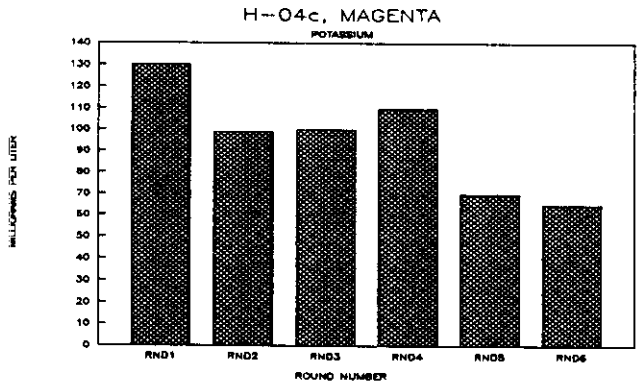


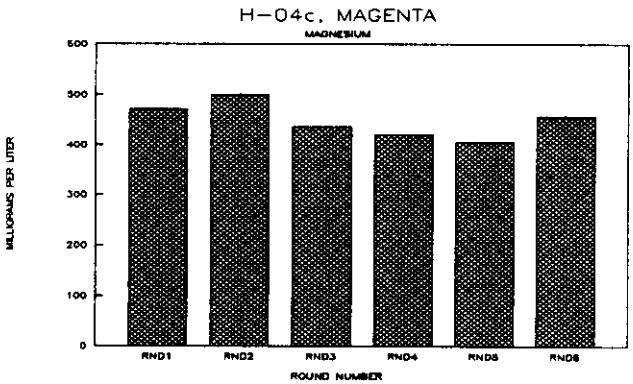
*FIELD VALUE **SUSPECT VALUE ***NO ANALYSIS

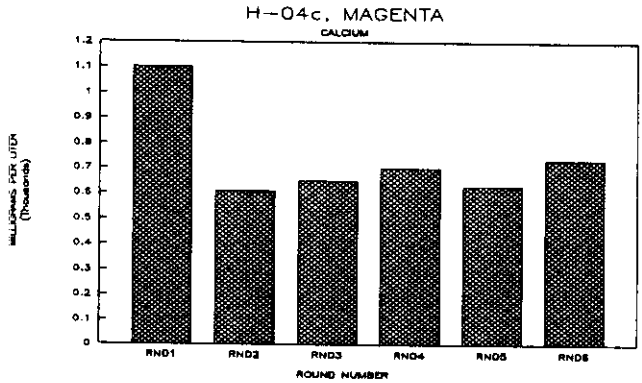
H-04c, MAGENTA
HISTORY
MAJOR CATIONS

ROUND	SODIUM	POTASSIUM	MAGNESIUM	CALCIUM
RND1	7500.00	130.00	470.00	1100.00
RND2	7250.00	99.00	500.00	610.00
RND3	7150.00	100.00	435.00	650.00
RND4	7100.00	110.00	420.00	700.00
RND5	3600.00 **	70.00	405.00	630.00
RND6	6480.00	65.00	456.00	734.00





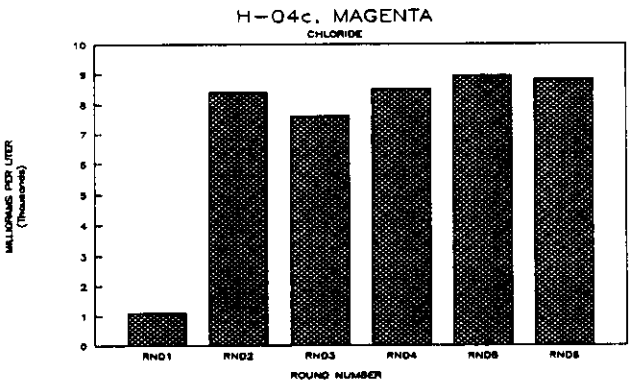


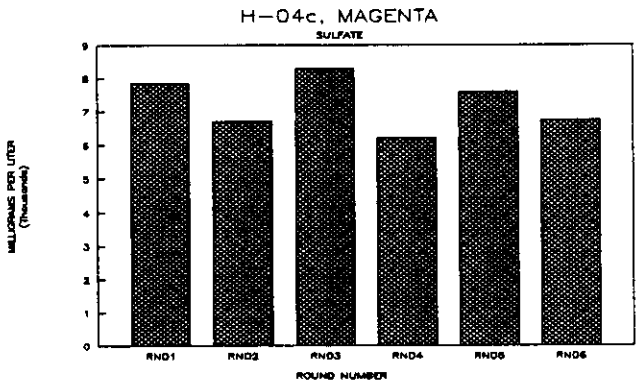


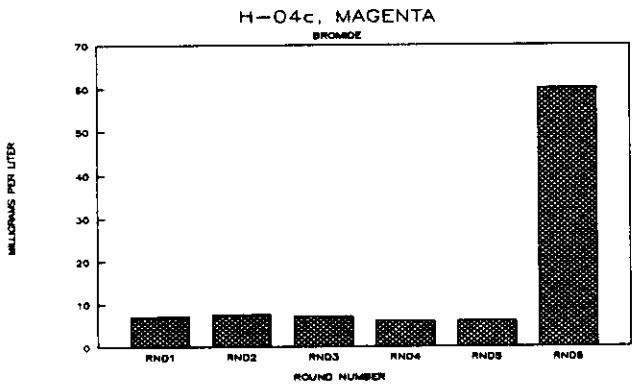
*FIELD VALUE **SUSPECT VALUE ***NO ANALYSIS

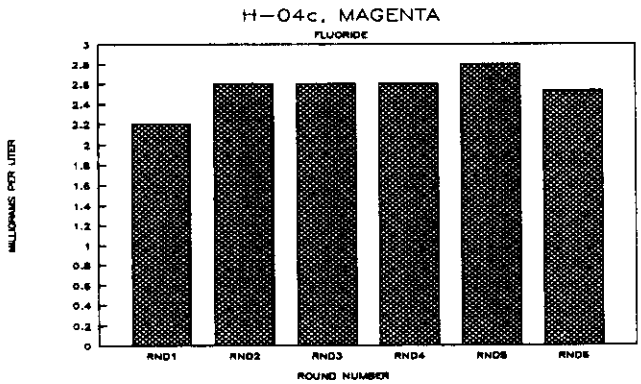
H-04c, MAGENTA
HISTORY
MAJOR ANIONS

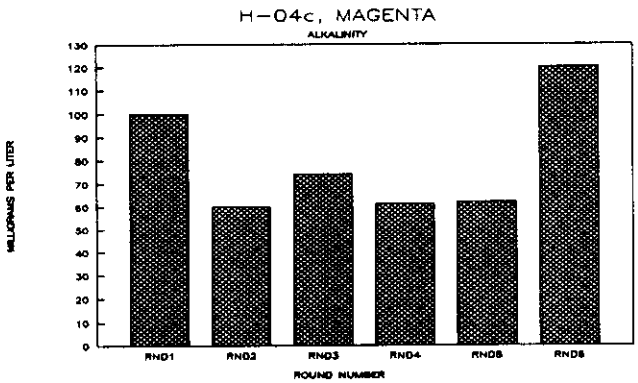
ROUND	CHLORIDE	SULFATE	BROMIDE	FLUORIDE	ALKALINITY
RND1	1100.00 **	7850.00	7.00	2.20	100.00
RND2	8400.00	6700.00	7.50	2.60	60.00
RND3	7600.00	8300.00	7.00	2.60	74.00
RND4	8500.00	6200.00	6.00	2.60	61.00
RND5	8950.00	7600.00	6.00	2.80	62.00
RND6	8812.00	6740.00	60.00 **	2.53	120.00







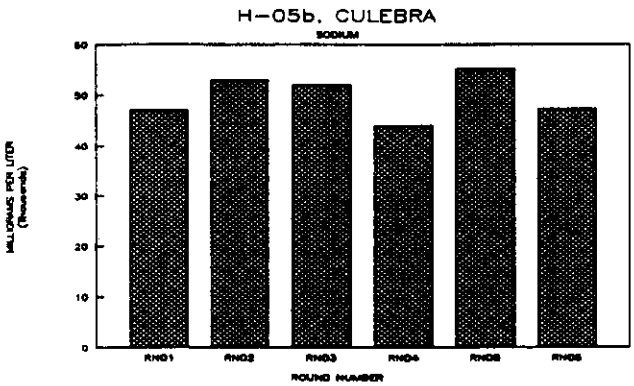


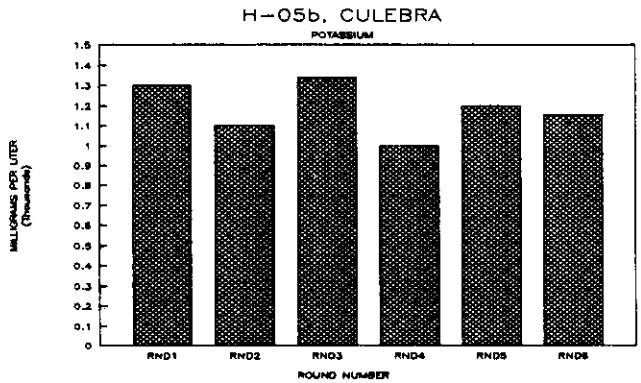


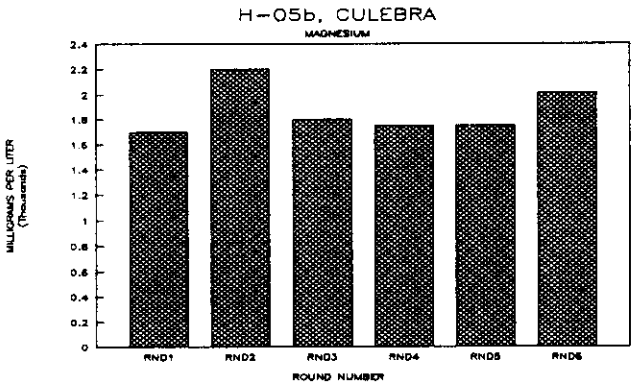
*FIELD VALUE **SUSPECT VALUE ***NO ANALYSIS

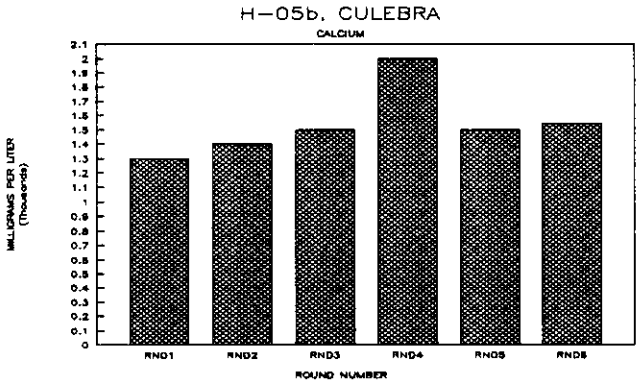
H-05b, CULEBRA
HISTORY
MAJOR CATIONS

ROUND	SODIUM	POTASSIUM	MAGNESIUM	CALCIUM
RND1	47000.00	1300.00	1700.00	1300.00
RND2	53000.00	1100.00	2200.00	1400.00
RND3	52000.00	1340.00	1800.00	1500.00
RND4	44000.00	1000.00	1750.00	2000.00
RND5	55200.00	1200.00	1750.00	1500.00
RND6	47300.00	1155.00	2015.00	1545.00





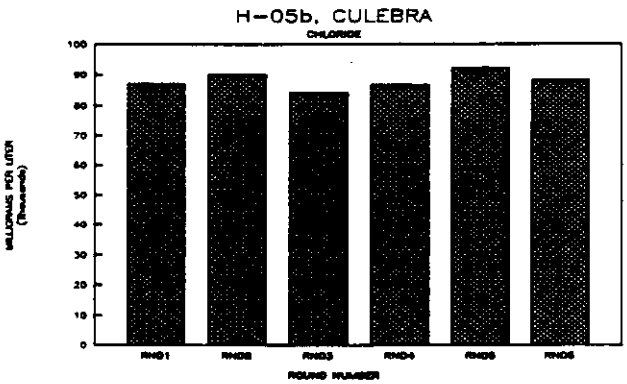


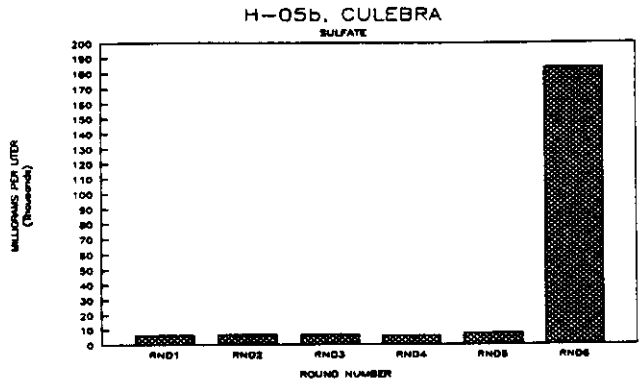


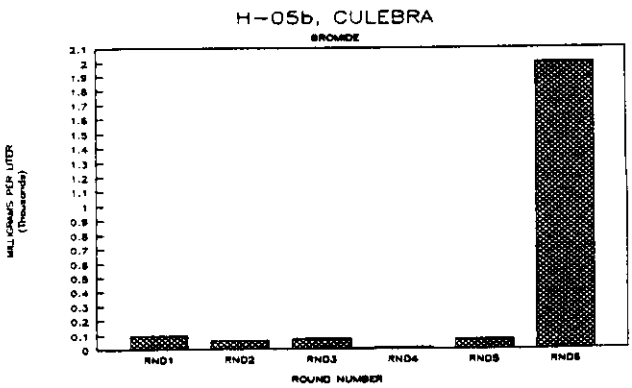
*FIELD VALUE **SUSPECT VALUE ***NO ANALYSIS

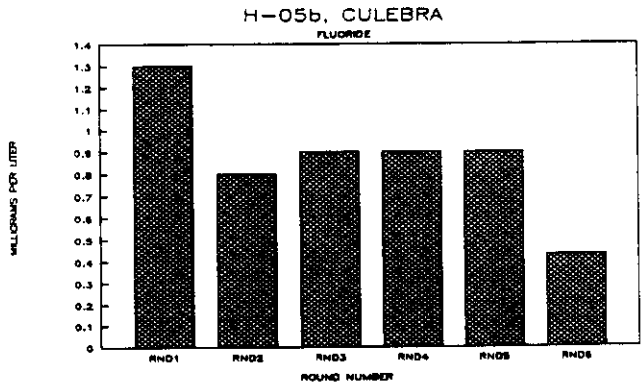
H-05b, CULEBRA
HISTORY
MAJOR ANIONS

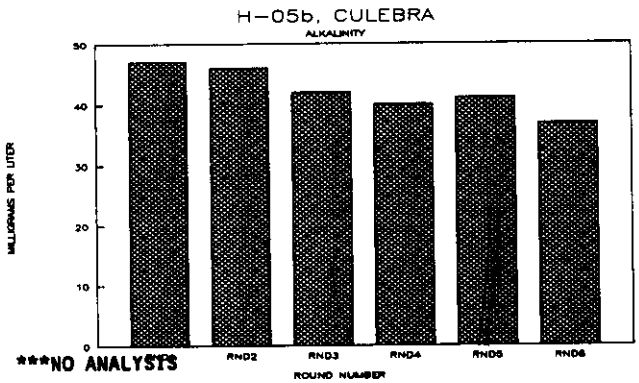
ROUND	CHLORIDE	SULFATE	BROMIDE	FLUORIDE	ALKALINITY
RND1	87000.00	6300.00	94.00	1.30	47.00
RND2	90000.00	7000.00	59.00	0.80	46.00
RND3	84100.00	7000.00	73.00	0.90	42.00
RND4	86600.00	5900.00	12.00	0.90	40.00
RND5	92100.00	7700.00	69.00	0.90	41.00
RND6	88050.00	184000.00 **	2000.00 **	0.43 **	36.80







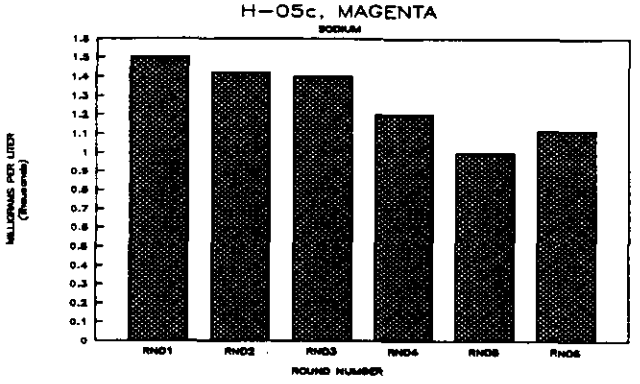


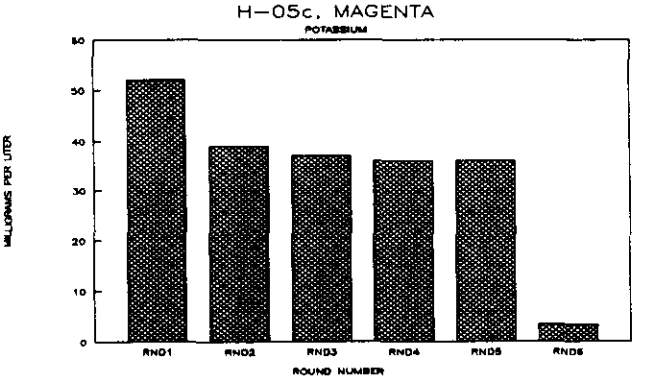


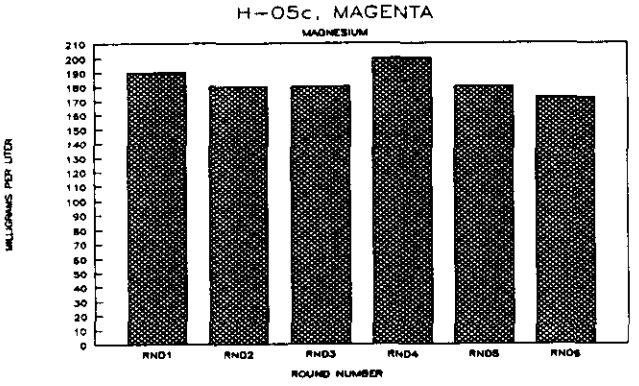
*FIELD VALUE **SUSPECT VALUE ***NO ANALYSIS

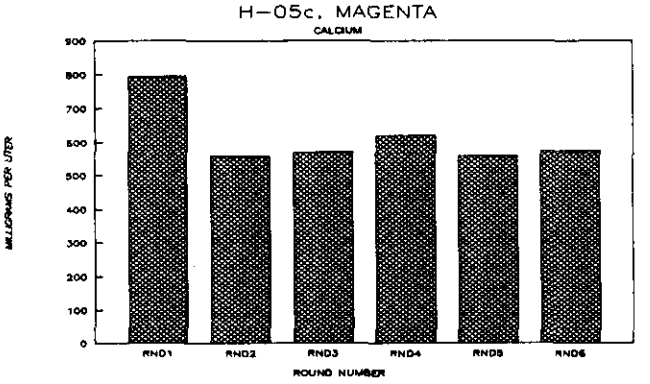
H-05c, MAGENTA
HISTORY
MAJOR CATIONS

ROUND	SODIUM	POTASSIUM	MAGNESIUM	CALCIUM
RND1	1500.00	52.00	190.00	795.00
RND2	1420.00	39.00	180.00	560.00
RND3	1400.00	37.00	180.00	570.00
RND4	1200.00	36.00	200.00	620.00
RND5	1000.00	36.00	180.00	560.00
RND6	1116.00	3.50 **	172.00	575.00





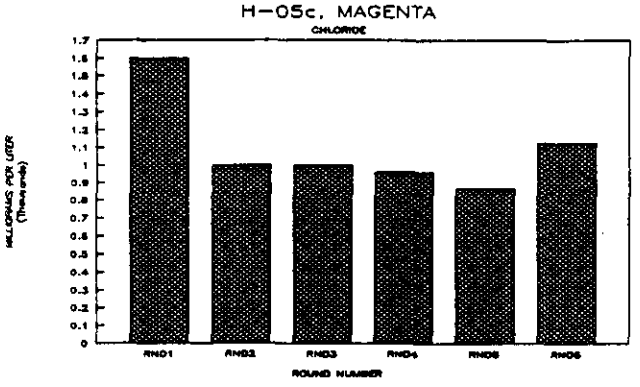


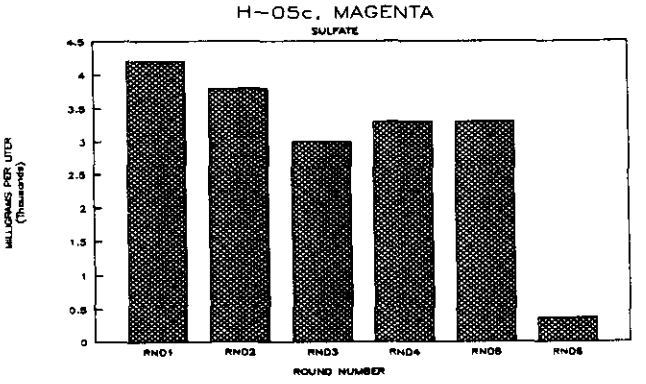


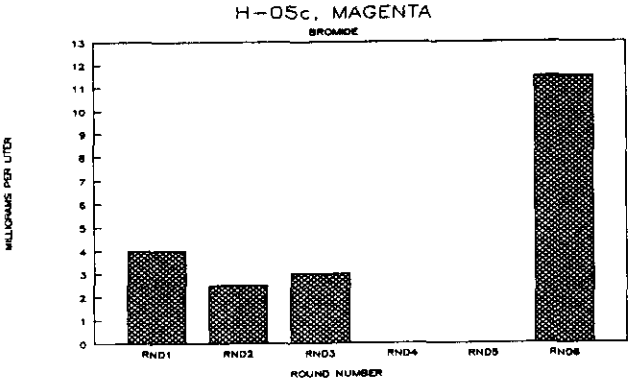
*FIELD VALUE **SUSPECT VALUE ***NO ANALYSIS

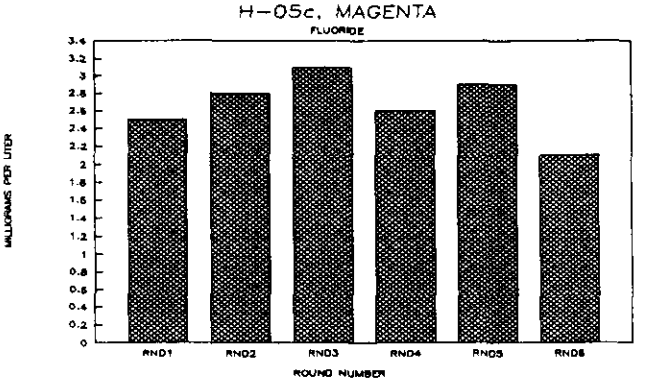
H-05c, MAGENTA
HISTORY
MAJOR ANIONS

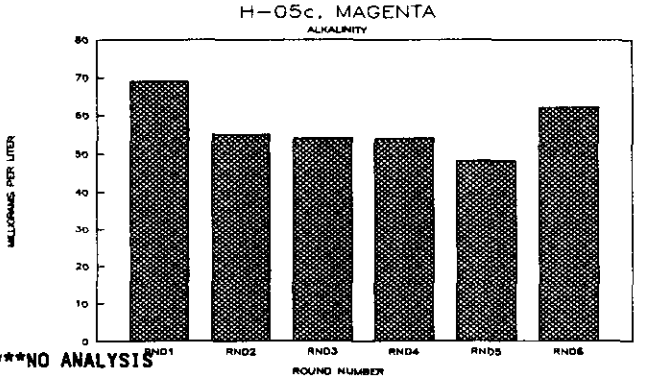
ROUND	CHLORIDE	SULFATE	BROMIDE	FLUORIDE	ALKALINITY
RND1	1600.00	4200.00	4.00	2.50	69.00
RND2	1000.00	3800.00	2.50	2.80	55.00
RND3	1000.00	3000.00	3.00	3.10	54.00
RND4	960.00	3300.00	0.00	2.60	54.00
RND5	865.00	3300.00	0.00	2.90	48.00
RND6	1124.00	365.10 **	11.50 **	2.10	62.00







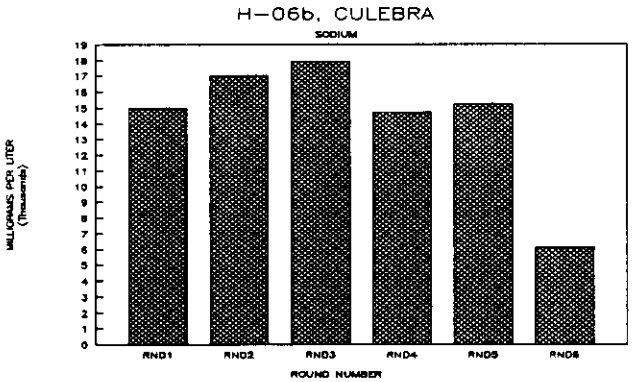


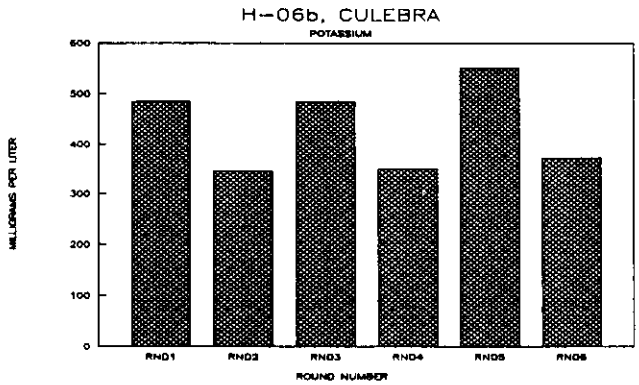


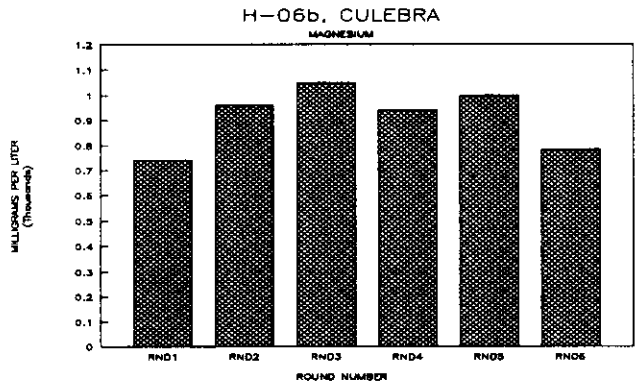
*FIELD VALUE **SUSPECT VALUE ***NO ANALYSIS

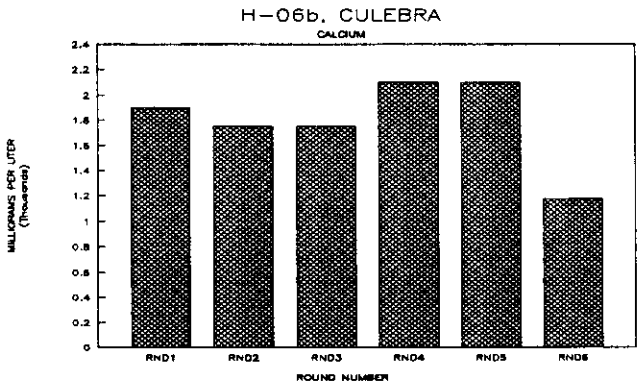
H-06b, CULEBRA
HISTORY
MAJOR CATIONS

ROUND	SODIUM	POTASSIUM	MAGNESIUM	CALCIUM
RND1	15000.00	485.00	740.00	1900.00
RND2	17000.00	345.00	960.00	1750.00
RND3	17900.00	485.00	1050.00	1750.00
RND4	14700.00	350.00	940.00	2100.00
RND5	15250.00	550.00	1000.00	2100.00
RND6	6110.00 **	372.00	783.00	1175.00





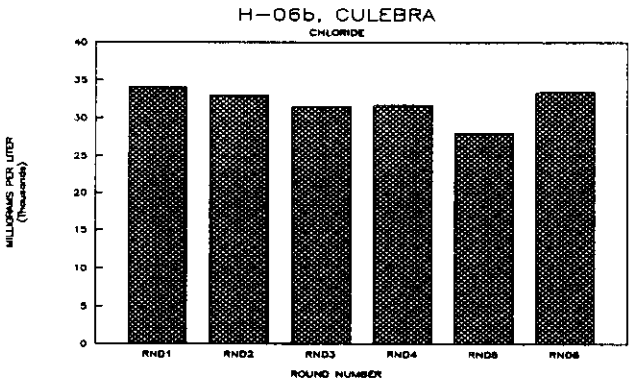


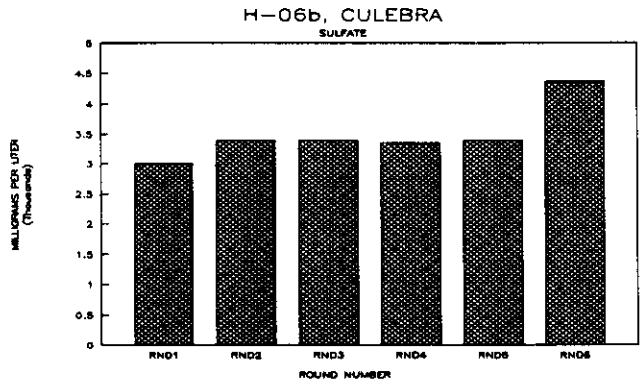


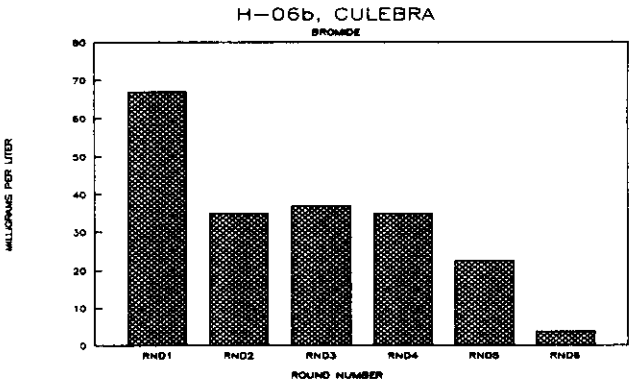
*FIELD VALUE **SUSPECT VALUE ***NO ANALYSIS

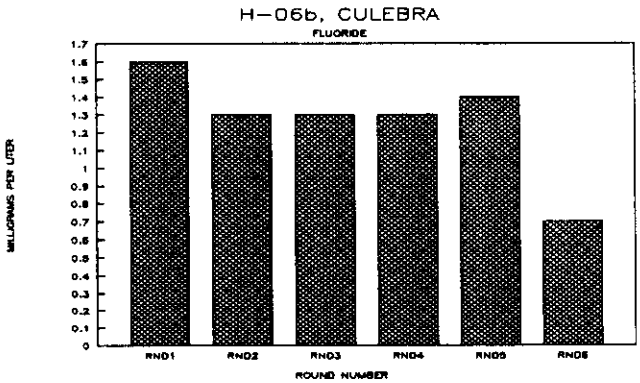
H-06b, CULEBRA
HISTORY
MAJOR ANIONS

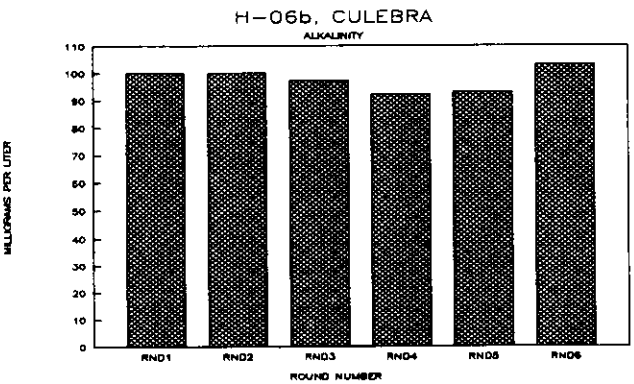
ROUND	CHLORIDE	SULFATE	BROMIDE	FLUORIDE	ALKALINITY
RND1	34000.00	3000.00	67.00	1.60	100.00
RND2	33000.00	3400.00	35.00	1.30	100.00
RND3	31500.00	3400.00	37.00	1.30	97.00
RND4	31700.00	3350.00	35.00	1.30	92.00
RND5	28000.00	3400.00	22.50	1.40	93.00
RND6	33400.00	4370.00 **	3.70 **	0.70 **	103.00







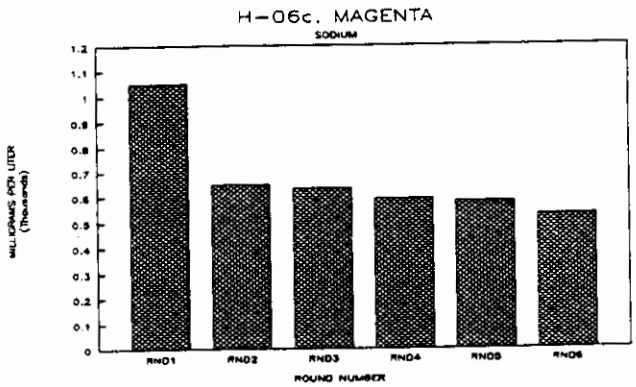


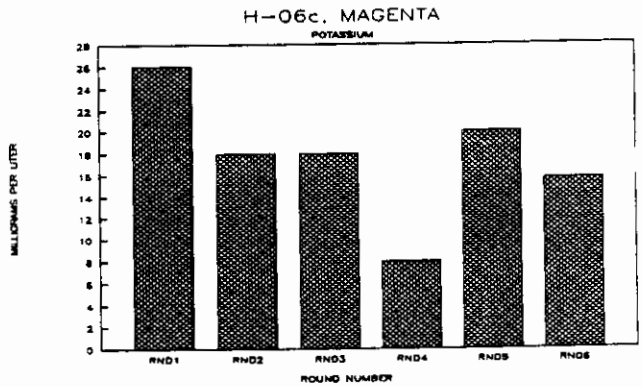


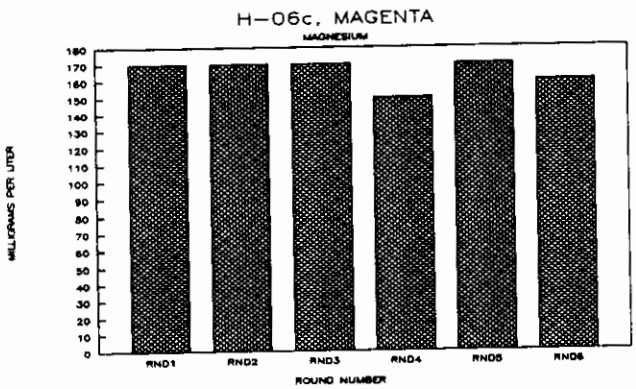
*FIELD VALUE **SUSPECT VALUE ***NO ANALYSIS

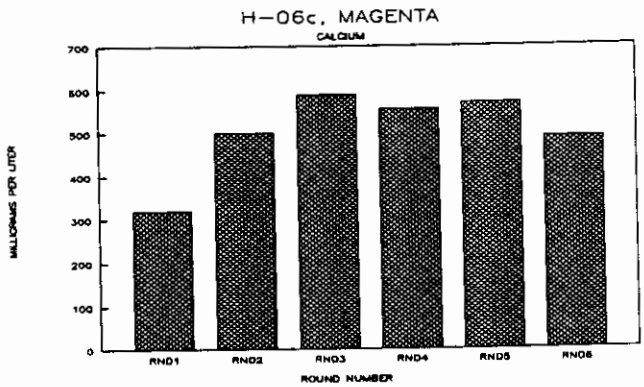
H-06c, MAGENTA
HISTORY
MAJOR CATIONS

ROUND	SODIUM	POTASSIUM	MAGNESIUM	CALCIUM
RND1	1050.00	26.00	170.00	320.00
RND2	650.00	18.00	170.00	500.00
RND3	635.00	18.00	170.00	590.00
RND4	590.00	8.00	150.00	555.00
RND5	580.00	20.00	170.00	570.00
RND6	528.00	15.70	160.00	490.00





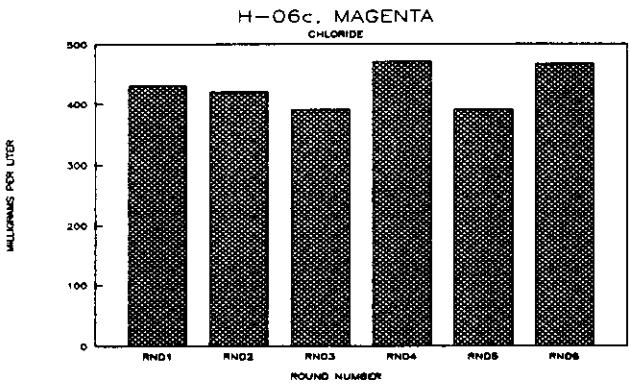


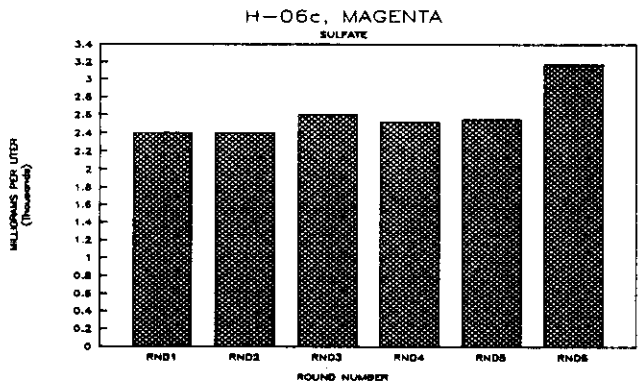


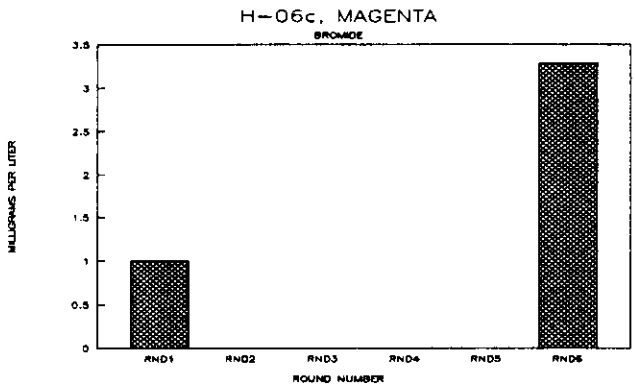
*FIELD VALUE **SUSPECT VALUE ***NO ANALYSIS

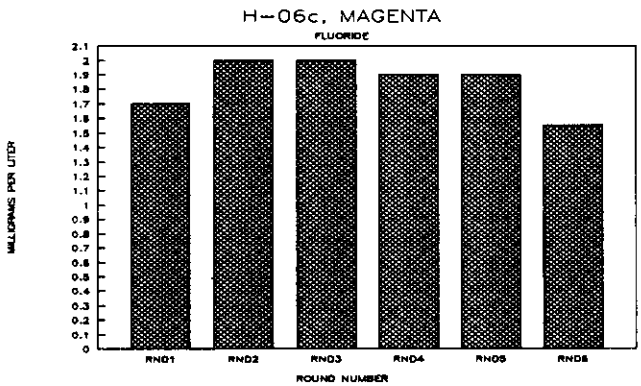
H-06c, MAGENTA
HISTORY
MAJOR ANIONS

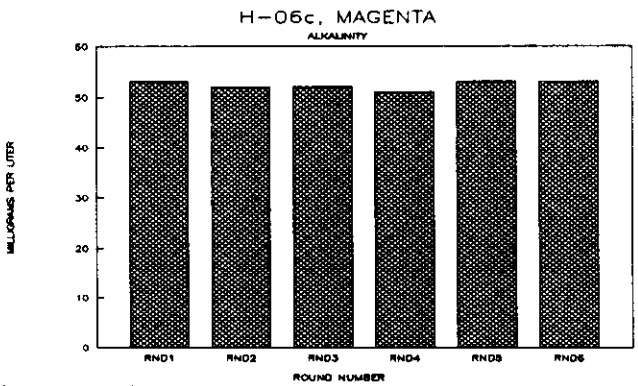
ROUND	CHLORIDE	SULFATE	BROMIDE	FLUORIDE	ALKALINITY
RND1	430.00	2400.00	1.00	1.70	53.00
RND2	420.00	2400.00	0.00	2.00	52.00
RND3	390.00	2600.00	0.00	2.00	52.00
RND4	470.00	2520.00	0.00	1.90	51.00
RND5	390.00	2550.00	0.00	1.90	53.00
RND6	466.00	3170.00	3.29 **	1.55	53.00







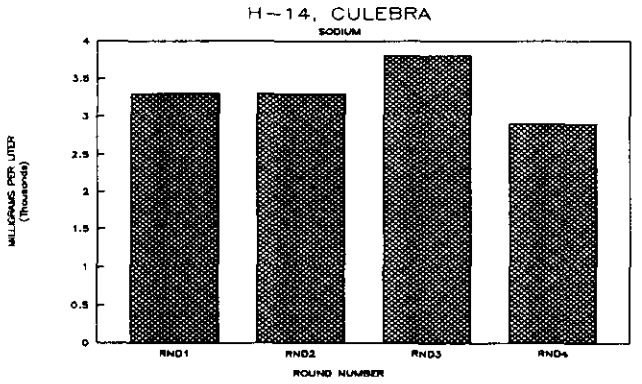


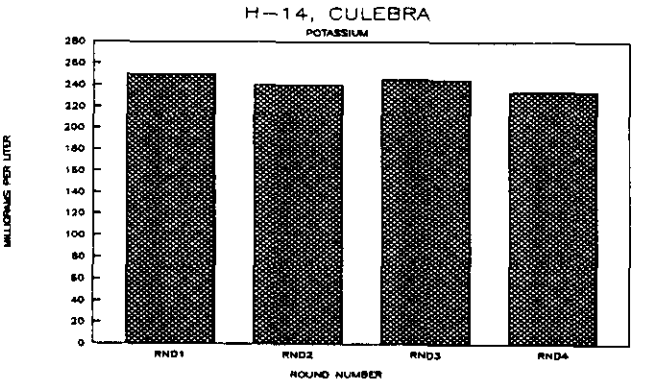


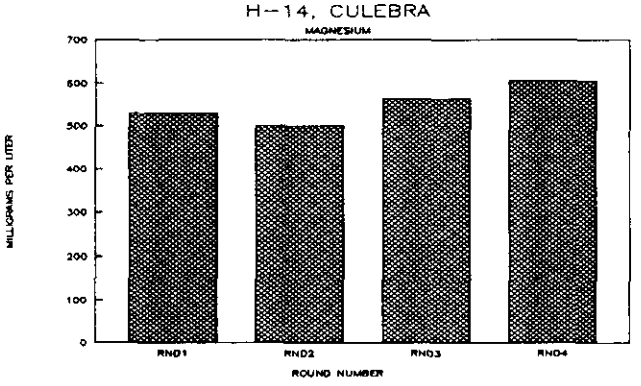
*FIELD VALUE **SUSPECT VALUE ***NO ANALYSIS

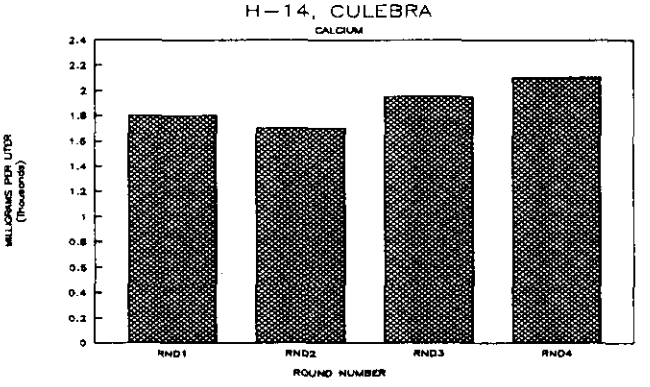
H-14, CULEBRA
HISTORY
MAJOR CATIONS

ROUND	SODIUM	POTASSIUM	MAGNESIUM	CALCIUM
RND1	3300.00	250.00	530.00	1800.00
RND2	3300.00	240.00	500.00	1700.00
RND3	3800.00	245.00	565.00	1950.00
RND4	2900.00	234.00	605.00	2105.00





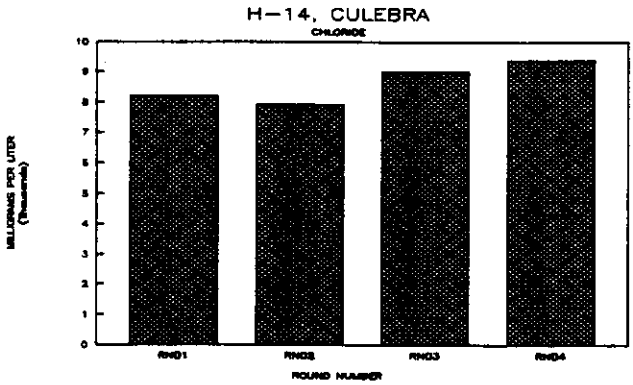


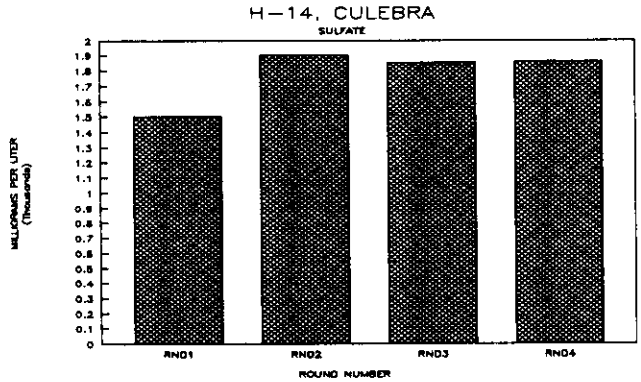


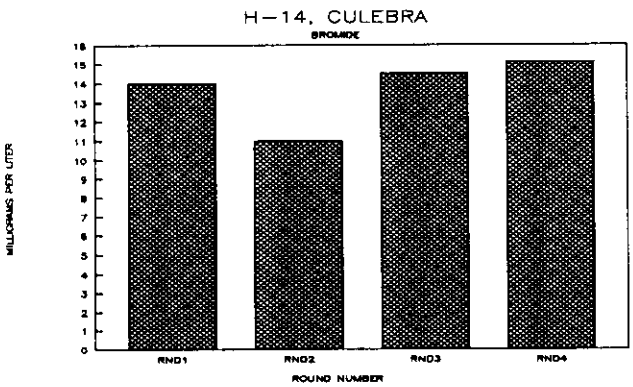
*FIELD VALUE **SUSPECT VALUE ***NO ANALYSIS

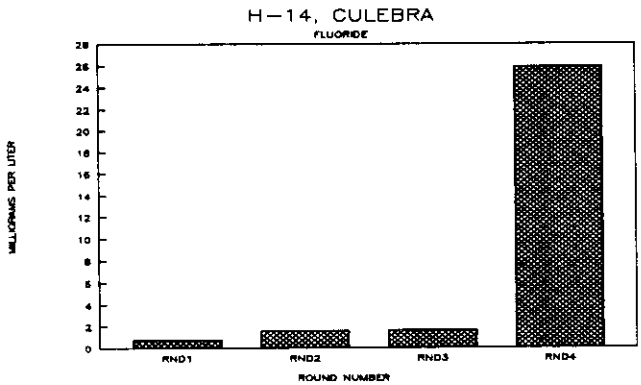
H-14, CULEBRA
HISTORY
MAJOR ANIONS

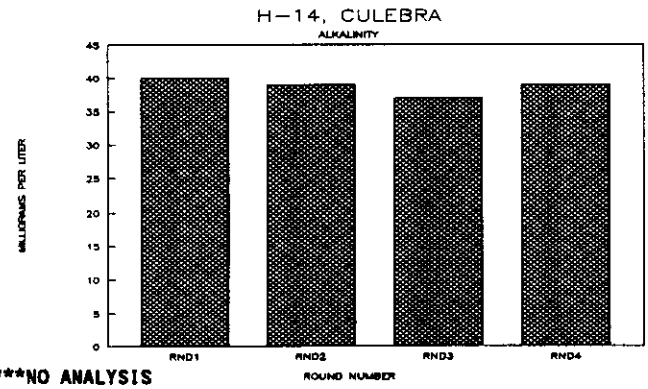
ROUND	CHLORIDE	SULFATE	BROMIDE	FLUORIDE	ALKALINITY
RND1	8200.00	1500.00	14.00	0.80	40.00
RND2	7900.00	1900.00	11.00	1.60	39.00
RND3	9000.00	1850.00	14.50	1.70	37.00
RND4	9385.00	1860.00	15.10	25.90 **	39.00







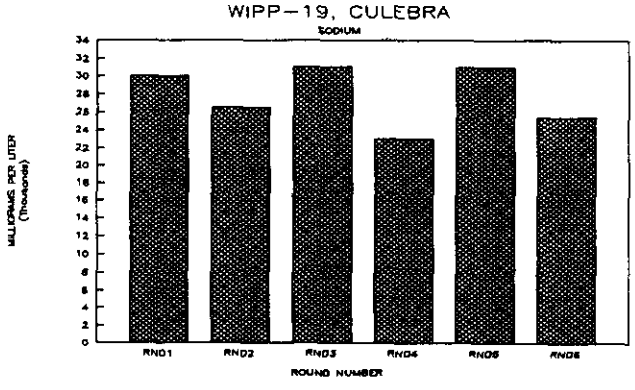


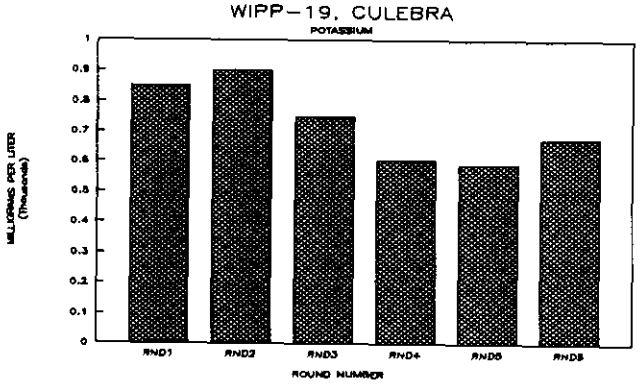


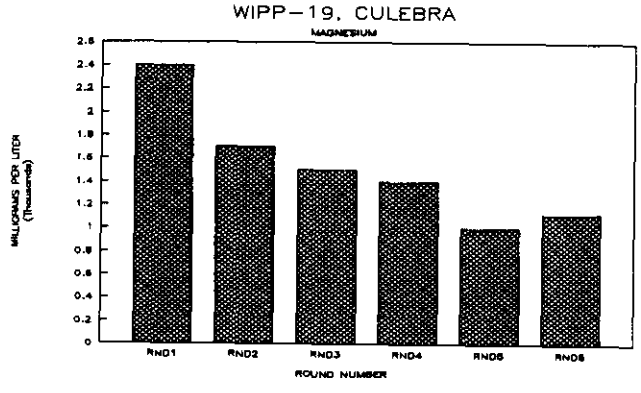
*FIELD VALUE **SUSPECT VALUE ***NO ANALYSIS

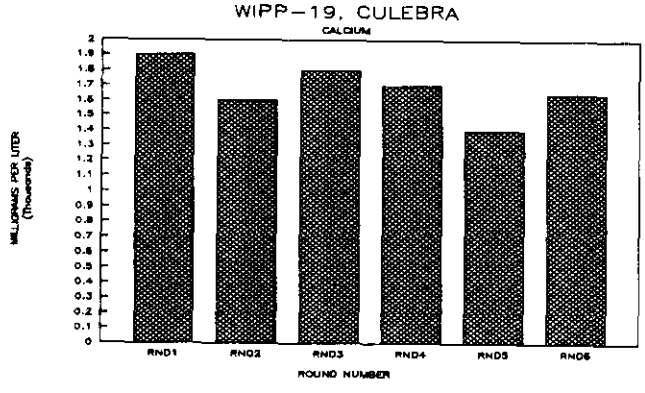
WIPP-19, CULEBRA
HISTORY
MAJOR CATIONS

ROUND	SODIUM	POTASSIUM	MAGNESIUM	CALCIUM
RND1	30000.00	850.00	2400.00	1900.00
RND2	26500.00	900.00	1700.00	1600.00
RND3	31050.00	750.00	1500.00	1800.00
RND4	23000.00	605.00	1400.00	1700.00
RND5	31000.00	590.00	1000.00	1400.00
RND6	25400.00	674.00	1125.00	1645.00





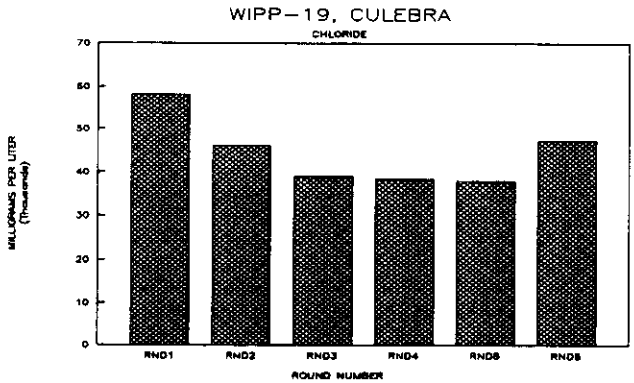


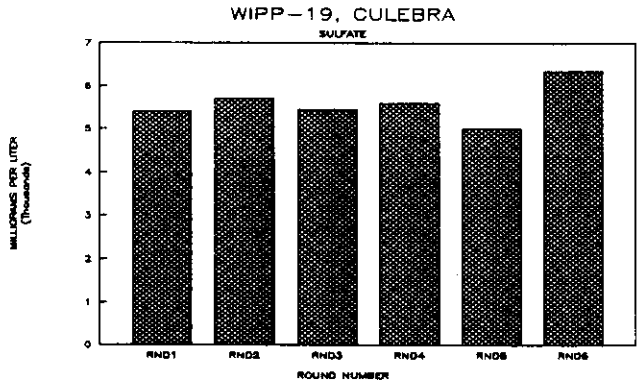


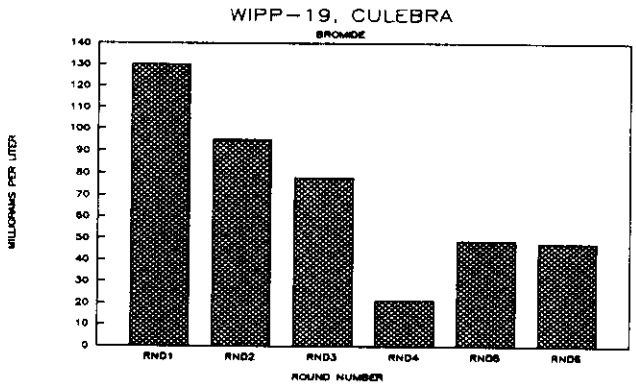
*FIELD VALUE **SUSPECT VALUE ***NO ANALYSIS

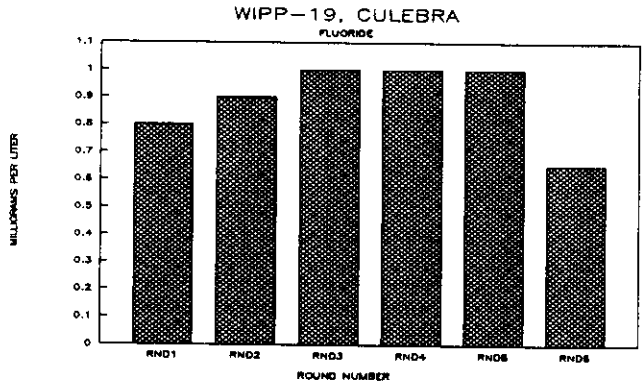
WIPP-19, CULEBRA
HISTORY
MAJOR ANIONS

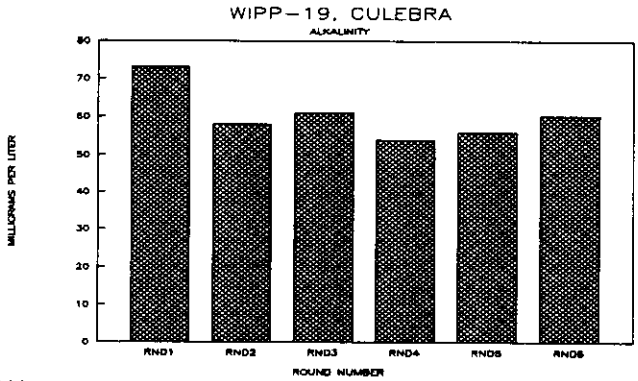
ROUND	CHLORIDE	SULFATE	BROMIDE	FLUORIDE	ALKALINITY
RND1	58000.00	5400.00	130.00	0.80	73.00
RND2	46100.00	5700.00	95.00	0.90	58.00
RND3	38900.00	5450.00	78.00	1.00	61.00
RND4	38400.00	5600.00	21.00	1.00	54.00
RND5	37900.00	5000.00	49.00	1.00	56.00
RND6	47300.00	6350.00	47.70	0.65	60.50







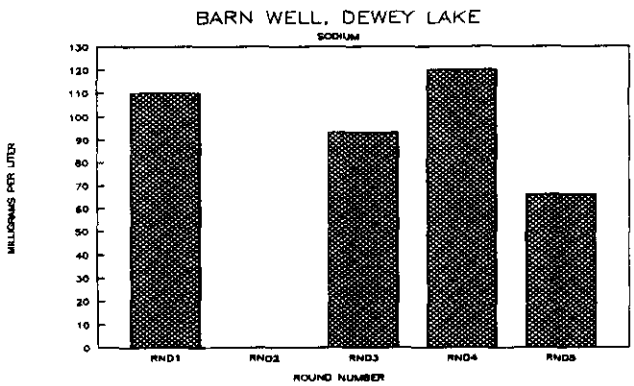


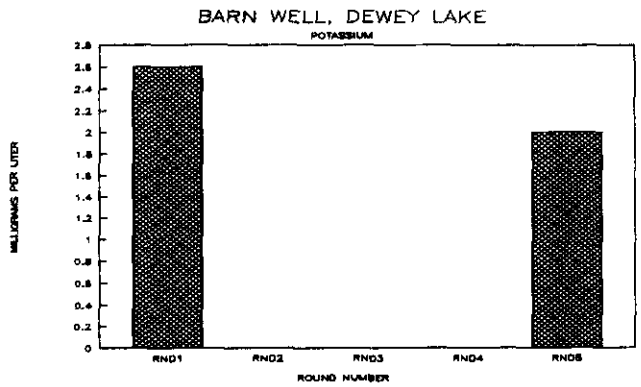


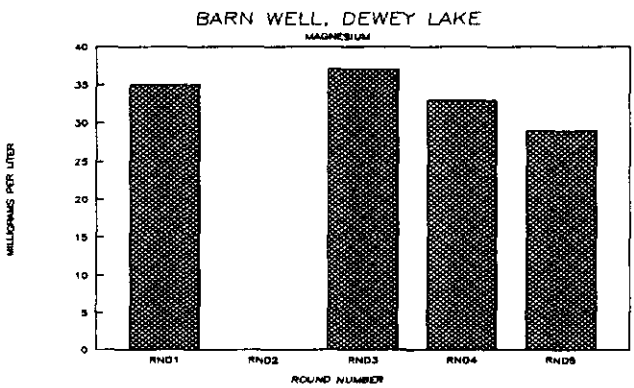
*FIELD VALUE **SUSPECT VALUE ***NO ANALYSIS

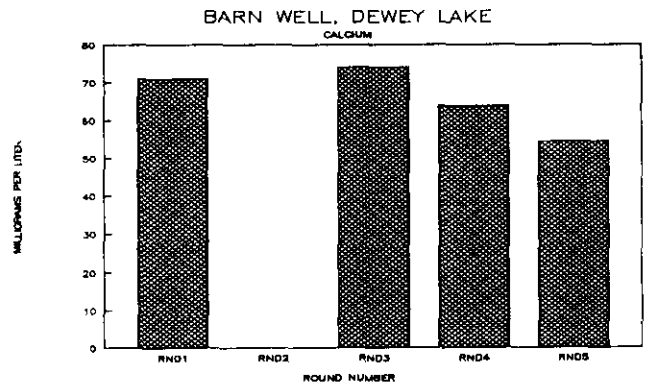
BARN WELL, DEWEY LAKE
HISTORY
MAJOR CATIONS

ROUND	SODIUM	POTASSIUM	MAGNESIUM	CALCIUM
RND1	110.00	2.60	35.00	71.00
RND2	0.00 ***	0.00 ***	0.00 ***	0.00 ***
RND3	93.00	0.00	37.00	74.00
RND4	120.00	0.00	33.00	64.00
RND5	66.00 **	2.00	29.00	54.50





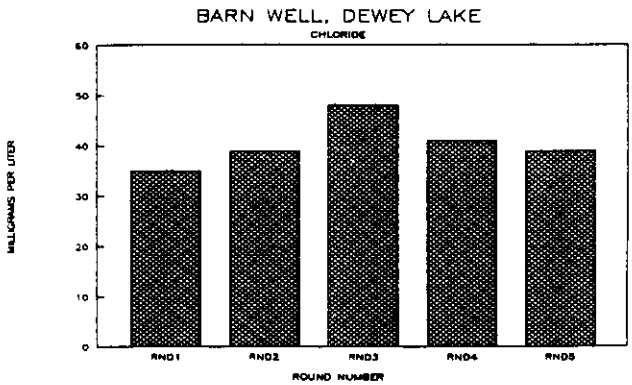


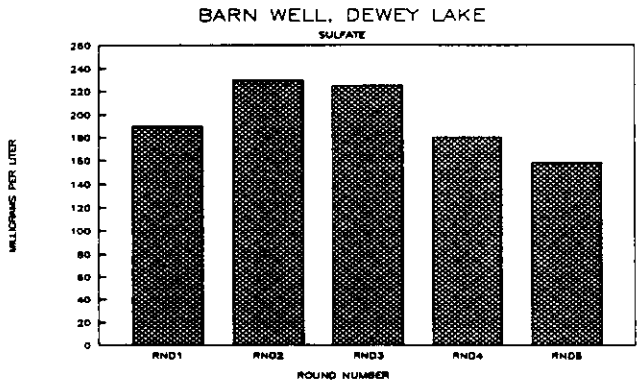


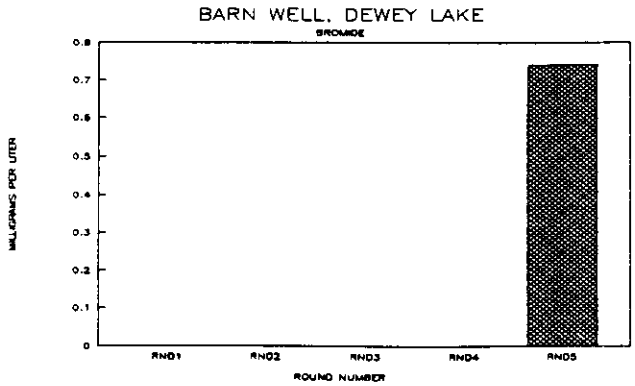
*FIELD VALUE **SUSPECT VALUE ***NO ANALYSIS

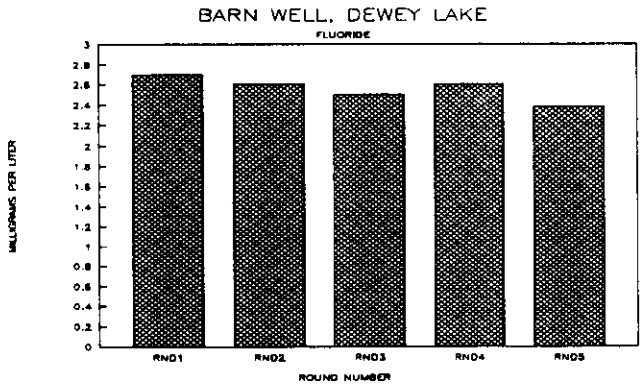
BARN WELL, DEWEY LAKE
HISTORY
MAJOR ANIONS

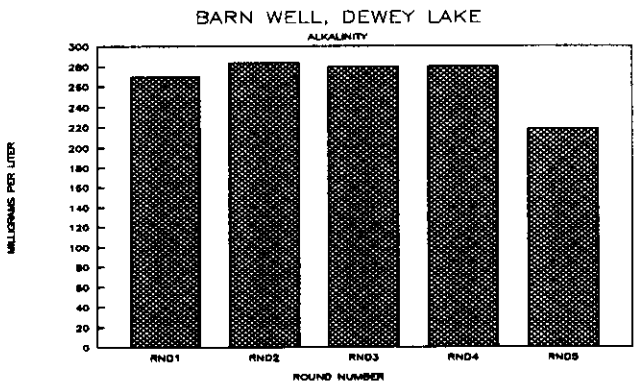
ROUND	CHLORIDE	SULFATE	BROMIDE	FLUORIDE	ALKALINITY
RND1	35.00	190.00	0.00	2.70	270.00
RND2	39.00	230.00	0.00	2.60	284.00 *
RND3	48.00	225.00	0.00	2.50	280.00
RND4	41.00	180.00	0.00	2.60	280.00
RND5	39.00	158.00	0.74	2.38	218.00







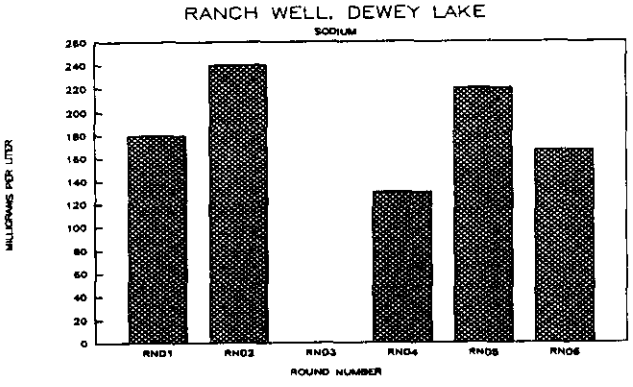


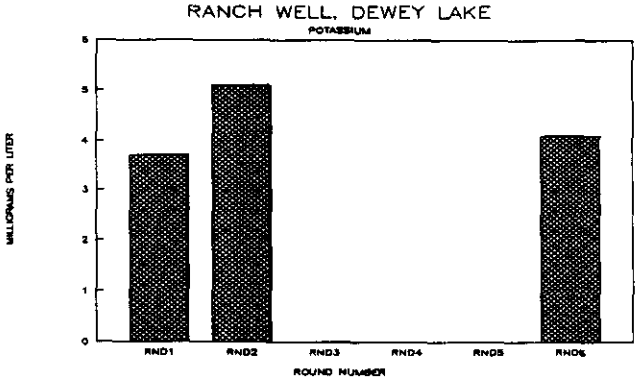


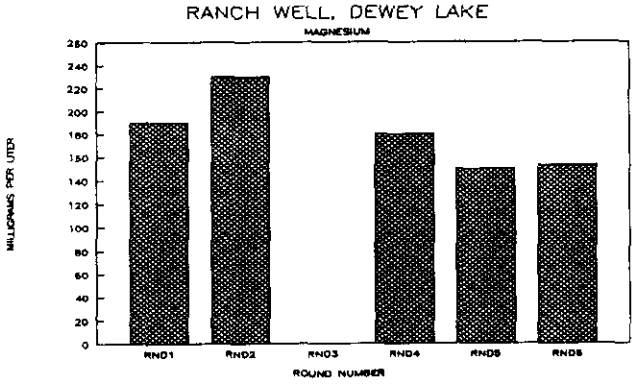
*FIELD VALUE **SUSPECT VALUE ***NO ANALYSIS

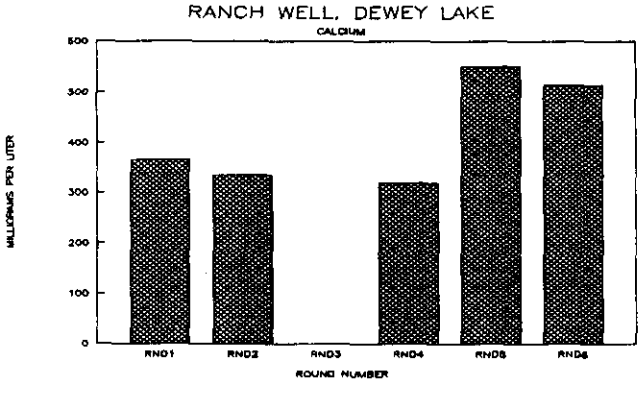
RANCH WELL, DEWEY LAKE
HISTORY
MAJOR CATIONS

ROUND	SODIUM	POTASSIUM	MAGNESIUM	CALCIUM
RND1	180.00	3.70	190.00	365.00
RND2	240.00	5.10	230.00	335.00
RND3	0.00 ***	0.00	0.00 ***	0.00 ***
RND4	130.00	0.00	180.00	320.00
RND5	220.00	0.00	150.00	550.00
RND6	167.00	4.10	153.00	514.00





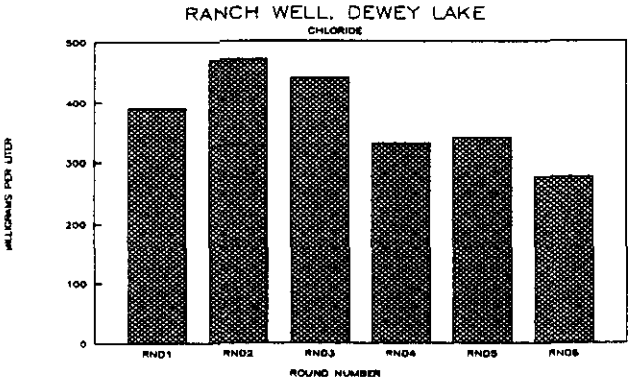


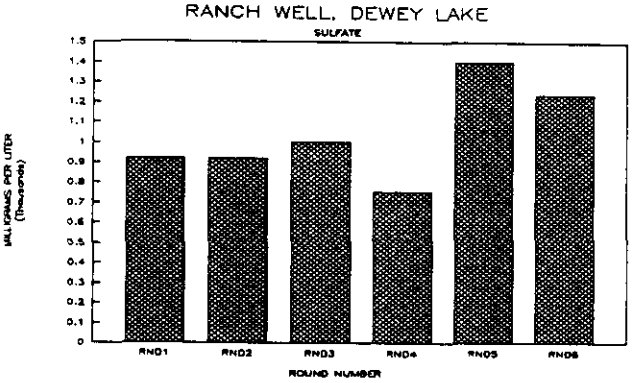


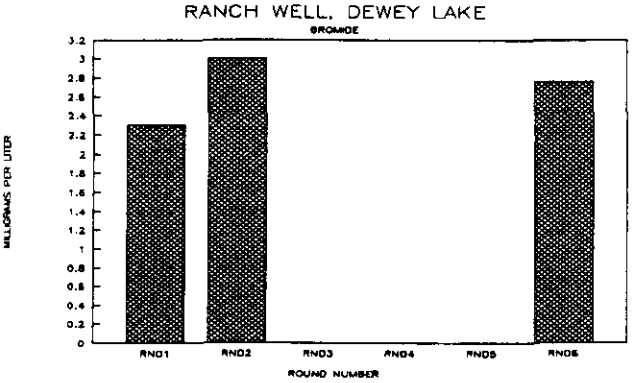
*FIELD VALUE **SUSPECT VALUE ***NO ANALYSIS

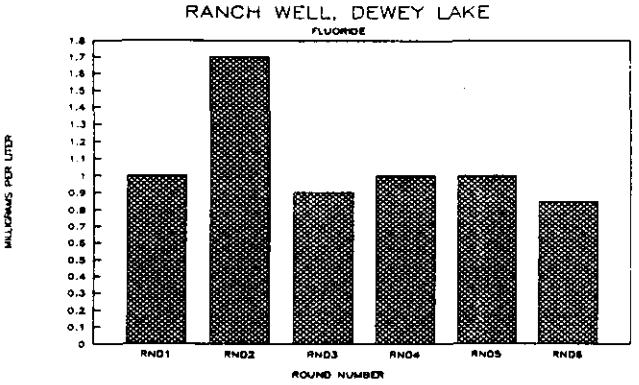
RANCH WELL, DEWEY LAKE
HISTORY
MAJOR ANIONS

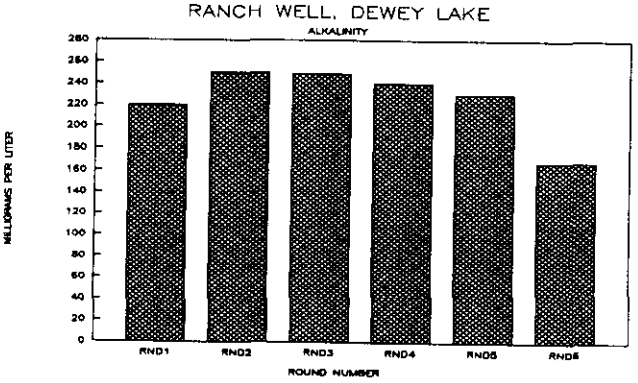
ROUND	CHLORIDE	SULFATE	BROMIDE	FLUORIDE	ALKALINITY
RND1	390.00	920.00	2.30	1.00	220.00
RND2	470.00	920.00	3.00	1.70	250.00
RND3	440.00	1000.00	0.00	0.90	249.00 *
RND4	330.00	755.00	0.00	1.00	240.00
RND5	340.00	1400.00	0.00	1.00	230.00
RND6	275.00	1235.00	2.76	0.85	168.00







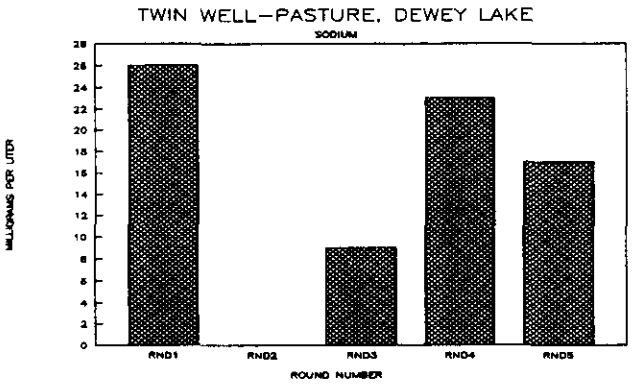


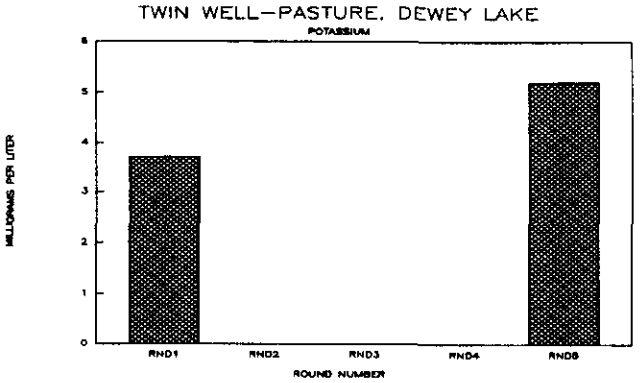


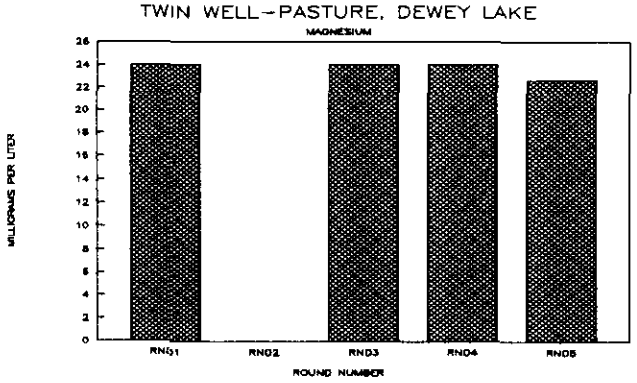
*FIELD VALUE **SUSPECT VALUE ***NO ANALYSIS

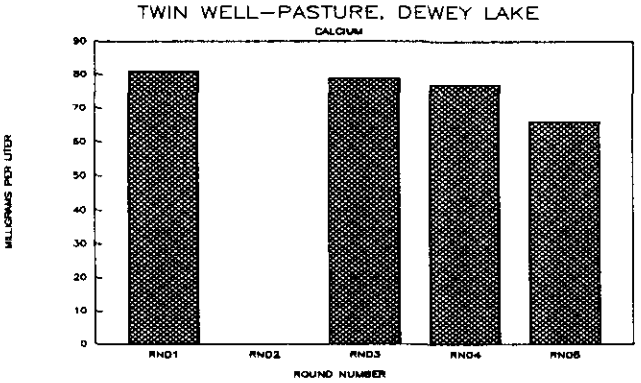
TWIN WELL (PASTURE), DEWEY LAKE
HISTORY
MAJOR CATIONS

ROUND	SODIUM	POTASSIUM	MAGNESIUM	CALCIUM
RND1	26.00	3.70	24.00	81.00
RND2	0.00 ***	0.00 ***	0.00 ***	0.00 ***
RND3	9.00	0.00	24.00	79.00
RND4	23.00	0.00	24.00	77.00
RND5	17.00	5.20 **	22.60	66.00





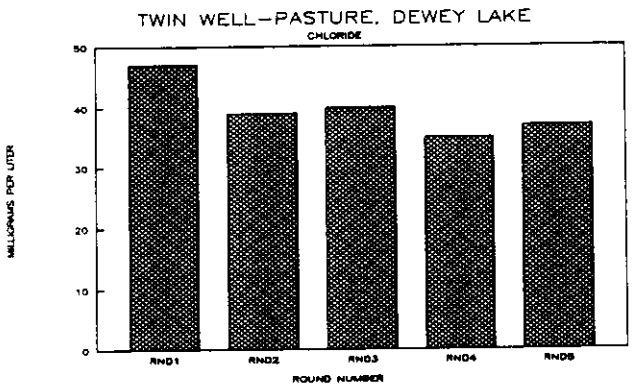


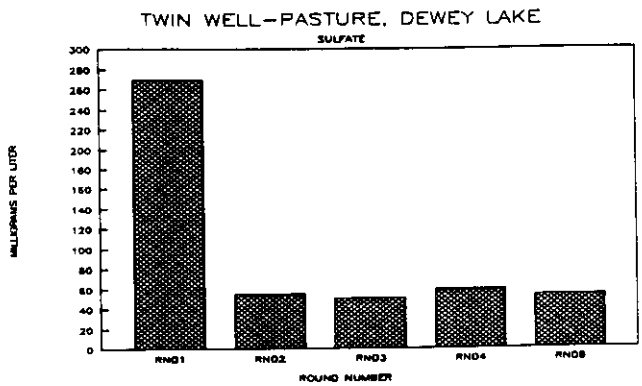


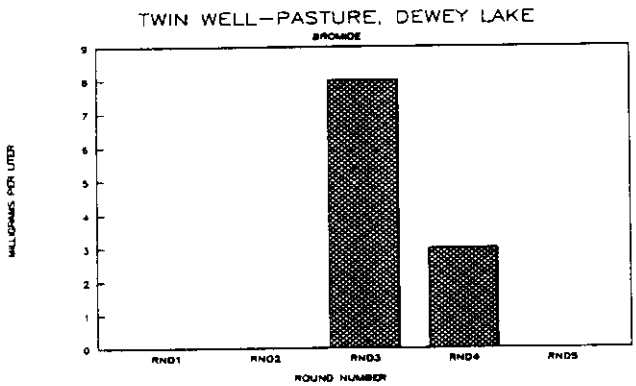
*FIELD VALUE **SUSPECT VALUE ***NO ANALYSIS

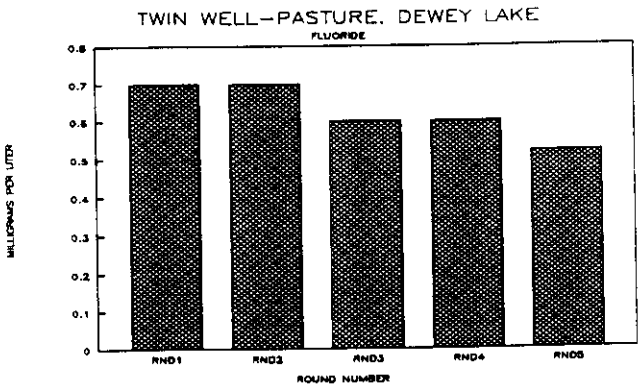
TWIN WELL (PASTURE), DEWEY LAKE
HISTORY
MAJOR ANIONS

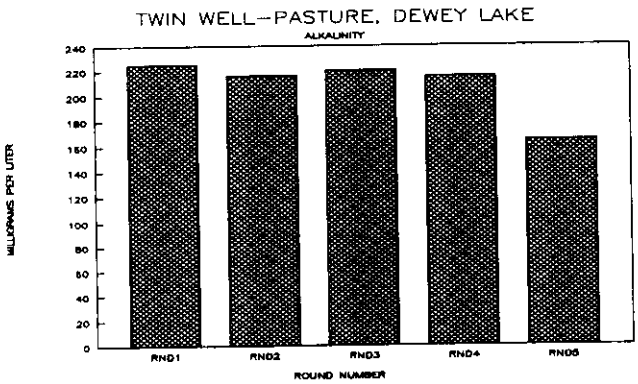
ROUND	CHLORIDE	SULFATE	BROMIDE	FLUORIDE	ALKALINITY
RND1	47.00	270.00	0.00	0.70	225.00
RND2	39.00	55.00	0.00	0.70	216.00 *
RND3	40.00	50.00	8.00	0.60	220.00
RND4	35.00	59.00	3.00	0.60	215.00
RND5	37.00	53.00	0.00	0.52	164.50 **









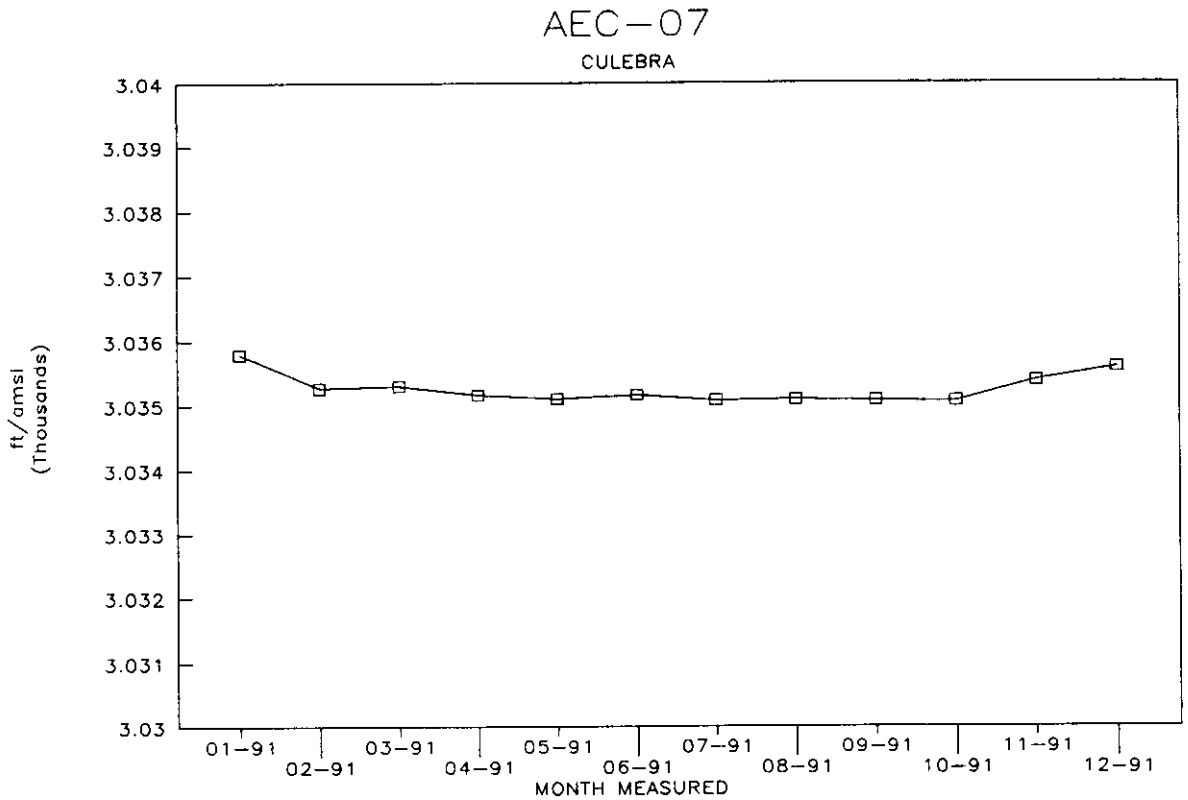


*FIELD VALUE **SUSPECT VALUE ***NO ANALYSIS

Appendix 12
Groundwater Level Data
for Calendar Year 1991

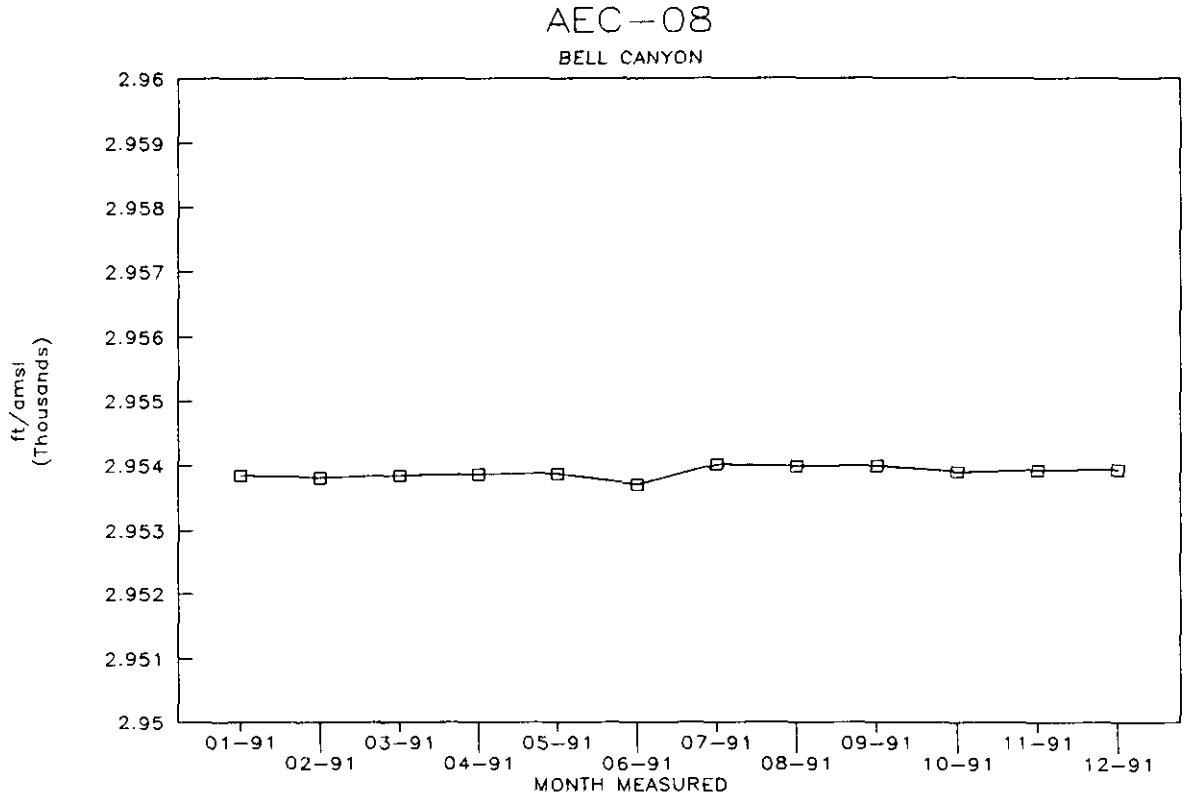
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
AEC-7	CUL	3657.25	01-14-91	10:08	622.44	0.98	621.46	189.42	3035.79	925.31
AEC-7	CUL	3657.25	02-11-91	08:35	622.97	0.98	621.99	189.58	3035.26	925.15
AEC-7	CUL	3657.25	03-11-91	08:50	622.93	0.98	621.95	189.57	3035.30	925.16
AEC-7	CUL	3657.25	04-16-91	08:25	623.07	0.98	622.09	189.61	3035.16	925.12
AEC-7	CUL	3657.25	05-14-91	08:37	623.13	0.98	622.15	189.63	3035.10	925.10
AEC-7	CUL	3657.25	06-18-91	08:11	623.07	0.98	622.09	189.61	3035.16	925.12
AEC-7	CUL	3657.25	07-15-91	08:15	623.16	0.98	622.18	189.64	3035.07	925.09
AEC-7	CUL	3657.25	08-12-91	09:25	623.15	0.98	622.17	189.64	3035.08	925.09
AEC-7	CUL	3657.25	09-23-91	10:02	623.16	0.98	622.18	189.64	3035.07	925.09
AEC-7	CUL	3657.25	10-14-91	10:50	623.17	0.98	622.19	189.64	3035.06	925.09
AEC-7	CUL	3657.25	11-19-91	09:20	622.85	0.98	621.87	189.55	3035.38	925.18
AEC-7	CUL	3657.25	12-09-91	10:59	622.65	0.98	621.67	189.49	3035.58	925.24



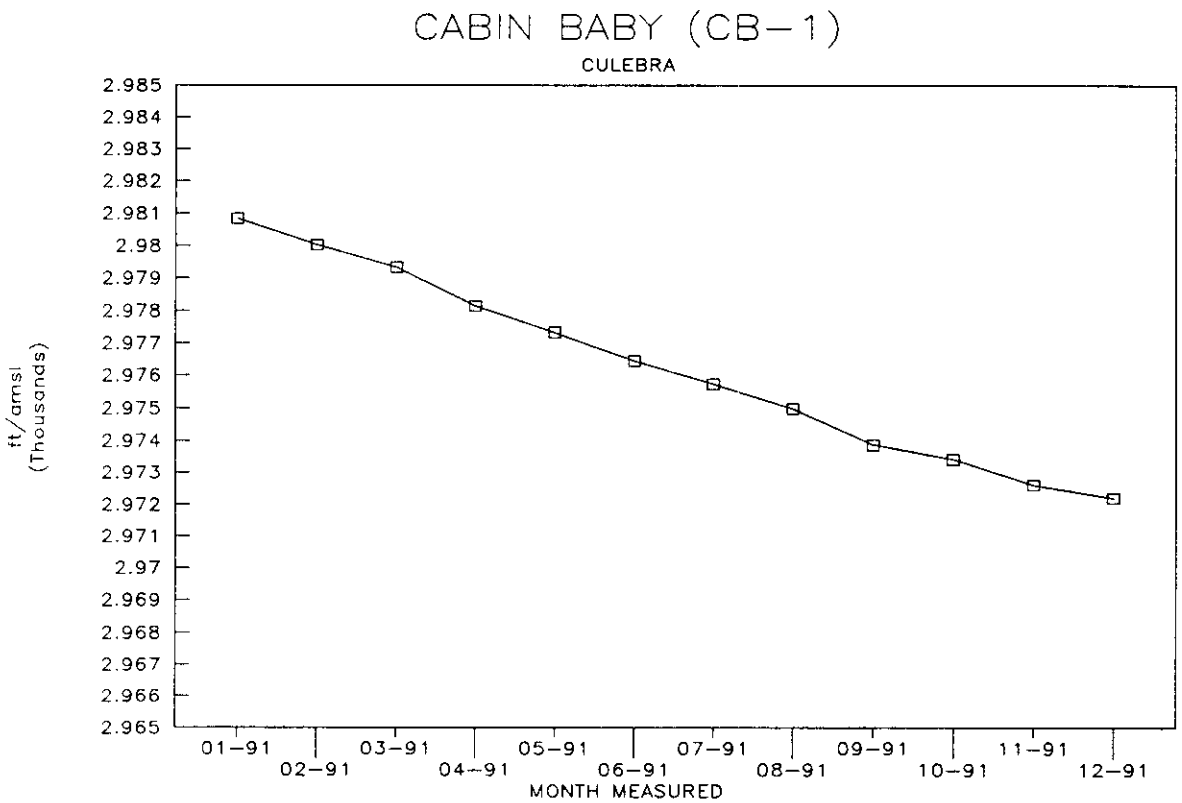
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
AEC-8	B/C	3537.10	01-14-91	10:28	583.26	0.00	583.26	177.78	2953.84	900.33
AEC-8	B/C	3537.10	02-11-91	08:55	583.29	0.00	583.29	177.79	2953.81	900.32
AEC-8	B/C	3537.10	03-11-91	09:14	583.26	0.00	583.26	177.78	2953.84	900.33
AEC-8	B/C	3537.10	04-16-91	12:15	583.24	0.00	583.24	177.77	2953.86	900.34
AEC-8	B/C	3537.10	05-14-91	09:06	583.23	0.00	583.23	177.77	2953.87	900.34
AEC-8	B/C	3537.10	06-18-91	08:40	583.40	0.00	583.40	177.82	2953.70	900.29
AEC-8	B/C	3537.10	07-15-91	08:42	583.09	0.00	583.09	177.73	2954.01	900.38
AEC-8	B/C	3537.10	08-12-91	09:53	583.12	0.00	583.12	177.73	2953.98	900.37
AEC-8	B/C	3537.10	09-23-91	10:29	583.11	0.00	583.11	177.73	2953.99	900.38
AEC-8	B/C	3537.10	10-14-91	11:38	583.21	0.00	583.21	177.76	2953.89	900.35
AEC-8	B/C	3537.10	11-19-91	09:40	583.18	0.00	583.18	177.75	2953.92	900.35
AEC-8	B/C	3537.10	12-09-91	10:15	583.17	0.00	583.17	177.75	2953.93	900.36



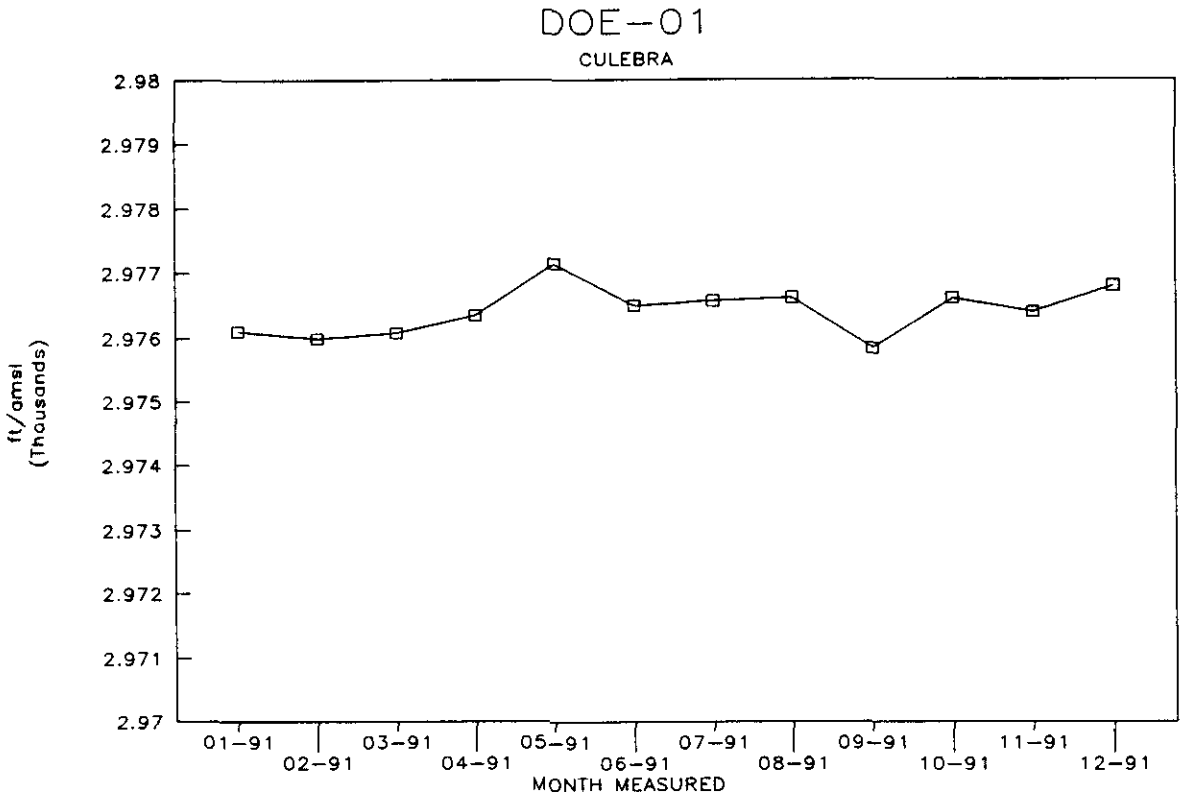
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
CABIN BABY	CUL	3328.38	01-16-91	14:05	347.54	0.00	347.54	105.93	2980.84	908.56
CABIN BABY	CUL	3328.38	02-12-91	15:15	348.36	0.00	348.36	106.18	2980.02	908.31
CABIN BABY	CUL	3328.38	03-12-91	15:01	349.05	0.00	349.05	106.39	2979.33	908.10
CABIN BABY	CUL	3328.38	04-18-91	15:00	350.25	0.00	350.25	106.76	2978.13	907.73
CABIN BABY	CUL	3328.38	05-14-91	16:33	351.05	0.00	351.05	107.00	2977.33	907.49
CABIN BABY	CUL	3328.38	06-19-91	08:30	351.93	0.00	351.93	107.27	2976.45	907.22
CABIN BABY	CUL	3328.38	07-16-91	13:27	352.65	0.00	352.65	107.49	2975.73	907.00
CABIN BABY	CUL	3328.38	08-13-91	10:38	353.41	0.00	353.41	107.72	2974.97	906.77
CABIN BABY	CUL	3328.38	09-26-91	08:02	354.51	0.00	354.51	108.05	2973.87	906.44
CABIN BABY	CUL	3328.38	10-17-91	08:20	354.97	0.00	354.97	108.19	2973.41	906.30
CABIN BABY	CUL	3328.38	11-20-91	13:54	355.77	0.00	355.77	108.44	2972.61	906.05
CABIN BABY	CUL	3328.38	12-11-91	12:37	356.18	0.00	356.18	108.56	2972.20	905.93



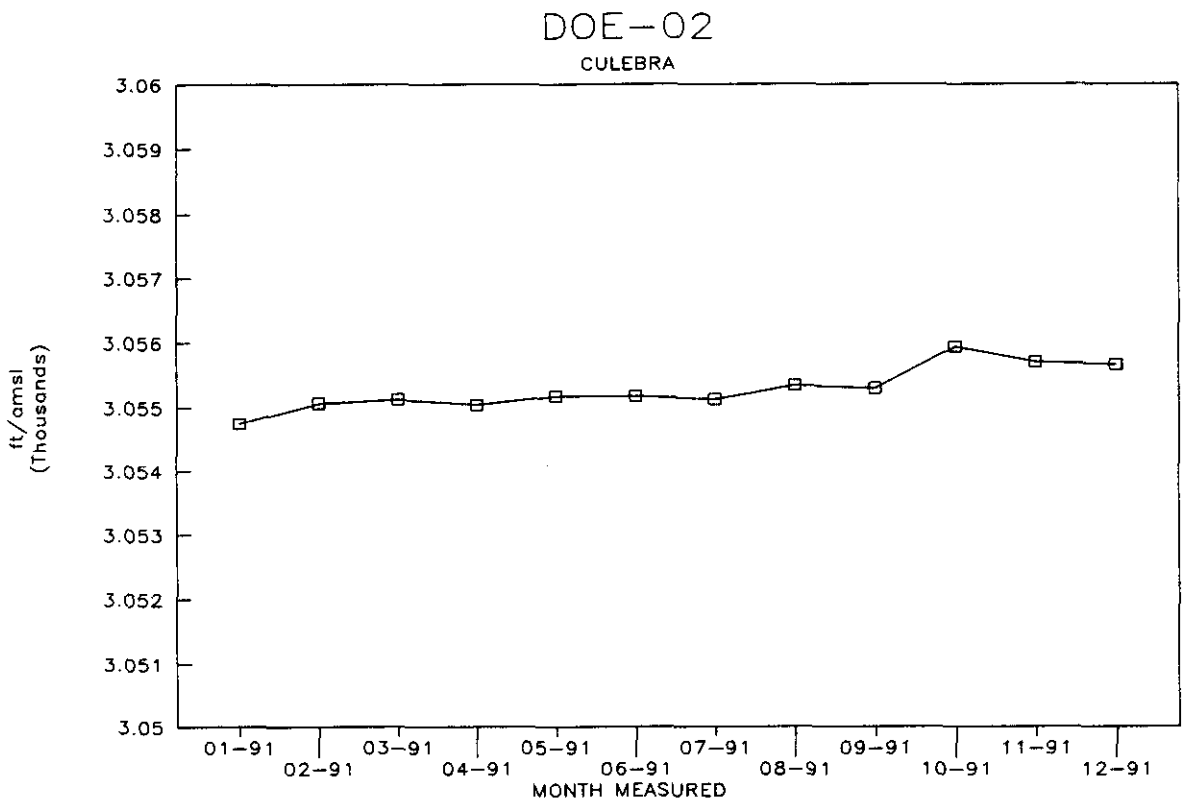
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
DOE-1	CUL	3465.22	01-16-91	09:05	489.10	0.00	489.10	149.08		
DOE-1	CUL	3465.22	02-11-91	09:40	489.21	0.00	489.21	149.11	2976.01	907.09
DOE-1	CUL	3465.22	03-12-91	09:58	489.12	0.00	489.12	149.08	2976.10	907.12
DOE-1	CUL	3465.22	04-18-91	09:30	488.85	0.00	488.85	149.00	2976.37	907.20
DOE-1	CUL	3465.22	05-16-91	07:30	488.07	0.00	488.07	148.76	2977.15	907.44
DOE-1	CUL	3465.22	06-17-91	11:50	488.71	0.00	488.71	148.96	2976.51	907.24
DOE-1	CUL	3465.22	07-16-91	11:53	488.64	0.00	488.64	148.94	2976.58	907.26
DOE-1	CUL	3465.22	08-12-91	14:30	488.59	0.00	488.59	148.92	2976.63	907.28
DOE-1	CUL	3465.22	09-24-91	08:53	489.37	0.00	489.37	149.16	2975.85	907.04
DOE-1	CUL	3465.22	10-15-91	13:00	488.60	0.00	488.60	148.93	2976.62	907.27
DOE-1	CUL	3465.22	11-19-91	10:50	488.81	0.00	488.81	148.99	2976.41	907.21
DOE-1	CUL	3465.22	12-12-91	08:02	488.41	0.00	488.41	148.87	2976.81	907.33



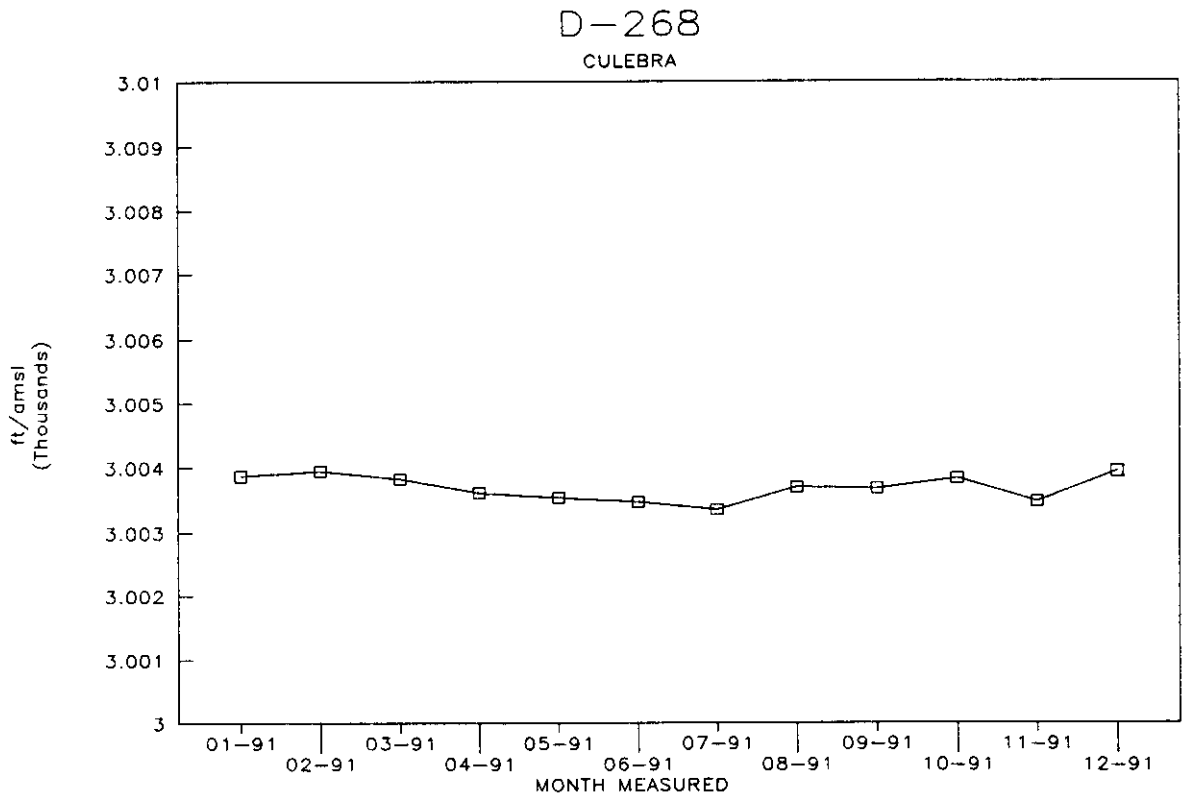
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
DOE-2	CUL	3419.09	01-16-91	13:30	364.34	0.00	364.34	111.05		
DOE-2	CUL	3419.09	02-13-91	09:05	364.03	0.00	364.03	110.96	3055.06	931.18
DOE-2	CUL	3419.09	03-12-91	13:20	363.97	0.00	363.97	110.94	3055.12	931.20
DOE-2	CUL	3419.09	04-16-91	11:04	364.06	0.00	364.06	110.97	3055.03	931.17
DOE-2	CUL	3419.09	05-15-91	16:52	363.92	0.00	363.92	110.92	3055.17	931.22
DOE-2	CUL	3419.09	06-17-91	16:56	363.92	0.00	363.92	110.92	3055.17	931.22
DOE-2	CUL	3419.09	07-15-91	15:01	363.97	0.00	363.97	110.94	3055.12	931.20
DOE-2	CUL	3419.09	08-13-91	15:30	363.76	0.00	363.76	110.87	3055.33	931.26
DOE-2	CUL	3419.09	09-24-91	14:34	363.80	0.00	363.80	110.89	3055.29	931.25
DOE-2	CUL	3419.09	10-15-91	09:18	363.16	0.00	363.16	110.69	3055.93	931.45
DOE-2	CUL	3419.09	11-20-91	15.03	363.40	0.00	363.40	110.76	3055.69	931.37
DOE-2	CUL	3419.09	12-09-91	14:38	363.44	0.00	363.44	110.78	3055.65	931.36



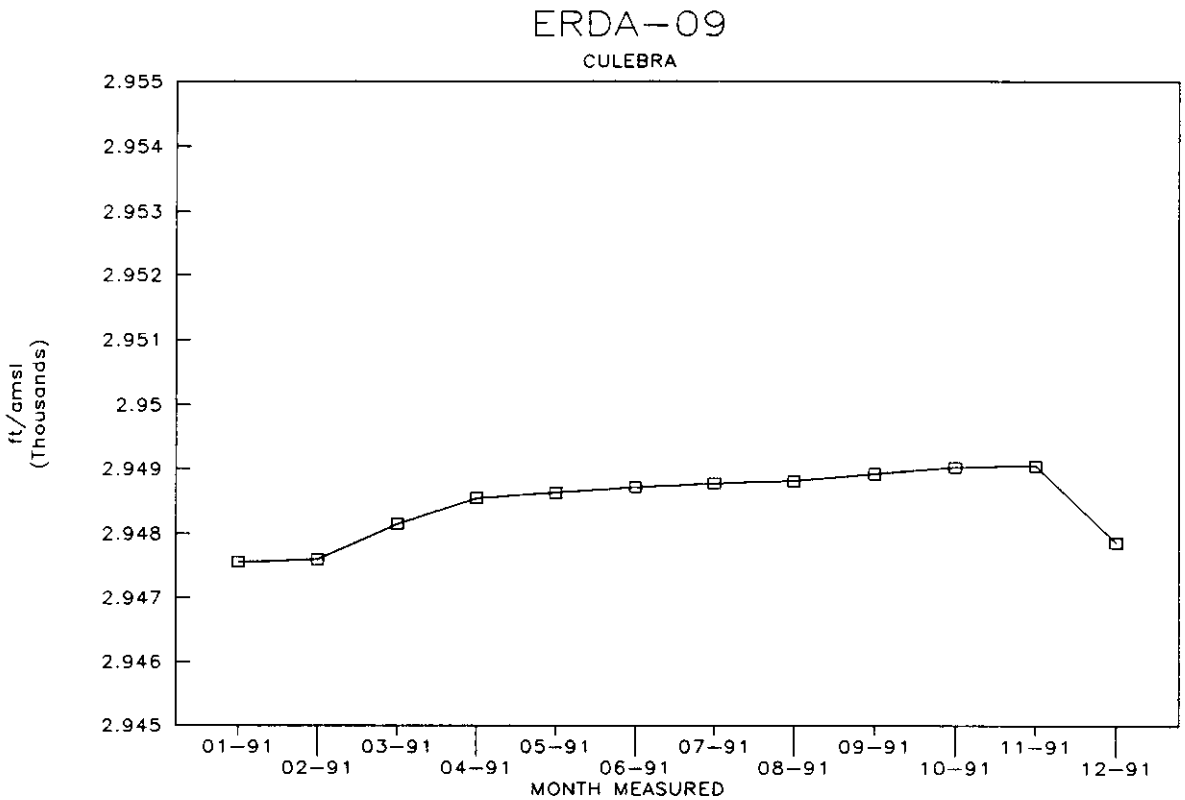
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
D-268	CUL	3280.70	01-16-91	06:36	277.58	0.75	276.83	84.38	3003.87	915.58
D-268	CUL	3280.70	02-12-91	14:30	277.51	0.75	276.76	84.36	3003.94	915.60
D-268	CUL	3280.70	03-12-91	14:31	277.63	0.75	276.88	84.39	3003.82	915.56
D-268	CUL	3280.70	04-18-91	10:21	277.84	0.75	277.09	84.46	3003.61	915.50
D-268	CUL	3280.70	05-16-91	06:05	277.91	0.75	277.16	84.48	3003.54	915.48
D-268	CUL	3280.70	06-17-91	13:20	277.98	0.75	277.23	84.50	3003.47	915.46
D-268	CUL	3280.70	07-16-91	15:33	278.10	0.75	277.35	84.54	3003.35	915.42
D-268	CUL	3280.70	08-13-91	14:46	277.76	0.75	277.01	84.43	3003.69	915.52
D-268	CUL	3280.70	09-24-91	07:38	277.78	0.75	277.03	84.44	3003.67	915.52
D-268	CUL	3280.70	10-15-91	14:36	277.63	0.75	276.88	84.39	3003.82	915.56
D-268	CUL	3280.70	11-20-91	09:50	277.98	0.75	277.23	84.50	3003.47	915.46
D-268	CUL	3280.70	12-11-91	14:30	277.52	0.75	276.77	84.36	3003.93	915.60



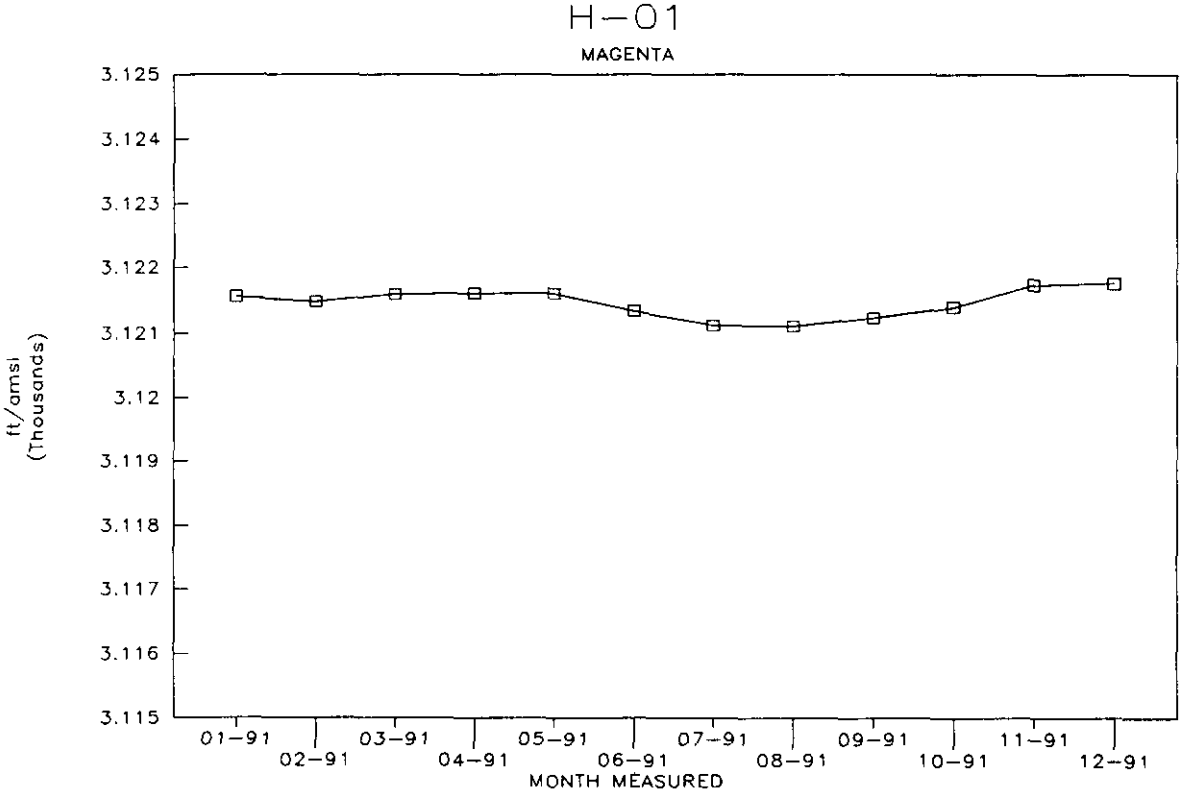
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
ERDA-9	CUL	3410.10	01-16-91	10:25	463.46	0.92	462.54	140.98		
ERDA-9	CUL	3410.10	02-12-91	13:10	463.42	0.92	462.50	140.97	2947.60	898.43
ERDA-9	CUL	3410.10	03-12-91	10:30	462.87	0.92	461.95	140.80	2948.15	898.60
ERDA-9	CUL	3410.10	04-17-91	15:00	462.47	0.92	461.55	140.68	2948.55	898.72
ERDA-9	CUL	3410.10	05-15-91	14:47	462.39	0.92	461.47	140.66	2948.63	898.74
ERDA-9	CUL	3410.10	06-17-91	09:45	462.31	0.92	461.39	140.63	2948.71	898.77
ERDA-9	CUL	3410.10	07-16-91	11:58	462.25	0.92	461.33	140.61	2948.77	898.79
ERDA-9	CUL	3410.10	08-12-91	13:38	462.21	0.92	461.29	140.60	2948.81	898.80
ERDA-9	CUL	3410.10	09-24-91	10:40	462.10	0.92	461.18	140.57	2948.92	898.83
ERDA-9	CUL	3410.10	10-15-91	10:57	462.00	0.92	461.08	140.54	2949.02	898.86
ERDA-9	CUL	3410.10	11-18-91	13:30	461.97	0.92	461.05	140.53	2949.05	898.87
ERDA-9	CUL	3410.10	12-12-91	09:00	463.16	0.92	462.24	140.89	2947.86	898.51



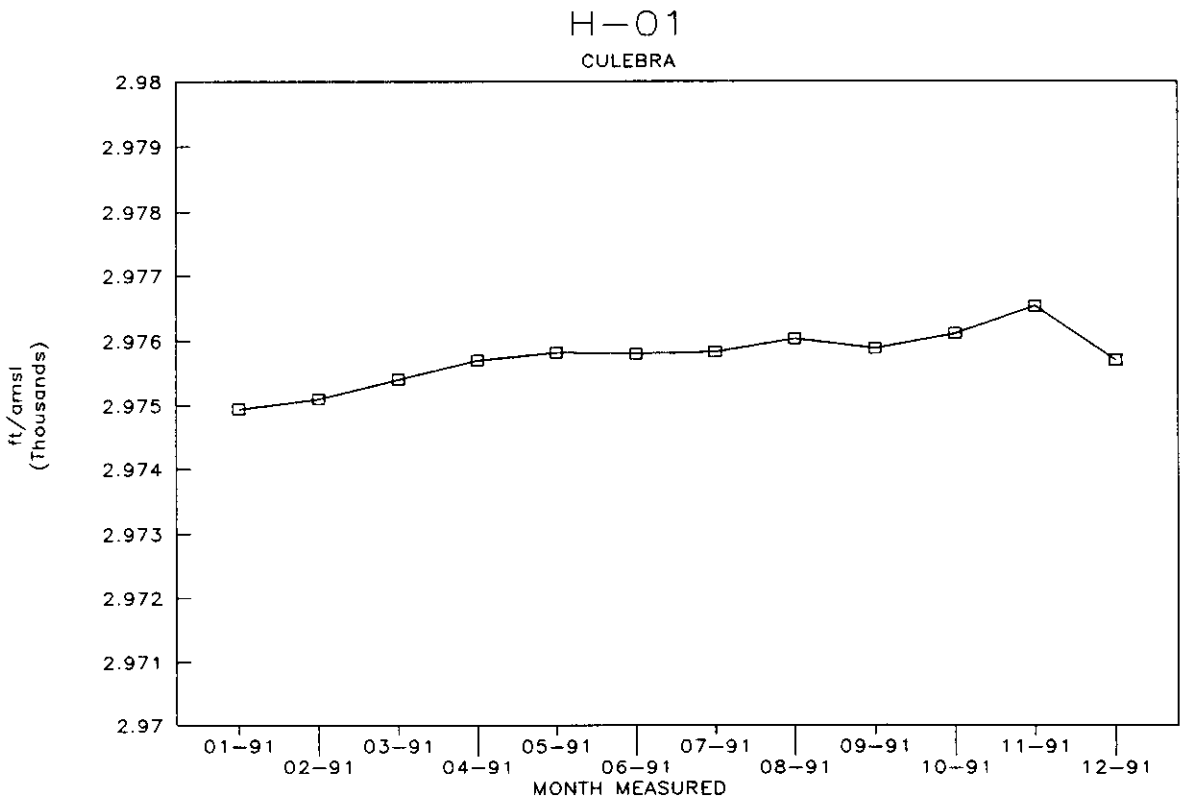
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-01 (ANNULUS)	MAG	3399.53	01-16-91	10:14	278.95	0.98	277.97	84.73	3121.56	951.45
H-01 (ANNULUS)	MAG	3399.53	02-12-91	13:30	279.03	0.98	278.05	84.75	3121.48	951.43
H-01 (ANNULUS)	MAG	3399.53	03-12-91	10:21	278.91	0.98	277.93	84.71	3121.60	951.46
H-01 (ANNULUS)	MAG	3399.53	04-17-91	15:10	278.90	0.98	277.92	84.71	3121.61	951.47
H-01 (ANNULUS)	MAG	3399.53	05-15-91	14:34	278.90	0.98	277.92	84.71	3121.61	951.47
H-01 (ANNULUS)	MAG	3399.53	06-17-91	10:06	279.17	0.98	278.19	84.79	3121.34	951.38
H-01 (ANNULUS)	MAG	3399.53	07-16-91	10:10	279.39	0.98	278.41	84.86	3121.12	951.32
H-01 (ANNULUS)	MAG	3399.53	08-12-91	13:45	279.40	0.98	278.42	84.86	3121.11	951.31
H-01 (ANNULUS)	MAG	3399.53	09-24-91	10:31	279.27	0.98	278.29	84.82	3121.24	951.35
H-01 (ANNULUS)	MAG	3399.53	10-15-91	11:16	279.11	0.98	278.13	84.77	3121.40	951.40
H-01 (ANNULUS)	MAG	3399.53	11-18-91	13:43	278.77	0.98	277.79	84.67	3121.74	951.51
H-01 (ANNULUS)	MAG	3399.53	12-12-91	09:24	278.75	0.98	277.77	84.66	3121.76	951.51



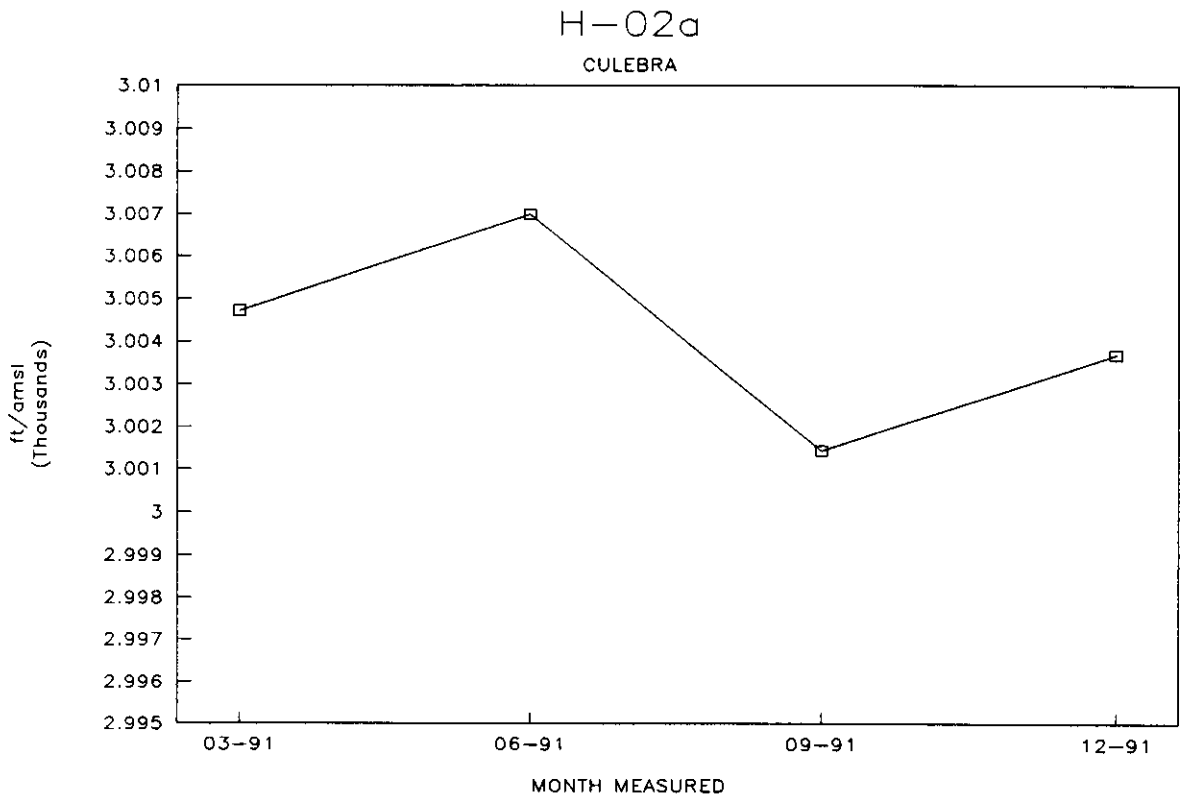
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-01 (PIP)	CUL	3399.53	01-16-91	10:08	425.57	0.98	424.59	129.42	2974.94	906.76
H-01 (PIP)	CUL	3399.53	02-12-91	13:20	425.41	0.98	424.43	129.37	2975.10	906.81
H-01 (PIP)	CUL	3399.53	03-12-91	10:16	425.10	0.98	424.12	129.27	2975.41	906.90
H-01 (PIP)	CUL	3399.53	04-17-91	15:15	424.81	0.98	423.83	129.18	2975.70	906.99
H-01 (PIP)	CUL	3399.53	05-15-91	14:25	424.69	0.98	423.71	129.15	2975.82	907.03
H-01 (PIP)	CUL	3399.53	06-17-91	09:55	424.71	0.98	423.73	129.15	2975.80	907.02
H-01 (PIP)	CUL	3399.53	07-16-91	10:45	424.68	0.98	423.70	129.14	2975.83	907.03
H-01 (PIP)	CUL	3399.53	08-12-91	13:52	424.48	0.98	423.50	129.08	2976.03	907.09
H-01 (PIP)	CUL	3399.53	09-24-91	10:23	424.63	0.98	423.65	129.13	2975.88	907.05
H-01 (PIP)	CUL	3399.53	10-15-91	11:06	424.40	0.98	423.42	129.06	2976.11	907.12
H-01 (PIP)	CUL	3399.53	11-18-91	13.38	423.98	0.98	423.00	128.93	2976.53	907.25
H-01 (PIP)	CUL	3399.53	12-12-91	09:10	424.81	0.98	423.83	129.18	2975.70	906.99



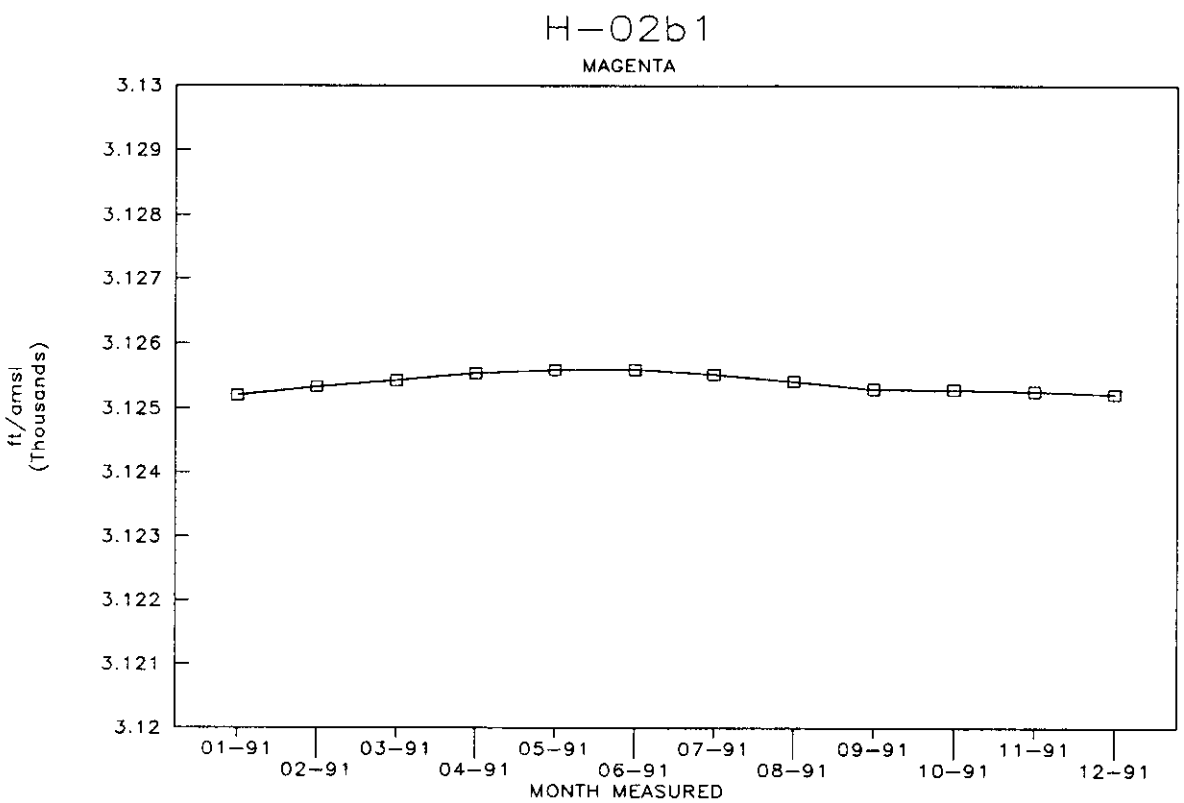
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-02a	CUL	3378.09	03-12-91	13:50	373.38	0.00	373.38	113.81	3004.71	915.84
H-02a	CUL	3378.09	06-17-91	13:52	371.11	0.00	371.11	113.11	3006.98	916.53
H-02a	CUL	3378.09	09-24-91	09:42	376.66	0.00	376.66	114.81	3001.43	914.84
H-02a	CUL	3378.09	12-12-91	09:41	374.40	0.00	374.40	114.12	3003.69	915.52



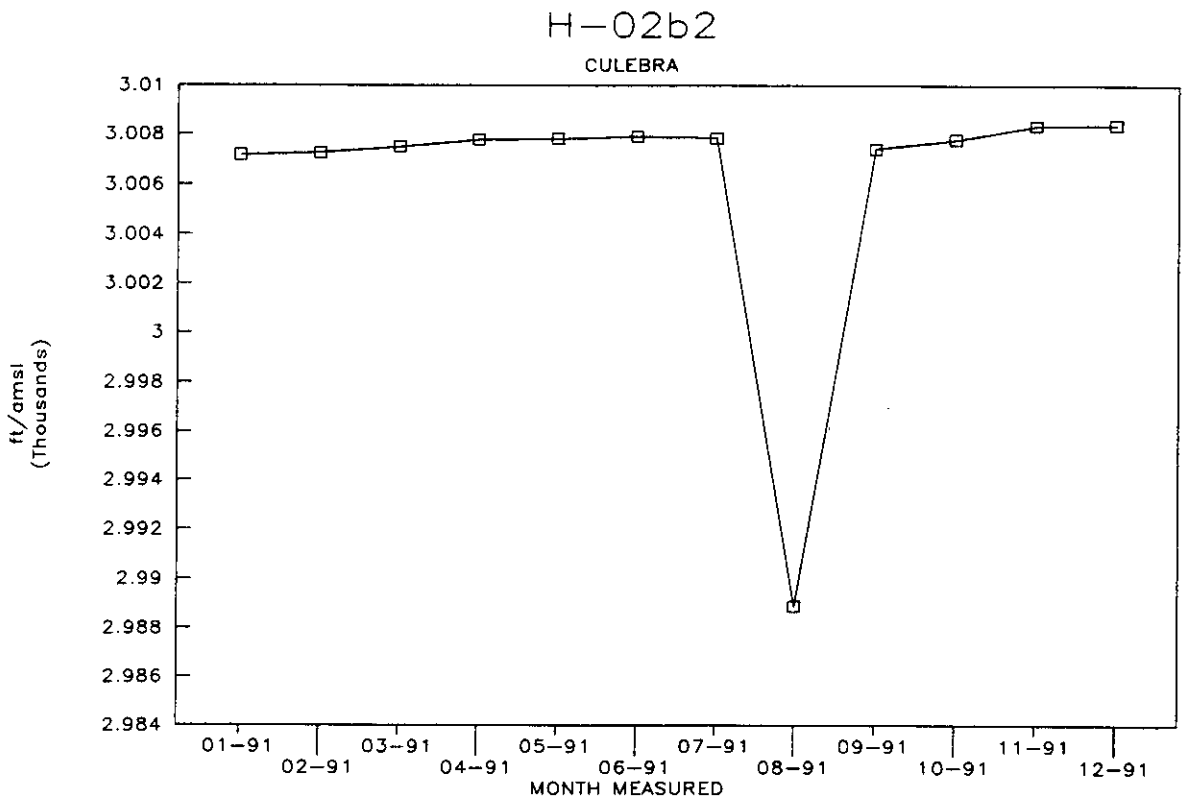
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-02b1	MAG	3378.46	01-16-91	08:30	253.26	0.00	253.26	77.19	3125.20	952.56
H-02b1	MAG	3378.46	02-12-91	13:45	253.13	0.00	253.13	77.15	3125.33	952.60
H-02b1	MAG	3378.46	03-12-91	14:02	253.03	0.00	253.03	77.12	3125.43	952.63
H-02b1	MAG	3378.46	04-18-91	08:19	252.92	0.00	252.92	77.09	3125.54	952.66
H-02b1	MAG	3378.46	05-15-91	17:10	252.87	0.00	252.87	77.07	3125.59	952.68
H-02b1	MAG	3378.46	06-17-91	14:09	252.86	0.00	252.86	77.07	3125.60	952.68
H-02b1	MAG	3378.46	07-16-91	11:08	252.94	0.00	252.94	77.10	3125.52	952.66
H-02b1	MAG	3378.46	08-13-91	12:50	253.04	0.00	253.04	77.13	3125.42	952.63
H-02b1	MAG	3378.46	09-24-91	09:58	253.16	0.00	253.16	77.16	3125.30	952.59
H-02b1	MAG	3378.46	10-15-91	11:32	253.17	0.00	253.17	77.17	3125.29	952.59
H-02b1	MAG	3378.46	11-18-91	14:01	253.20	0.00	253.20	77.18	3125.26	952.58
H-02b1	MAG	3378.46	12-12-91	10:00	253.24	0.00	253.24	77.19	3125.22	952.57



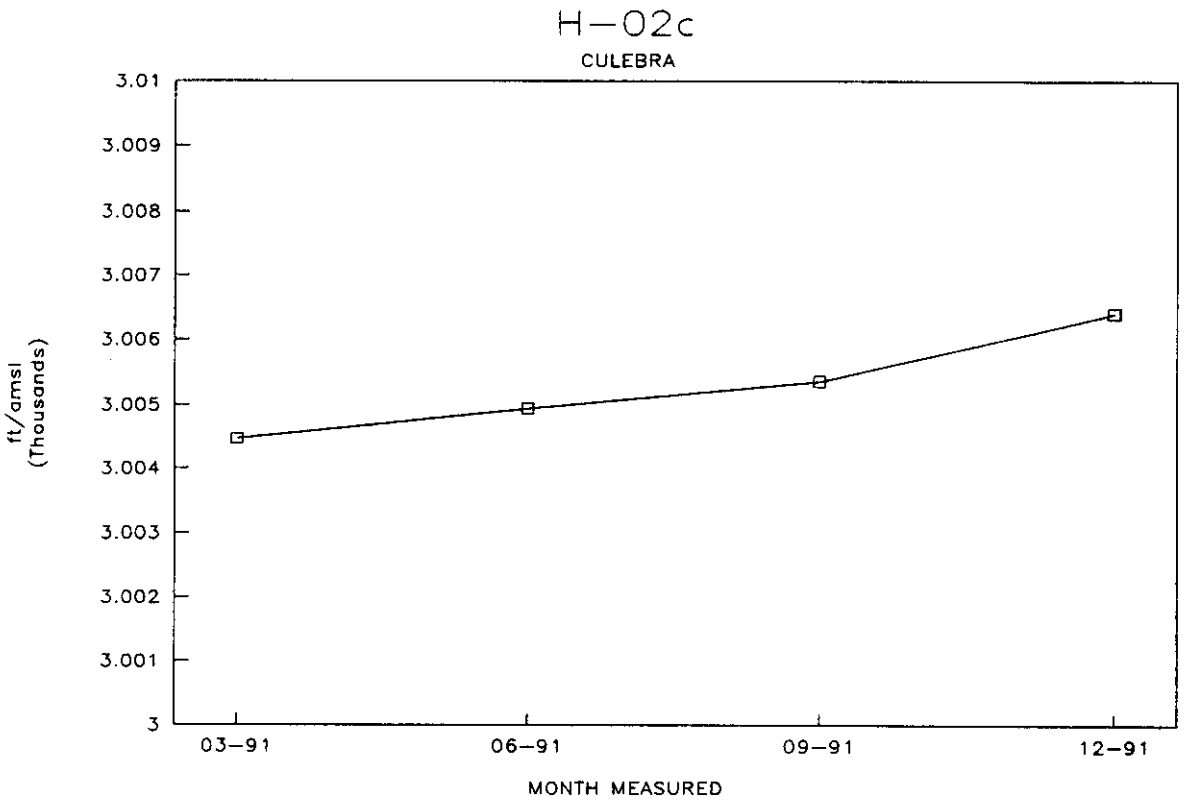
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-02b2	CUL	3378.31	01-16-91	08:35	371.15	0.00	371.15	113.13	3007.16	916.58
H-02b2	CUL	3378.31	02-12-91	13:50	371.06	0.00	371.06	113.10	3007.25	916.61
H-02b2	CUL	3378.31	03-12-91	13:56	370.80	0.00	370.80	113.02	3007.51	916.69
H-02b2	CUL	3378.31	04-18-91	08:25	370.54	0.00	370.54	112.94	3007.77	916.77
H-02b2	CUL	3378.31	05-15-91	17:20	370.49	0.00	370.49	112.93	3007.82	916.78
H-02b2	CUL	3378.31	06-17-91	14:01	370.41	0.00	370.41	112.90	3007.90	916.81
H-02b2	CUL	3378.31	07-16-91	11:13	370.46	0.00	370.46	112.92	3007.85	916.79
H-02b2	CUL	3378.31	08-13-91	13:00	389.43	0.00	389.43	118.70	2988.88	911.01
H-02b2	CUL	3378.31	09-24-91	09:48	370.91	0.00	370.91	113.05	3007.40	916.66
H-02b2	CUL	3378.31	10-15-91	11:27	370.52	0.00	370.52	112.93	3007.79	916.77
H-02b2	CUL	3378.31	11-18-91	13:56	369.96	0.00	369.96	112.76	3008.35	916.95
H-02b2	CUL	3378.31	12-12-91	09:50	369.93	0.00	369.93	112.75	3008.38	916.95



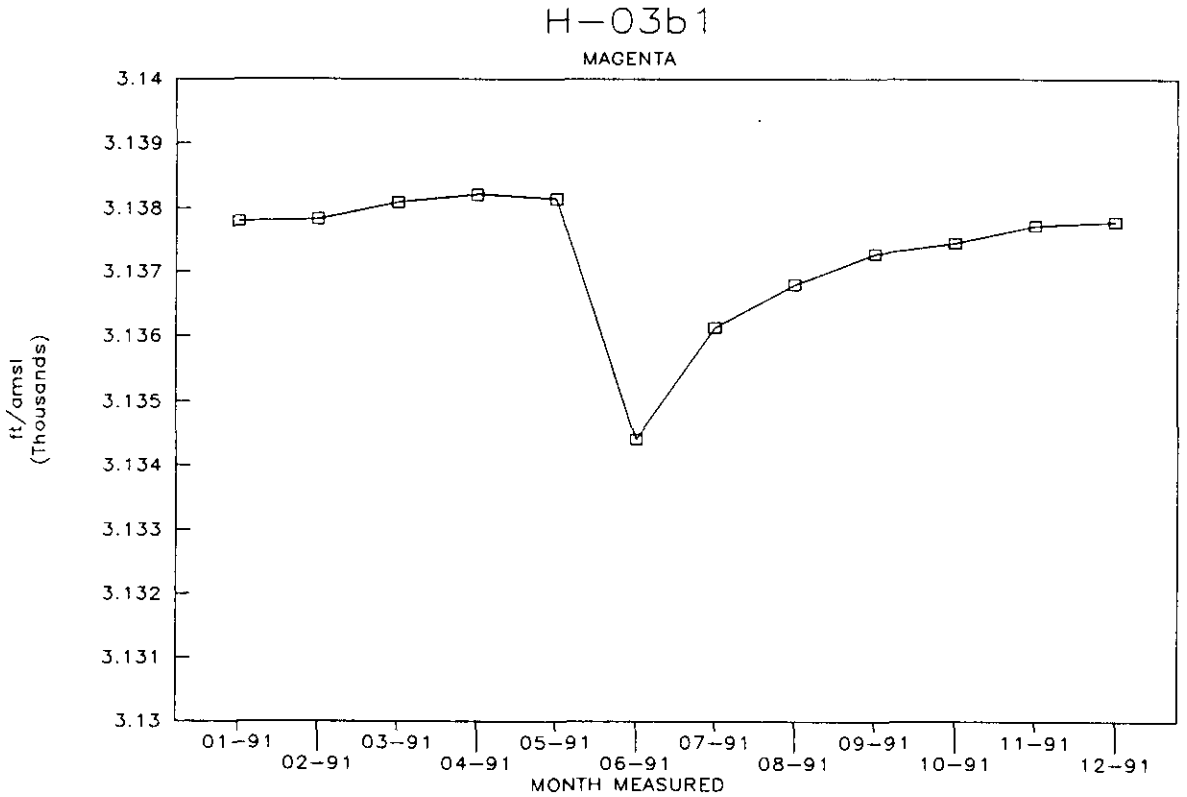
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-02c	CUL	3378.41	03-12-91	14:08	373.94	0.00	373.94	113.98	3004.47	915.76
H-02c	CUL	3378.41	06-17-91	14:20	373.47	0.00	373.47	113.83	3004.94	915.91
H-02c	CUL	3378.41	09-24-91	10:03	373.05	0.00	373.05	113.71	3005.36	916.03
H-02c	CUL	3378.41	12-12-91	10:10	372.01	0.00	372.01	113.39	3006.40	916.35



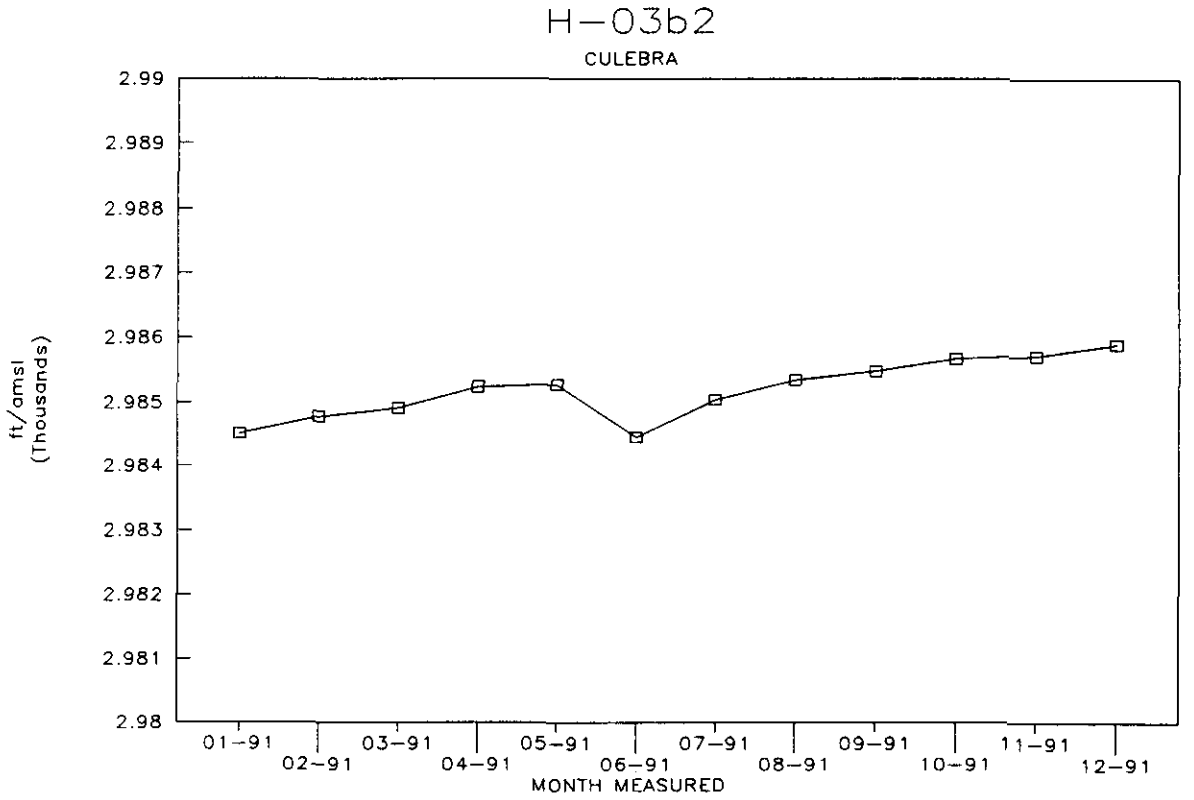
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-03b1	MAG	3390.64	01-16-91	09:42	252.84	0.00	252.84	77.07	3137.80	956.40
H-03b1	MAG	3390.64	02-12-91	12:40	252.81	0.00	252.81	77.06	3137.83	956.41
H-03b1	MAG	3390.64	03-12-91	09:16	252.55	0.00	252.55	76.98	3138.09	956.49
H-03b1	MAG	3390.64	04-18-91	08:48	252.43	0.00	252.43	76.94	3138.21	956.53
H-03b1	MAG	3390.64	05-13-91	07:47	252.49	0.00	252.49	76.96	3138.15	956.51
H-03b1	MAG	3390.64	06-17-91	10:33	256.23	0.00	256.23	78.10	3134.41	955.37
H-03b1	MAG	3390.64	07-16-91	11:25	254.51	0.00	254.51	77.57	3136.13	955.89
H-03b1	MAG	3390.64	08-12-91	14.01	253.84	0.00	253.84	77.37	3136.80	956.10
H-03b1	MAG	3390.64	09-24-91	09:03	253.36	0.00	253.36	77.22	3137.28	956.24
H-03b1	MAG	3390.64	10-15-91	13:11	253.19	0.00	253.19	77.17	3137.45	956.29
H-03b1	MAG	3390.64	11-19-91	10:20	252.91	0.00	252.91	77.09	3137.73	956.38
H-03b1	MAG	3390.64	12-12-91	08:16	252.85	0.00	252.85	77.07	3137.79	956.40



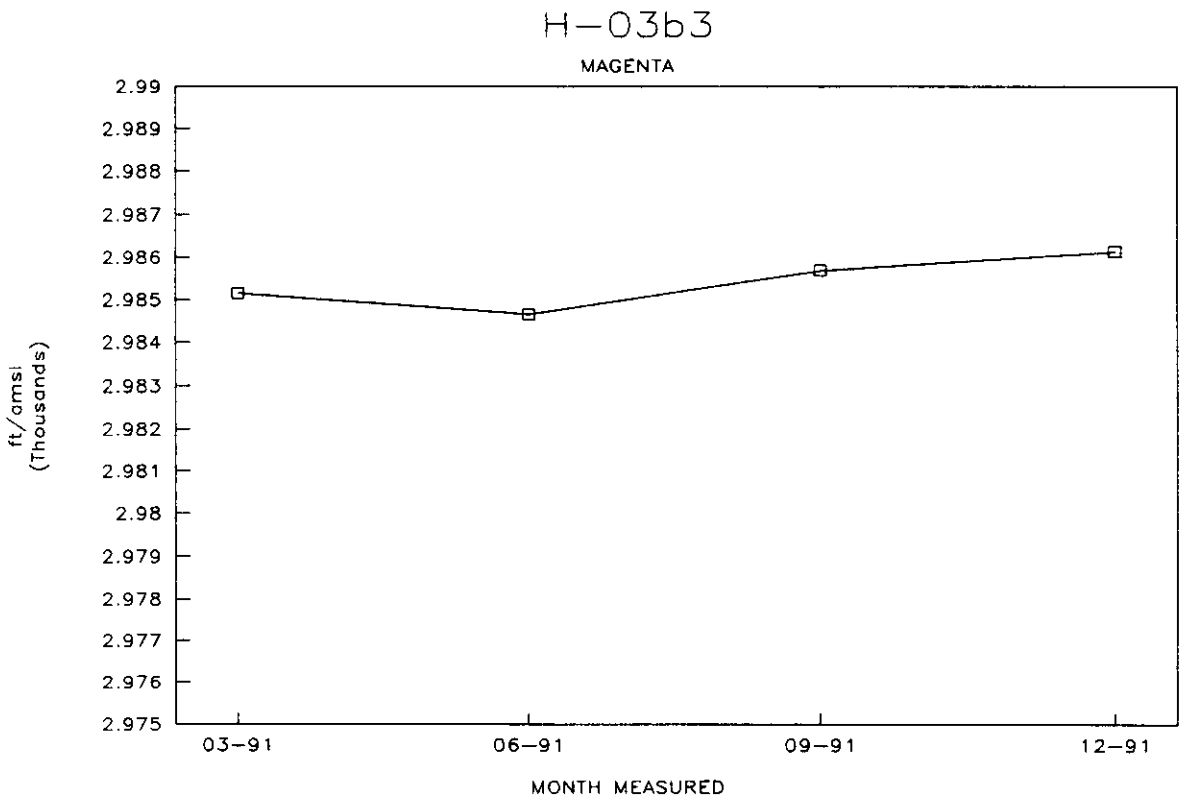
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-03b2	CUL	3390.03	01-16-91	09:56	405.52	0.00	405.52	123.60	2984.51	909.68
H-03b2	CUL	3390.03	02-12-91	13:00	405.26	0.00	405.26	123.52	2984.77	909.76
H-03b2	CUL	3390.03	03-12-91	09:40	405.13	0.00	405.13	123.48	2984.90	909.80
H-03b2	CUL	3390.03	04-18-91	09:06	404.79	0.00	404.79	123.38	2985.24	909.90
H-03b2	CUL	3390.03	05-16-91	09:09	404.76	0.00	404.76	123.37	2985.27	909.91
H-03b2	CUL	3390.03	06-17-91	11:13	405.58	0.00	405.58	123.62	2984.45	909.66
H-03b2	CUL	3390.03	07-16-91	11:42	404.99	0.00	404.99	123.44	2985.04	909.84
H-03b2	CUL	3390.03	08-12-91	14:18	404.69	0.00	404.69	123.35	2985.34	909.93
H-03b2	CUL	3390.03	09-24-91	09:28	404.55	0.00	404.55	123.31	2985.48	909.97
H-03b2	CUL	3390.03	10-15-91	13:25	404.36	0.00	404.36	123.25	2985.67	910.03
H-03b2	CUL	3390.03	11-19-91	10:35	404.31	0.00	404.31	123.23	2985.72	910.05
H-03b2	CUL	3390.03	12-12-91	08:46	404.13	0.00	404.13	123.18	2985.90	910.10



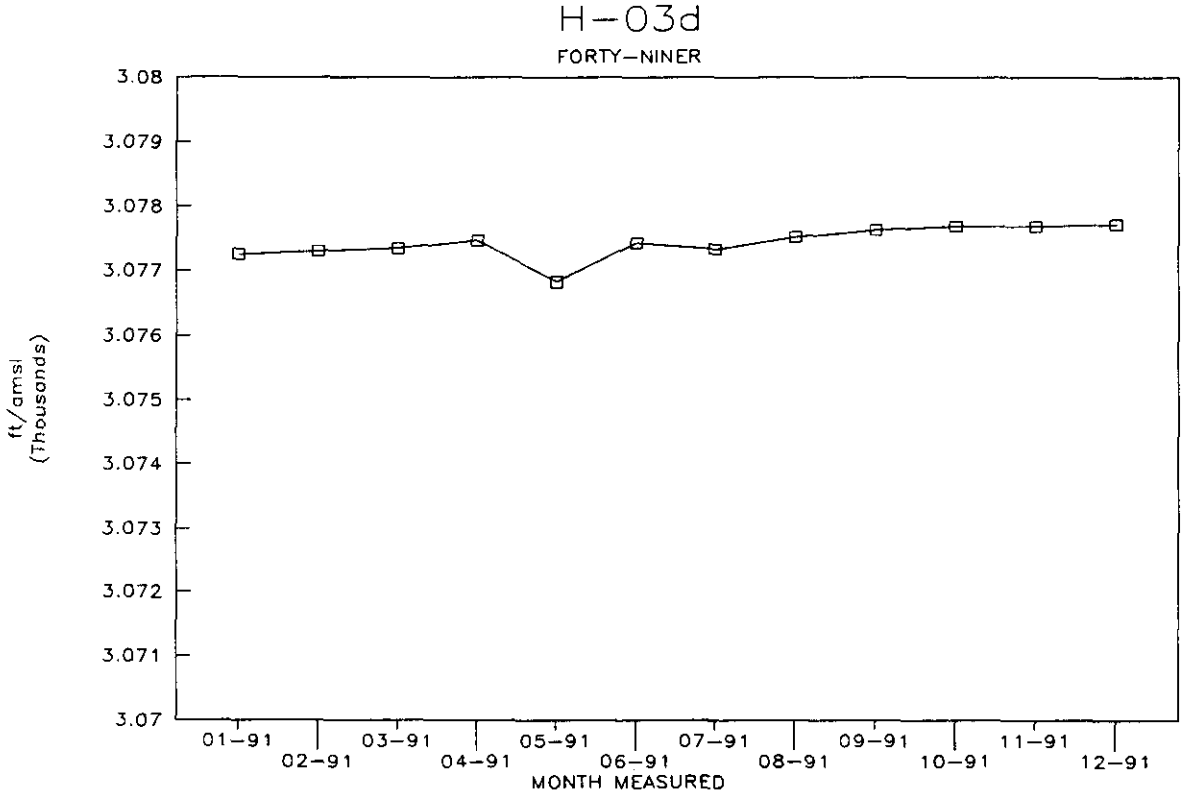
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-03b3	CUL	3388.67	03-12-91	09:34	403.53	0.00	403.53	123.00	2985.14	909.87
H-03b3	CUL	3388.67	06-17-91	11:02	404.02	0.00	404.02	123.15	2984.65	909.72
H-03b3	CUL	3388.67	09-24-91	09:20	402.98	0.00	402.98	122.83	2985.69	910.04
H-03b3	CUL	3388.67	12-12-91	08:39	402.53	0.00	402.53	122.69	2986.14	910.18



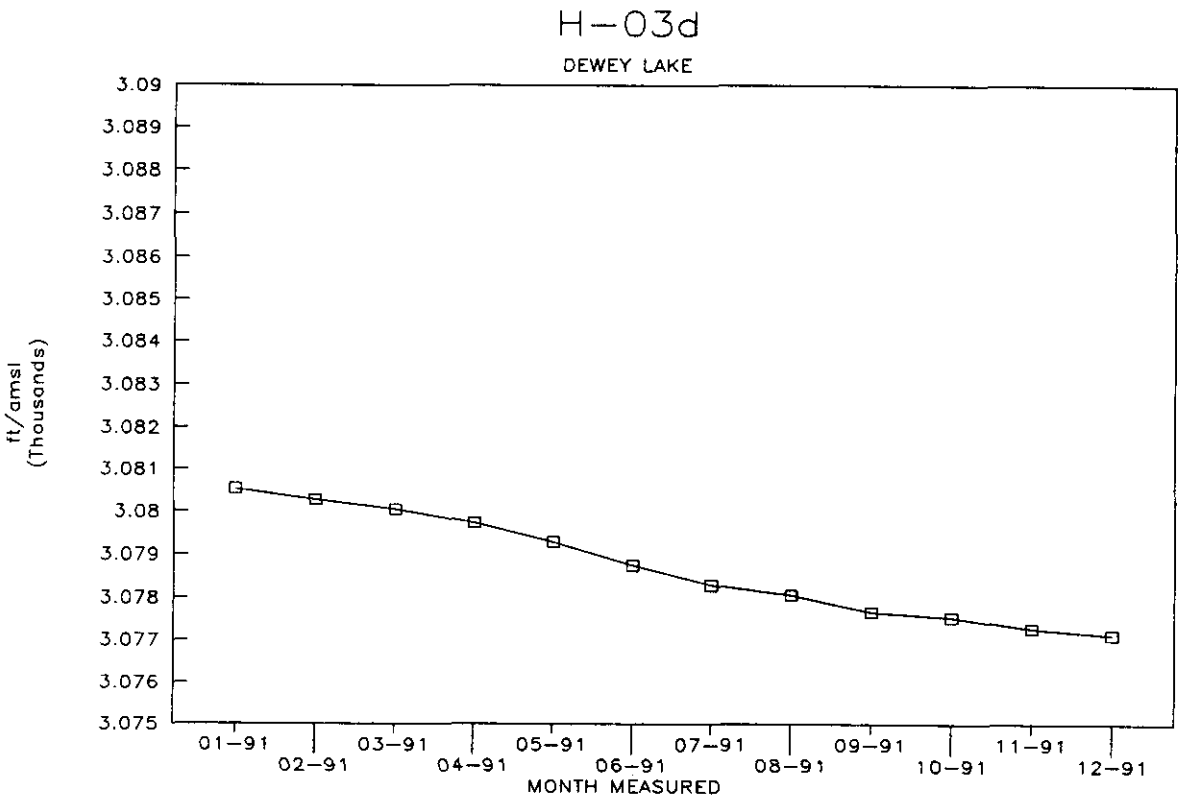
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-03d/49 (PIP)	49ER	3390.01	01-16-91	09:48	314.98	2.22	312.76	95.33	3077.25	937.95
H-03d/49 (PIP)	49ER	3390.01	02-12-91	12:45	314.93	2.22	312.71	95.31	3077.30	937.96
H-03d/49 (PIP)	49ER	3390.01	03-12-91	09:22	314.88	2.22	312.66	95.30	3077.35	937.98
H-03d/49 (PIP)	49ER	3390.01	04-18-91	08:56	314.76	2.22	312.54	95.26	3077.47	938.01
H-03d/49 (PIP)	49ER	3390.01	05-16-91	08:55	315.40	2.22	313.18	95.46	3076.83	937.82
H-03d/49 (PIP)	49ER	3390.01	06-17-91	10:51	314.80	2.22	312.58	95.27	3077.43	938.00
H-03d/49 (PIP)	49ER	3390.01	07-16-91	11:32	314.90	2.22	312.68	95.30	3077.33	937.97
H-03d/49 (PIP)	49ER	3390.01	08-12-91	14:12	314.71	2.22	312.49	95.25	3077.52	938.03
H-03d/49 (PIP)	49ER	3390.01	09-24-91	09:08	314.60	2.22	312.38	95.21	3077.63	938.06
H-03d/49 (PIP)	49ER	3390.01	10-15-91	13:16	314.54	2.22	312.32	95.20	3077.69	938.08
H-03d/49 (PIP)	49ER	3390.01	11-19-91	10:25	314.54	2.22	312.32	95.20	3077.69	938.08
H-03d/49 (PIP)	49ER	3390.01	12-12-91	08:25	314.51	2.22	312.29	95.19	3077.72	938.09



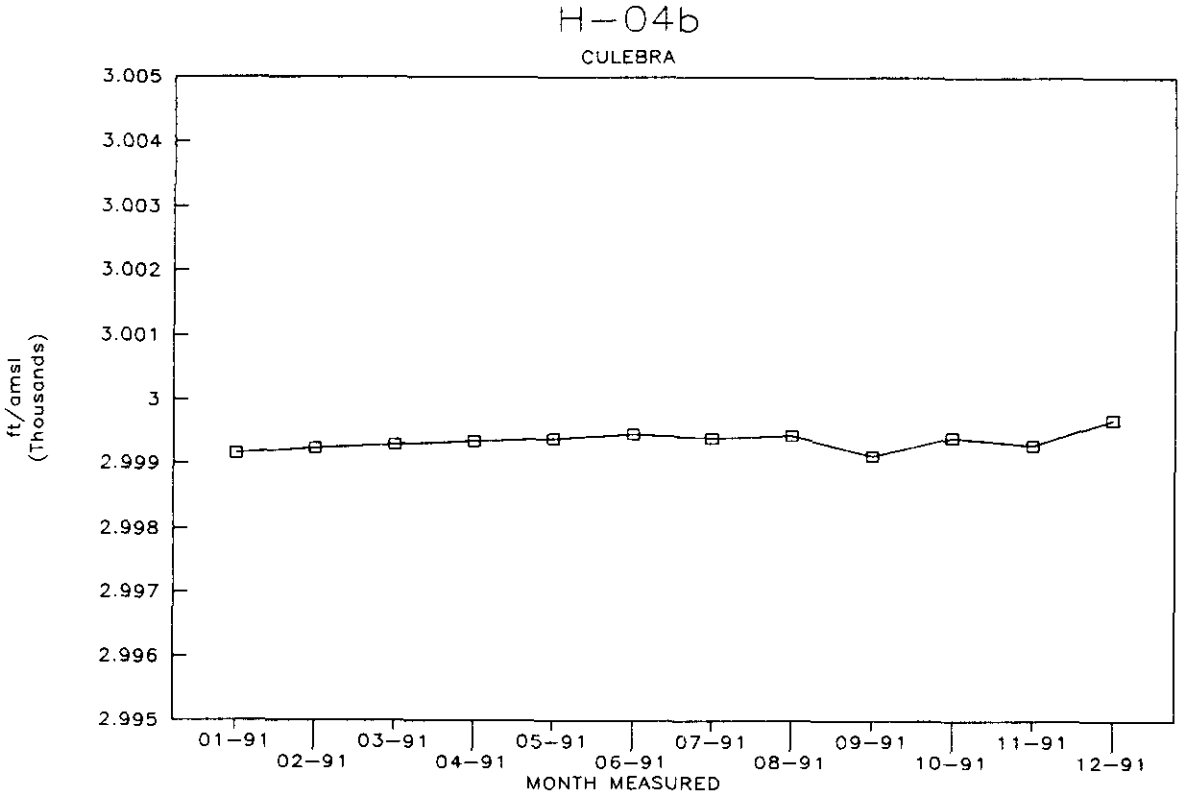
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-03d/DL (PIP)	DL	3390.01	01-16-91	09:51	311.70	2.22	309.48	94.33	3080.53	938.95
H-03d/DL (PIP)	DL	3390.01	02-12-91	12:50	311.96	2.22	309.74	94.41	3080.27	938.87
H-03d/DL (PVC)	DL	3390.01	03-12-91	09:28	312.18	2.22	309.96	94.48	3080.05	938.80
H-03d/DL (PVC)	DL	3390.01	04-18-91	09:01	312.50	2.22	310.28	94.57	3079.73	938.70
H-03d/DL (PVC)	DL	3390.01	05-16-91	09:00	312.95	2.22	310.73	94.71	3079.28	938.56
H-03d/DL (PVC)	DL	3390.01	06-17-91	10:43	313.49	2.22	311.27	94.88	3078.74	938.40
H-03d/DL (PVC)	DL	3390.01	07-16-91	11:36	313.94	2.22	311.72	95.01	3078.29	938.26
H-03d/DL (PVC)	DL	3390.01	08-12-91	14.06	314.17	2.22	311.95	95.08	3078.06	938.19
H-03d/DL (PVC)	DL	3390.01	09-24-91	09:12	314.57	2.22	312.35	95.20	3077.66	938.07
H-03d/DL (PVC)	DL	3390.01	10-15-91	13:19	314.69	2.22	312.47	95.24	3077.54	938.03
H-03d/DL (PVC)	DL	3390.01	11-19-91	10:28	314.95	2.22	312.73	95.32	3077.28	937.95
H-03d/DL (PVC)	DL	3390.01	12-12-91	08:30	315.11	2.22	312.89	95.37	3077.12	937.91



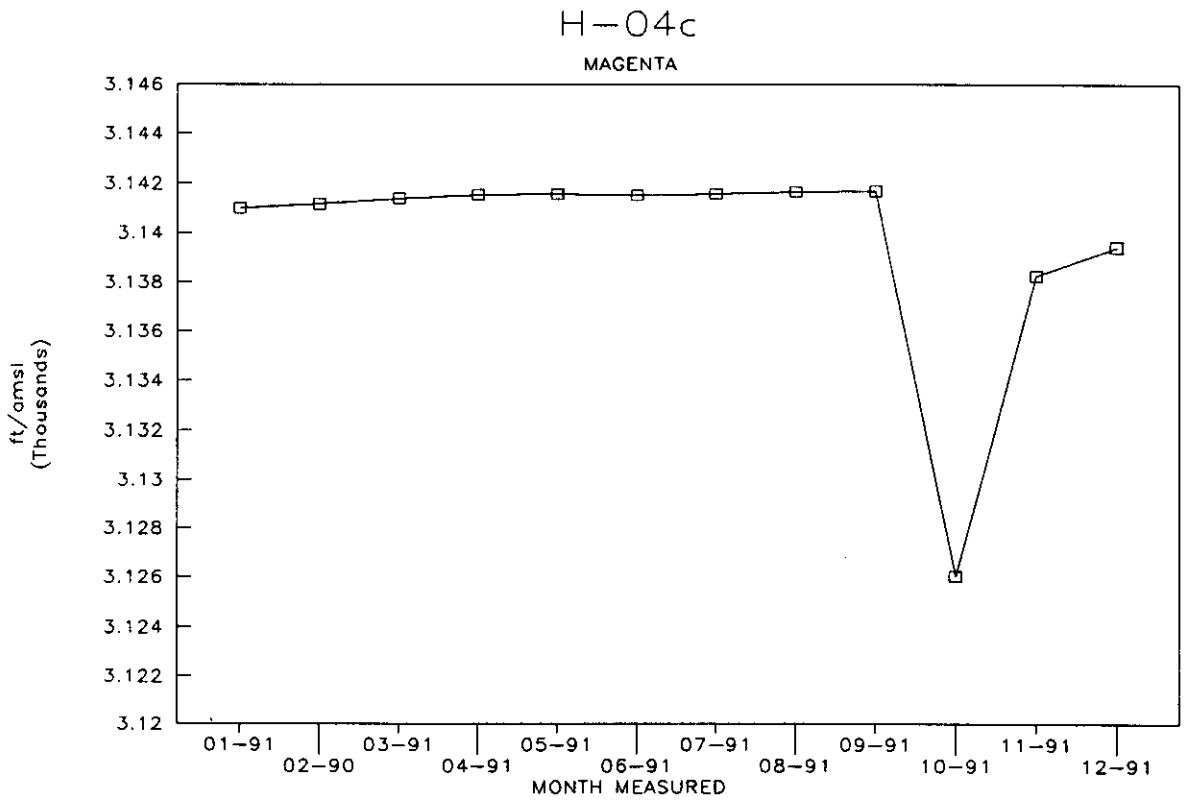
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-04b	CUL	3333.35	01-16-91	07:48	334.19	0.00	334.19	101.86	2999.16	914.14
H-04b	CUL	3333.35	02-13-91	10:00	334.11	0.00	334.11	101.84	2999.24	914.17
H-04b	CUL	3333.35	03-12-91	15:45	334.05	0.00	334.05	101.82	2999.30	914.19
H-04b	CUL	3333.35	04-18-91	13:19	334.00	0.00	334.00	101.80	2999.35	914.20
H-04b	CUL	3333.35	05-16-91	06:44	333.96	0.00	333.96	101.79	2999.39	914.21
H-04b	CUL	3333.35	06-17-91	12:30	333.89	0.00	333.89	101.77	2999.46	914.24
H-04b	CUL	3333.35	07-16-91	12:33	333.95	0.00	333.95	101.79	2999.40	914.22
H-04b	CUL	3333.35	08-13-91	13:26	333.91	0.00	333.91	101.78	2999.44	914.23
H-04b	CUL	3333.35	09-24-91	08:20	334.23	0.00	334.23	101.87	2999.12	914.13
H-04b	CUL	3333.35	10-15-91	13:50	333.94	0.00	333.94	101.78	2999.41	914.22
H-04b	CUL	3333.35	11-20-91	13:20	334.06	0.00	334.06	101.82	2999.29	914.18
H-04b	CUL	3333.35	12-11-91	13:49	333.66	0.00	333.66	101.70	2999.69	914.31



WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

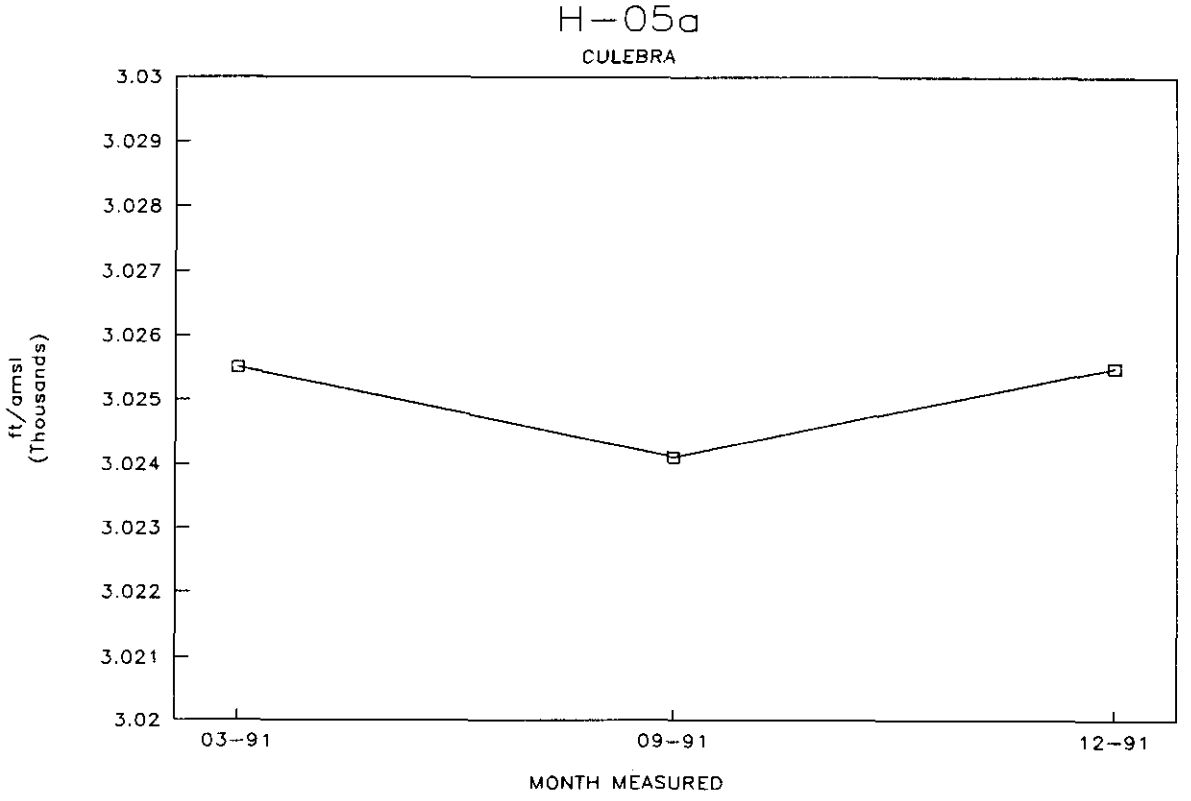
WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-04c	MAG	3334.04	01-16-91	07:54	193.06	0.00	193.06	58.84	3140.98	957.37
H-04c	MAG	3334.04	02-13-90	09:50	192.89	0.00	192.89	58.79	3141.15	957.42
H-04c	MAG	3334.04	03-12-91	15:42	192.67	0.00	192.67	58.73	3141.37	957.49
H-04c	MAG	3334.04	04-18-91	13:23	192.52	0.00	192.52	58.68	3141.52	957.54
H-04c	MAG	3334.04	05-16-91	06:52	192.50	0.00	192.50	58.67	3141.54	957.54
H-04c	MAG	3334.04	06-17-91	12:38	192.55	0.00	192.55	58.69	3141.49	957.53
H-04c	MAG	3334.04	07-16-91	12:38	192.50	0.00	192.50	58.67	3141.54	957.54
H-04c	MAG	3334.04	08-13-91	14:18	192.41	0.00	192.41	58.65	3141.63	957.57
H-04c	MAG	3334.04	09-23-91	07:45	192.38	0.00	192.38	58.64	3141.66	957.58
H-04c	MAG	3334.04	10-15-91	14:00	208.00	0.00	208.00	63.40	3126.04	952.82
H-04c	MAG	3334.04	11-20-91	13:25	195.80	0.00	195.80	59.68	3138.24	956.54
H-04c	MAG	3334.04	12-11-91	13:36	194.63	0.00	194.63	59.32	3139.41	956.89



WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

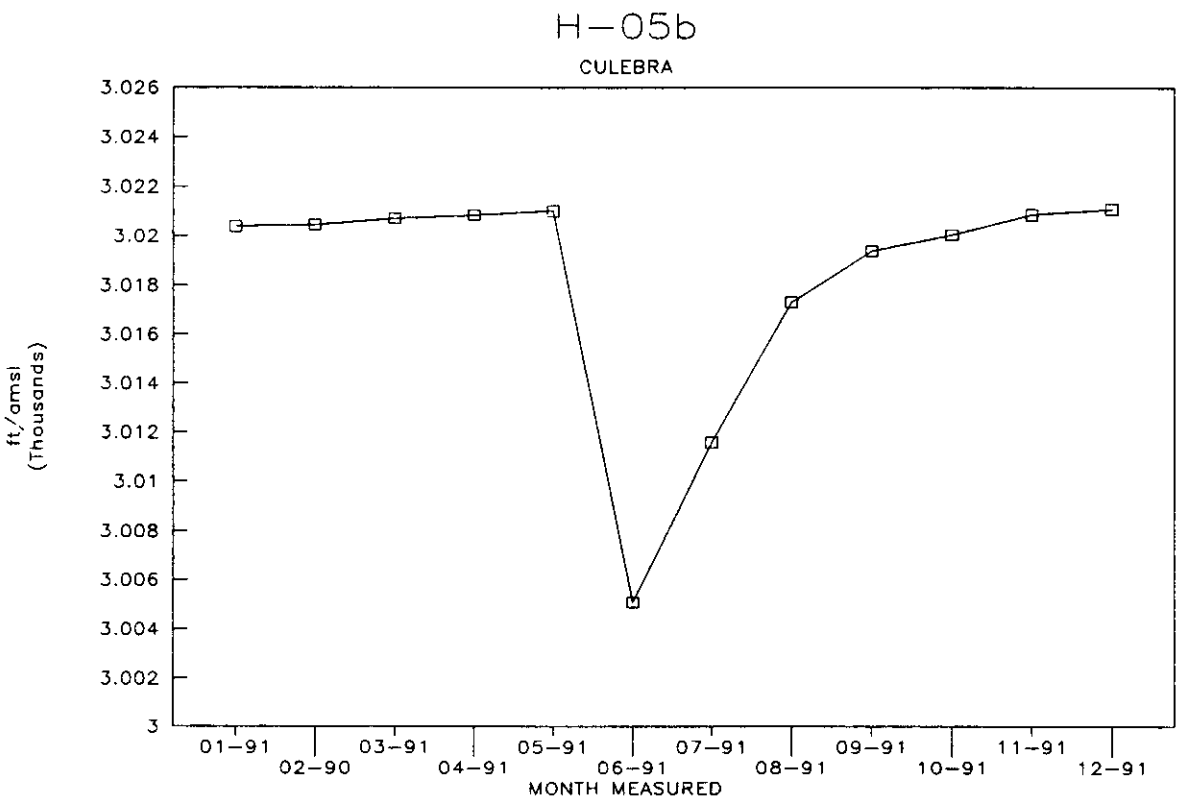
WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-05a	CUL	3506.24	03-12-91	08:36	480.74	0.00	480.74	146.53	3025.50	922.17
H-05a	CUL	3506.24	09-24-91	15:16	482.13	0.00	482.13	146.95	3024.11	921.75
H-05a	CUL	3506.24	12-11-91	10:55	480.75	0.00	480.75	146.53	3025.49	922.17

JUNE 1991 READING NOT RECORDED DUE TO OBSTRUCTED CASING AT 495 FEET BTOC



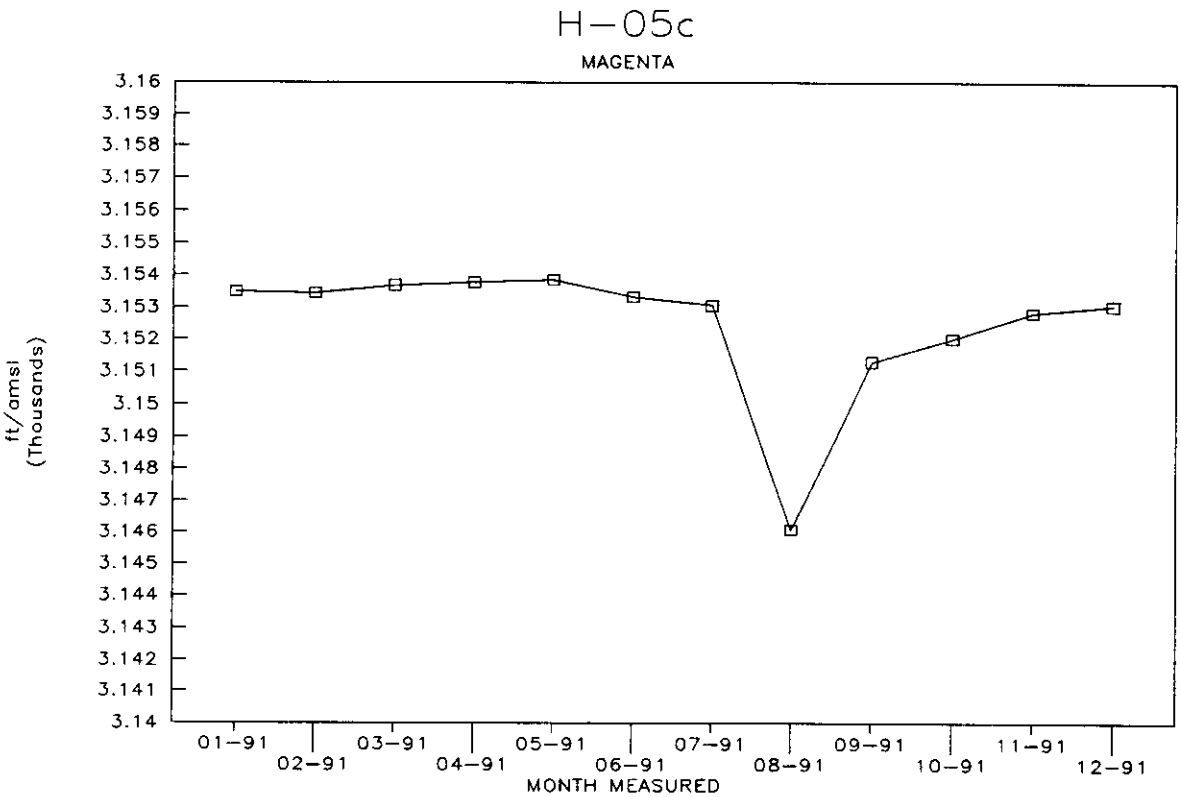
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-05b	CUL	3506.04	01-15-91	09:36	485.67	0.00	485.67	148.03	3020.37	920.61
H-05b	CUL	3506.04	02-12-90	09:00	485.61	0.00	485.61	148.01	3020.43	920.63
H-05b	CUL	3506.04	03-12-91	08:44	485.34	0.00	485.34	147.93	3020.70	920.71
H-05b	CUL	3506.04	04-16-91	14:23	485.22	0.00	485.22	147.90	3020.82	920.75
H-05b	CUL	3506.04	05-16-91	08:06	485.05	0.00	485.05	147.84	3020.99	920.80
H-05b	CUL	3506.04	06-17-91	16:03	500.96	0.00	500.96	152.69	3005.08	915.95
H-05b	CUL	3506.04	07-16-91	09:17	494.46	0.00	494.46	150.71	3011.58	917.93
H-05b	CUL	3506.04	08-13-91	09:13	488.73	0.00	488.73	148.96	3017.31	919.68
H-05b	CUL	3506.04	09-24-91	15:36	486.66	0.00	486.66	148.33	3019.38	920.31
H-05b	CUL	3506.04	10-14-91	12:48	486.03	0.00	486.03	148.14	3020.01	920.50
H-05b	CUL	3506.04	11-19-91	12:13	485.21	0.00	485.21	147.89	3020.83	920.75
H-05b	CUL	3506.04	12-11-91	11:02	484.97	0.00	484.97	147.82	3021.07	920.82



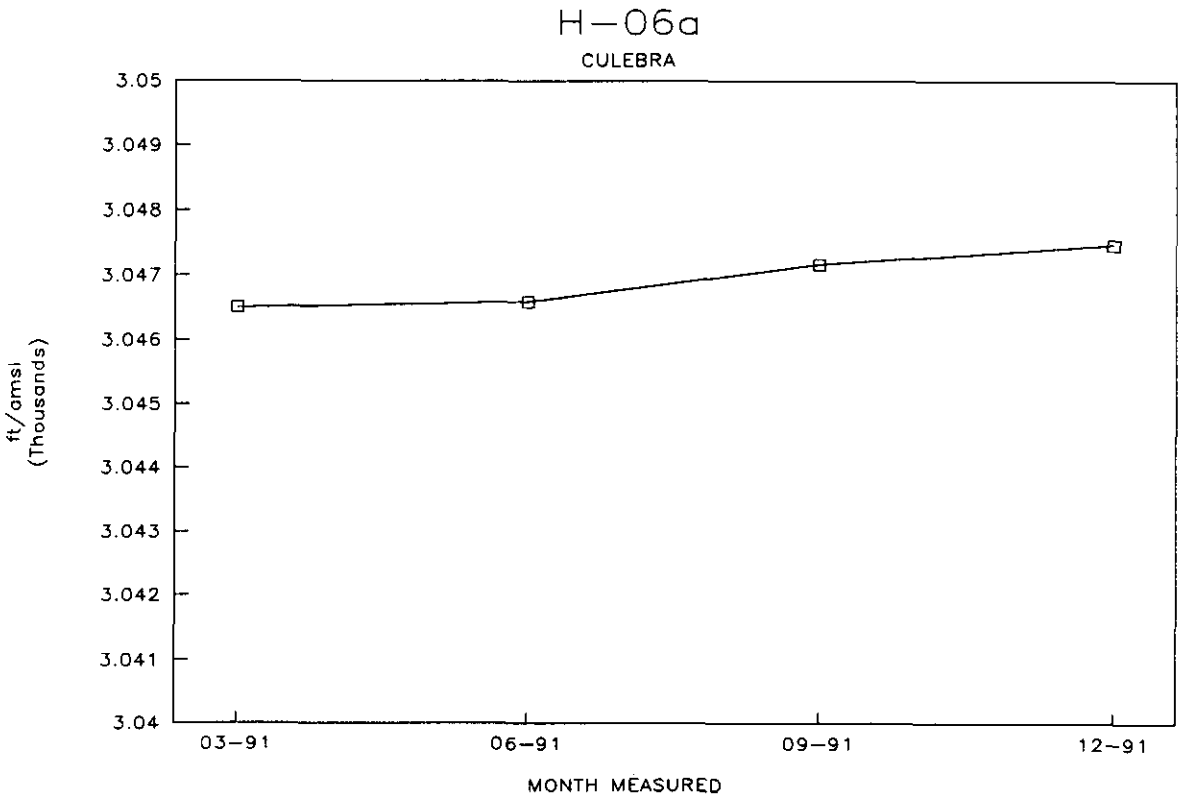
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-05c	MAG	3506.04	01-15-91	09:45	352.55	0.00	352.55	107.46	3153.49	961.18
H-05c	MAG	3506.04	02-12-91	09:10	352.58	0.00	352.58	107.47	3153.46	961.17
H-05c	MAG	3506.04	03-12-91	08:53	352.34	0.00	352.34	107.39	3153.70	961.25
H-05c	MAG	3506.04	04-16-91	14:38	352.26	0.00	352.26	107.37	3153.78	961.27
H-05c	MAG	3506.04	05-16-91	08:20	352.17	0.00	352.17	107.34	3153.87	961.30
H-05c	MAG	3506.04	06-17-91	16:20	352.71	0.00	352.71	107.51	3153.33	961.13
H-05c	MAG	3506.04	07-11-91	06:00	352.98	0.00	352.98	107.59	3153.06	961.05
H-05c	MAG	3506.04	08-13-91	09:21	359.96	0.00	359.96	109.72	3146.08	958.93
H-05c	MAG	3506.04	09-24-91	15:41	354.75	0.00	354.75	108.13	3151.29	960.51
H-05c	MAG	3506.04	10-14-91	12:55	354.02	0.00	354.02	107.91	3152.02	960.74
H-05c	MAG	3506.04	11-19-91	12:19	353.20	0.00	353.20	107.66	3152.84	960.99
H-05c	MAG	3506.04	12-11-91	11:09	352.97	0.00	352.97	107.59	3153.07	961.06



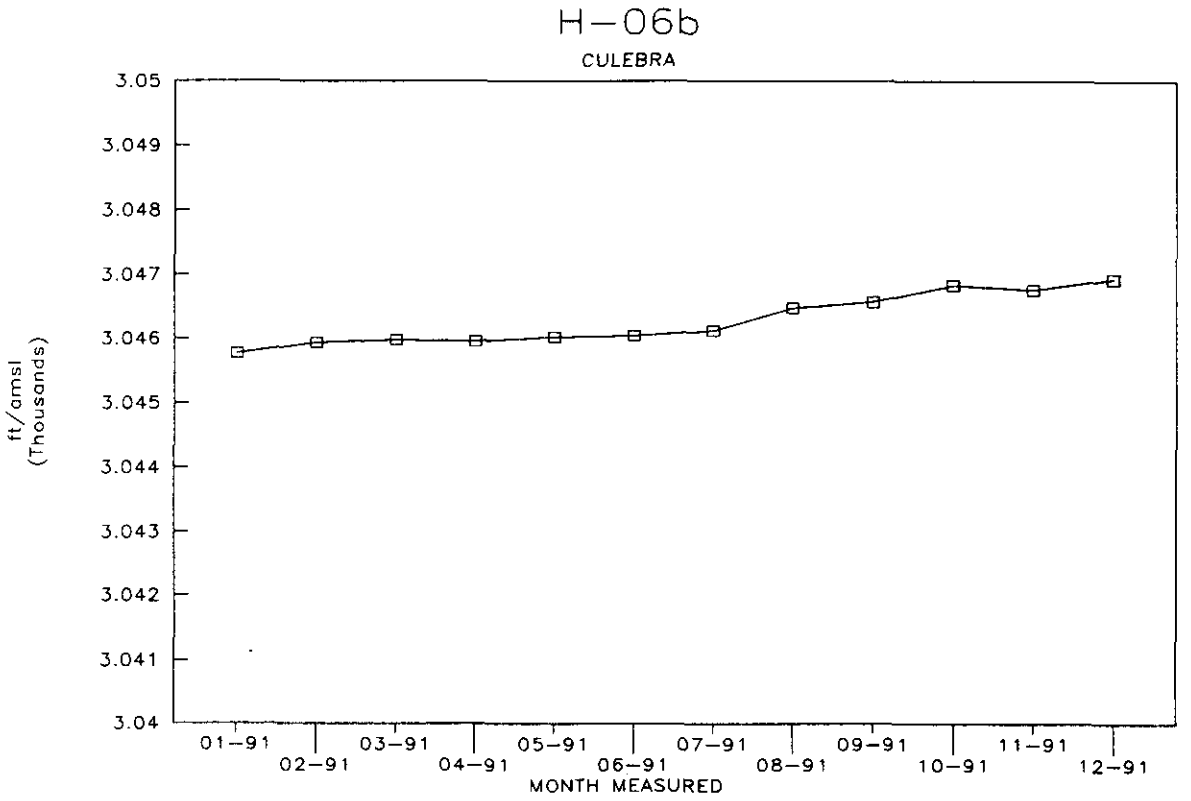
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-06a	CUL	3348.11	03-12-91	07:25	301.60	0.00	301.60	91.93	3046.51	928.58
H-06a	CUL	3348.11	06-19-91	07:13	301.52	0.00	301.52	91.90	3046.59	928.60
H-06a	CUL	3348.11	09-23-91	13:53	300.94	0.00	300.94	91.73	3047.17	928.78
H-06a	CUL	3348.11	12-11-91	08:42	300.64	0.00	300.64	91.64	3047.47	928.87



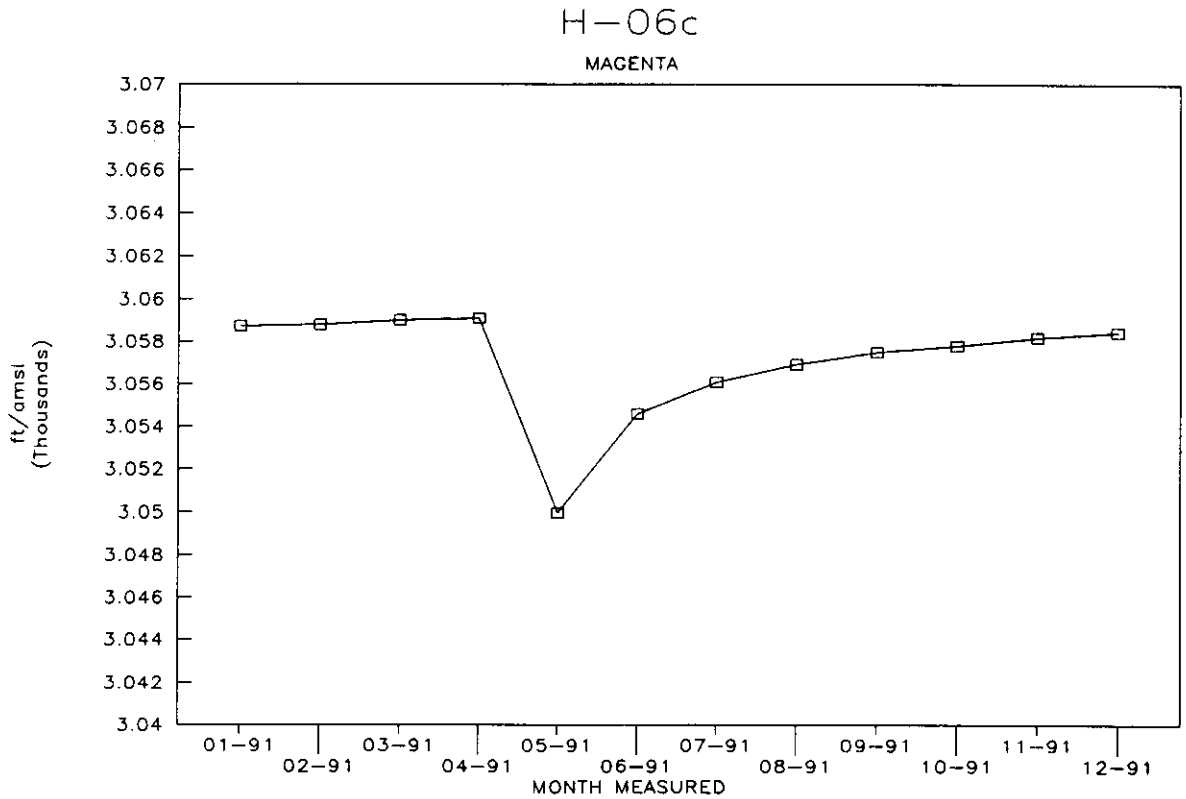
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-06b	CUL	3348.25	01-15-91	08:16	302.48	0.00	302.48	92.20	3045.77	928.35
H-06b	CUL	3348.25	02-12-91	08:20	302.31	0.00	302.31	92.14	3045.94	928.40
H-06b	CUL	3348.25	03-12-91	08:38	302.27	0.00	302.27	92.13	3045.98	928.41
H-06b	CUL	3348.25	04-15-91	09:00	302.29	0.00	302.29	92.14	3045.96	928.41
H-06b	CUL	3348.25	05-14-91	12:39	302.22	0.00	302.22	92.12	3046.03	928.43
H-06b	CUL	3348.25	06-19-91	07:30	302.20	0.00	302.20	92.11	3046.05	928.44
H-06b	CUL	3348.25	07-16-91	08:26	302.12	0.00	302.12	92.09	3046.13	928.46
H-06b	CUL	3348.25	08-13-91	08:28	301.76	0.00	301.76	91.98	3046.49	928.57
H-06b	CUL	3348.25	09-23-91	14:35	301.67	0.00	301.67	91.95	3046.58	928.60
H-06b	CUL	3348.25	10-14-91	13:42	301.41	0.00	301.41	91.87	3046.84	928.68
H-06b	CUL	3348.25	11-21-91	09:44	301.48	0.00	301.48	91.89	3046.77	928.66
H-06b	CUL	3348.25	12-11-91	09:10	301.31	0.00	301.31	91.84	3046.94	928.71



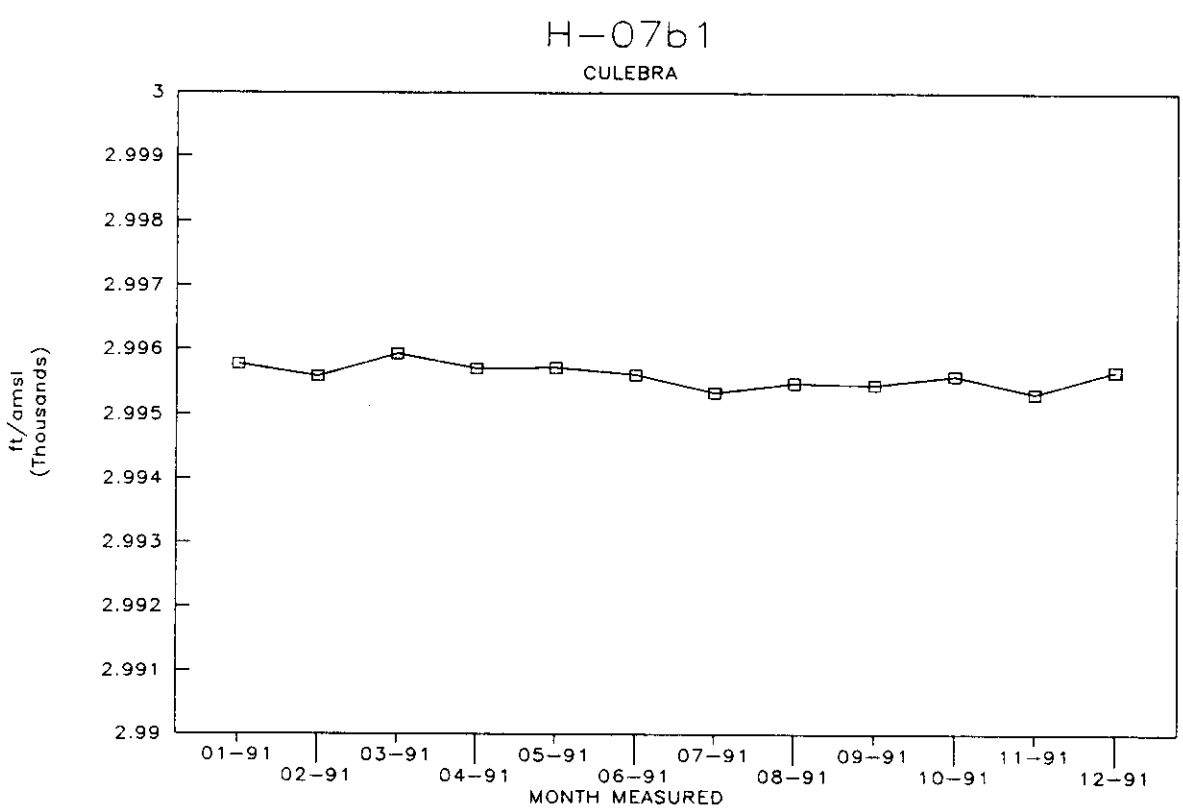
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-06c	MAG	3348.52	01-15-91	08:24	289.80	0.00	289.80	88.33	3058.72	932.30
H-06c	MAG	3348.52	02-12-91	08:05	289.73	0.00	289.73	88.31	3058.79	932.32
H-06c	MAG	3348.52	03-12-91	08:30	289.52	0.00	289.52	88.25	3059.00	932.38
H-06c	MAG	3348.52	04-16-91	10:05	289.44	0.00	289.44	88.22	3059.08	932.41
H-06c	MAG	3348.52	05-14-91	12:55	298.55	0.00	298.55	91.00	3049.97	929.63
H-06c	MAG	3348.52	06-19-91	07:20	293.93	0.00	293.93	89.59	3054.59	931.04
H-06c	MAG	3348.52	07-16-91	08:33	292.44	0.00	292.44	89.14	3056.08	931.49
H-06c	MAG	3348.52	08-13-91	08:21	291.60	0.00	291.60	88.88	3056.92	931.75
H-06c	MAG	3348.52	09-23-91	14:21	291.02	0.00	291.02	88.70	3057.50	931.93
H-06c	MAG	3348.52	10-14-91	13:48	290.72	0.00	290.72	88.61	3057.80	932.02
H-06c	MAG	3348.52	11-21-91	09:50	290.33	0.00	290.33	88.49	3058.19	932.14
H-06c	MAG	3348.52	12-11-91	09:02	290.10	0.00	290.10	88.42	3058.42	932.21



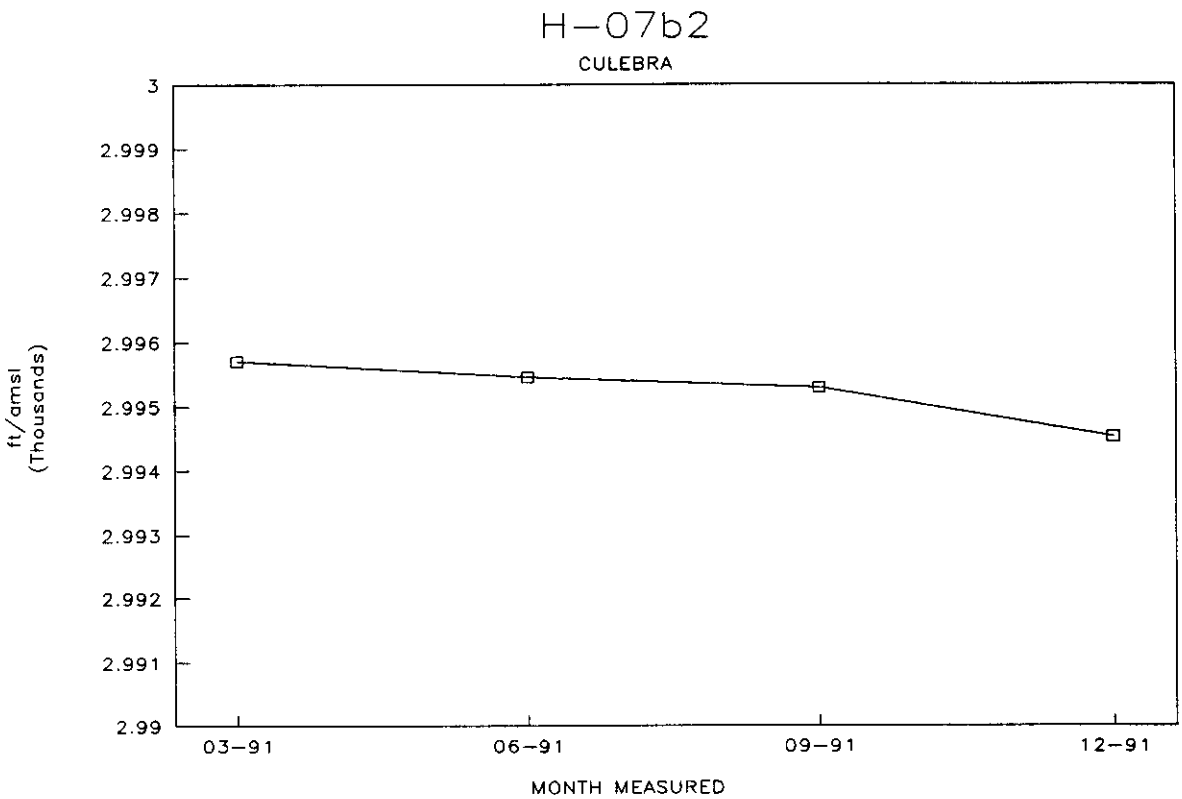
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-07b1	CUL	3164.17	01-14-91	15:38	168.40	0.00	168.40	51.33	2995.77	913.11
H-07b1	CUL	3164.17	02-11-91	16:35	168.59	0.00	168.59	51.39	2995.58	913.05
H-07b1	CUL	3164.17	03-11-91	15:50	168.24	0.00	168.24	51.28	2995.93	913.16
H-07b1	CUL	3164.17	04-17-91	07:14	168.47	0.00	168.47	51.35	2995.70	913.09
H-07b1	CUL	3164.17	05-15-91	07:21	168.45	0.00	168.45	51.34	2995.72	913.10
H-07b1	CUL	3164.17	06-18-91	15:38	168.56	0.00	168.56	51.38	2995.61	913.06
H-07b1	CUL	3164.17	07-16-91	07:27	168.84	0.00	168.84	51.46	2995.33	912.98
H-07b1	CUL	3164.17	08-13-91	07:30	168.69	0.00	168.69	51.42	2995.48	913.02
H-07b1	CUL	3164.17	09-25-91	07:18	168.72	0.00	168.72	51.43	2995.45	913.01
H-07b1	CUL	3164.17	10-16-91	08:10	168.58	0.00	168.58	51.38	2995.59	913.06
H-07b1	CUL	3164.17	11-20-91	07:25	168.85	0.00	168.85	51.47	2995.32	912.97
H-07b1	CUL	3164.17	12-10-91	09:04	168.50	0.00	168.50	51.36	2995.67	913.08



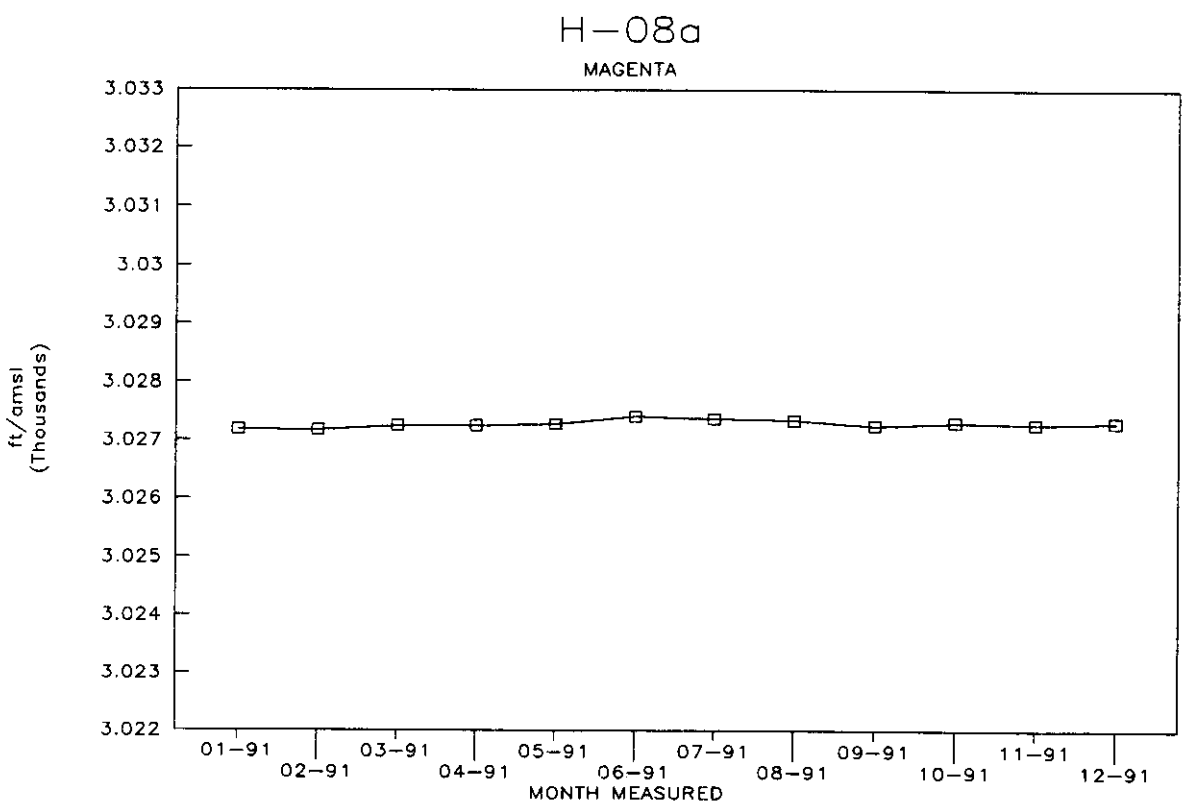
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-07b2	CUL	3164.40	03-11-91	15:58	168.70	0.00	168.70	51.42	2995.70	913.09
H-07b2	CUL	3164.40	06-18-91	15:47	168.95	0.00	168.95	51.50	2995.45	913.01
H-07b2	CUL	3164.40	09-25-91	07:25	169.12	0.00	169.12	51.55	2995.28	912.96
H-07b2	CUL	3164.40	12-10-91	09:14	169.88	0.00	169.88	51.78	2994.52	912.73



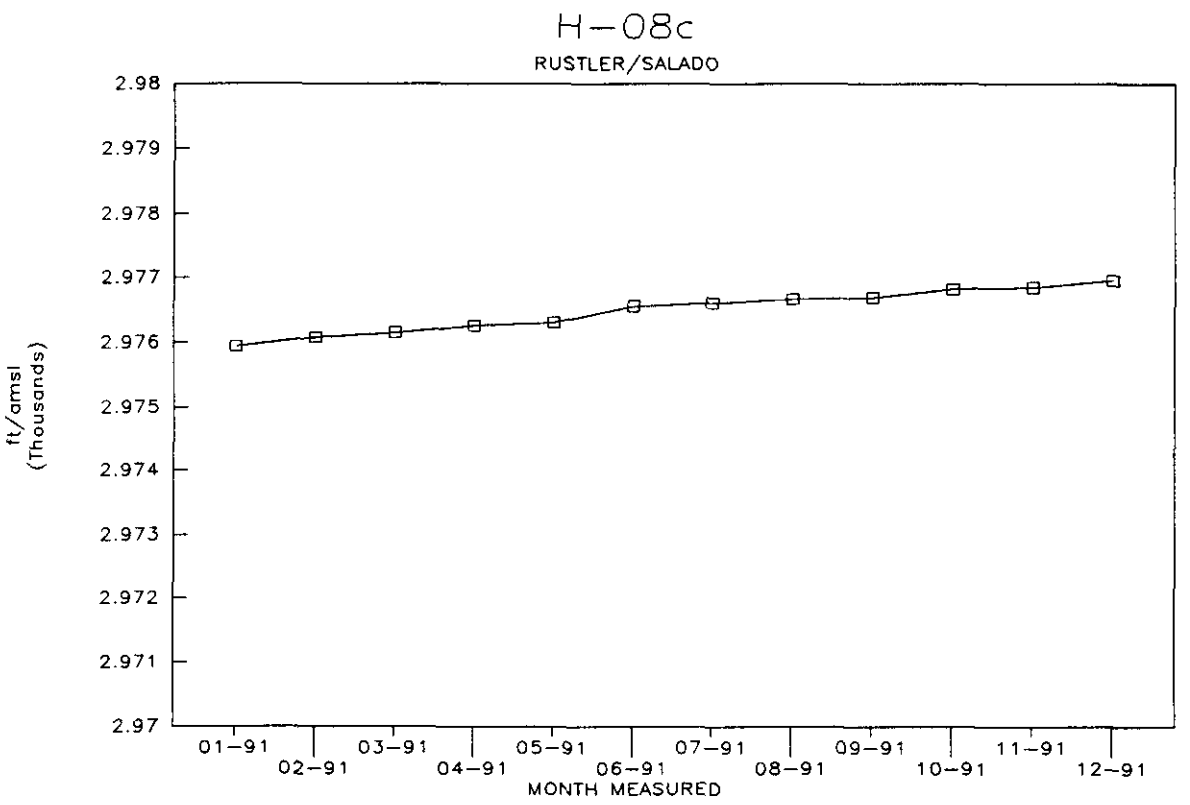
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-08a	MAG	3432.99	01-14-91	16:35	405.80	0.00	405.80	123.69	3027.19	922.69
H-08a	MAG	3432.99	02-11-91	15:30	405.81	0.00	405.81	123.69	3027.18	922.68
H-08a	MAG	3432.99	03-11-91	14:43	405.73	0.00	405.73	123.67	3027.26	922.71
H-08a	MAG	3432.99	04-17-91	09:06	405.73	0.00	405.73	123.67	3027.26	922.71
H-08a	MAG	3432.99	05-15-91	08:33	405.70	0.00	405.70	123.66	3027.29	922.72
H-08a	MAG	3432.99	06-18-91	14:30	405.57	0.00	405.57	123.62	3027.42	922.76
H-08a	MAG	3432.99	07-15-91	12:05	405.62	0.00	405.62	123.63	3027.37	922.74
H-08a	MAG	3432.99	08-12-91	17:42	405.64	0.00	405.64	123.64	3027.35	922.74
H-08a	MAG	3432.99	09-25-91	09:02	405.73	0.00	405.73	123.67	3027.26	922.71
H-08a	MAG	3432.99	10-16-91	10:14	405.68	0.00	405.68	123.65	3027.31	922.72
H-08a	MAG	3432.99	11-20-91	09:06	405.71	0.00	405.71	123.66	3027.28	922.71
H-08a	MAG	3432.99	12-10-91	10:45	405.68	0.00	405.68	123.65	3027.31	922.72



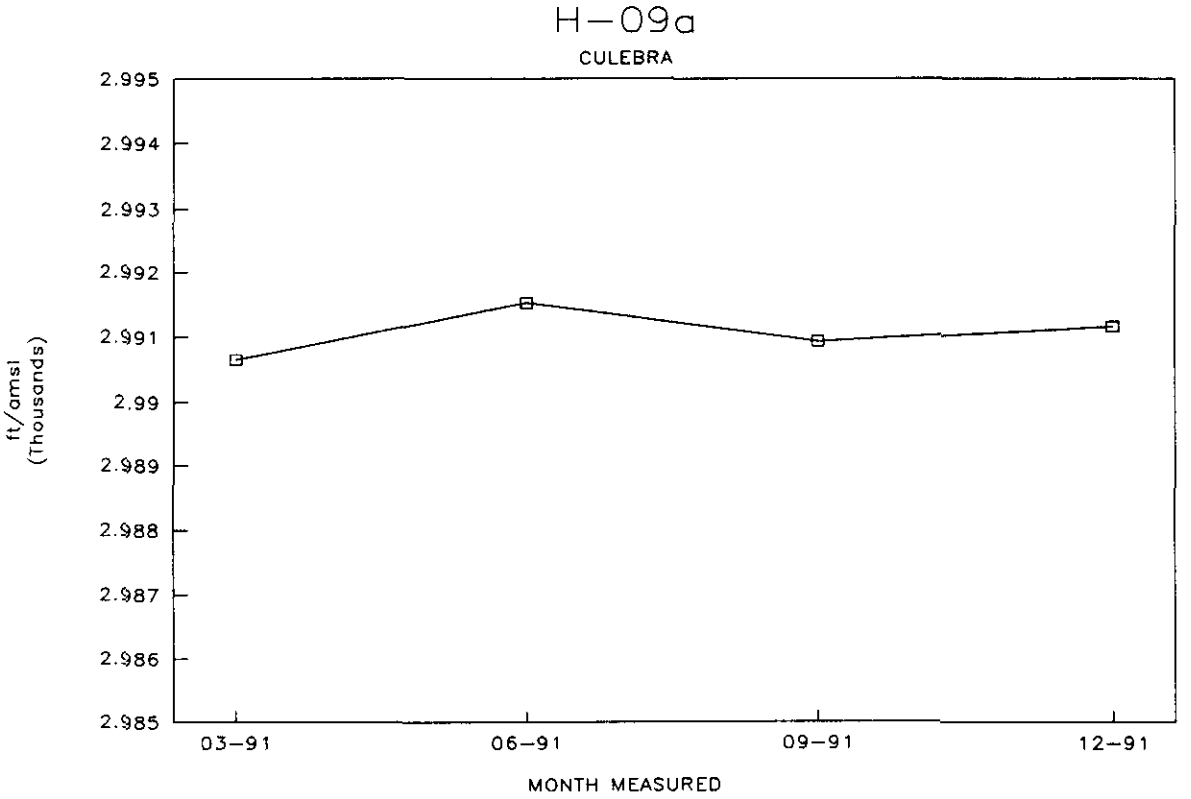
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-08c	RUS/SAL	3432.90	01-14-91	16:45	456.96	0.00	456.96	139.28	2975.94	907.07
H-08c	RUS/SAL	3432.90	02-11-91	15:40	456.82	0.00	456.82	139.24	2976.08	907.11
H-08c	RUS/SAL	3432.90	03-11-91	14:48	456.75	0.00	456.75	139.22	2976.15	907.13
H-08c	RUS/SAL	3432.90	04-17-91	09:28	456.64	0.00	456.64	139.18	2976.26	907.16
H-08c	RUS/SAL	3432.90	05-15-91	08:45	456.59	0.00	456.59	139.17	2976.31	907.18
H-08c	RUS/SAL	3432.90	06-18-91	14:36	456.34	0.00	456.34	139.09	2976.56	907.26
H-08c	RUS/SAL	3432.90	07-15-91	12:12	456.29	0.00	456.29	139.08	2976.61	907.27
H-08c	RUS/SAL	3432.90	08-12-91	17:51	456.23	0.00	456.23	139.06	2976.67	907.29
H-08c	RUS/SAL	3432.90	09-25-91	09:09	456.21	0.00	456.21	139.05	2976.69	907.30
H-08c	RUS/SAL	3432.90	10-16-91	10:20	456.08	0.00	456.08	139.01	2976.82	907.33
H-08c	RUS/SAL	3432.90	11-20-91	09:12	456.05	0.00	456.05	139.00	2976.85	907.34
H-08c	RUS/SAL	3432.90	12-10-91	10:58	455.95	0.00	455.95	138.97	2976.95	907.37



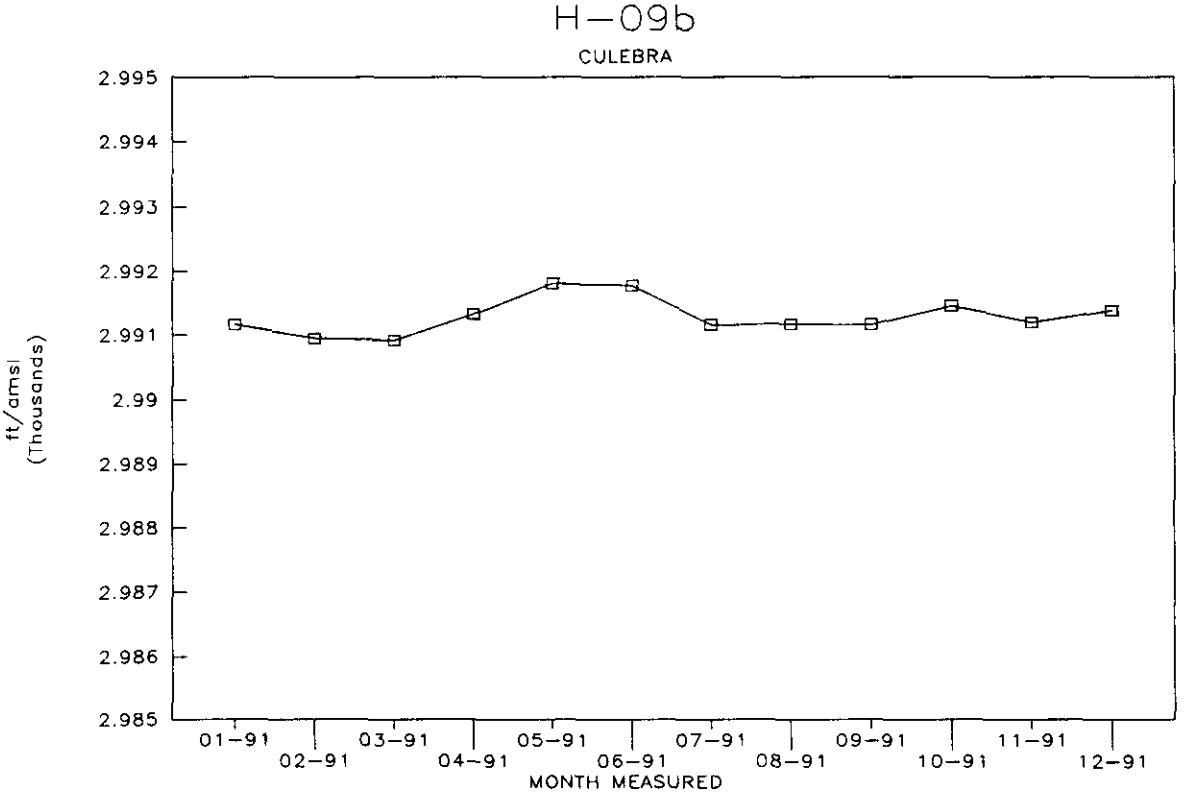
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-09a	CUL	3406.68	03-11-91	13:23	416.03	0.00	416.03	126.81	2990.65	911.55
H-09a	CUL	3406.68	06-18-91	13:30	415.16	0.00	415.16	126.54	2991.52	911.82
H-09a	CUL	3406.68	09-25-91	09:52	415.76	0.00	415.76	126.72	2990.92	911.63
H-09a	CUL	3406.68	12-10-91	11:48	415.52	0.00	415.52	126.65	2991.16	911.71



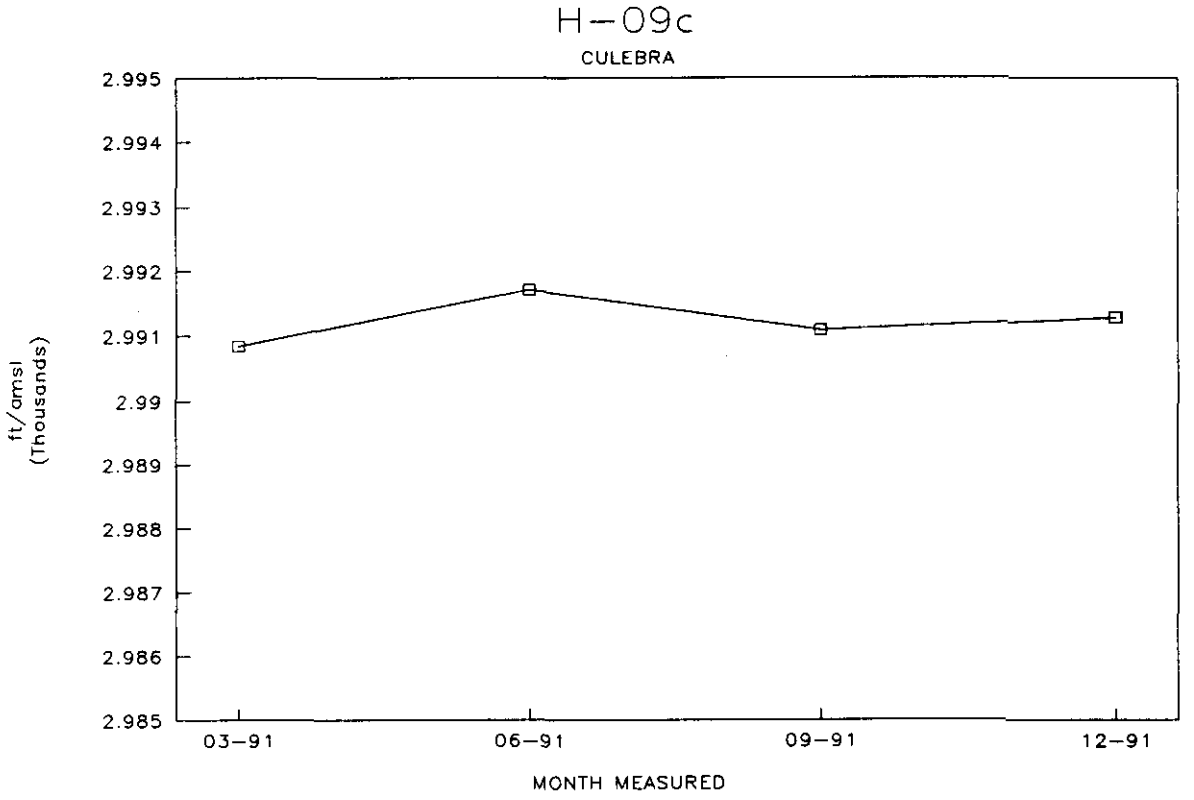
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-09b	CUL	3406.86	01-14-91	14:22	415.70	0.00	415.70	126.71	2991.16	911.71
H-09b	CUL	3406.86	02-11-91	15:00	415.92	0.00	415.92	126.77	2990.94	911.64
H-09b	CUL	3406.86	03-11-91	13:28	415.95	0.00	415.95	126.78	2990.91	911.63
H-09b	CUL	3406.86	04-17-91	09:58	415.54	0.00	415.54	126.66	2991.32	911.75
H-09b	CUL	3406.86	05-15-91	09:15	415.05	0.00	415.05	126.51	2991.81	911.90
H-09b	CUL	3406.86	06-18-91	13:40	415.09	0.00	415.09	126.52	2991.77	911.89
H-09b	CUL	3406.86	07-15-91	11:24	415.71	0.00	415.71	126.71	2991.15	911.70
H-09b	CUL	3406.86	08-12-91	17:05	415.70	0.00	415.70	126.71	2991.16	911.71
H-09b	CUL	3406.86	09-25-91	09:58	415.71	0.00	415.71	126.71	2991.15	911.70
H-09b	CUL	3406.86	10-16-91	15:20	415.41	0.00	415.41	126.62	2991.45	911.79
H-09b	CUL	3406.86	11-19-91	15:22	415.67	0.00	415.67	126.70	2991.19	911.71
H-09b	CUL	3406.86	12-10-91	11:30	415.48	0.00	415.48	126.64	2991.38	911.77



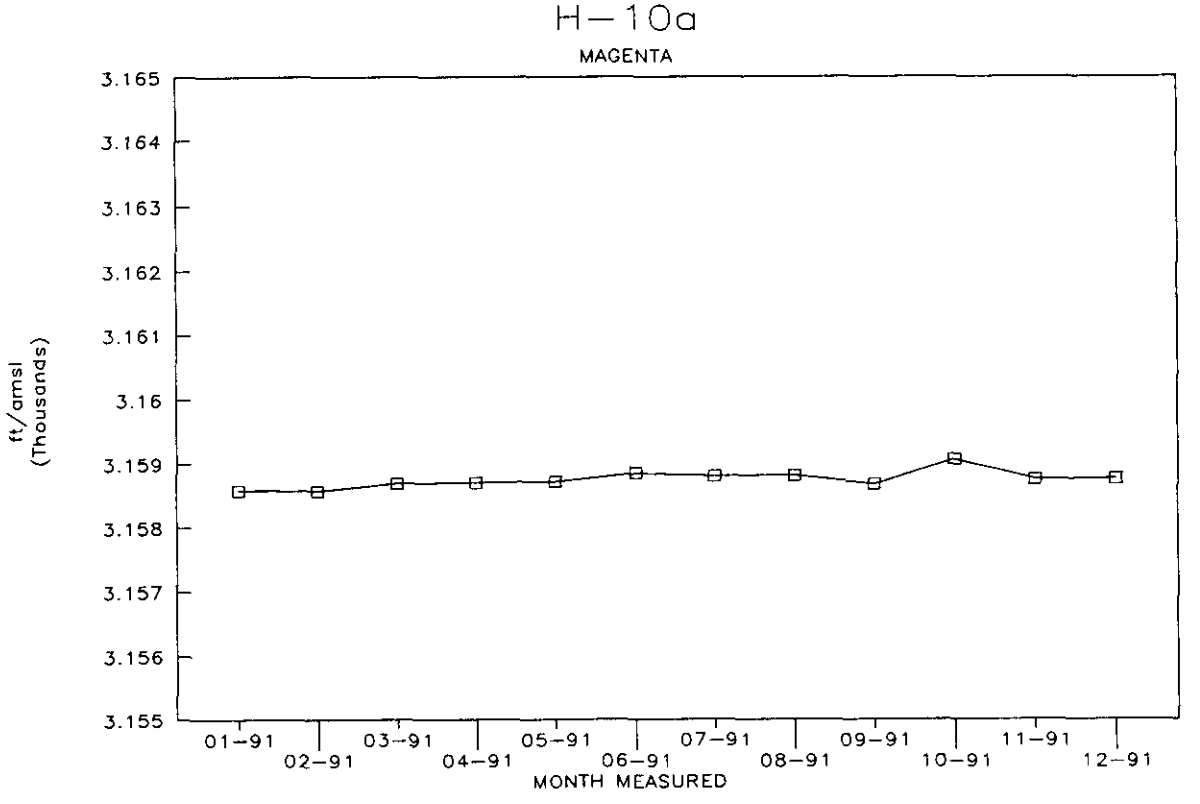
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-09c	CUL	3407.30	03-11-91	13:35	416.46	0.00	416.46	126.94	2990.84	911.61
H-09c	CUL	3407.30	06-18-91	13:38	415.60	0.00	415.60	126.67	2991.70	911.87
H-09c	CUL	3407.30	09-25-91	10:06	416.22	0.00	416.22	126.86	2991.08	911.68
H-09c	CUL	3407.30	12-10-91	11:40	416.03	0.00	416.03	126.81	2991.27	911.74



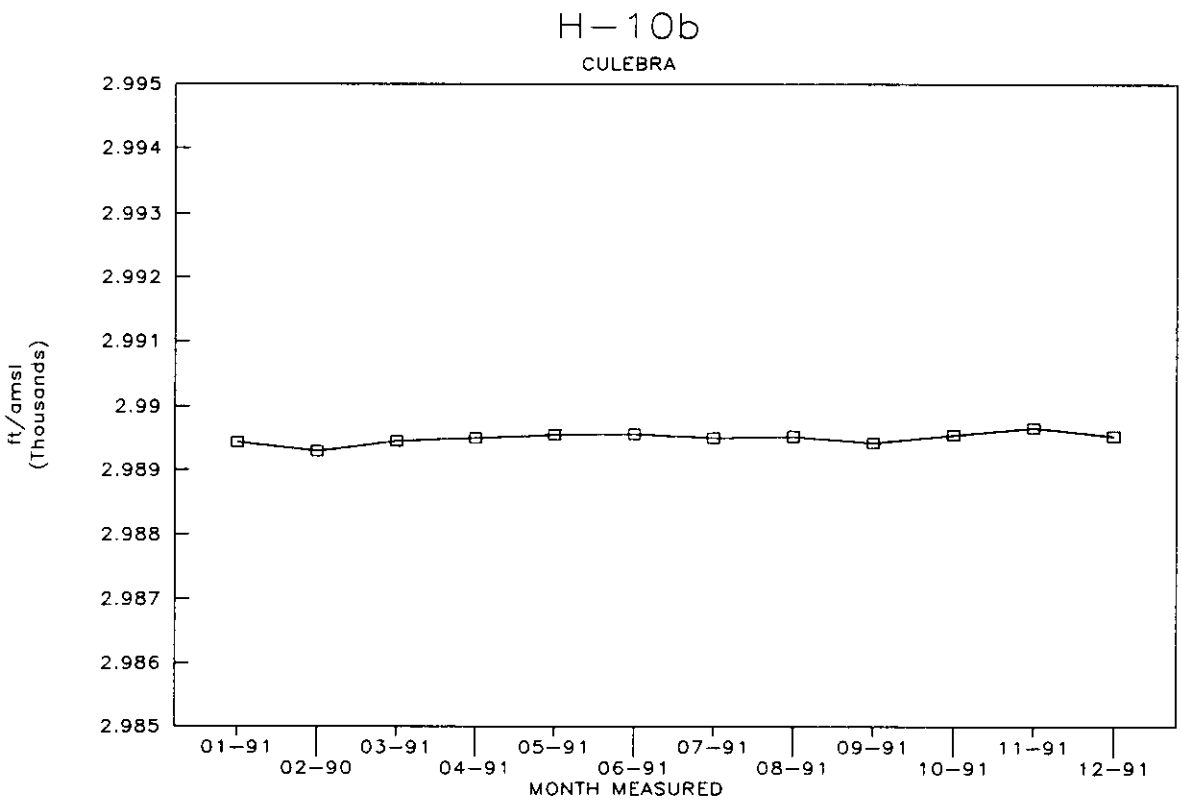
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-10a	MAG	3688.67	01-14-91	13:36	530.09	0.00	530.09	161.57	3158.58	962.74
H-10a	MAG	3688.67	02-11-91	14:30	530.10	0.00	530.10	161.57	3158.57	962.73
H-10a	MAG	3688.67	03-11-91	12:50	529.98	0.00	529.98	161.54	3158.69	962.77
H-10a	MAG	3688.67	04-17-91	10:30	529.97	0.00	529.97	161.53	3158.70	962.77
H-10a	MAG	3688.67	05-15-91	10:52	529.95	0.00	529.95	161.53	3158.72	962.78
H-10a	MAG	3688.67	06-18-91	12:50	529.82	0.00	529.82	161.49	3158.85	962.82
H-10a	MAG	3688.67	07-15-91	10:47	529.87	0.00	529.87	161.50	3158.80	962.80
H-10a	MAG	3688.67	08-12-91	16:10	529.86	0.00	529.86	161.50	3158.81	962.81
H-10a	MAG	3688.67	09-25-91	14:13	529.99	0.00	529.99	161.54	3158.68	962.77
H-10a	MAG	3688.67	10-16-91	14:25	529.61	0.00	529.61	161.43	3159.06	962.88
H-10a	MAG	3688.67	11-19-91	14:15	529.92	0.00	529.92	161.52	3158.75	962.79
H-10a	MAG	3688.67	12-10-91	12:36	529.91	0.00	529.91	161.52	3158.76	962.79



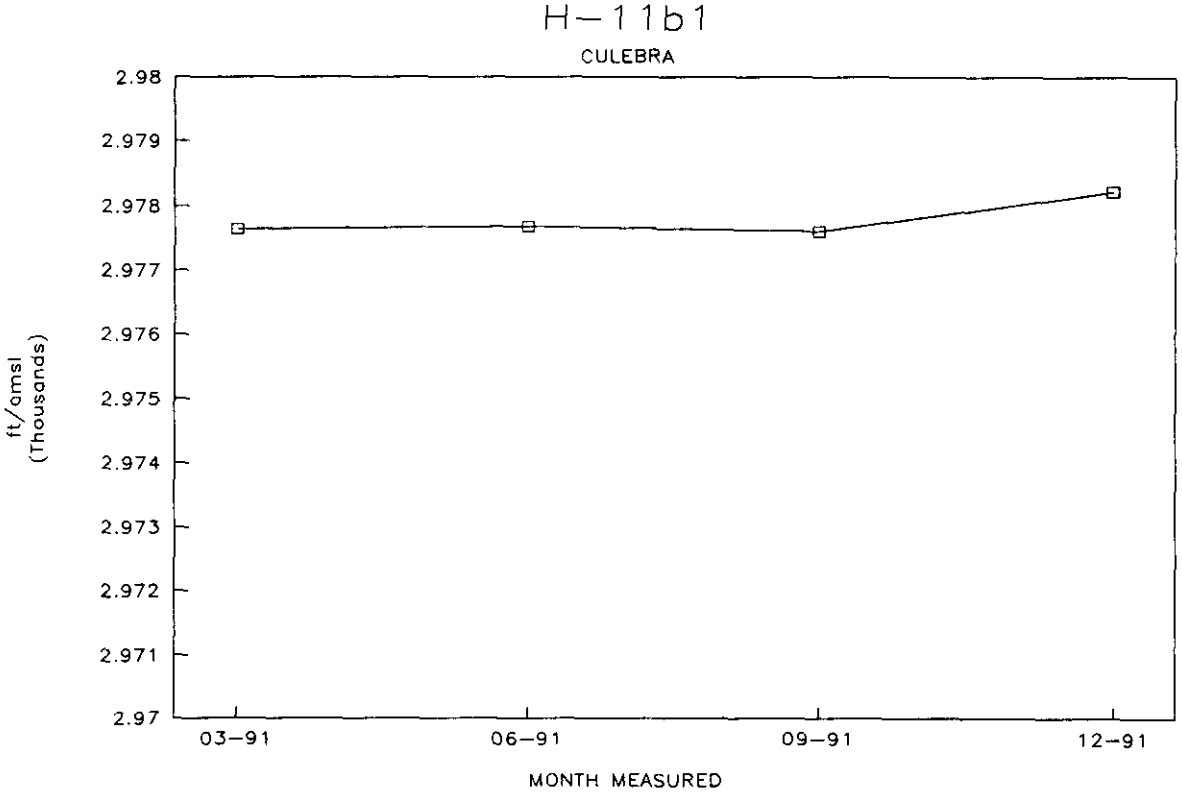
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-10b	CUL	3689.47	01-14-91	13:48	700.03	0.00	700.03	213.37	2989.44	911.18
H-10b	CUL	3689.47	02-11-90	14:10	700.17	0.00	700.17	213.41	2989.30	911.14
H-10b	CUL	3689.47	03-11-91	12:40	700.01	0.00	700.01	213.36	2989.46	911.19
H-10b	CUL	3689.47	04-17-91	10:50	699.96	0.00	699.96	213.35	2989.51	911.20
H-10b	CUL	3689.47	05-15-91	11:05	699.91	0.00	699.91	213.33	2989.56	911.22
H-10b	CUL	3689.47	06-18-91	12:36	699.90	0.00	699.90	213.33	2989.57	911.22
H-10b	CUL	3689.47	07-15-91	10:32	699.96	0.00	699.96	213.35	2989.51	911.20
H-10b	CUL	3689.47	08-12-91	16:20	699.94	0.00	699.94	213.34	2989.53	911.21
H-10b	CUL	3689.47	09-25-91	14:26	700.04	0.00	700.04	213.37	2989.43	911.18
H-10b	CUL	3689.47	10-16-91	14:38	699.91	0.00	699.91	213.33	2989.56	911.22
H-10b	CUL	3689.47	11-19-91	14:26	699.80	0.00	699.80	213.30	2989.67	911.25
H-10b	CUL	3689.47	12-10-91	12:52	699.93	0.00	699.93	213.34	2989.54	911.21



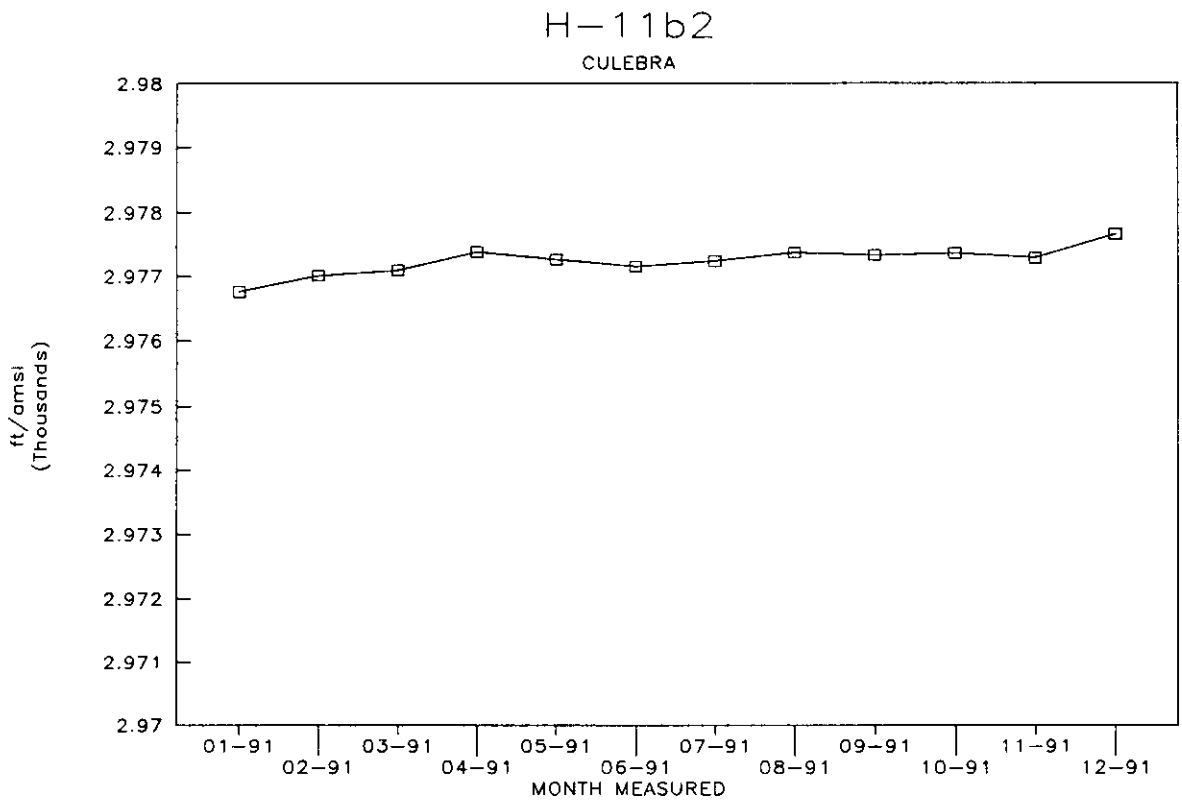
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-11b1	CUL	3411.62	03-12-91	15:22	433.98	0.00	433.98	132.28	2977.64	907.58
H-11b1	CUL	3411.62	06-19-91	09:08	433.94	0.00	433.94	132.26	2977.68	907.60
H-11b1	CUL	3411.62	09-26-91	08:40	434.02	0.00	434.02	132.29	2977.60	907.57
H-11b1	CUL	3411.62	12-11-91	13:16	433.40	0.00	433.40	132.10	2978.22	907.76



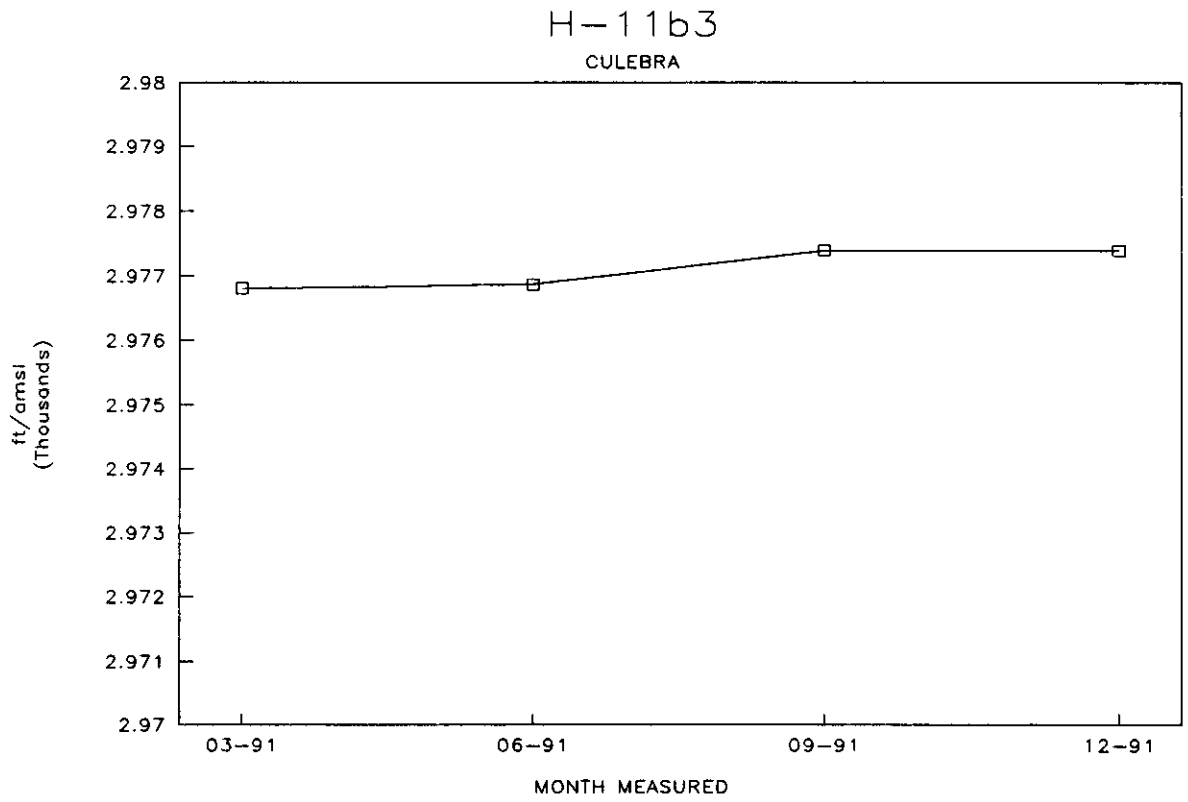
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-11B2	CUL	3411.64	01-16-91	14:15	434.88	0.00	434.88	132.55	2976.76	907.32
H-11b2	CUL	3411.64	02-12-91	15:30	434.63	0.00	434.63	132.48	2977.01	907.39
H-11b2	CUL	3411.64	03-12-91	15:27	434.55	0.00	434.55	132.45	2977.09	907.42
H-11b2	CUL	3411.64	04-18-91	15:40	434.26	0.00	434.26	132.36	2977.38	907.51
H-11b2	CUL	3411.64	05-14-91	17:05	434.38	0.00	434.38	132.40	2977.26	907.47
H-11b2	CUL	3411.64	06-19-91	09:25	434.49	0.00	434.49	132.43	2977.15	907.44
H-11b2	CUL	3411.64	07-16-91	13:57	434.40	0.00	434.40	132.41	2977.24	907.46
H-11b2	CUL	3411.64	08-13-91	09:58	434.27	0.00	434.27	132.37	2977.37	907.50
H-11b2	CUL	3411.64	09-26-91	09:54	434.31	0.00	434.31	132.38	2977.33	907.49
H-11b2	CUL	3411.64	10-17-91	09:00	434.28	0.00	434.28	132.37	2977.36	907.50
H-11b2	CUL	3411.64	11-20-91	14:24	434.35	0.00	434.35	132.39	2977.29	907.48
H-11b2	CUL	3411.64	12-11-91	13:29	433.98	0.00	433.98	132.28	2977.66	907.59



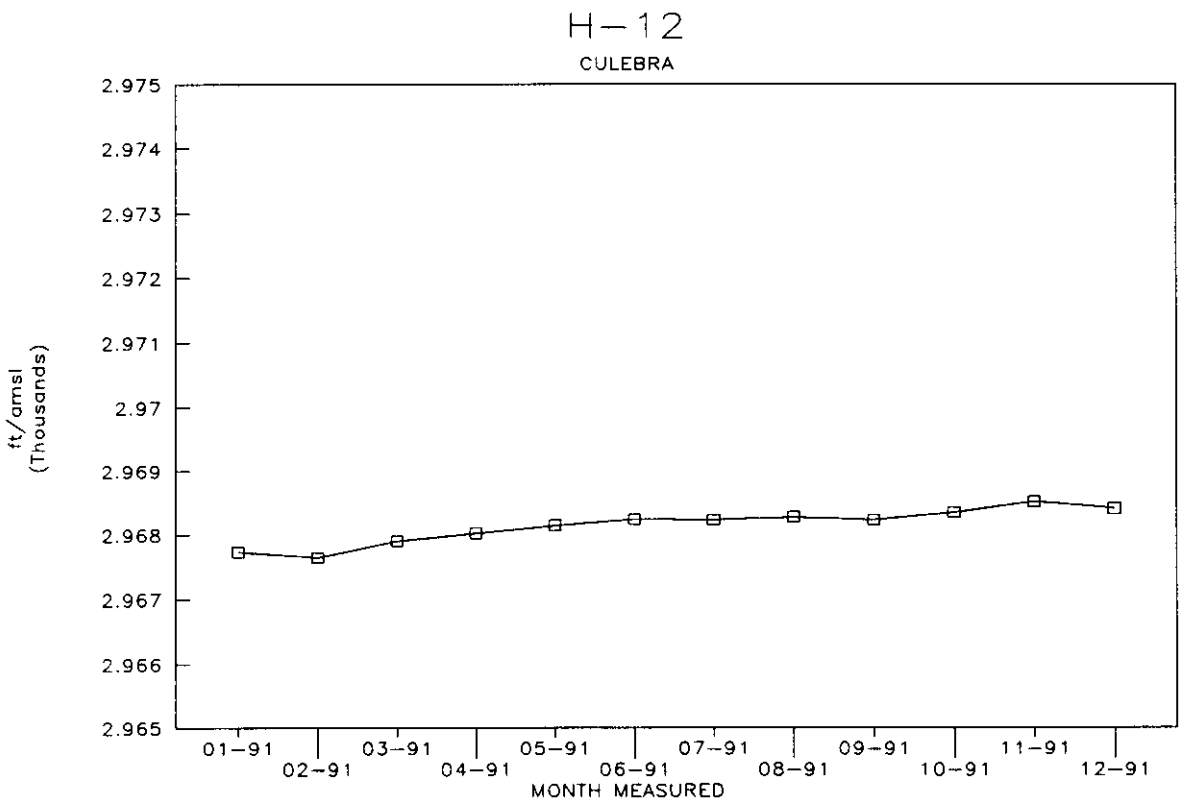
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-11b3	CUL	3412.42	03-12-91	15:35	435.61	0.00	435.61	132.77	2976.81	907.33
H-11b3	CUL	3412.42	06-19-91	09:15	435.55	0.00	435.55	132.76	2976.87	907.35
H-11b3	CUL	3412.42	09-26-91	09:00	435.03	0.00	435.03	132.60	2977.39	907.51
H-11b3	CUL	3412.42	12-11-91	13:22	435.03	0.00	435.03	132.60	2977.39	907.51



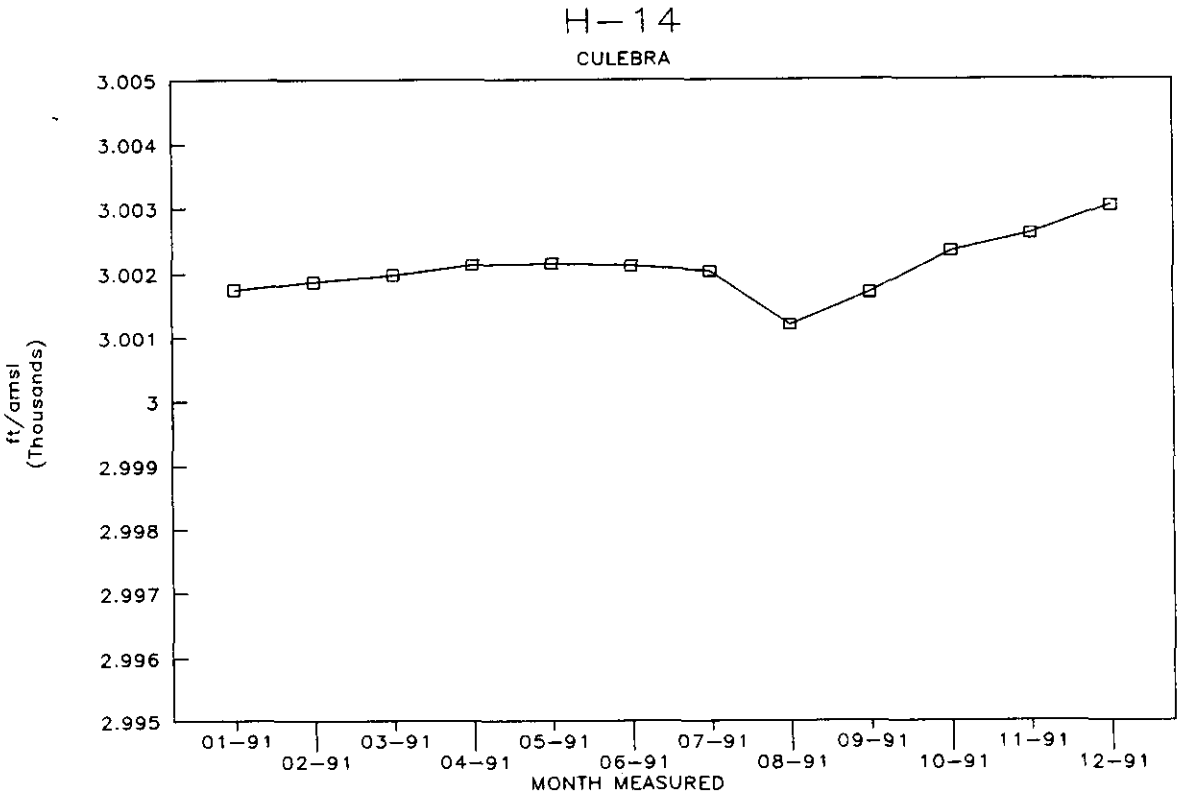
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-12	CUL	3427.19	01-14-91	12:44	459.46	0.00	459.46	140.04	2967.73	904.56
H-12	CUL	3427.19	02-11-91	12:48	459.55	0.00	459.55	140.07	2967.64	904.54
H-12	CUL	3427.19	03-11-91	11:45	459.29	0.00	459.29	139.99	2967.90	904.62
H-12	CUL	3427.19	04-17-91	11:23	459.17	0.00	459.17	139.96	2968.02	904.65
H-12	CUL	3427.19	05-15-91	11:55	459.05	0.00	459.05	139.92	2968.14	904.69
H-12	CUL	3427.19	06-18-91	11:01	458.95	0.00	458.95	139.89	2968.24	904.72
H-12	CUL	3427.19	07-15-91	09:36	458.96	0.00	458.96	139.89	2968.23	904.72
H-12	CUL	3427.19	08-12-91	15:34	458.92	0.00	458.92	139.88	2968.27	904.73
H-12	CUL	3427.19	09-25-91	13:13	458.96	0.00	458.96	139.89	2968.23	904.72
H-12	CUL	3427.19	10-16-91	13:04	458.84	0.00	458.84	139.85	2968.35	904.75
H-12	CUL	3427.19	11-19-91	13:05	458.68	0.00	458.68	139.81	2968.51	904.80
H-12	CUL	3427.19	12-10-91	14:02	458.79	0.00	458.79	139.84	2968.40	904.77



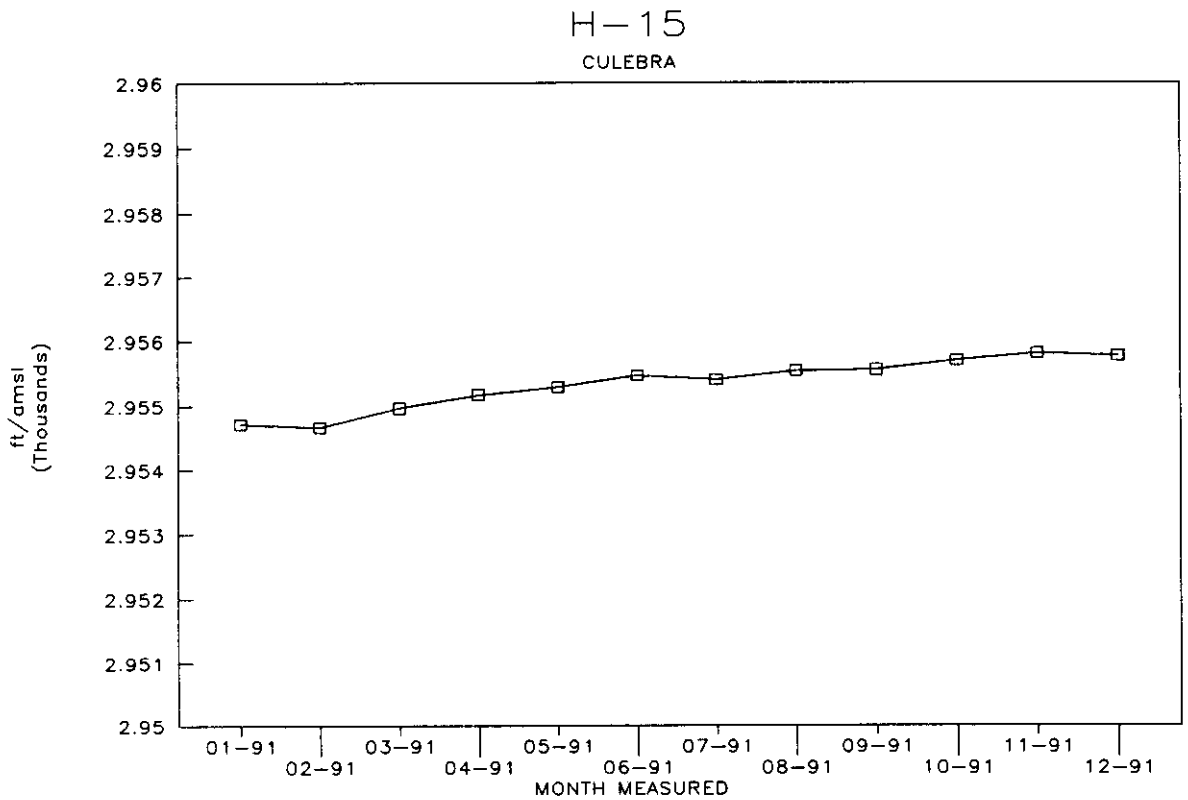
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-14	CUL	3347.11	01-16-91	08:50	345.36	0.00	345.36	105.27	3001.75	914.93
H-14	CUL	3347.11	02-13-91	09:30	345.24	0.00	345.24	105.23	3001.87	914.97
H-14	CUL	3347.11	03-12-91	16:05	345.13	0.00	345.13	105.20	3001.98	915.00
H-14	CUL	3347.11	04-18-91	09:45	344.98	0.00	344.98	105.15	3002.13	915.05
H-14	CUL	3347.11	05-16-91	07:15	344.96	0.00	344.96	105.14	3002.15	915.06
H-14	CUL	3347.11	06-17-91	12:09	344.99	0.00	344.99	105.15	3002.12	915.05
H-14	CUL	3347.11	07-16-91	12:16	345.08	0.00	345.08	105.18	3002.03	915.02
H-14	CUL	3347.11	08-13-91	13:12	345.91	0.00	345.91	105.43	3001.20	914.77
H-14	CUL	3347.11	09-24-91	08:34	345.41	0.00	345.41	105.28	3001.70	914.92
H-14	CUL	3347.11	10-15-91	12:38	344.77	0.00	344.77	105.09	3002.34	915.11
H-14	CUL	3347.11	11-20-91	13:00	344.51	0.00	344.51	105.01	3002.60	915.19
H-14	CUL	3347.11	12-12-91	07:30	344.08	0.00	344.08	104.88	3003.03	915.32



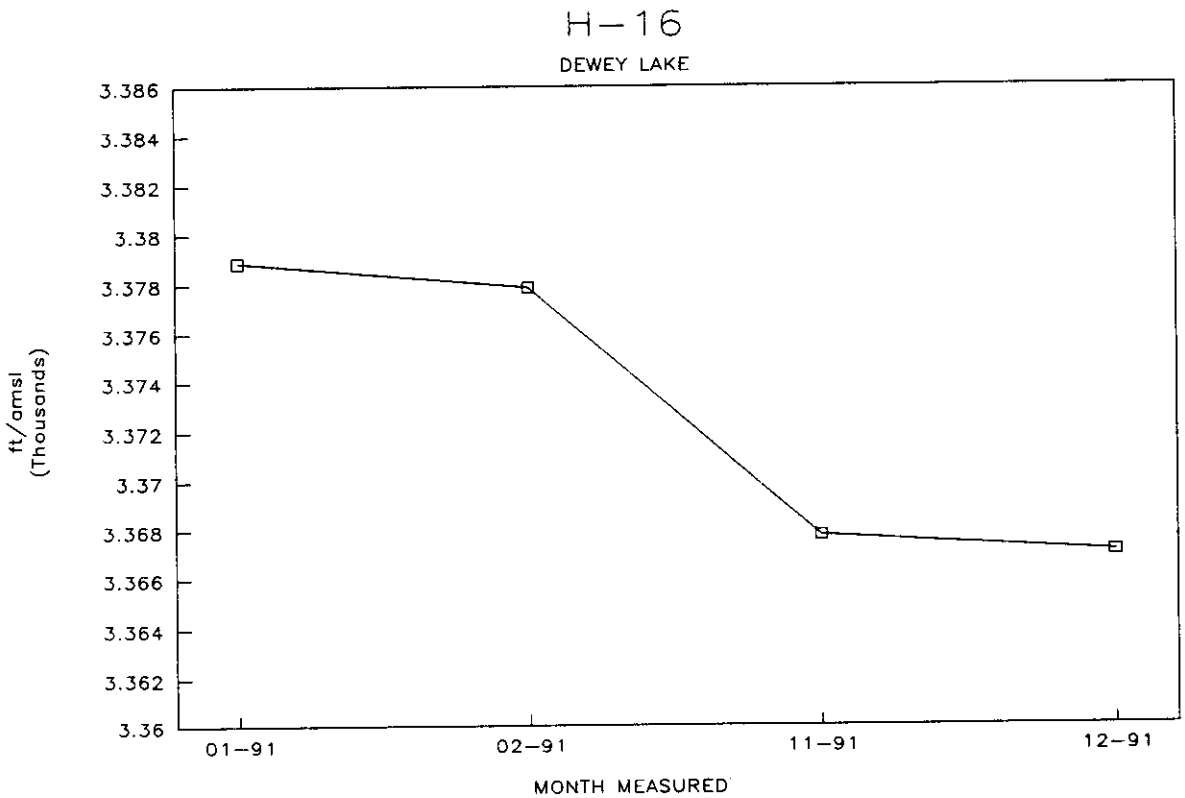
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-15	CUL	3481.63	01-16-91	08:15	526.91	0.00	526.91	160.60	2954.72	900.60
H-15	CUL	3481.63	02-11-91	10:00	526.96	0.00	526.96	160.62	2954.67	900.58
H-15	CUL	3481.63	03-11-91	10:32	526.67	0.00	526.67	160.53	2954.96	900.67
H-15	CUL	3481.63	04-18-91	08:36	526.46	0.00	526.46	160.47	2955.17	900.74
H-15	CUL	3481.63	05-15-91	12:05	526.35	0.00	526.35	160.43	2955.28	900.77
H-15	CUL	3481.63	06-17-91	14:43	526.17	0.00	526.17	160.38	2955.46	900.82
H-15	CUL	3481.63	07-16-91	09:43	526.24	0.00	526.24	160.40	2955.39	900.80
H-15	CUL	3481.63	08-12-91	10:30	526.10	0.00	526.10	160.36	2955.53	900.85
H-15	CUL	3481.63	09-25-91	10:45	526.08	0.00	526.08	160.35	2955.55	900.85
H-15	CUL	3481.63	10-16-91	12:35	525.94	0.00	525.94	160.31	2955.69	900.89
H-15	CUL	3481.63	11-19-91	10:05	525.83	0.00	525.83	160.27	2955.80	900.93
H-15	CUL	3481.63	12-09-91	09:48	525.87	0.00	525.87	160.29	2955.76	900.92



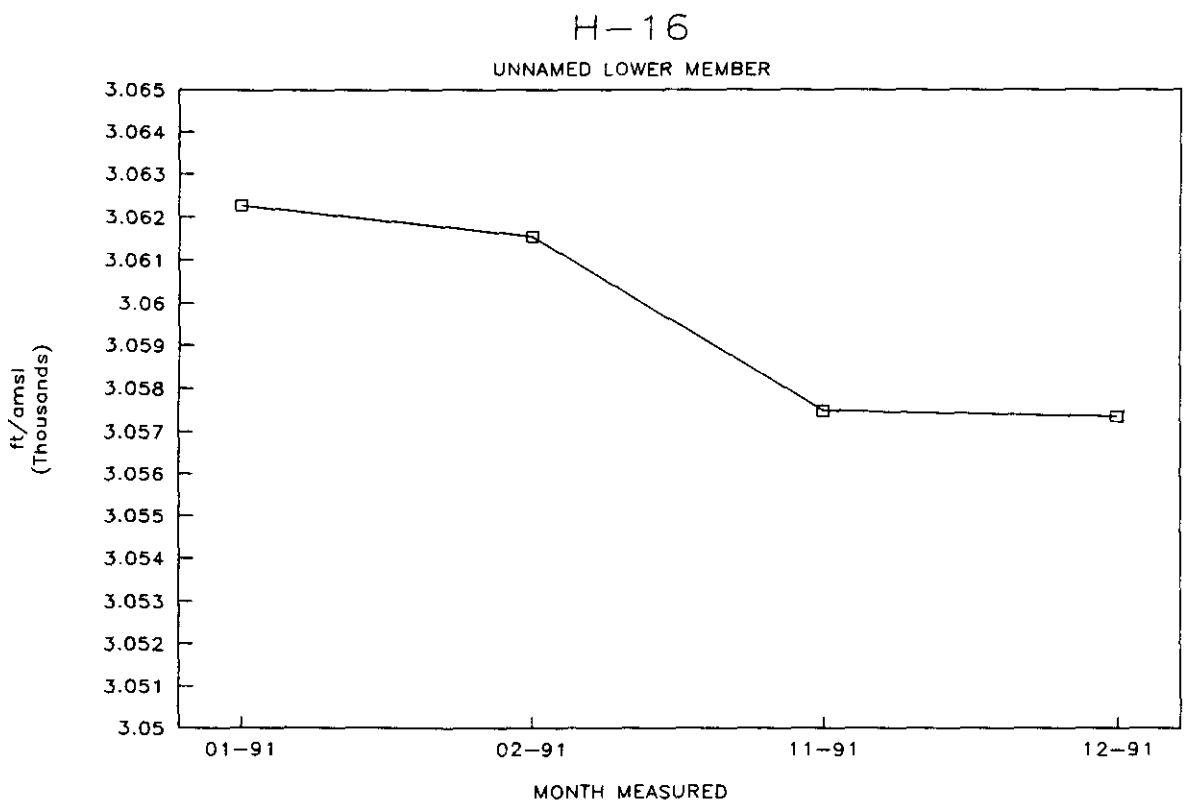
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-16 (PVC)	DL	3406.77	01-17-91	10:35	28.20	0.30	27.90	8.50	3378.87	1029.88
H-16 (PVC)	DL	3406.77	02-13-91	13:50	29.21	0.30	28.91	8.81	3377.86	1029.57
H-16 (PVC)	DL	3406.77	11-21-91	10:52	42.69	3.70	38.99	11.88	3367.78	1026.50
H-16 (PVC)	DL	3406.77	12-12-91	12:28	43.39	3.70	39.69	12.10	3367.08	1026.29



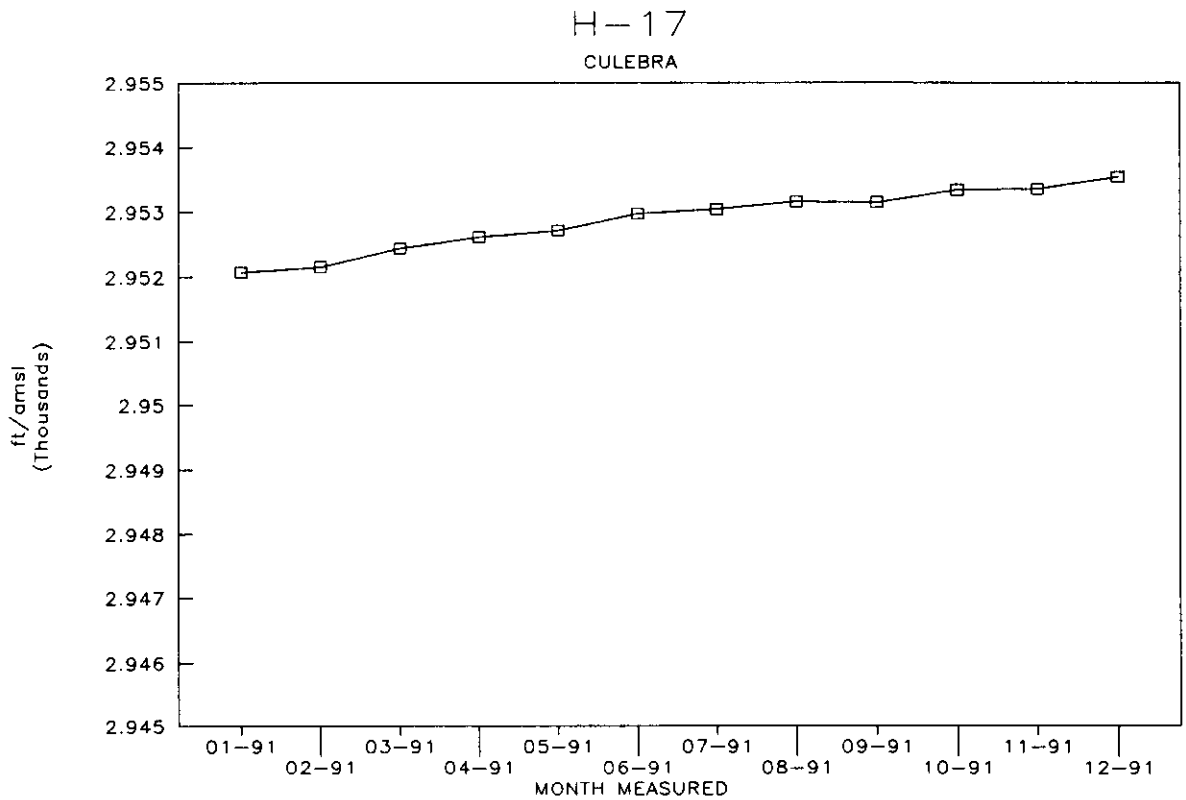
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-16 (PIP)	ULM	3406.77	01-17-91	10:33	346.51	2.03	344.48	105.00	3062.29	933.39
H-16 (PIP)	ULM	3406.77	02-13-91	13:45	347.25	2.03	345.22	105.22	3061.55	933.16
H-16 (PIP)	ULM	3406.77	11-21-91	10:46	353.18	3.89	349.29	106.46	3057.48	931.92
H-16 (PIP)	ULM	3406.77	12-12-91	12:22	353.31	3.89	349.42	106.50	3057.35	931.88



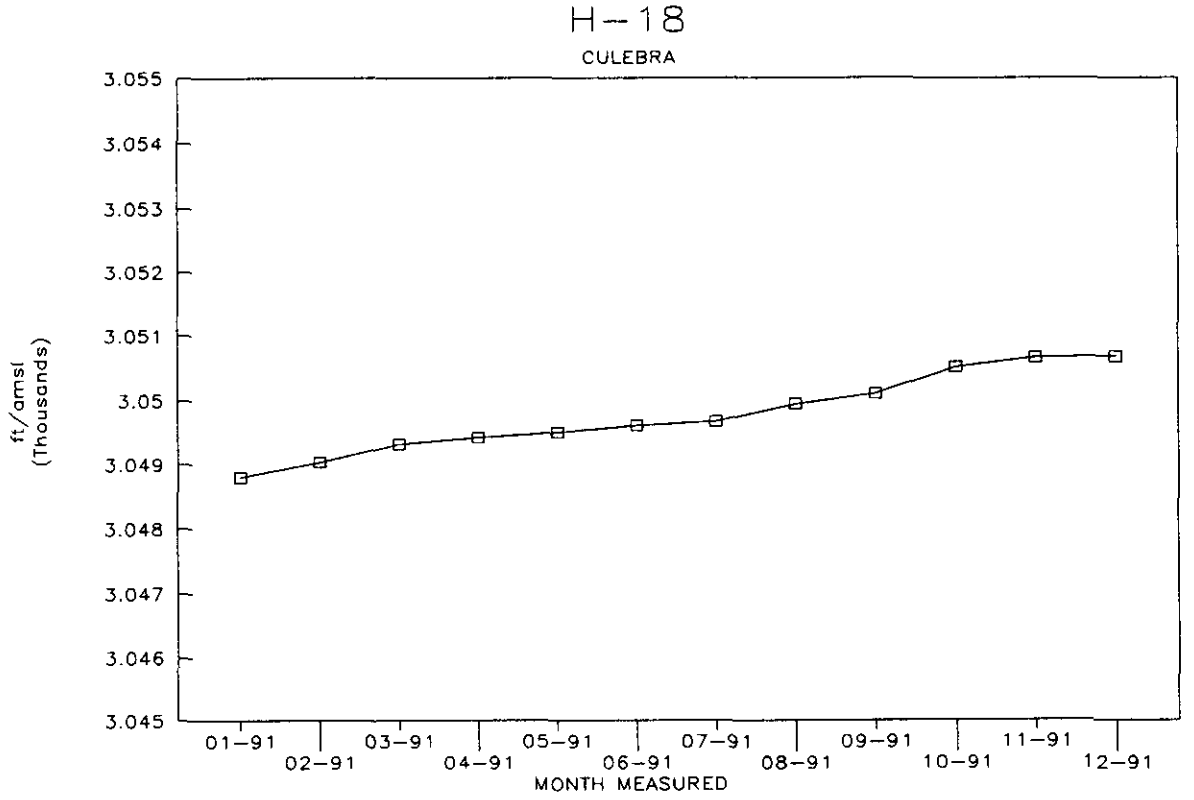
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-17	CUL	3385.31	01-16-91	14:25	433.24	0.00	433.24	132.05	2952.07	899.79
H-17	CUL	3385.31	02-12-91	15:50	433.15	0.00	433.15	132.02	2952.16	899.82
H-17	CUL	3385.31	03-12-91	15:12	432.87	0.00	432.87	131.94	2952.44	899.90
H-17	CUL	3385.31	04-18-91	15:22	432.70	0.00	432.70	131.89	2952.61	899.96
H-17	CUL	3385.31	05-14-91	16:50	432.60	0.00	432.60	131.86	2952.71	899.99
H-17	CUL	3385.31	06-19-91	08:54	432.34	0.00	432.34	131.78	2952.97	900.07
H-17	CUL	3385.31	07-16-91	13:46	432.28	0.00	432.28	131.76	2953.03	900.08
H-17	CUL	3385.31	08-13-91	10:14	432.16	0.00	432.16	131.72	2953.15	900.12
H-17	CUL	3385.31	09-26-91	08:20	432.17	0.00	432.17	131.73	2953.14	900.12
H-17	CUL	3385.31	10-17-91	08:40	431.98	0.00	431.98	131.67	2953.33	900.17
H-17	CUL	3385.31	11-20-91	14:13	431.96	0.00	431.96	131.66	2953.35	900.18
H-17	CUL	3385.31	12-11-91	13:03	431.78	0.00	431.78	131.61	2953.53	900.24



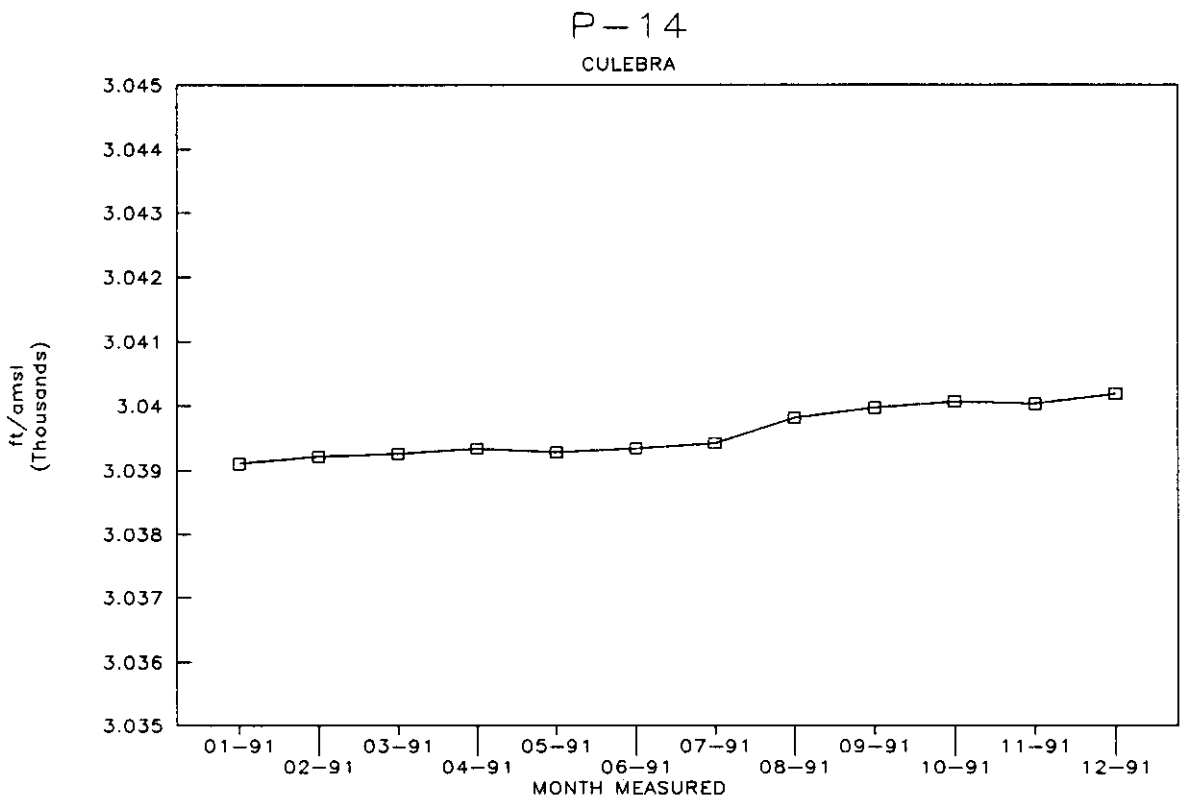
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
H-18	CUL	3414.21	01-15-91	09:00	365.41	0.00	365.41	111.38	3048.80	929.27
H-18	CUL	3414.21	02-12-91	08:35	365.18	0.00	365.18	111.31	3049.03	929.34
H-18	CUL	3414.21	03-12-91	08:00	364.89	0.00	364.89	111.22	3049.32	929.43
H-18	CUL	3414.21	04-16-91	10:36	364.79	0.00	364.79	111.19	3049.42	929.46
H-18	CUL	3414.21	05-14-91	13:36	364.71	0.00	364.71	111.16	3049.50	929.49
H-18	CUL	3414.21	06-19-91	07:45	364.60	0.00	364.60	111.13	3049.61	929.52
H-18	CUL	3414.21	07-16-91	08:53	364.54	0.00	364.54	111.11	3049.67	929.54
H-18	CUL	3414.21	08-13-91	08:44	364.27	0.00	364.27	111.03	3049.94	929.62
H-18	CUL	3414.21	09-23-91	13:30	364.11	0.00	364.11	110.98	3050.10	929.67
H-18	CUL	3414.21	10-14-91	13:20	363.70	0.00	363.70	110.86	3050.51	929.80
H-18	CUL	3414.21	11-21-91	10:05	363.55	0.00	363.55	110.81	3050.66	929.84
H-18	CUL	3414.21	12-11-91	09:25	363.54	0.00	363.54	110.81	3050.67	929.84



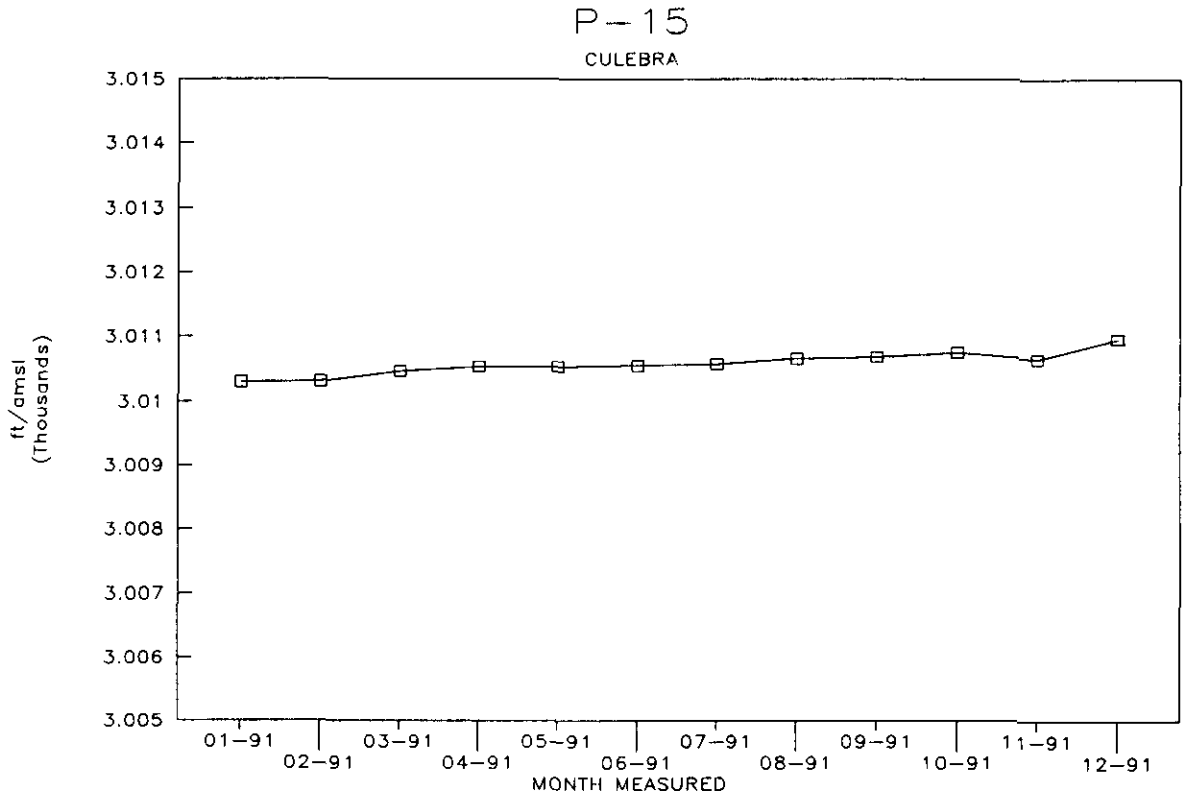
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
P-14	CUL	3361.06	01-15-91	07:50	321.95	0.00	321.95	98.13	3039.11	926.32
P-14	CUL	3361.06	02-12-91	07:30	321.84	0.00	321.84	98.10	3039.22	926.35
P-14	CUL	3361.06	03-12-91	07:04	321.80	0.00	321.80	98.08	3039.26	926.37
P-14	CUL	3361.06	04-18-91	07:15	321.72	0.00	321.72	98.06	3039.34	926.39
P-14	CUL	3361.06	05-14-91	12:05	321.78	0.00	321.78	98.08	3039.28	926.37
P-14	CUL	3361.06	06-19-91	06:46	321.72	0.00	321.72	98.06	3039.34	926.39
P-14	CUL	3361.06	07-16-91	08:08	321.64	0.00	321.64	98.04	3039.42	926.42
P-14	CUL	3361.06	08-13-91	08:00	321.25	0.00	321.25	97.92	3039.81	926.53
P-14	CUL	3361.06	09-23-91	15:00	321.10	0.00	321.10	97.87	3039.96	926.58
P-14	CUL	3361.06	10-14-91	14:08	321.00	0.00	321.00	97.84	3040.06	926.61
P-14	CUL	3361.06	11-21-91	09:25	321.04	0.00	321.04	97.85	3040.02	926.60
P-14	CUL	3361.06	12-11-91	08:15	320.88	0.00	320.88	97.80	3040.18	926.65



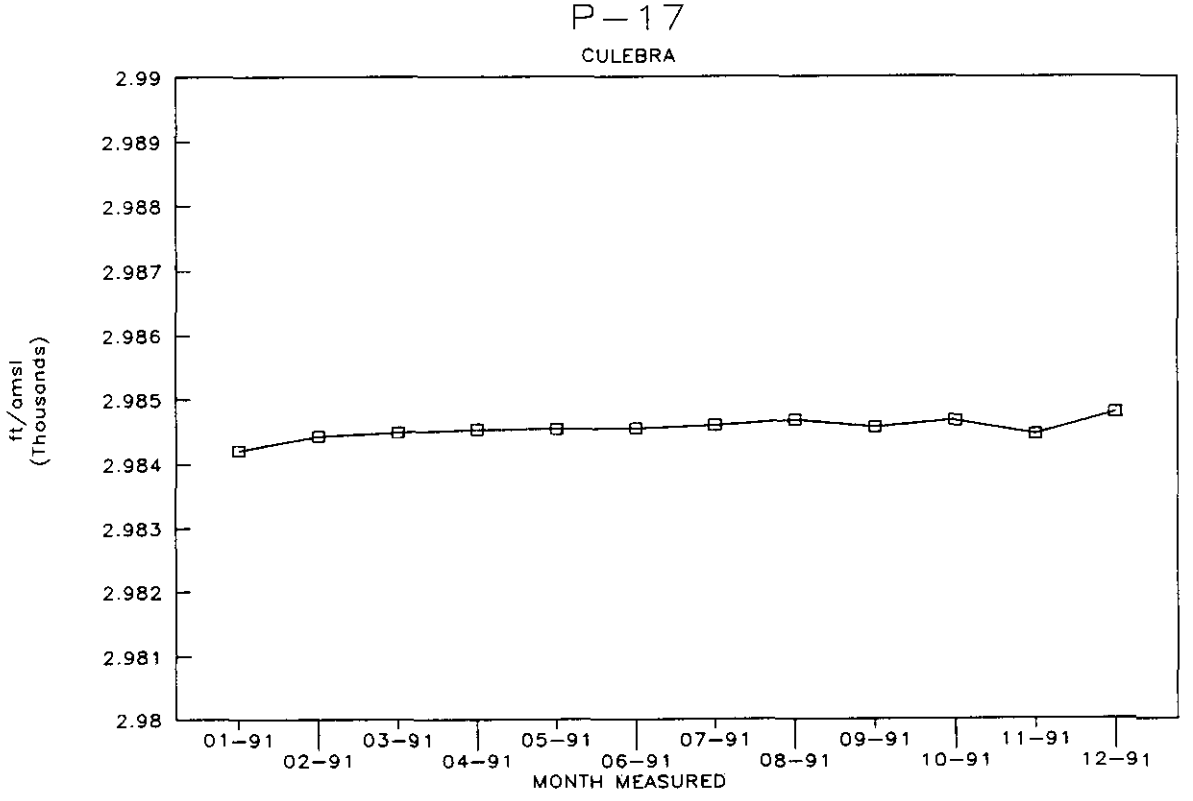
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
P-15	CUL	3311.38	01-16-91	07:25	301.08	0.00	301.08	91.77	3010.30	917.54
P-15	CUL	3311.38	02-12-91	14:10	301.07	0.00	301.07	91.77	3010.31	917.54
P-15	CUL	3311.38	03-12-91	14:18	300.92	0.00	300.92	91.72	3010.46	917.59
P-15	CUL	3311.38	04-18-91	10:06	300.85	0.00	300.85	91.70	3010.53	917.61
P-15	CUL	3311.38	05-16-91	06:26	300.85	0.00	300.85	91.70	3010.53	917.61
P-15	CUL	3311.38	06-17-91	13:02	300.83	0.00	300.83	91.69	3010.55	917.62
P-15	CUL	3311.38	07-16-91	15:13	300.81	0.00	300.81	91.69	3010.57	917.62
P-15	CUL	3311.38	08-13-91	14:30	300.72	0.00	300.72	91.66	3010.66	917.65
P-15	CUL	3311.38	09-24-91	08:06	300.70	0.00	300.70	91.65	3010.68	917.66
P-15	CUL	3311.38	10-15-91	14:20	300.63	0.00	300.63	91.63	3010.75	917.68
P-15	CUL	3311.38	11-20-91	10:30	300.73	0.00	300.73	91.66	3010.65	917.65
P-15	CUL	3311.38	12-11-91	14:12	300.42	0.00	300.42	91.57	3010.96	917.74



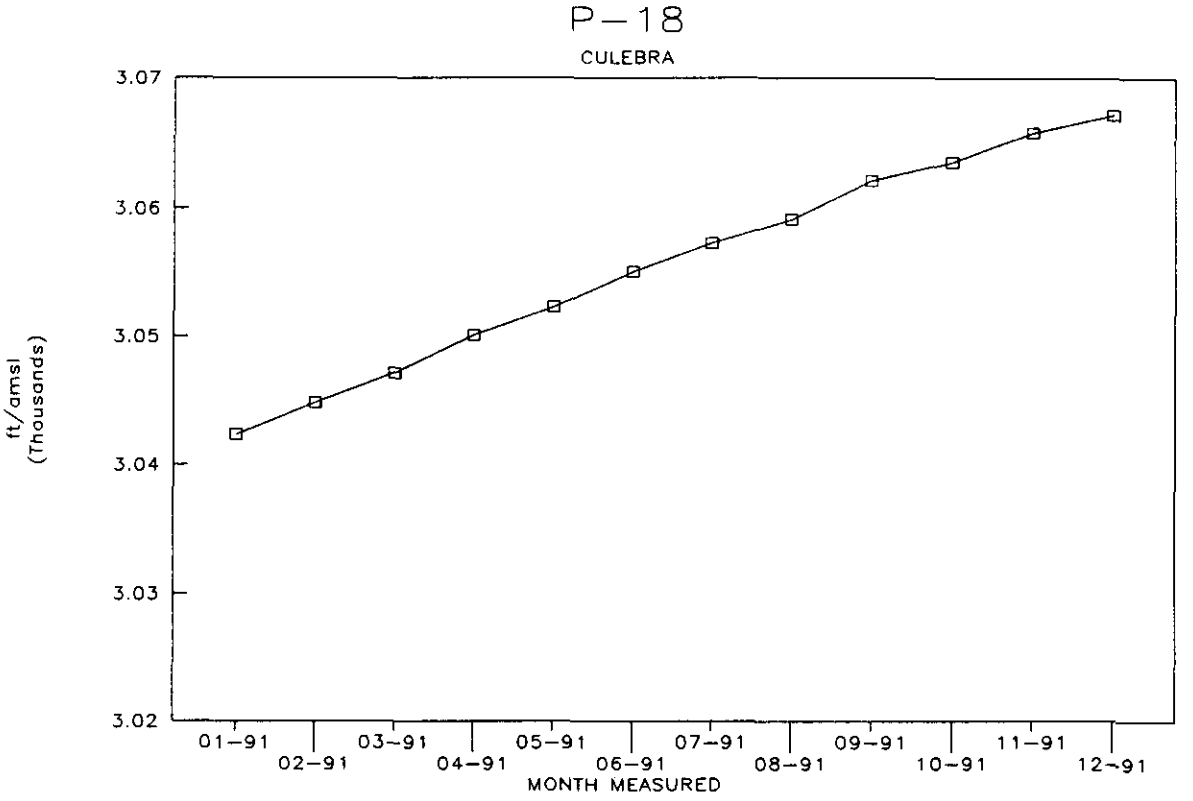
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
P-17	CUL	3337.24	01-16-91	13:50	353.03	0.00	353.03	107.60	2984.21	909.59
P-17	CUL	3337.24	02-12-91	15:00	352.81	0.00	352.81	107.54	2984.43	909.65
P-17	CUL	3337.24	03-12-91	14:50	352.75	0.00	352.75	107.52	2984.49	909.67
P-17	CUL	3337.24	04-18-91	13:42	352.71	0.00	352.71	107.51	2984.53	909.68
P-17	CUL	3337.24	05-14-91	16:10	352.70	0.00	352.70	107.50	2984.54	909.69
P-17	CUL	3337.24	06-19-91	08:11	352.69	0.00	352.69	107.50	2984.55	909.69
P-17	CUL	3337.24	07-16-91	13:01	352.65	0.00	352.65	107.49	2984.59	909.70
P-17	CUL	3337.24	08-13-91	10:44	352.57	0.00	352.57	107.46	2984.67	909.73
P-17	CUL	3337.24	09-26-91	07:20	352.68	0.00	352.68	107.50	2984.56	909.69
P-17	CUL	3337.24	10-17-91	07:42	352.57	0.00	352.57	107.46	2984.67	909.73
P-17	CUL	3337.24	11-20-91	13:43	352.78	0.00	352.78	107.53	2984.46	909.66
P-17	CUL	3337.24	12-11-91	12:05	352.45	0.00	352.45	107.43	2984.79	909.76



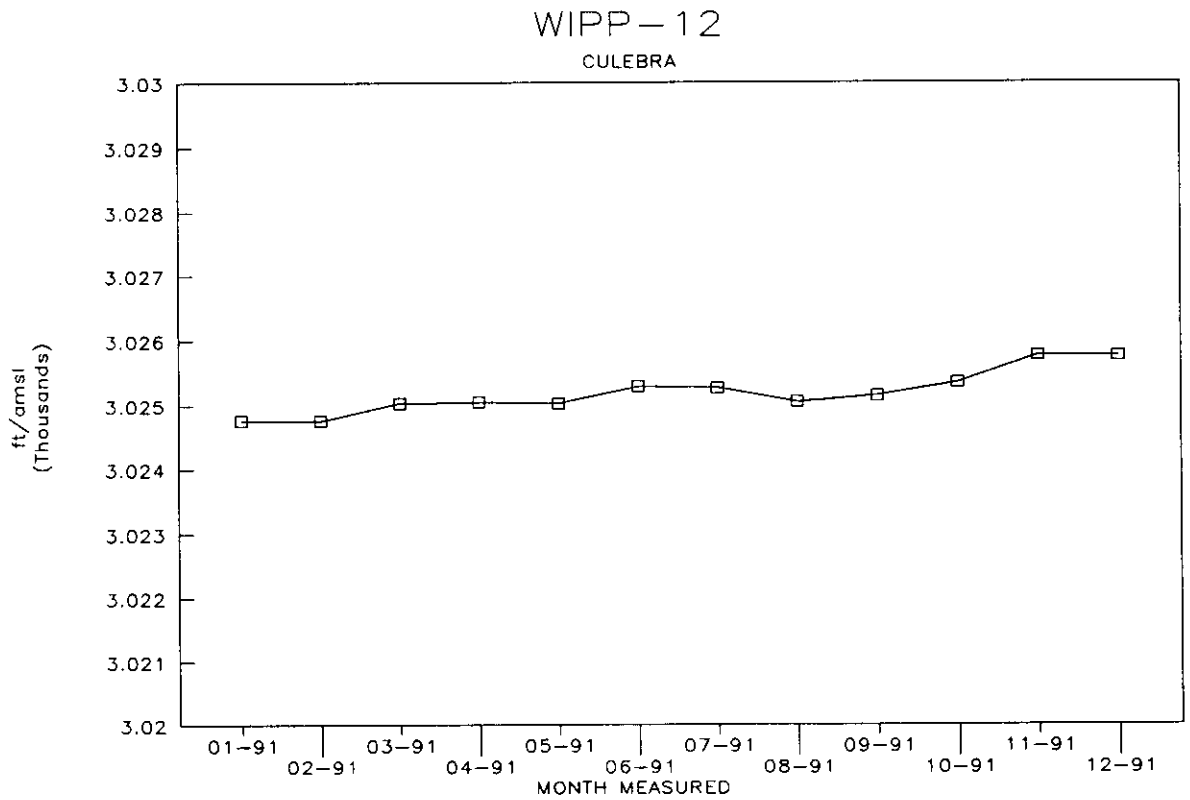
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
P-18	CUL	3478.42	01-14-91	12:25	436.67	0.68	435.99	132.89	3042.43	927.33
P-18	CUL	3478.42	02-11-91	10:35	434.22	0.68	433.54	132.14	3044.88	928.08
P-18	CUL	3478.42	03-11-91	11:06	431.96	0.68	431.28	131.45	3047.14	928.77
P-18	CUL	3478.42	04-17-91	11:45	428.98	0.68	428.30	130.55	3050.12	929.68
P-18	CUL	3478.42	05-15-91	11:25	426.78	0.68	426.10	129.88	3052.32	930.35
P-18	CUL	3478.42	06-18-91	10:36	424.02	0.68	423.34	129.03	3055.08	931.19
P-18	CUL	3478.42	07-16-91	14:15	421.79	0.68	421.11	128.35	3057.31	931.87
P-18	CUL	3478.42	08-12-91	15:12	419.93	0.68	419.25	127.79	3059.17	932.44
P-18	CUL	3478.42	09-25-91	12:57	416.98	0.68	416.30	126.89	3062.12	933.33
P-18	CUL	3478.42	10-16-91	12:50	415.55	0.68	414.87	126.45	3063.55	933.77
P-18	CUL	3478.42	11-19-91	12:48	413.30	0.68	412.62	125.77	3065.80	934.46
P-18	CUL	3478.42	12-10-91	15:12	411.90	0.68	411.22	125.34	3067.20	934.88



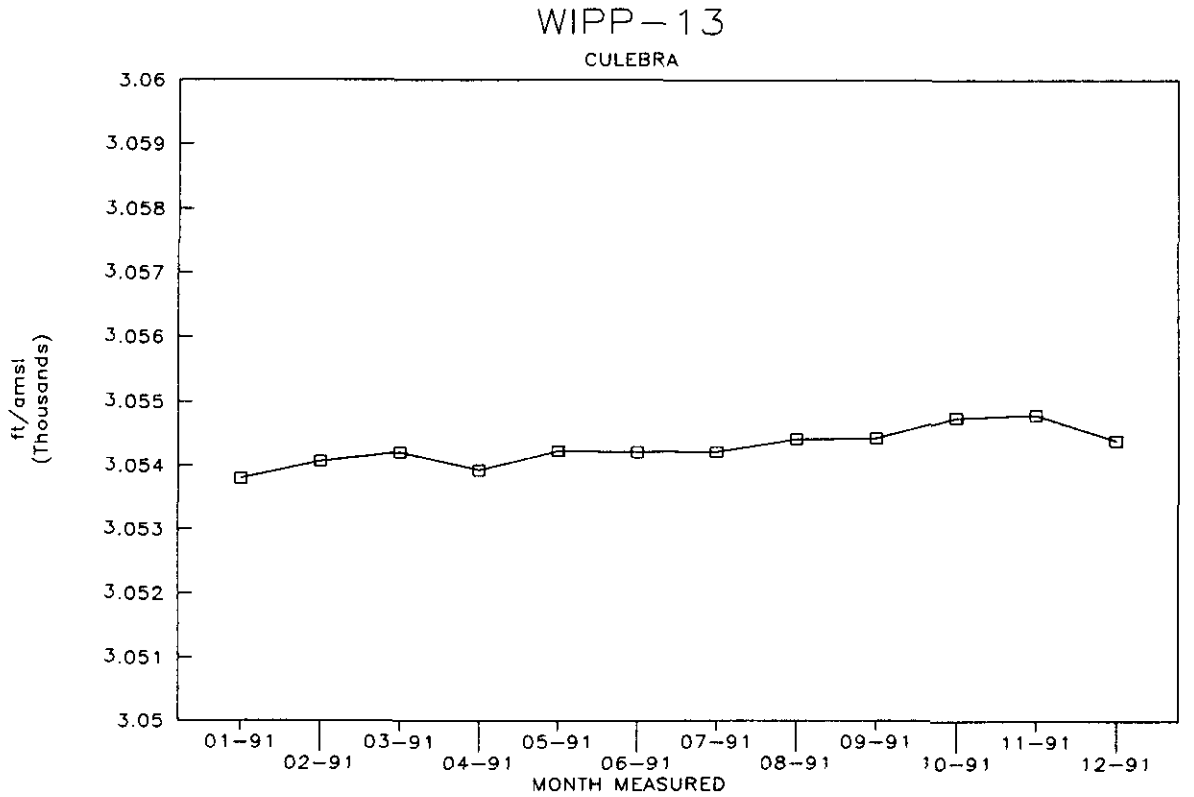
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
WIPP-12	CUL	3472.06	01-16-91	13:00	447.30	0.00	447.30	136.34	3024.76	921.95
WIPP-12	CUL	3472.06	02-12-91	10:15	447.30	0.00	447.30	136.34	3024.76	921.95
WIPP-12	CUL	3472.06	03-12-91	12:58	447.03	0.00	447.03	136.25	3025.03	922.03
WIPP-12	CUL	3472.06	04-17-91	14:36	447.01	0.00	447.01	136.25	3025.05	922.04
WIPP-12	CUL	3472.06	05-15-91	16:07	447.04	0.00	447.04	136.26	3025.02	922.03
WIPP-12	CUL	3472.06	06-17-91	09:23	446.77	0.00	446.77	136.18	3025.29	922.11
WIPP-12	CUL	3472.06	07-15-91	14:24	446.80	0.00	446.80	136.18	3025.26	922.10
WIPP-12	CUL	3472.06	08-12-91	13:24	447.01	0.00	447.01	136.25	3025.05	922.04
WIPP-12	CUL	3472.06	09-24-91	13:36	446.92	0.00	446.92	136.22	3025.14	922.06
WIPP-12	CUL	3472.06	10-15-91	10:43	446.72	0.00	446.72	136.16	3025.34	922.12
WIPP-12	CUL	3472.06	11-18-91	13:12	446.30	0.00	446.30	136.03	3025.76	922.25
WIPP-12	CUL	3472.06	12-12-91	15:15	446.31	0.00	446.31	136.04	3025.75	922.25



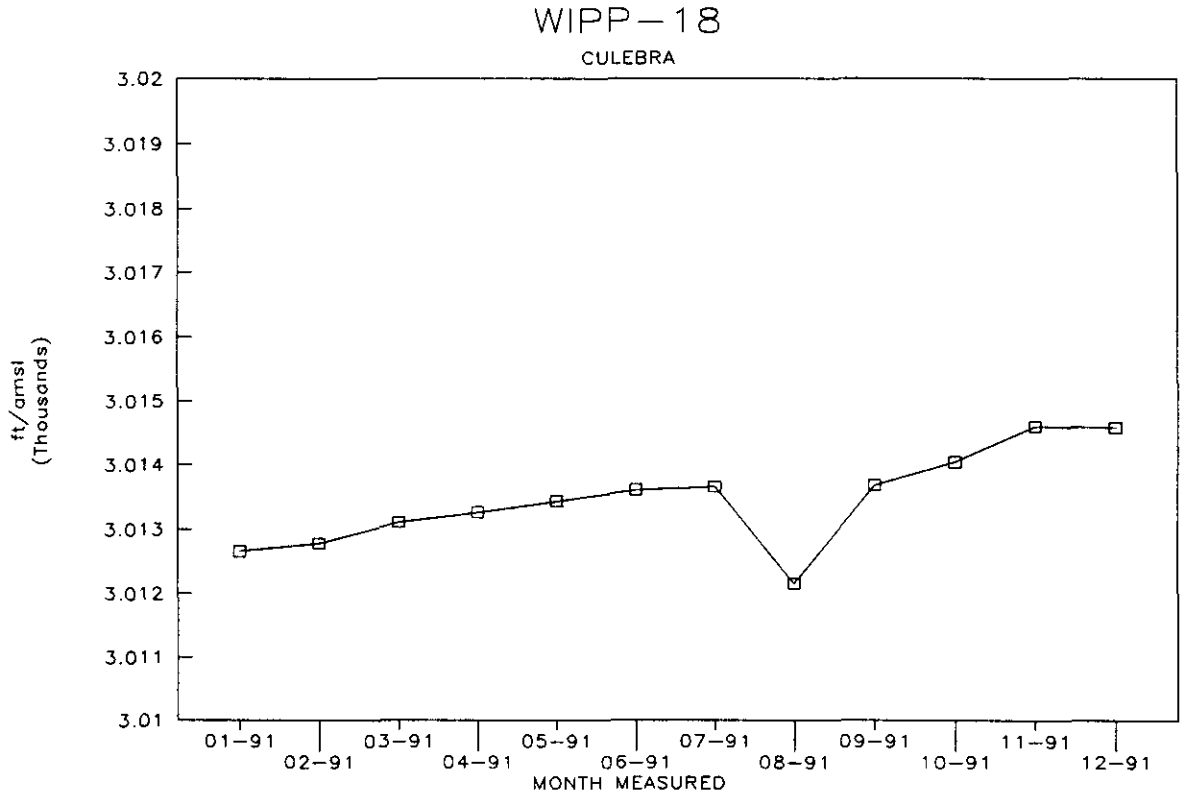
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
WIPP-13	CUL	3405.71	01-16-91	13:15	351.91	0.00	351.91	107.26	3053.80	930.80
WIPP-13	CUL	3405.71	02-13-91	09:15	351.64	0.00	351.64	107.18	3054.07	930.88
WIPP-13	CUL	3405.71	03-12-91	13:35	351.50	0.00	351.50	107.14	3054.21	930.92
WIPP-13	CUL	3405.71	04-16-91	10:52	351.78	0.00	351.78	107.22	3053.93	930.84
WIPP-13	CUL	3405.71	05-15-91	16:36	351.48	0.00	351.48	107.13	3054.23	930.93
WIPP-13	CUL	3405.71	06-17-91	16:42	351.49	0.00	351.49	107.13	3054.22	930.93
WIPP-13	CUL	3405.71	07-15-91	14:44	351.50	0.00	351.50	107.14	3054.21	930.92
WIPP-13	CUL	3405.71	08-13-91	15:16	351.30	0.00	351.30	107.08	3054.41	930.98
WIPP-13	CUL	3405.71	09-24-91	14:13	351.29	0.00	351.29	107.07	3054.42	930.99
WIPP-13	CUL	3405.71	10-15-91	09:41	350.96	0.00	350.96	106.97	3054.75	931.09
WIPP-13	CUL	3405.71	11-20-91	14:48	350.93	0.00	350.93	106.96	3054.78	931.10
WIPP-13	CUL	3405.71	12-09-91	15:02	351.32	0.00	351.32	107.08	3054.39	930.98



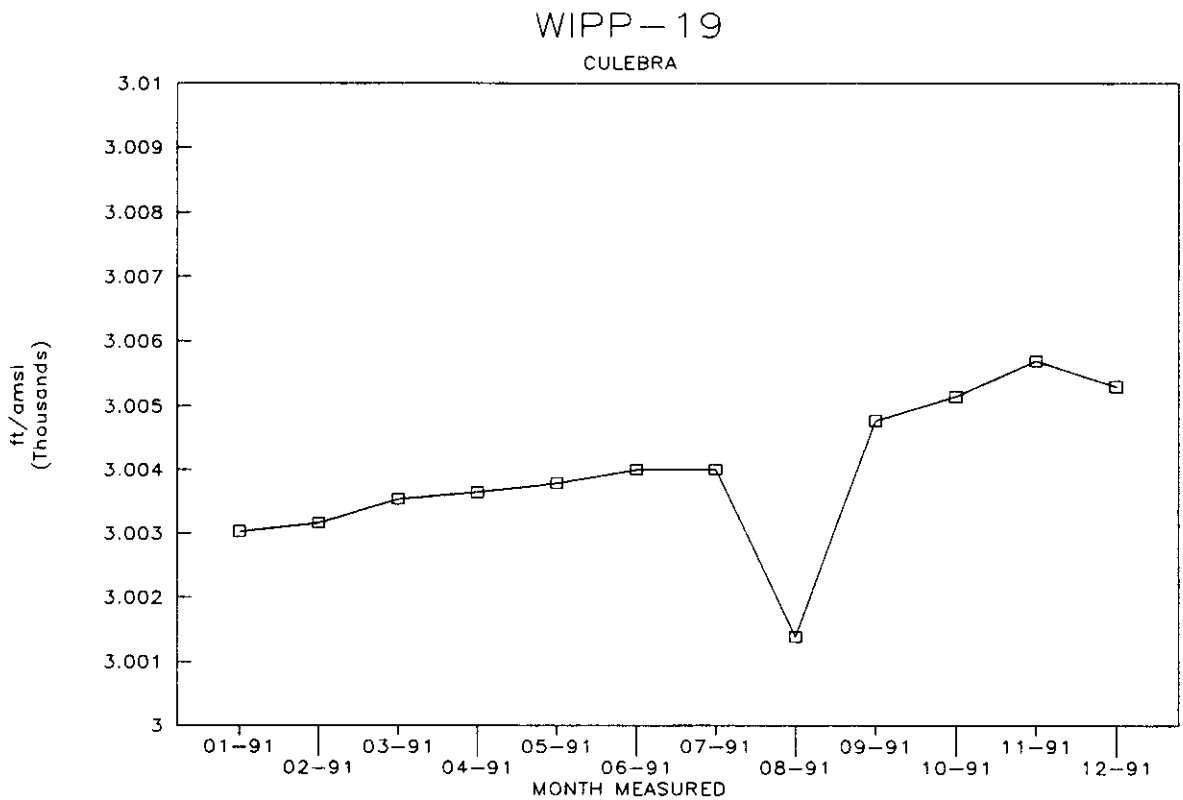
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
WIPP-18	CUL	3458.76	01-16-91	12:48	446.10	0.00	446.10	135.97	3012.66	918.26
WIPP-18	CUL	3458.76	02-12-91	10:08	445.98	0.00	445.98	135.93	3012.78	918.30
WIPP-18	CUL	3458.76	03-12-91	12:50	445.65	0.00	445.65	135.83	3013.11	918.40
WIPP-18	CUL	3458.76	04-17-91	14:25	445.50	0.00	445.50	135.79	3013.26	918.44
WIPP-18	CUL	3458.76	05-15-91	15:51	445.33	0.00	445.33	135.74	3013.43	918.49
WIPP-18	CUL	3458.76	06-17-91	09:16	445.15	0.00	445.15	135.68	3013.61	918.55
WIPP-18	CUL	3458.76	07-15-91	14:15	445.11	0.00	445.11	135.67	3013.65	918.56
WIPP-18	CUL	3458.76	08-12-91	13:16	446.61	0.00	446.61	136.13	3012.15	918.10
WIPP-18	CUL	3458.76	09-24-91	13:13	445.08	0.00	445.08	135.66	3013.68	918.57
WIPP-18	CUL	3458.76	10-15-91	10:30	444.72	0.00	444.72	135.55	3014.04	918.68
WIPP-18	CUL	3458.76	11-18-91	13:05	444.16	0.00	444.16	135.38	3014.60	918.85
WIPP-18	CUL	3458.76	12-12-91	10:58	444.18	0.00	444.18	135.39	3014.58	918.84



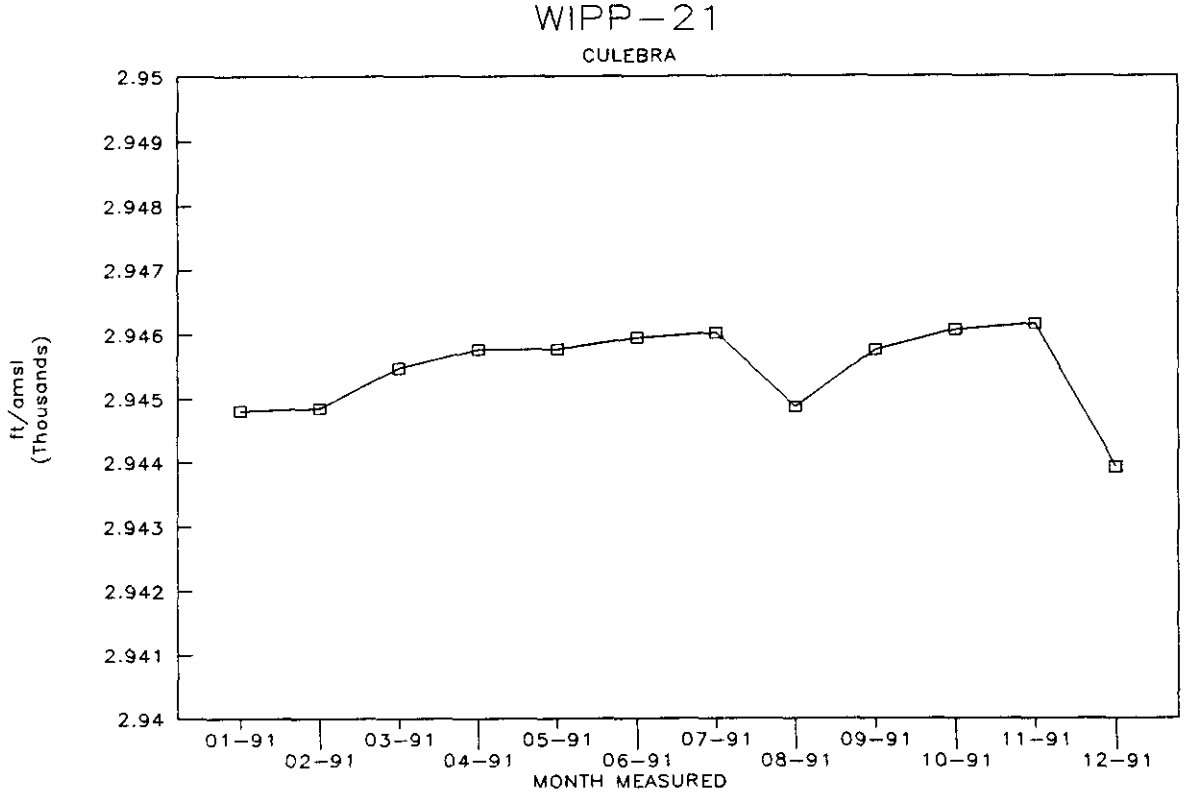
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
WIPP-19	CUL	3435.14	01-16-91	12:38	432.12	0.00	432.12	131.71	3003.02	915.32
WIPP-19	CUL	3435.14	02-12-91	09:55	431.98	0.00	431.98	131.67	3003.16	915.36
WIPP-19	CUL	3435.14	03-12-91	12:40	431.61	0.00	431.61	131.55	3003.53	915.48
WIPP-19	CUL	3435.14	04-17-91	14:15	431.50	0.00	431.50	131.52	3003.64	915.51
WIPP-19	CUL	3435.14	05-15-91	15:31	431.35	0.00	431.35	131.48	3003.79	915.56
WIPP-19	CUL	3435.14	06-17-91	09:06	431.14	0.00	431.14	131.41	3004.00	915.62
WIPP-19	CUL	3435.14	07-15-91	14:04	431.14	0.00	431.14	131.41	3004.00	915.62
WIPP-19	CUL	3435.14	08-12-91	13:08	433.75	0.00	433.75	132.21	3001.39	914.82
WIPP-19	CUL	3435.14	09-24-91	13:04	430.37	0.00	430.37	131.18	3004.77	915.85
WIPP-19	CUL	3435.14	10-15-91	10:21	430.00	0.00	430.00	131.06	3005.14	915.97
WIPP-19	CUL	3435.14	11-18-91	12:52	429.45	0.00	429.45	130.90	3005.69	916.13
WIPP-19	CUL	3435.14	12-12-91	10:48	429.84	0.00	429.84	131.02	3005.30	916.02



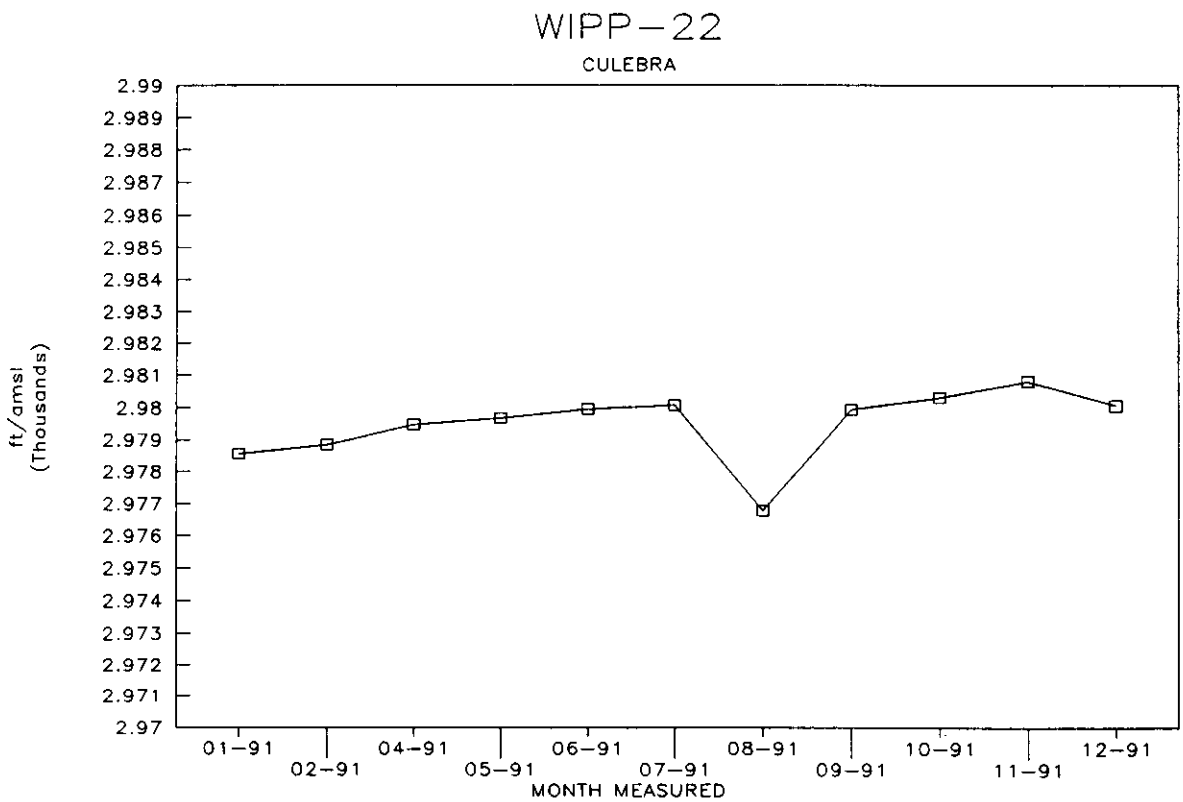
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
WIPP-21	CUL	3418.96	01-16-91	12:20	474.77	0.62	474.15	144.52	2944.81	897.58
WIPP-21	CUL	3418.96	02-12-91	09:30	474.73	0.62	474.11	144.51	2944.85	897.59
WIPP-21	CUL	3418.96	03-12-91	12:15	474.10	0.62	473.48	144.32	2945.48	897.78
WIPP-21	CUL	3418.96	04-17-91	13:54	473.81	0.62	473.19	144.23	2945.77	897.87
WIPP-21	CUL	3418.96	05-15-91	15:10	473.81	0.62	473.19	144.23	2945.77	897.87
WIPP-21	CUL	3418.96	06-17-91	08:43	473.63	0.62	473.01	144.17	2945.95	897.93
WIPP-21	CUL	3418.96	07-15-91	13:51	473.56	0.62	472.94	144.15	2946.02	897.95
WIPP-21	CUL	3418.96	08-12-91	12:54	474.71	0.62	474.09	144.50	2944.87	897.60
WIPP-21	CUL	3418.96	09-24-91	13:56	473.82	0.62	473.20	144.23	2945.76	897.87
WIPP-21	CUL	3418.96	10-15-91	10:07	473.51	0.62	472.89	144.14	2946.07	897.96
WIPP-21	CUL	3418.96	11-18-91	12:35	473.42	0.62	472.80	144.11	2946.16	897.99
WIPP-21	CUL	3418.96	12-12-91	10:26	475.66	0.62	475.04	144.79	2943.92	897.31



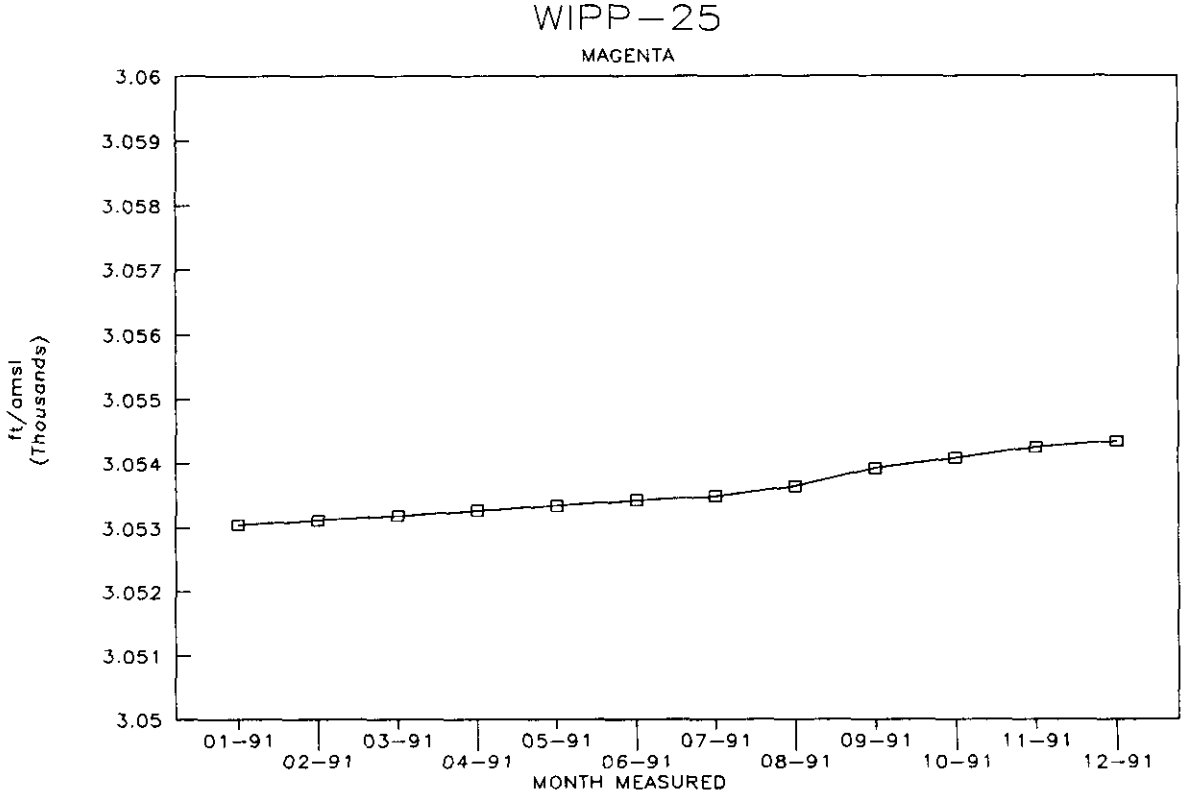
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
WIPP-22	CUL	3428.12	01-16-91	12:30	449.55	0.00	449.55	137.02	2978.57	907.87
WIPP-22	CUL	3428.12	02-12-91	09:45	449.27	0.00	449.27	136.94	2978.85	907.95
WIPP-22	CUL	3428.12	03-12-91	12:28	448.97	0.00	448.97	136.85	2979.15	908.04
WIPP-22	CUL	3428.12	04-17-91	14:05	448.64	0.00	448.64	136.75	2979.48	908.15
WIPP-22	CUL	3428.12	05-15-91	15:22	448.45	0.00	448.45	136.69	2979.67	908.20
WIPP-22	CUL	3428.12	06-17-91	08:51	448.16	0.00	448.16	136.60	2979.96	908.29
WIPP-22	CUL	3428.12	07-15-91	13:57	448.04	0.00	448.04	136.56	2980.08	908.33
WIPP-22	CUL	3428.12	08-12-91	13:02	451.35	0.00	451.35	137.57	2976.77	907.32
WIPP-22	CUL	3428.12	09-24-91	12:48	448.18	0.00	448.18	136.61	2979.94	908.29
WIPP-22	CUL	3428.12	10-15-91	10:15	447.81	0.00	447.81	136.49	2980.31	908.40
WIPP-22	CUL	3428.12	11-18-91	12:45	447.30	0.00	447.30	136.34	2980.82	908.55
WIPP-22	CUL	3428.12	12-12-91	10:37	448.05	0.00	448.05	136.57	2980.07	908.33



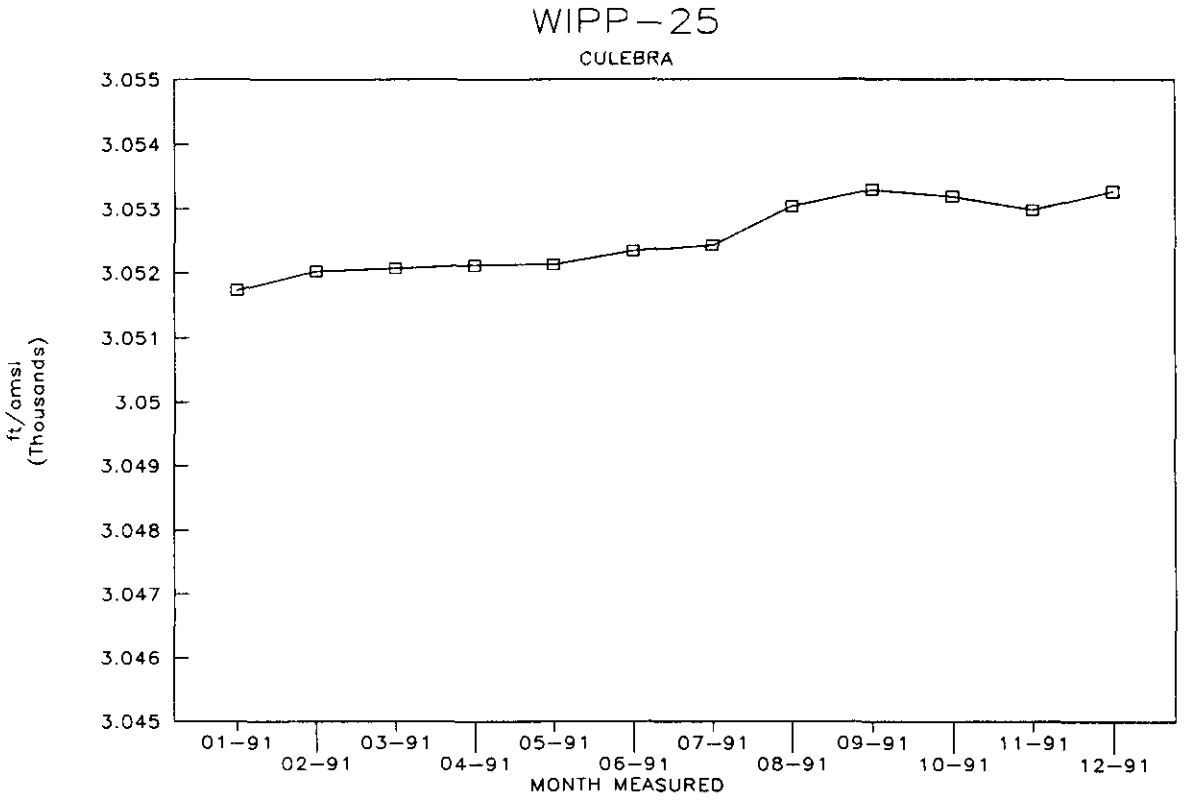
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
WIPP-25 (ANNULUS)	MAG	3214.39	01-16-91	15:40	161.34	0.00	161.34	49.18	3053.05	930.57
WIPP-25 (ANNULUS)	MAG	3214.39	02-13-91	08:10	161.27	0.00	161.27	49.16	3053.12	930.59
WIPP-25 (ANNULUS)	MAG	3214.39	03-12-91	17:34	161.20	0.00	161.20	49.13	3053.19	930.61
WIPP-25 (ANNULUS)	MAG	3214.39	04-18-91	06:44	161.12	0.00	161.12	49.11	3053.27	930.64
WIPP-25 (ANNULUS)	MAG	3214.39	05-14-91	11:45	161.05	0.00	161.05	49.09	3053.34	930.66
WIPP-25 (ANNULUS)	MAG	3214.39	06-17-91	17:50	160.96	0.00	160.96	49.06	3053.43	930.69
WIPP-25 (ANNULUS)	MAG	3214.39	07-15-91	16:30	160.90	0.00	160.90	49.04	3053.49	930.70
WIPP-25 (ANNULUS)	MAG	3214.39	08-13-91	16:42	160.75	0.00	160.75	49.00	3053.64	930.75
WIPP-25 (ANNULUS)	MAG	3214.39	09-23-91	16:32	160.47	0.00	160.47	48.91	3053.92	930.83
WIPP-25 (ANNULUS)	MAG	3214.39	10-14-91	15:40	160.31	0.00	160.31	48.86	3054.08	930.88
WIPP-25 (ANNULUS)	MAG	3214.39	11-21-91	09:00	160.14	0.00	160.14	48.81	3054.25	930.94
WIPP-25 (ANNULUS)	MAG	3214.39	12-11-91	15:15	160.05	0.00	160.05	48.78	3054.34	930.96



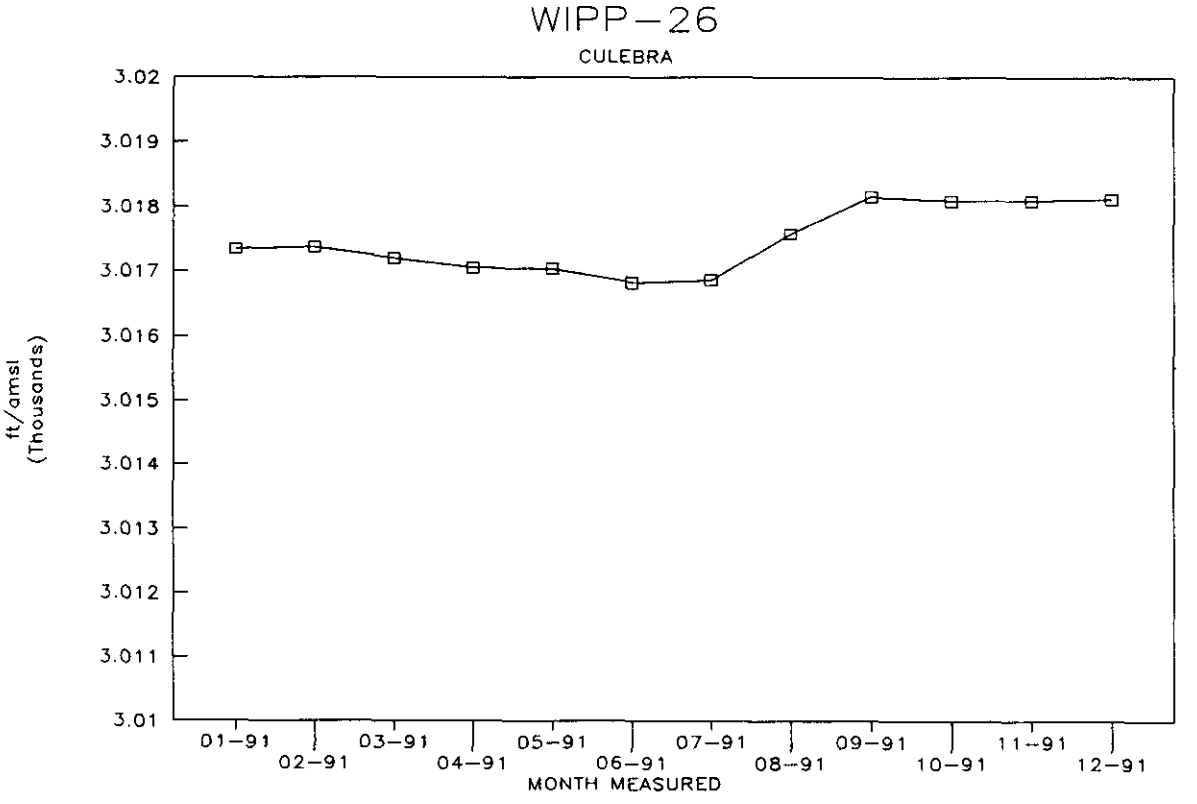
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
WIPP-25 (PIP)	CUL	3214.39	01-16-91	15:33	163.07	0.42	162.65	49.58	3051.74	930.17
WIPP-25 (PIP)	CUL	3214.39	02-13-91	08:00	162.78	0.42	162.36	49.49	3052.03	930.26
WIPP-25 (PIP)	CUL	3214.39	03-12-91	17:30	162.74	0.42	162.32	49.48	3052.07	930.27
WIPP-25 (PIP)	CUL	3214.39	04-18-91	06:40	162.69	0.42	162.27	49.46	3052.12	930.29
WIPP-25 (PIP)	CUL	3214.39	05-14-91	11:35	162.68	0.42	162.26	49.46	3052.13	930.29
WIPP-25 (PIP)	CUL	3214.39	06-17-91	17:56	162.47	0.42	162.05	49.39	3052.34	930.35
WIPP-25 (PIP)	CUL	3214.39	07-15-91	16:22	162.38	0.42	161.96	49.37	3052.43	930.38
WIPP-25 (PIP)	CUL	3214.39	08-13-91	16:38	161.78	0.42	161.36	49.18	3053.03	930.56
WIPP-25 (PIP)	CUL	3214.39	09-23-91	15:28	161.51	0.42	161.09	49.10	3053.30	930.65
WIPP-25 (PIP)	CUL	3214.39	10-14-91	15:36	161.62	0.42	161.20	49.13	3053.19	930.61
WIPP-25 (PIP)	CUL	3214.39	11-21-91	08:55	161.83	0.42	161.41	49.20	3052.98	930.55
WIPP-25 (PIP)	CUL	3214.39	12-11-91	15:08	161.54	0.42	161.12	49.11	3053.27	930.64



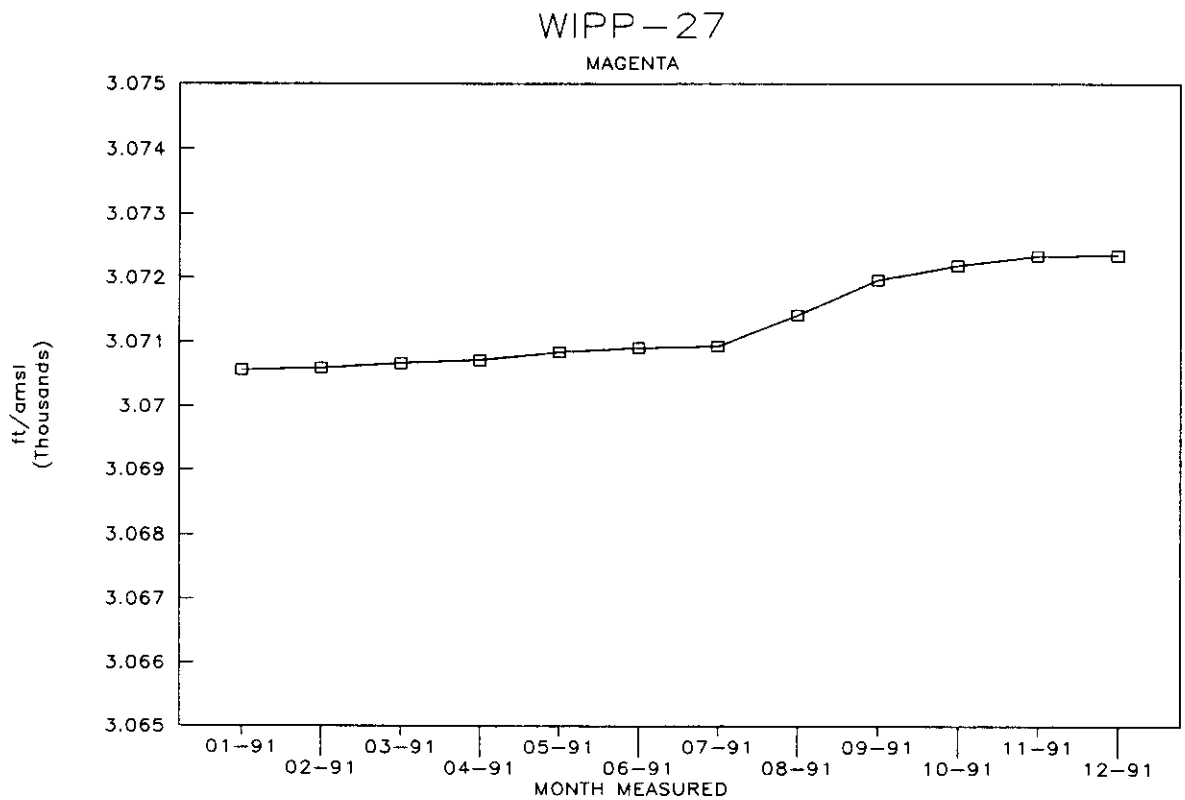
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
WIPP-26	CUL	3153.20	01-15-91	07:10	135.86	0.00	135.86	41.41	3017.34	919.69
WIPP-26	CUL	3153.20	02-12-91	07:05	135.83	0.00	135.83	41.40	3017.37	919.69
WIPP-26	CUL	3153.20	03-12-91	06:32	136.00	0.00	136.00	41.45	3017.20	919.64
WIPP-26	CUL	3153.20	04-17-91	06:46	136.15	0.00	136.15	41.50	3017.05	919.60
WIPP-26	CUL	3153.20	05-15-91	06:20	136.16	0.00	136.16	41.50	3017.04	919.59
WIPP-26	CUL	3153.20	06-19-91	06:16	136.38	0.00	136.38	41.57	3016.82	919.53
WIPP-26	CUL	3153.20	07-16-91	06:20	136.34	0.00	136.34	41.56	3016.86	919.54
WIPP-26	CUL	3153.20	08-13-91	07:02	135.62	0.00	135.62	41.34	3017.58	919.76
WIPP-26	CUL	3153.20	09-25-91	15:30	135.05	0.00	135.05	41.16	3018.15	919.93
WIPP-26	CUL	3153.20	10-15-91	07:30	135.11	0.00	135.11	41.18	3018.09	919.91
WIPP-26	CUL	3153.20	11-21-91	08:21	135.11	0.00	135.11	41.18	3018.09	919.91
WIPP-26	CUL	3153.20	12-11-91	07:30	135.08	0.00	135.08	41.17	3018.12	919.92



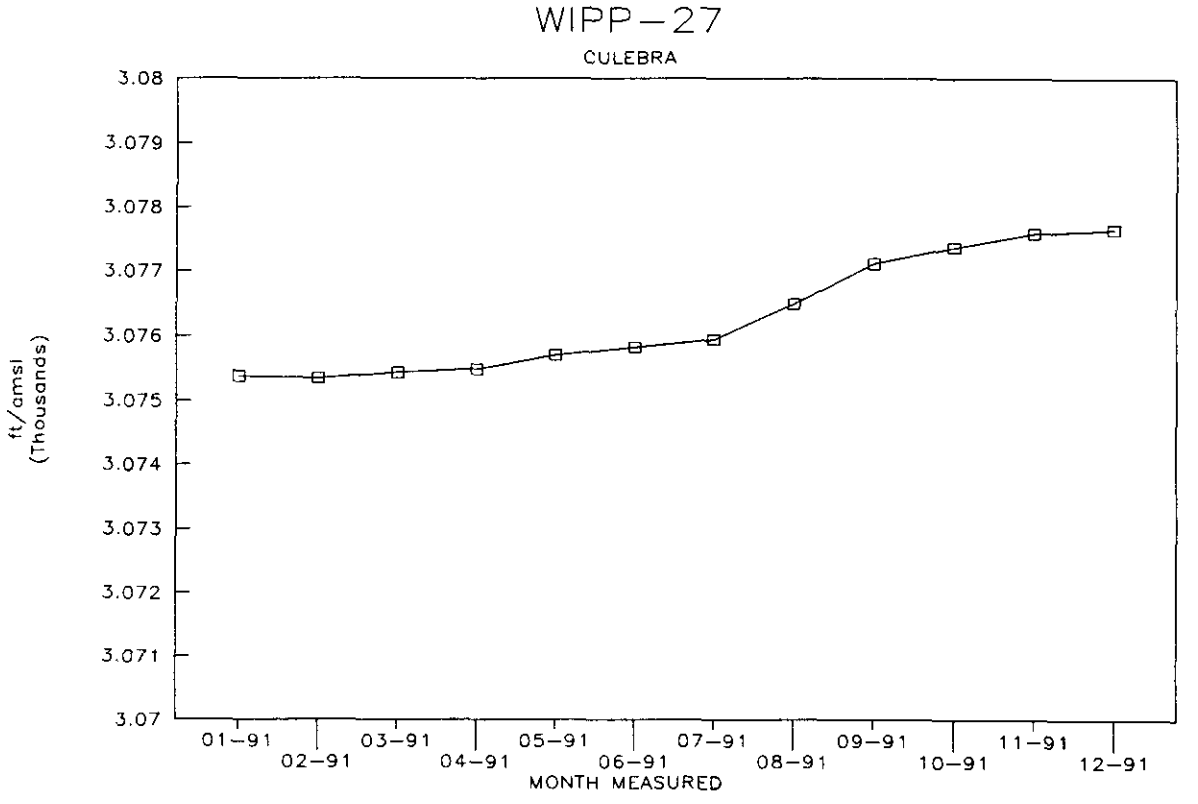
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
WIPP-27 (ANNULUS)	MAG	3178.98	01-14-91	07:06	108.42	0.00	108.42	33.05	3070.56	935.91
WIPP-27 (ANNULUS)	MAG	3178.98	02-11-91	06:55	108.39	0.00	108.39	33.04	3070.59	935.92
WIPP-27 (ANNULUS)	MAG	3178.98	03-11-91	06:42	108.31	0.00	108.31	33.01	3070.67	935.94
WIPP-27 (ANNULUS)	MAG	3178.98	04-16-91	06:40	108.26	0.00	108.26	33.00	3070.72	935.96
WIPP-27 (ANNULUS)	MAG	3178.98	05-14-91	06:24	108.14	0.00	108.14	32.96	3070.84	935.99
WIPP-27 (ANNULUS)	MAG	3178.98	06-18-91	06:05	108.07	0.00	108.07	32.94	3070.91	936.01
WIPP-27 (ANNULUS)	MAG	3178.98	07-15-91	06:22	108.05	0.00	108.05	32.93	3070.93	936.02
WIPP-27 (ANNULUS)	MAG	3178.98	08-12-91	06:19	107.56	0.00	107.56	32.78	3071.42	936.17
WIPP-27 (ANNULUS)	MAG	3178.98	09-23-91	07:52	107.02	0.00	107.02	32.62	3071.96	936.33
WIPP-27 (ANNULUS)	MAG	3178.98	10-14-91	08:04	106.79	0.00	106.79	32.55	3072.19	936.40
WIPP-27 (ANNULUS)	MAG	3178.98	11-19-91	07:36	106.64	0.00	106.64	32.50	3072.34	936.45
WIPP-27 (ANNULUS)	MAG	3178.98	12-09-91	07:48	106.63	0.00	106.63	32.50	3072.35	936.45



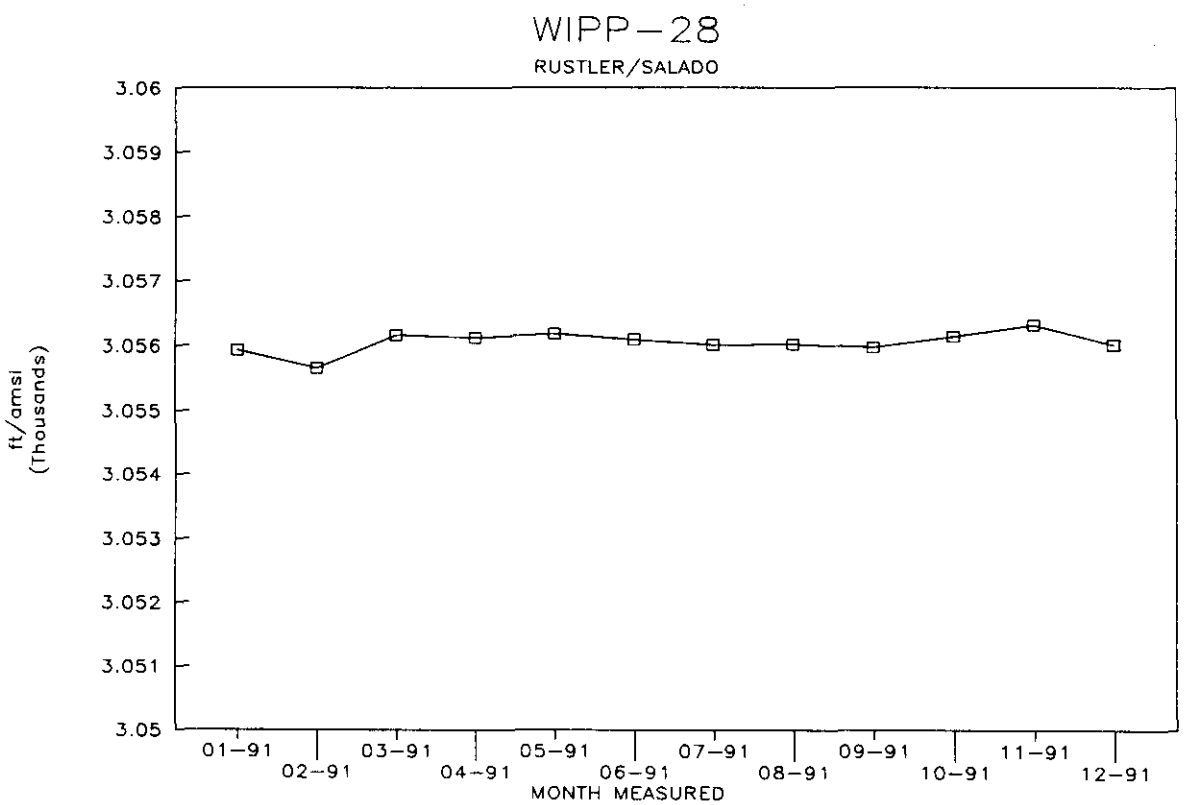
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
WIPP-27 (PIP)	CUL	3178.98	01-14-91	07:00	104.03	0.42	103.61	31.58	3075.37	937.37
WIPP-27 (PIP)	CUL	3178.98	02-11-91	06:47	104.06	0.42	103.64	31.59	3075.34	937.36
WIPP-27 (PIP)	CUL	3178.98	03-11-91	06:38	103.97	0.42	103.55	31.56	3075.43	937.39
WIPP-27 (PIP)	CUL	3178.98	04-16-91	06:35	103.92	0.42	103.50	31.55	3075.48	937.41
WIPP-27 (PIP)	CUL	3178.98	05-14-91	06:22	103.70	0.42	103.28	31.48	3075.70	937.47
WIPP-27 (PIP)	CUL	3178.98	06-18-91	06:00	103.58	0.42	103.16	31.44	3075.82	937.51
WIPP-27 (PIP)	CUL	3178.98	07-15-91	06:19	103.46	0.42	103.04	31.41	3075.94	937.55
WIPP-27 (PIP)	CUL	3178.98	08-12-91	06:15	102.91	0.42	102.49	31.24	3076.49	937.71
WIPP-27 (PIP)	CUL	3178.98	09-23-91	07:50	102.28	0.42	101.86	31.05	3077.12	937.91
WIPP-27 (PIP)	CUL	3178.98	10-14-91	08:00	102.03	0.42	101.61	30.97	3077.37	937.98
WIPP-27 (PIP)	CUL	3178.98	11-19-91	07:30	101.81	0.42	101.39	30.90	3077.59	938.05
WIPP-27 (PIP)	CUL	3178.98	12-09-91	07:45	101.75	0.42	101.33	30.89	3077.65	938.07



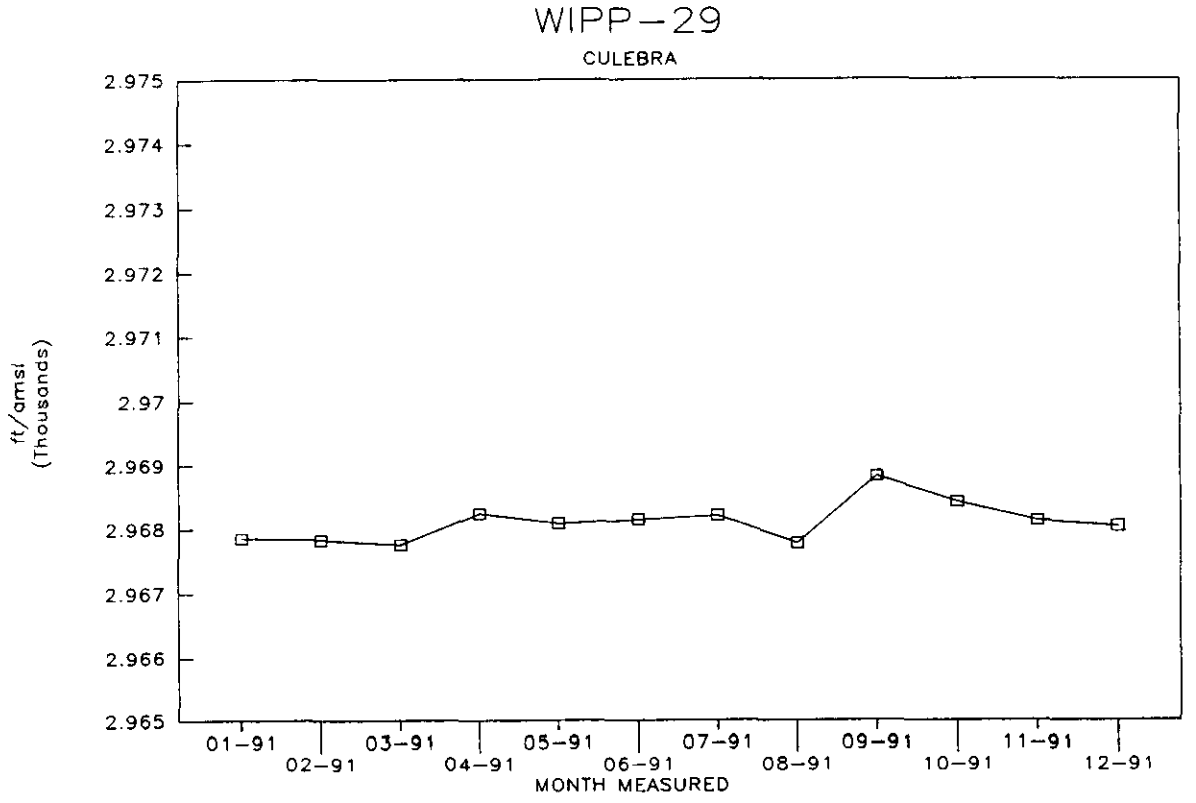
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
WIPP-28 (PIP)	RUS/SAL	3349.21	01-14-91	09:25	293.70	0.42	293.28	89.39	3055.93	931.45
WIPP-28 (PIP)	RUS/SAL	3349.21	02-11-91	07:45	293.98	0.42	293.56	89.48	3055.65	931.36
WIPP-28 (PIP)	RUS/SAL	3349.21	03-11-91	08:10	293.47	0.42	293.05	89.32	3056.16	931.52
WIPP-28 (PIP)	RUS/SAL	3349.21	04-16-91	07:42	293.51	0.42	293.09	89.33	3056.12	931.51
WIPP-28 (PIP)	RUS/SAL	3349.21	05-14-91	07:48	293.45	0.42	293.03	89.32	3056.18	931.52
WIPP-28 (PIP)	RUS/SAL	3349.21	06-18-91	08:20	293.54	0.42	293.12	89.34	3056.09	931.50
WIPP-28 (PIP)	RUS/SAL	3349.21	07-15-91	07:28	293.62	0.42	293.20	89.37	3056.01	931.47
WIPP-28 (PIP)	RUS/SAL	3349.21	08-12-91	08:33	293.61	0.42	293.19	89.36	3056.02	931.47
WIPP-28 (PIP)	RUS/SAL	3349.21	09-23-91	09:18	293.66	0.42	293.24	89.38	3055.97	931.46
WIPP-28 (PIP)	RUS/SAL	3349.21	10-14-91	10:00	293.49	0.42	293.07	89.33	3056.14	931.51
WIPP-28 (PIP)	RUS/SAL	3349.21	11-19-91	08:40	293.31	0.42	292.89	89.27	3056.32	931.57
WIPP-28 (PIP)	RUS/SAL	3349.21	12-09-91	12:14	293.62	0.42	293.20	89.37	3056.01	931.47



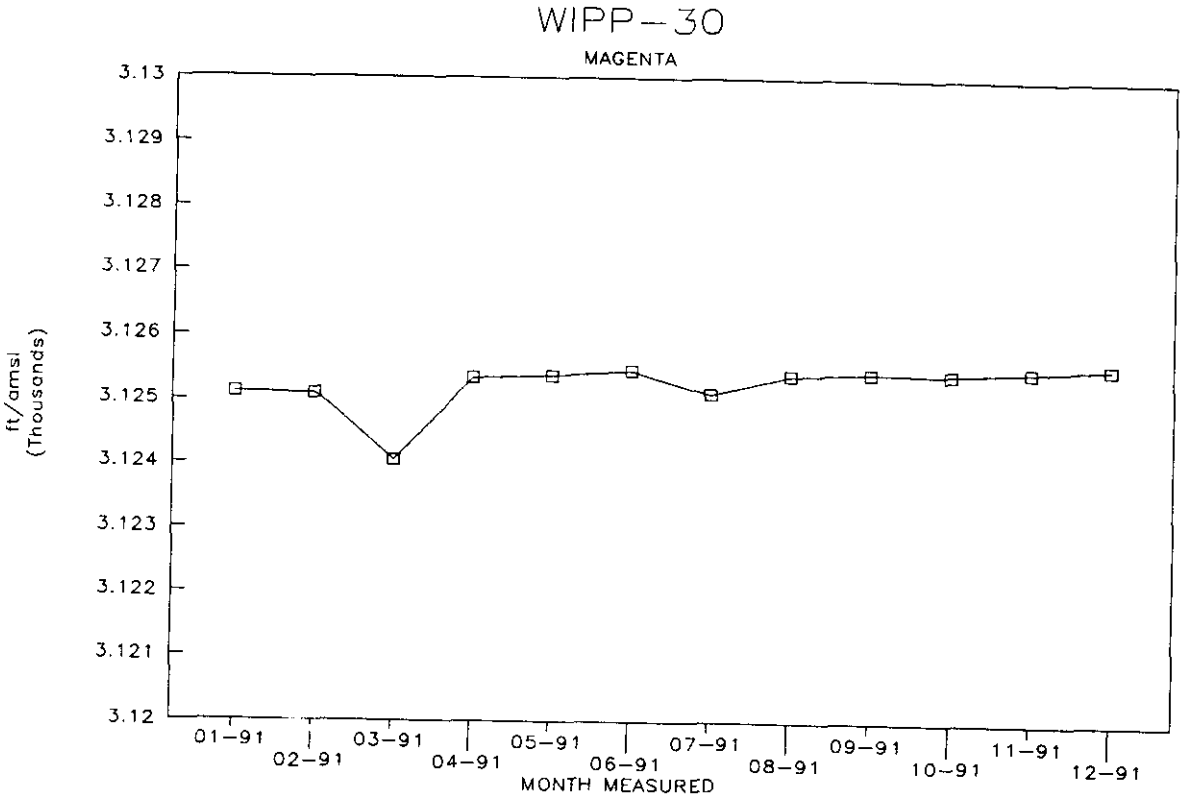
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
WIPP-29	CUL	2978.26	01-15-91	06:35	10.41	0.00	10.41	3.17	2967.85	904.60
WIPP-29	CUL	2978.26	02-12-91	06:40	10.43	0.00	10.43	3.18	2967.83	904.59
WIPP-29	CUL	2978.26	03-12-91	06:00	10.51	0.00	10.51	3.20	2967.75	904.57
WIPP-29	CUL	2978.26	04-17-91	06:11	10.02	0.00	10.02	3.05	2968.24	904.72
WIPP-29	CUL	2978.26	05-15-91	05:52	10.18	0.00	10.18	3.10	2968.08	904.67
WIPP-29	CUL	2978.26	06-19-91	05:50	10.12	0.00	10.12	3.08	2968.14	904.69
WIPP-29	CUL	2978.26	07-16-91	05:49	10.06	0.00	10.06	3.07	2968.20	904.71
WIPP-29	CUL	2978.26	08-13-91	05:50	10.49	0.00	10.49	3.20	2967.77	904.58
WIPP-29	CUL	2978.26	09-25-91	15:58	9.44	0.00	9.44	2.88	2968.82	904.90
WIPP-29	CUL	2978.26	10-15-91	15:30	9.84	0.00	9.84	3.00	2968.42	904.77
WIPP-29	CUL	2978.26	11-21-91	07:28	10.14	0.00	10.14	3.09	2968.12	904.68
WIPP-29	CUL	2978.26	12-10-91	15:58	10.23	0.00	10.23	3.12	2968.03	904.66



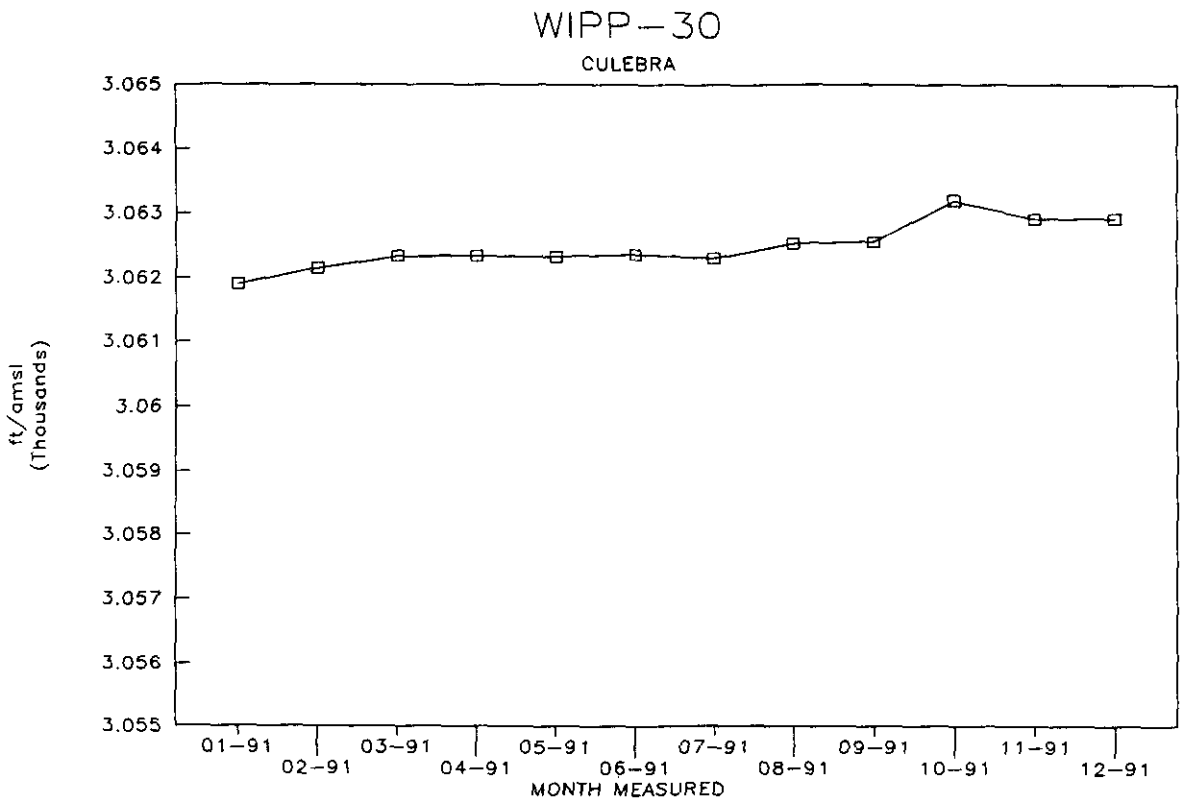
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
WIPP-30 (ANNULUS)	MAG	3429.05	01-16-91	15:08	303.94	0.00	303.94	92.64	3125.11	952.53
WIPP-30 (ANNULUS)	MAG	3429.05	02-13-91	08:40	303.96	0.00	303.96	92.65	3125.09	952.53
WIPP-30 (ANNULUS)	MAG	3429.05	03-12-91	17:05	305.00	0.00	305.00	92.96	3124.05	952.21
WIPP-30 (ANNULUS)	MAG	3429.05	04-16-91	11:46	303.70	0.00	303.70	92.57	3125.35	952.61
WIPP-30 (ANNULUS)	MAG	3429.05	05-14-91	10:56	303.67	0.00	303.67	92.56	3125.38	952.62
WIPP-30 (ANNULUS)	MAG	3429.05	06-17-91	17:19	303.58	0.00	303.58	92.53	3125.47	952.64
WIPP-30 (ANNULUS)	MAG	3429.05	07-15-91	15:38	303.94	0.00	303.94	92.64	3125.11	952.53
WIPP-30 (ANNULUS)	MAG	3429.05	08-13-91	16:00	303.64	0.00	303.64	92.55	3125.41	952.62
WIPP-30 (ANNULUS)	MAG	3429.05	09-23-91	13:07	303.61	0.00	303.61	92.54	3125.44	952.63
WIPP-30 (ANNULUS)	MAG	3429.05	10-15-91	08:53	303.62	0.00	303.62	92.54	3125.43	952.63
WIPP-30 (ANNULUS)	MAG	3429.05	11-20-91	15:30	303.56	0.00	303.56	92.53	3125.49	952.65
WIPP-30 (ANNULUS)	MAG	3429.05	12-09-91	14:09	303.50	0.00	303.50	92.51	3125.55	952.67



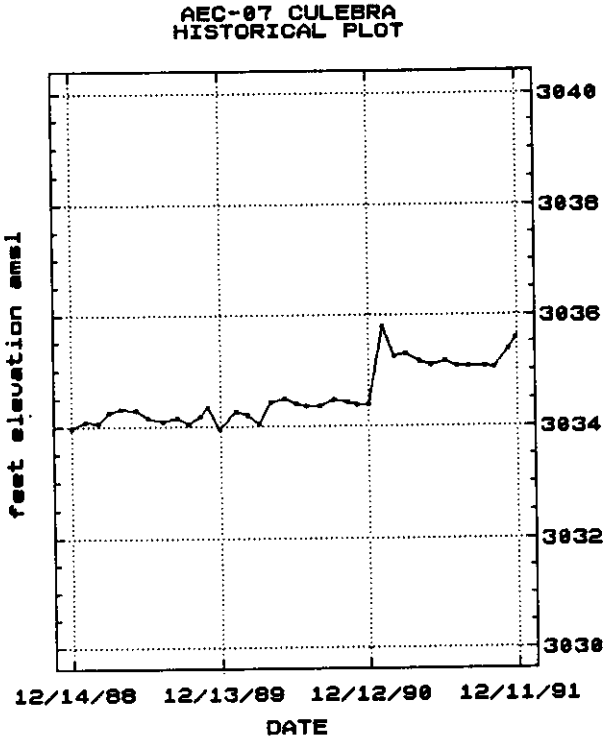
WATER LEVEL ELEVATION
DATA
CALENDAR YEAR 1991

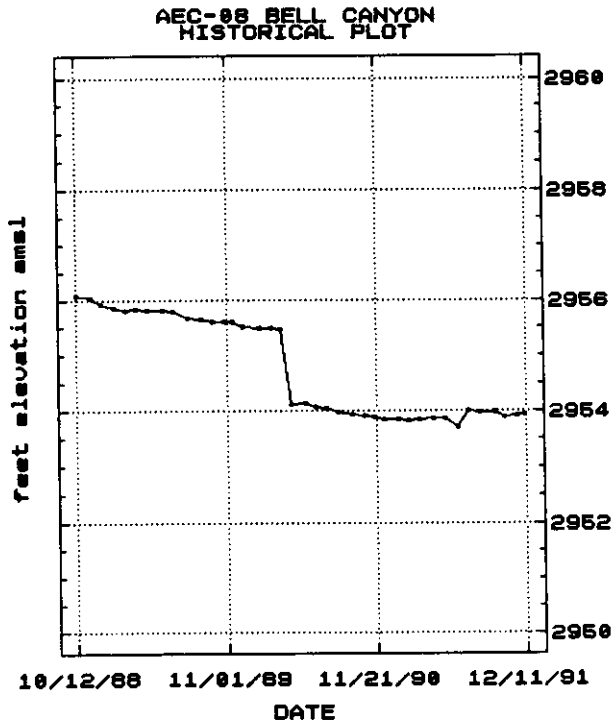
WELL NUMBER	ZONE	CASING ELEVATION ft amsl	DATE	TIME	DEPTH TO WATER	ADJUST TO TOC	ADJUSTED DEPTH TOC	ADJUSTED DEPTH METERS	WATER LEVEL ELEVATION	ELEVATION IN METERS
WIPP-30 (PIP)	CUL	3429.05	01-16-91	15:00	368.34	1.20	367.14	111.90	3061.91	933.27
WIPP-30 (PIP)	CUL	3429.05	02-13-91	08:30	368.09	1.20	366.89	111.83	3062.16	933.35
WIPP-30 (PIP)	CUL	3429.05	03-12-91	17:00	367.92	1.20	366.72	111.78	3062.33	933.40
WIPP-30 (PIP)	CUL	3429.05	04-16-91	11:30	367.91	1.20	366.71	111.77	3062.34	933.40
WIPP-30 (PIP)	CUL	3429.05	05-14-91	10:45	367.92	1.20	366.72	111.78	3062.33	933.40
WIPP-30 (PIP)	CUL	3429.05	06-17-91	17:23	367.89	1.20	366.69	111.77	3062.36	933.41
WIPP-30 (PIP)	CUL	3429.05	07-15-91	15:32	367.94	1.20	366.74	111.78	3062.31	933.39
WIPP-30 (PIP)	CUL	3429.05	08-13-91	15:53	367.72	1.20	366.52	111.72	3062.53	933.46
WIPP-30 (PIP)	CUL	3429.05	09-23-91	13:02	367.69	1.20	366.49	111.71	3062.56	933.47
WIPP-30 (PIP)	CUL	3429.05	10-15-91	08:43	367.06	1.20	365.86	111.51	3063.19	933.66
WIPP-30 (PIP)	CUL	3429.05	11-20-91	15:25	367.34	1.20	366.14	111.60	3062.91	933.57
WIPP-30 (PIP)	CUL	3429.05	12-09-91	13:58	367.33	1.20	366.13	111.60	3062.92	933.58

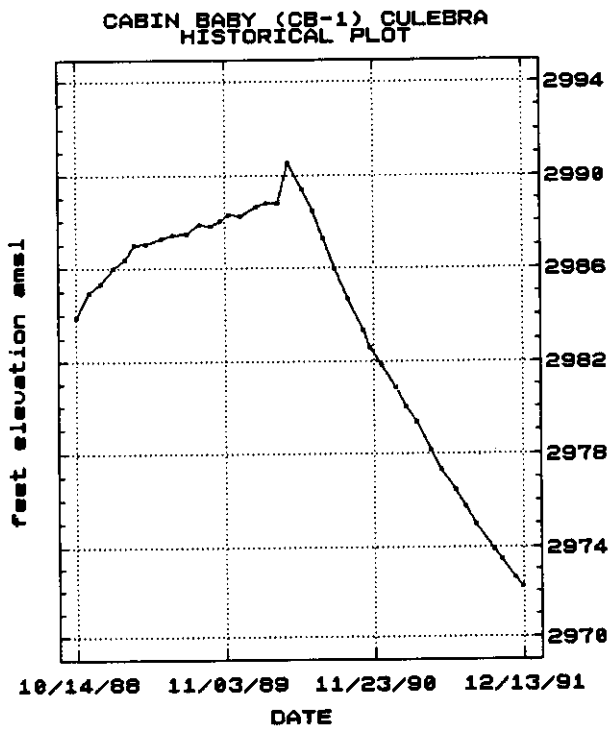


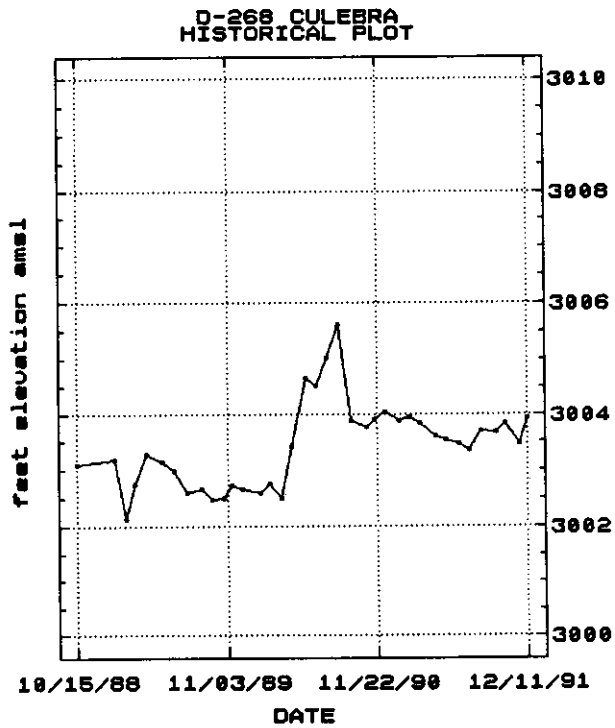
Appendix 13
Historical Groundwater Level Data

HISTORICAL GROUNDWATER LEVEL DATA

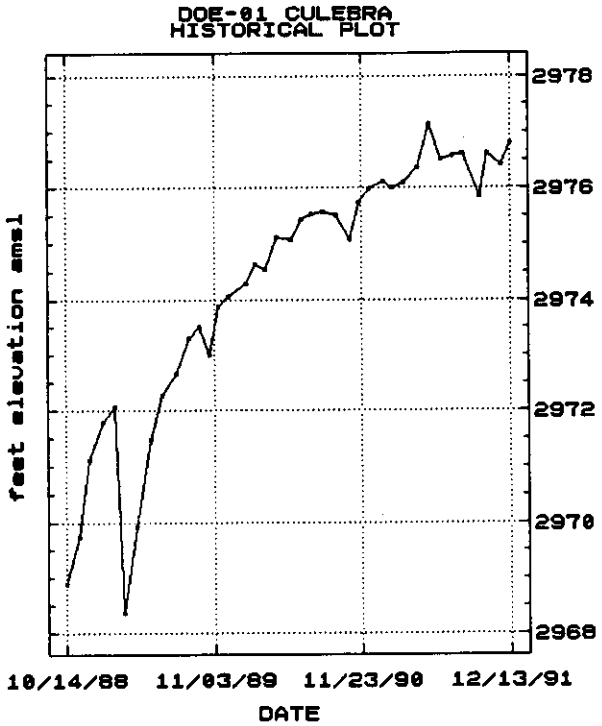


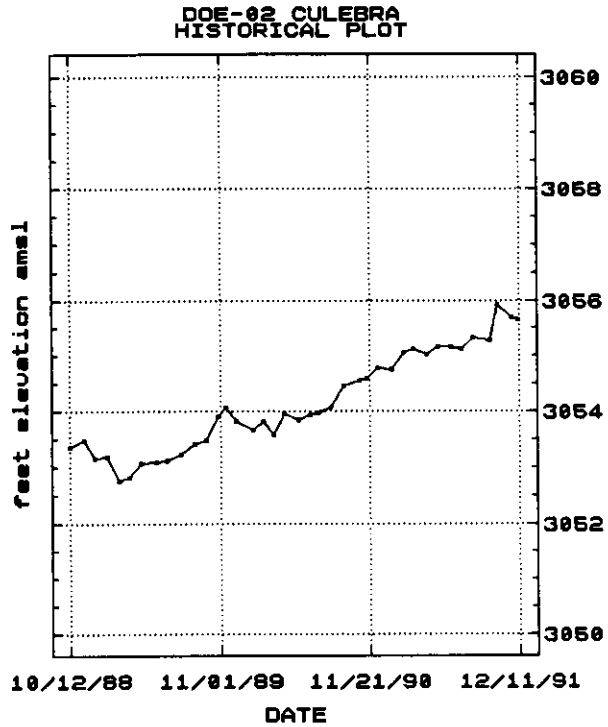


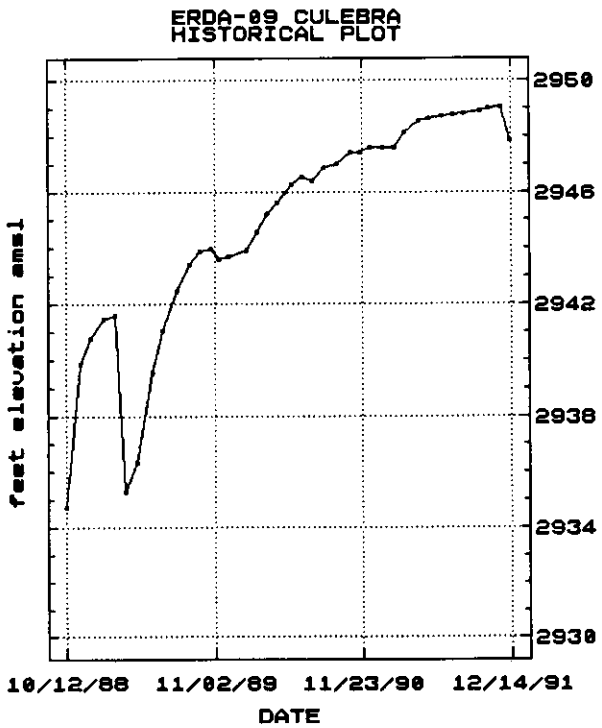


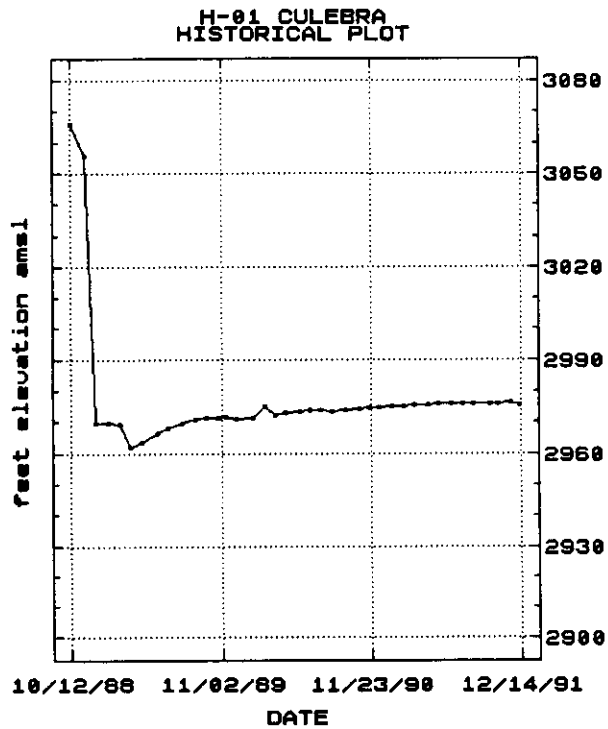


HISTORICAL GROUNDWATER LEVEL DATA

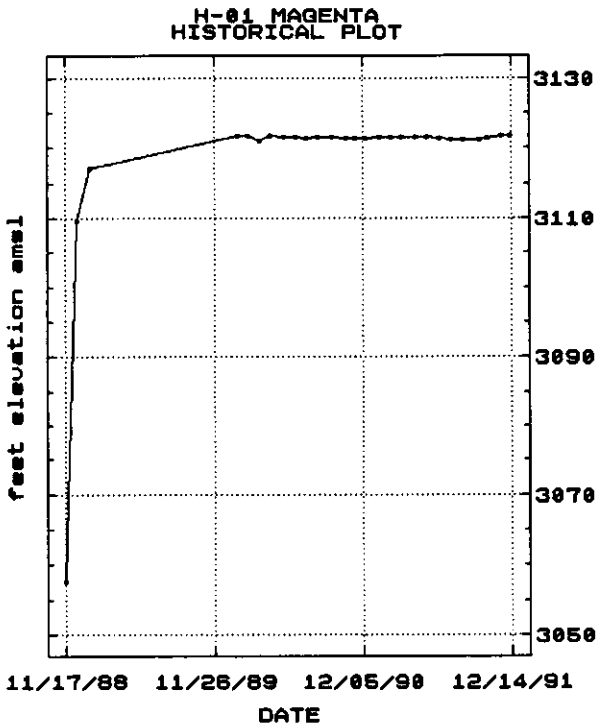


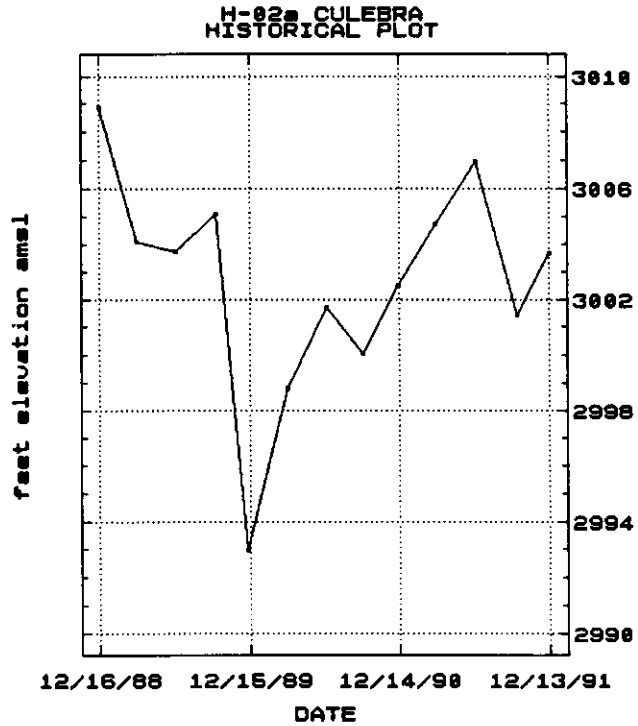


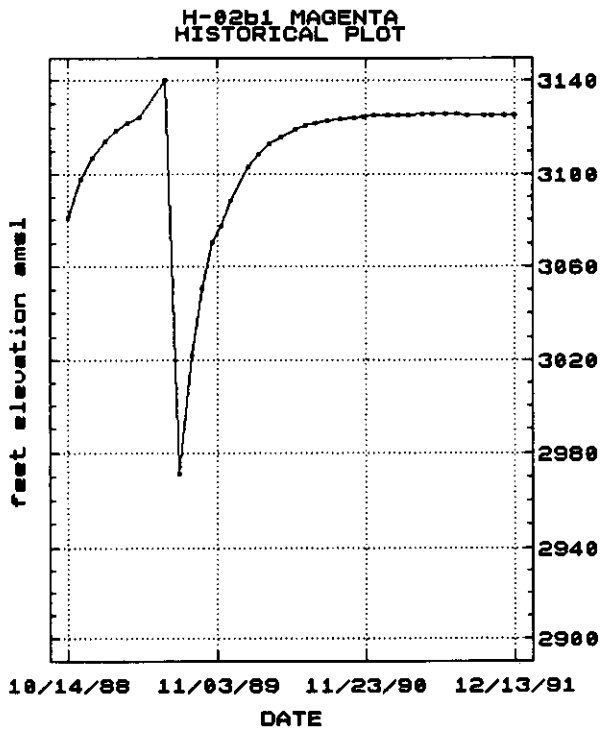


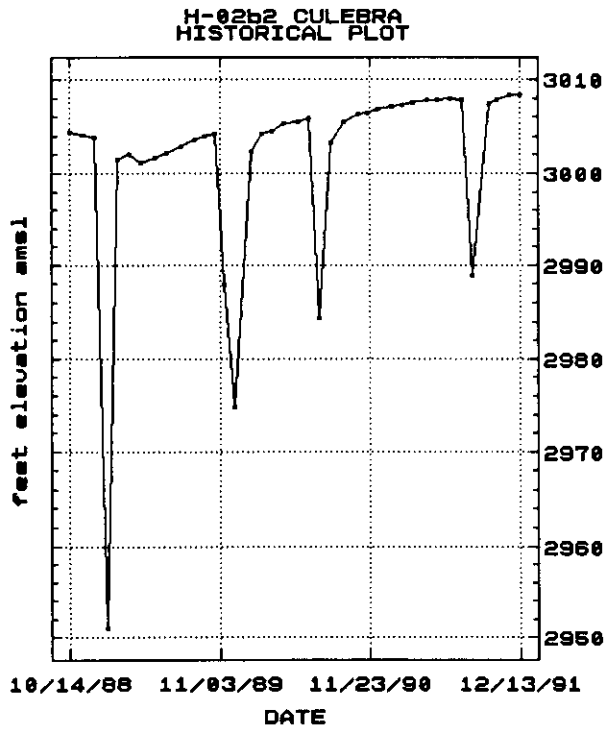


HISTORICAL GROUNDWATER LEVEL DATA

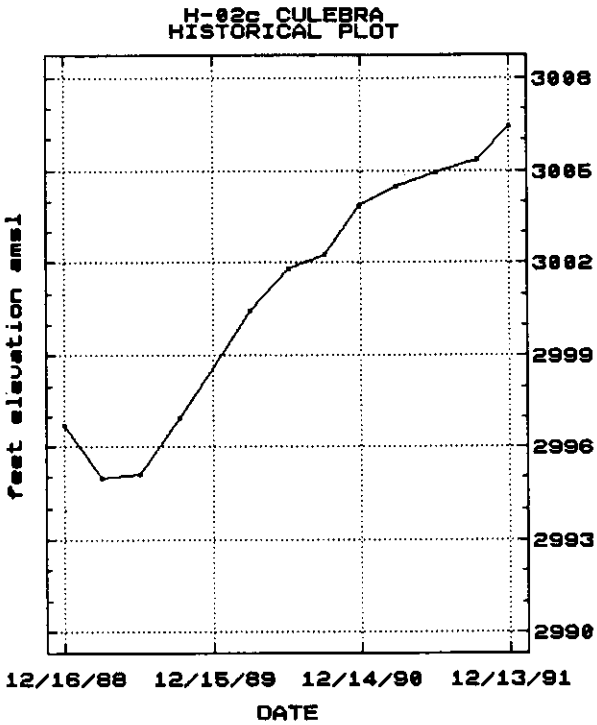


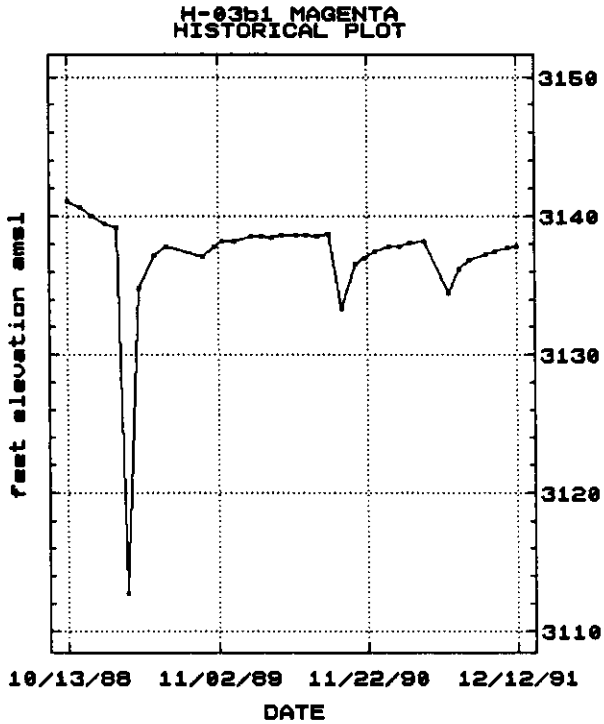


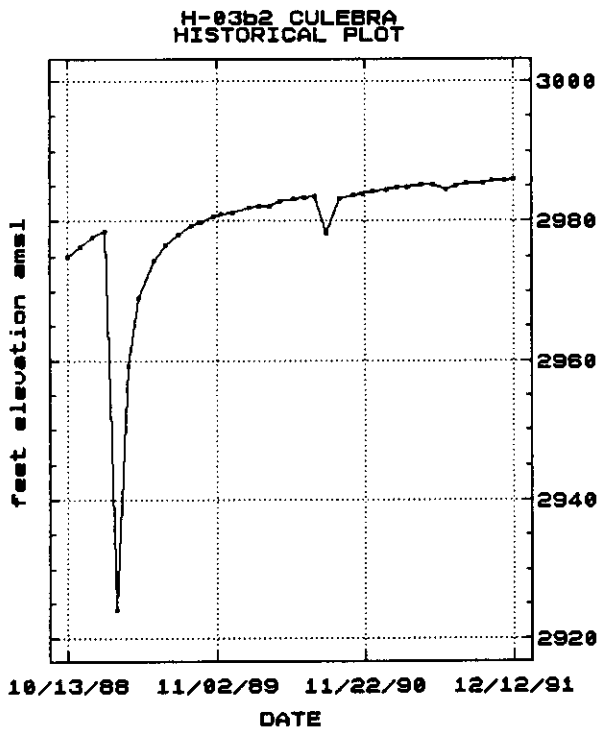


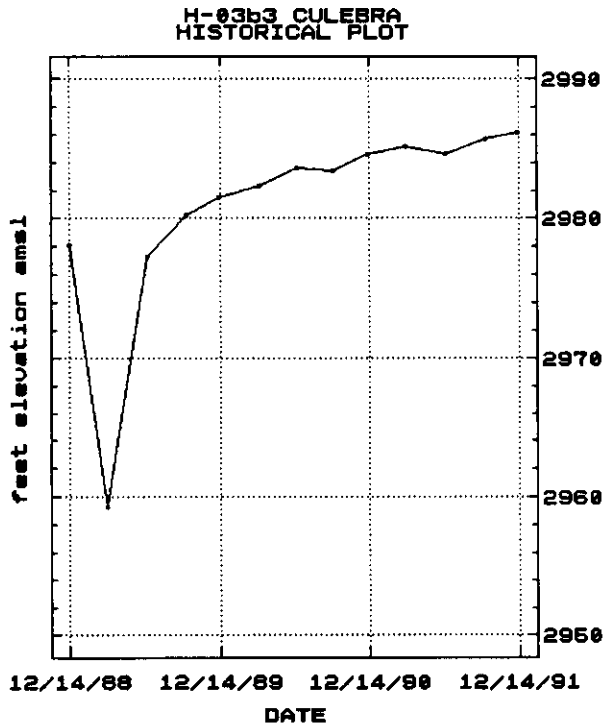


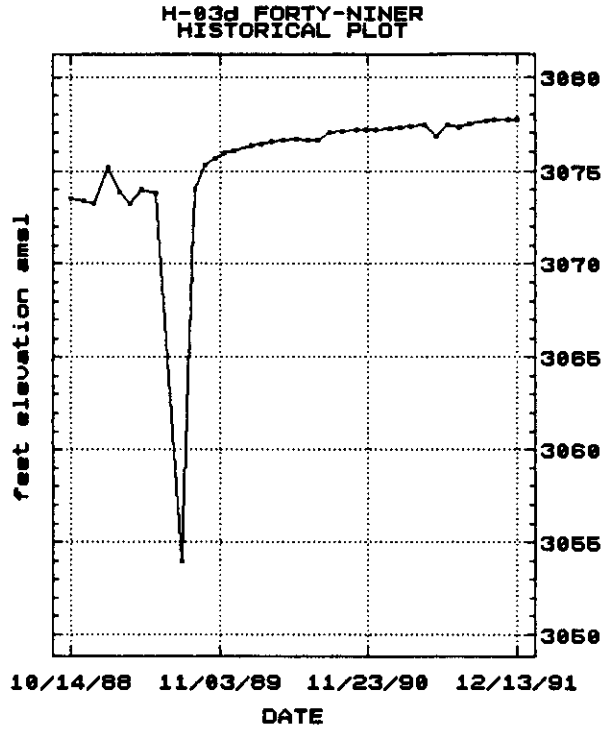
HISTORICAL GROUNDWATER LEVEL DATA

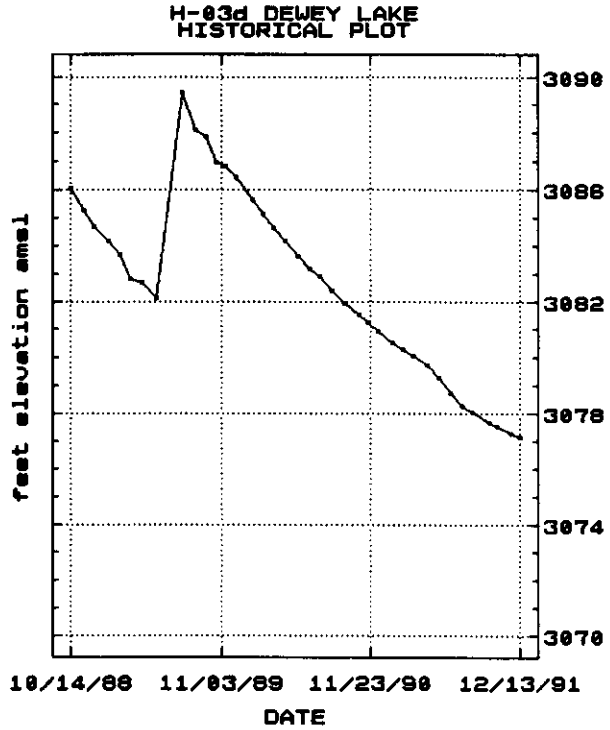









H-03d FORTY-NINER
HISTORICAL PLOT
feet elevation amsl
3080
3075
3070
3065
3060
3055
3050
10/14/88
11/03/89
11/23/90
12/13/91
DATE


H-03d DEWEY LAKE
HISTORICAL PLOT
feet elevation amsl
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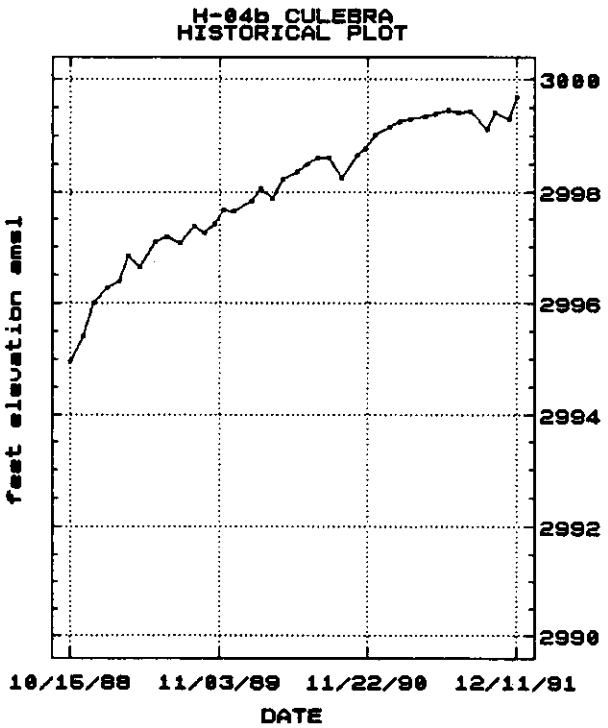
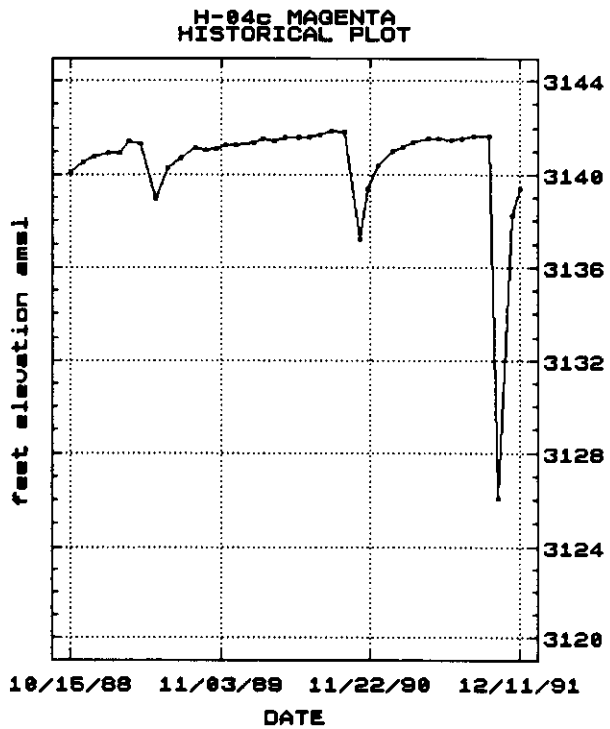
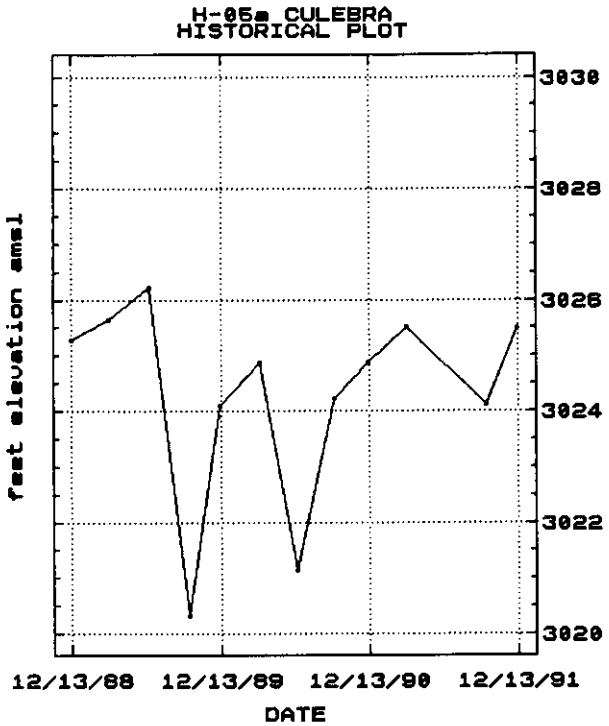
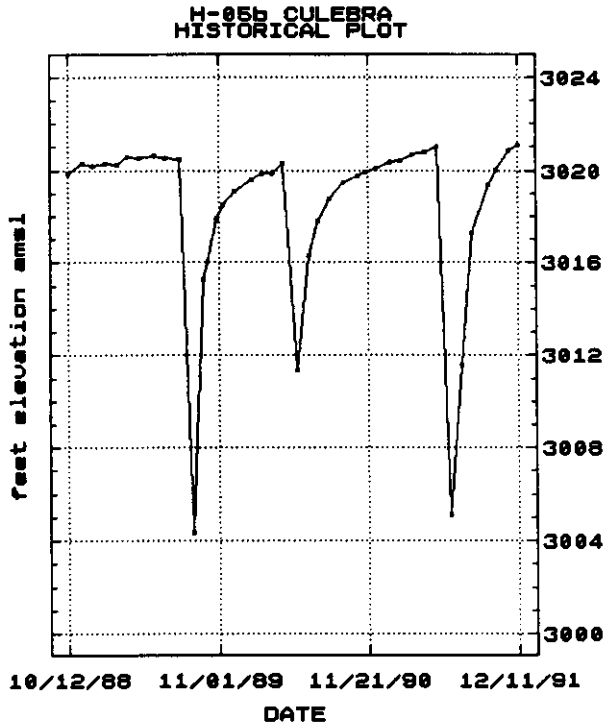
3086
3082
3078
3074
3070
10/14/88
11/03/89
11/23/90
12/13/91
DATE

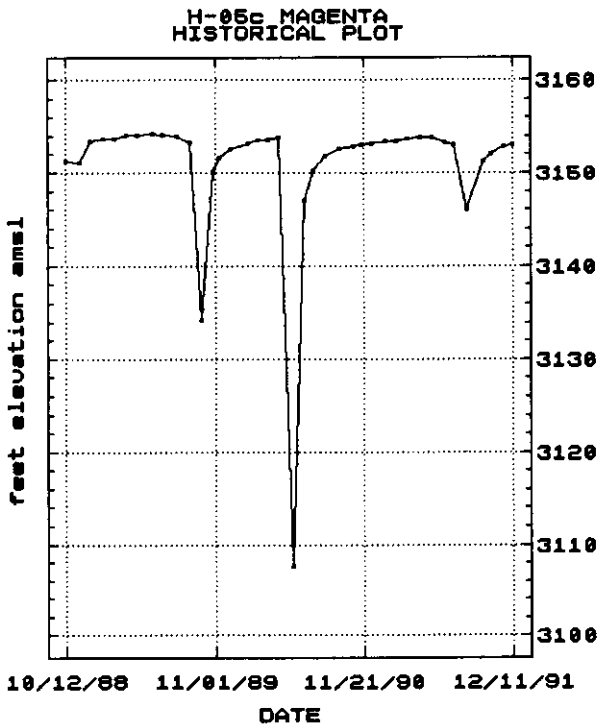

H-04b CULEBRA
HISTORICAL PLOT
feet elevation amsl
3000
2998
2996
2994
2992
2990
10/15/88
11/03/89
11/22/90
12/11/91
DATE

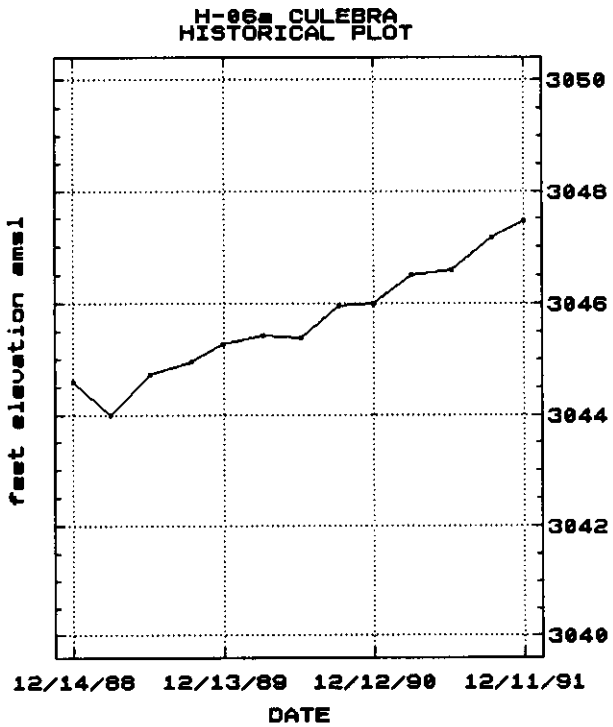

H-04c MAGENTA
HISTORICAL PLOT
feet elevation amsl
3144
3140
3136
3132
3128
3124
3120
10/15/88
11/03/89
11/22/90
12/11/91
DATE

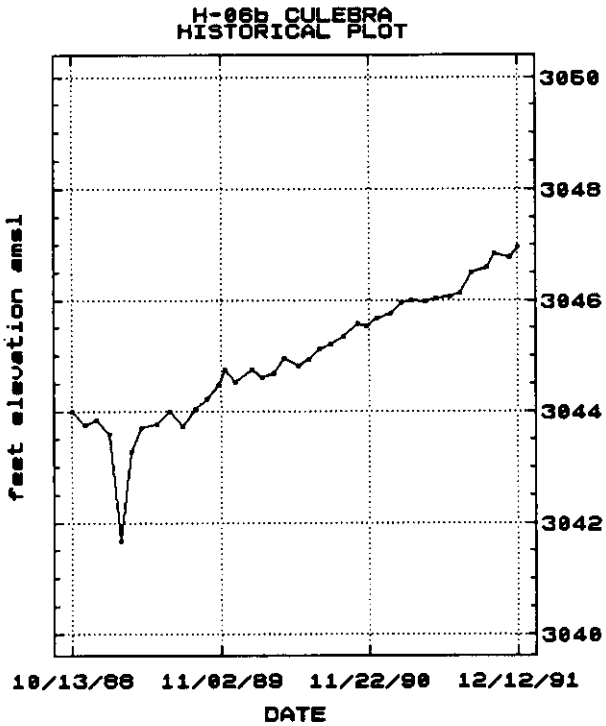
HISTORICAL GROUNDWATER LEVEL DATA

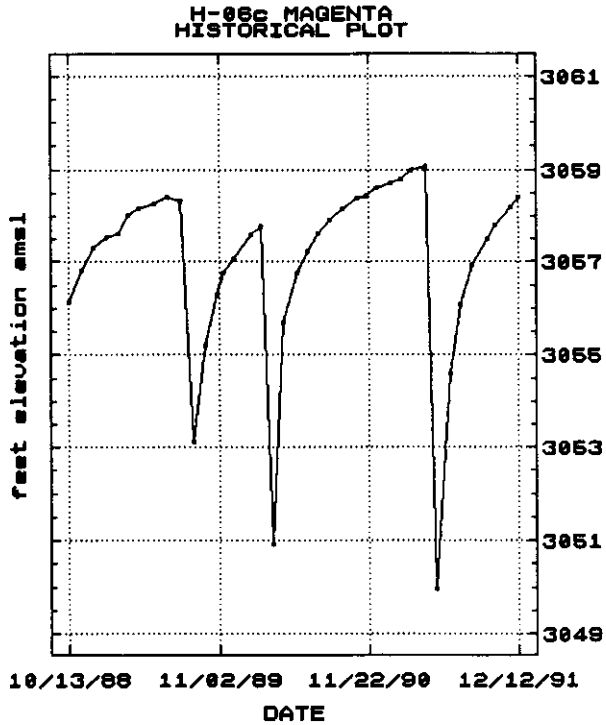


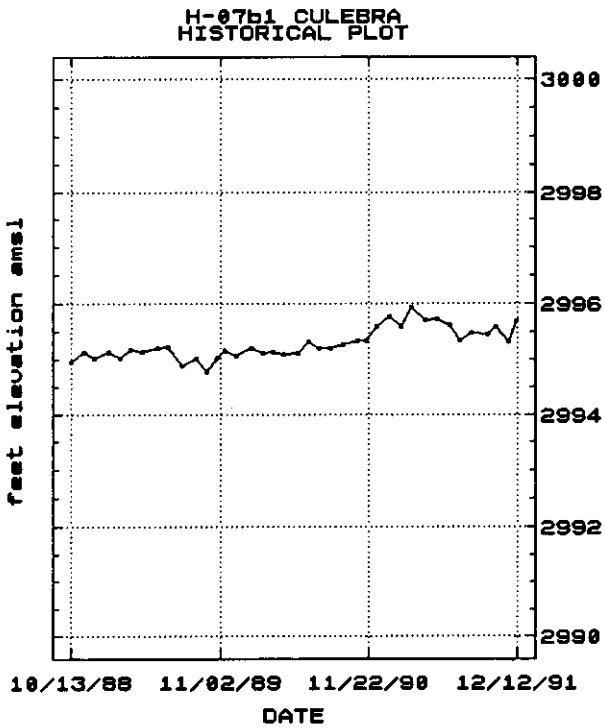


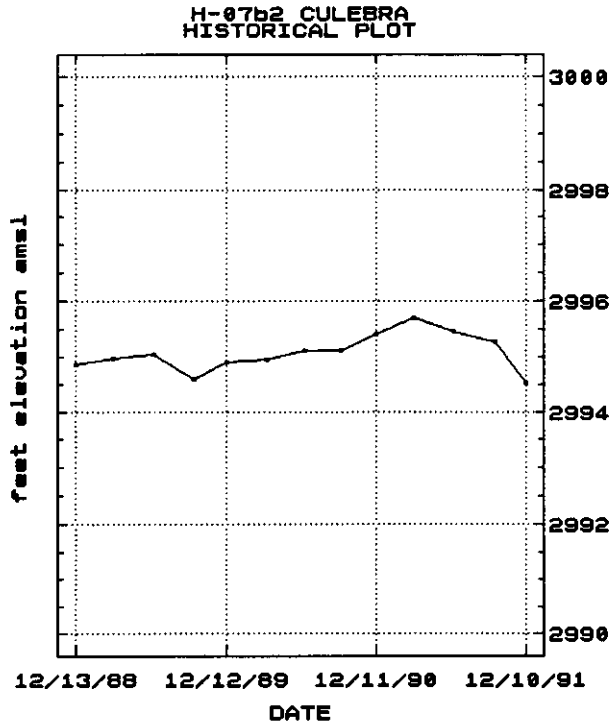




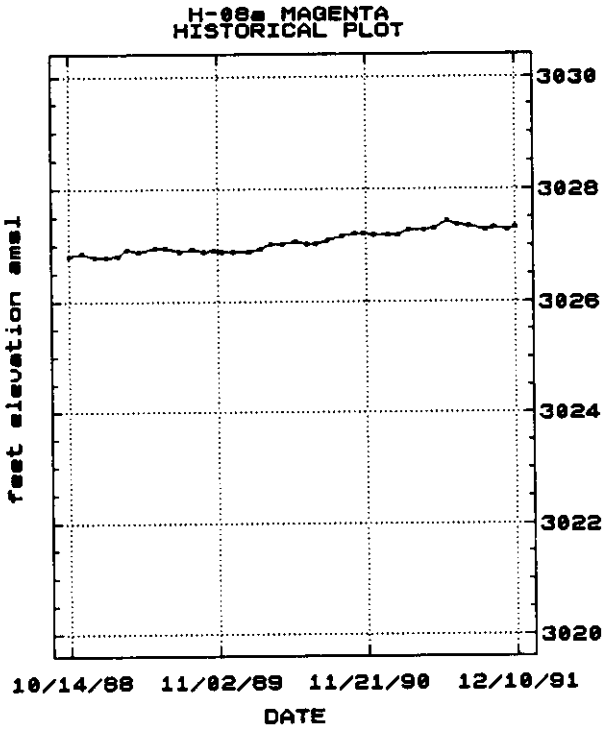

H-06b CULEBRA
HISTORICAL PLOT
feet elevation amsl
3050
3048
3046
3044
3042
3040
10/13/88
11/02/89
11/22/90
12/12/91
DATE

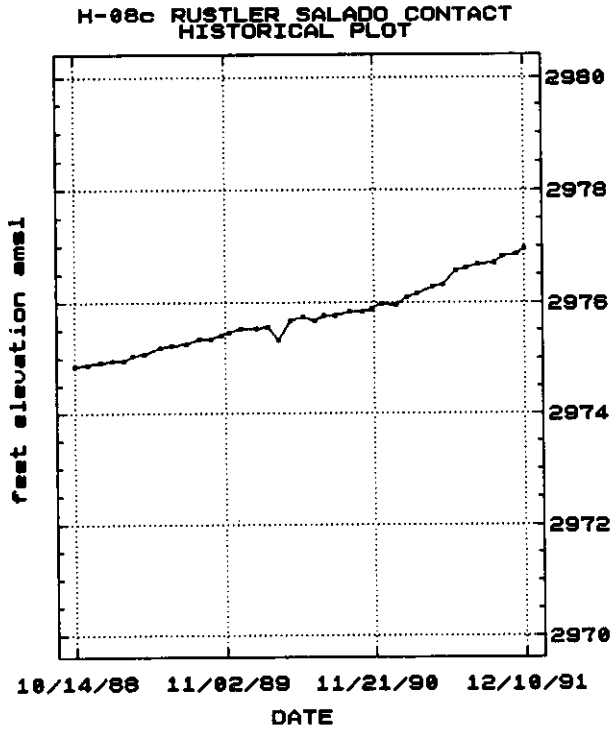

H-06c MAGENTA
HISTORICAL PLOT
feet elevation amsl
3061
3059
3057
3055
3053
3051
3049
10/13/88
11/02/89
11/22/90
12/12/91
DATE

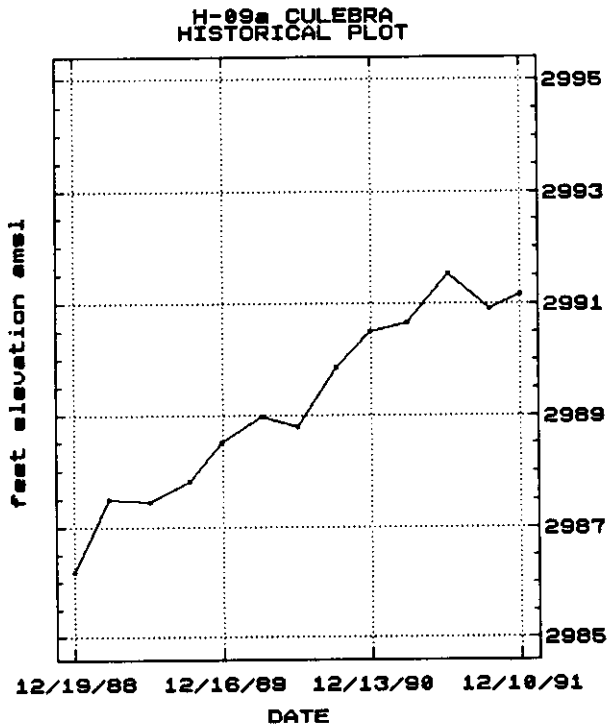

H-07b1 CULEBRA
HISTORICAL PLOT
feet elevation amsl
3000
2998
2996
2994
2992
2990
10/13/88
11/02/89
11/22/90
12/12/91
DATE

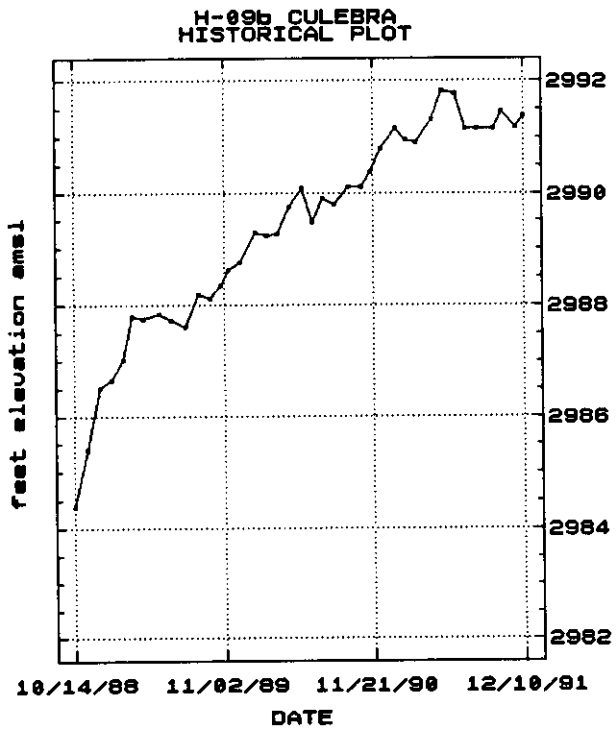

H-07b2 CULEBRA
HISTORICAL PLOT
feet elevation amsl
3000
2998
2996
2994
2992
2990
12/13/88
12/12/89
12/11/90
12/10/91
DATE

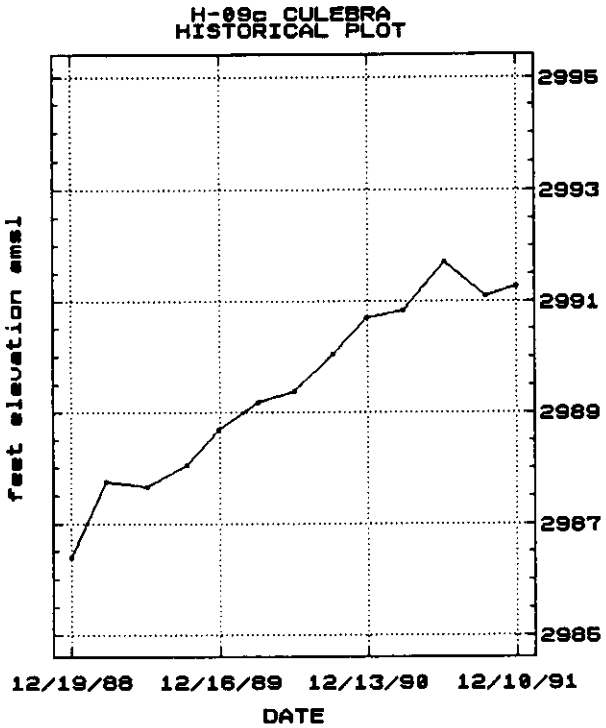
HISTORICAL GROUNDWATER LEVEL DATA

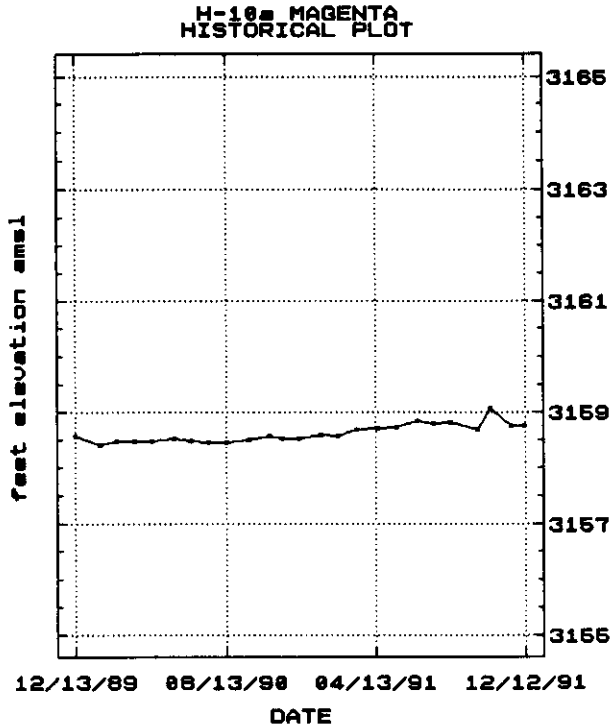


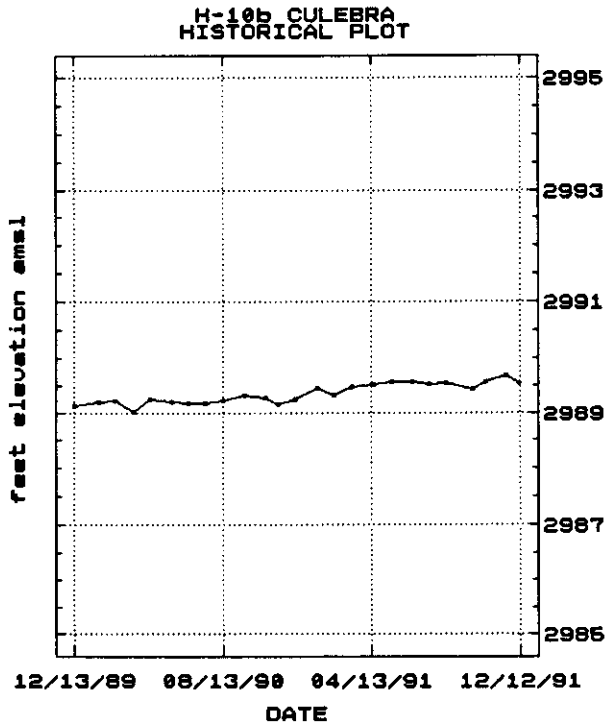


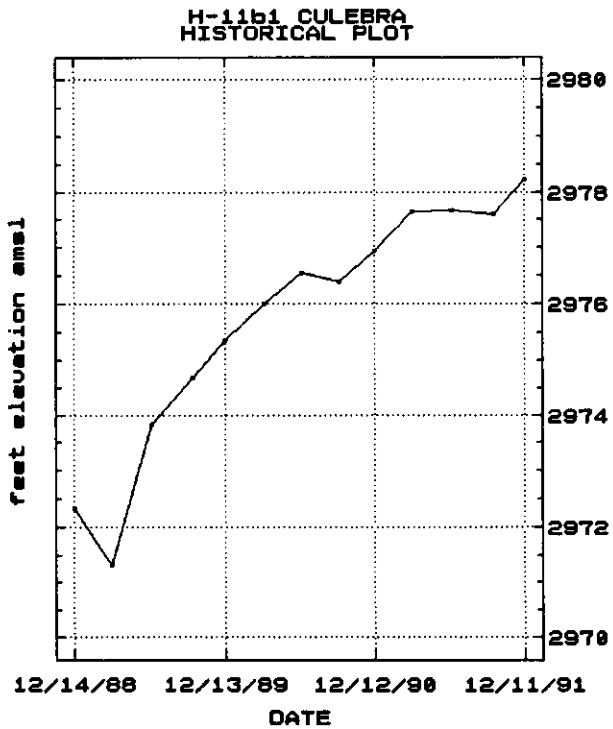




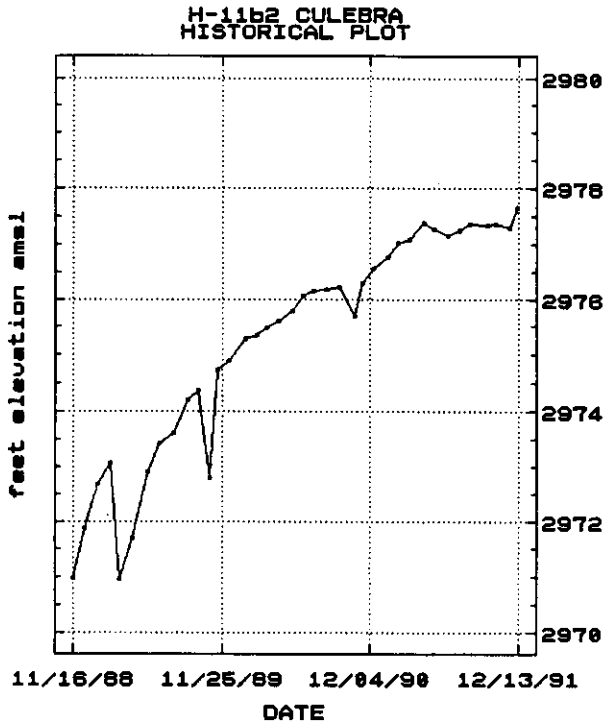

H-09c CULEBRA
HISTORICAL PLOT
feet elevation amsl
2995
2993
2991
2989
2987
2985
12/19/88
12/16/89
12/13/90
12/10/91
DATE

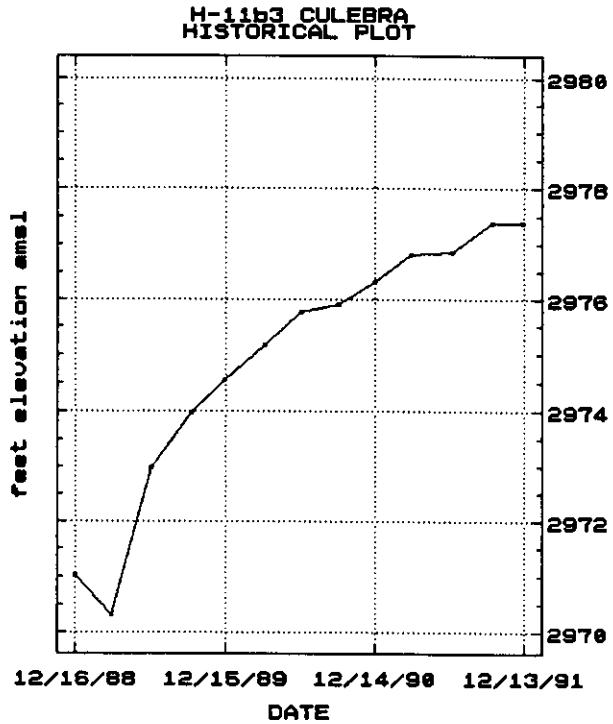

H-10a MAGENTA
HISTORICAL PLOT
feet elevation amsl
3165
3163
3161
3159
3157
3155
12/13/89
08/13/90
04/13/91
12/12/91
DATE

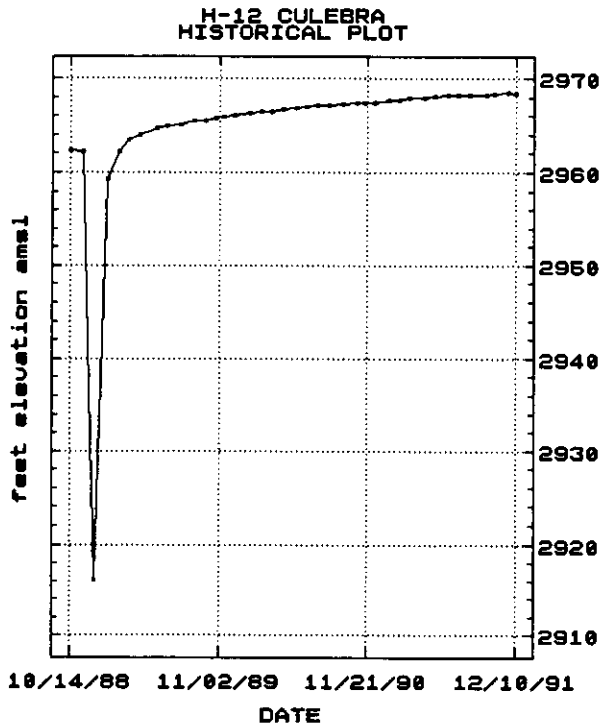

H-10b CULEBRA
HISTORICAL PLOT
feet elevation amsl
2995
2993
2991
2989
2987
2985
12/13/89
08/13/90
04/13/91
12/12/91
DATE

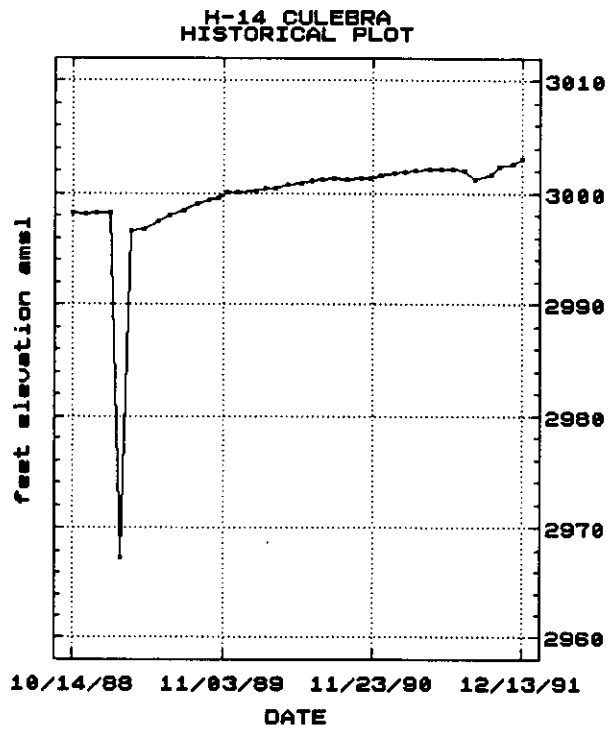

H-11b1 CULEBRA
HISTORICAL PLOT
feet elevation amsl
2980
2978
2976
2974
2972
2970
12/14/88
12/13/89
12/12/90
12/11/91
DATE

HISTORICAL GROUNDWATER LEVEL DATA

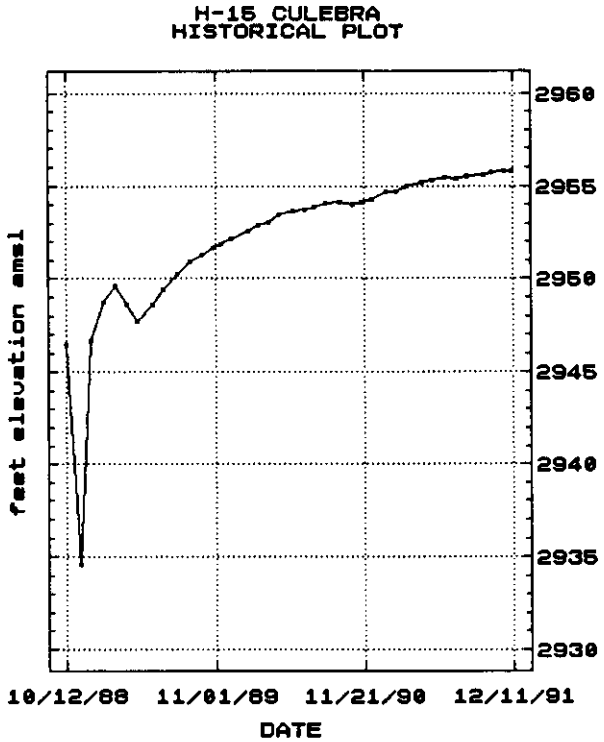


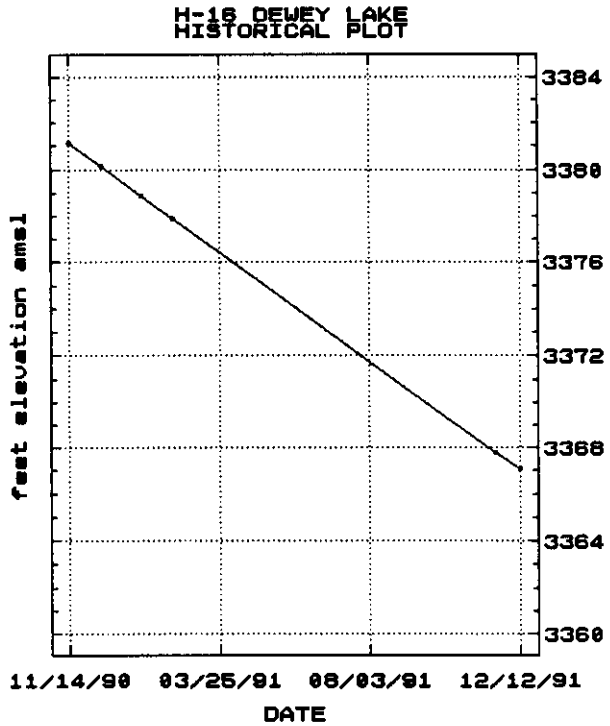


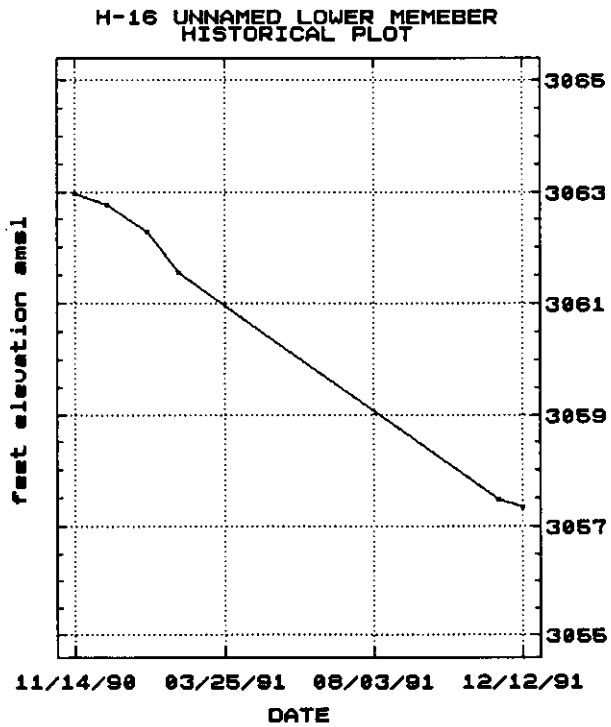


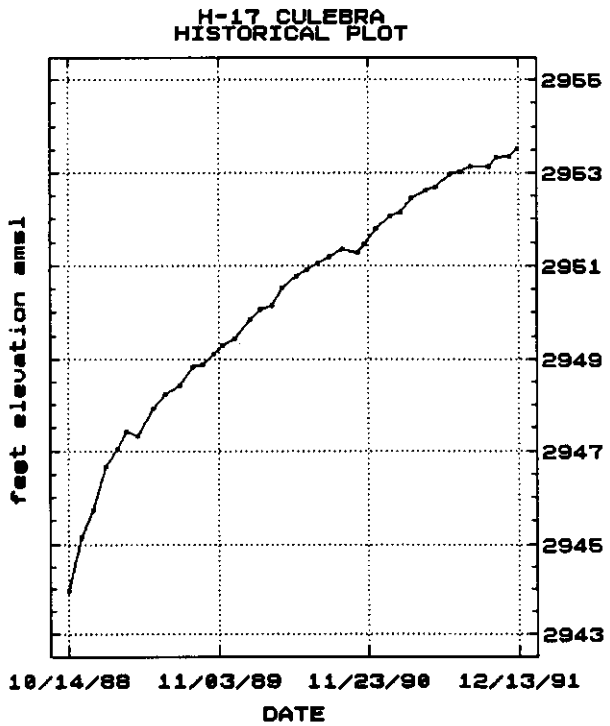


HISTORICAL GROUNDWATER LEVEL DATA

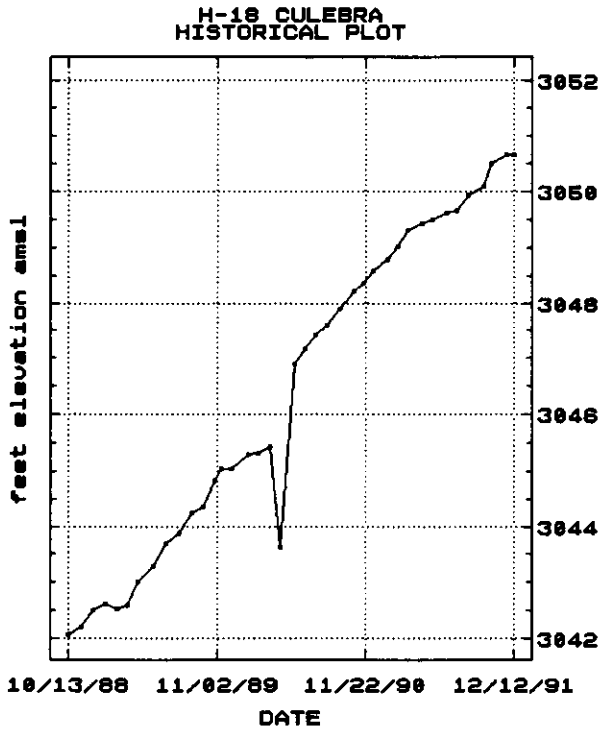


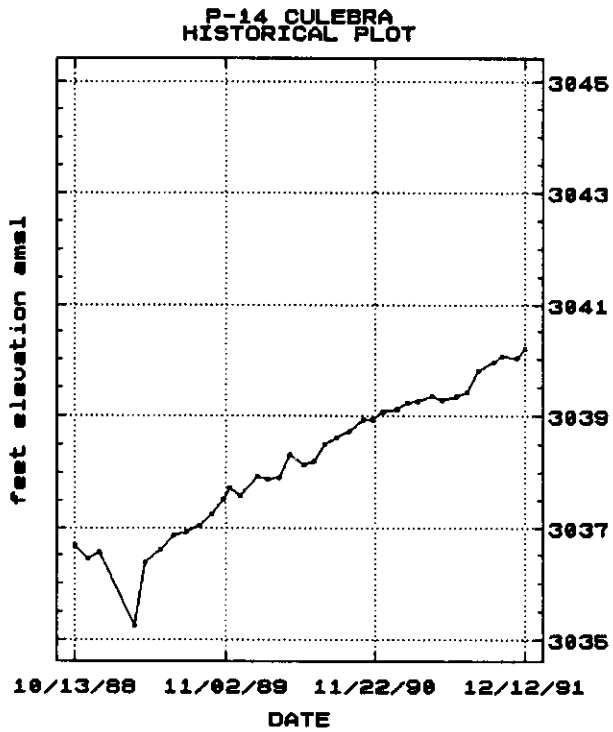


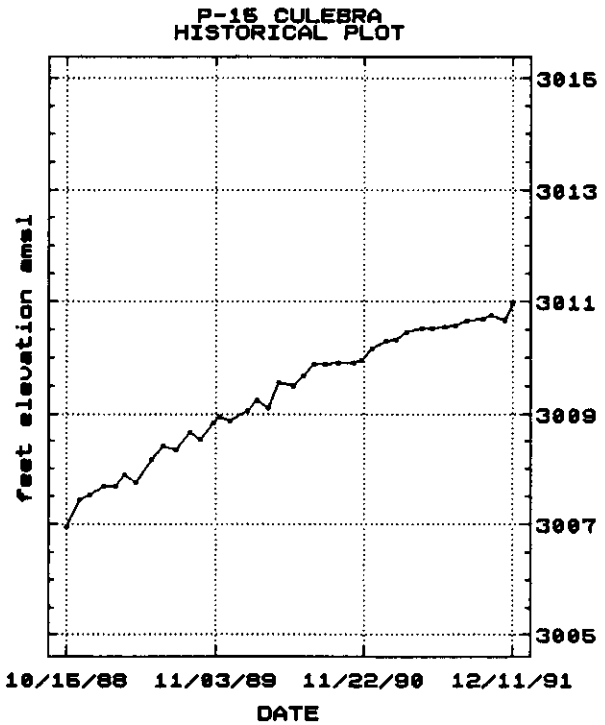


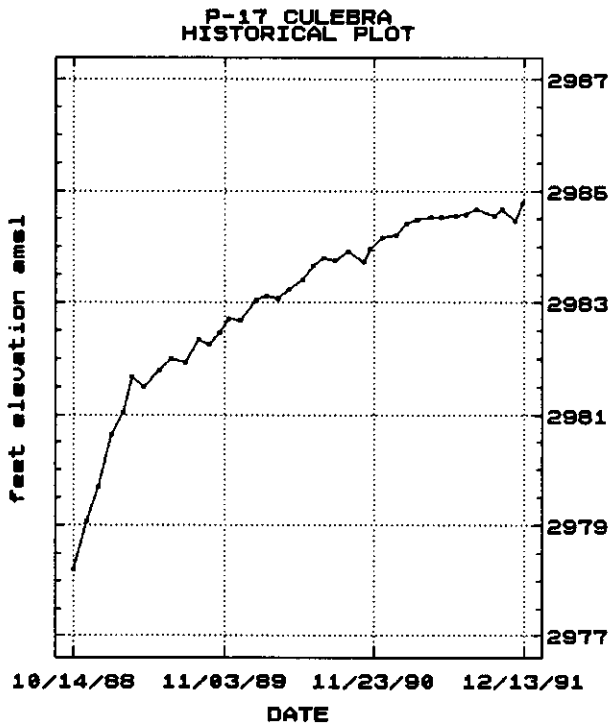


HISTORICAL GROUNDWATER LEVEL DATA

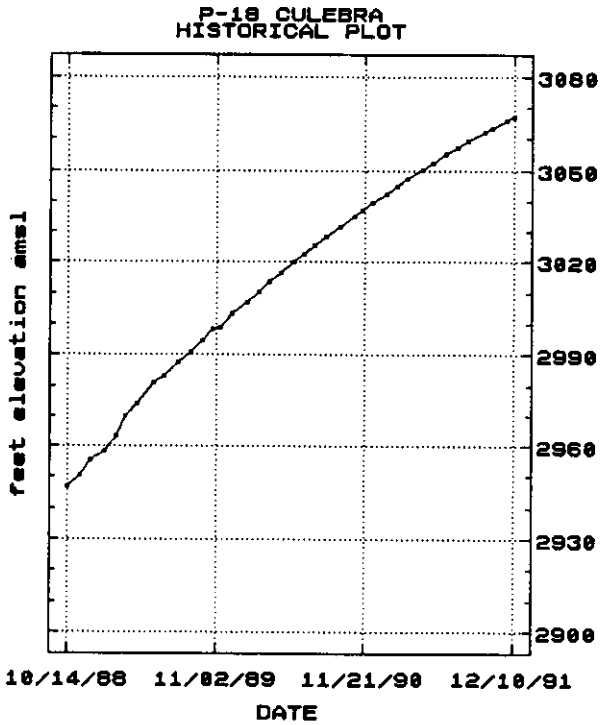


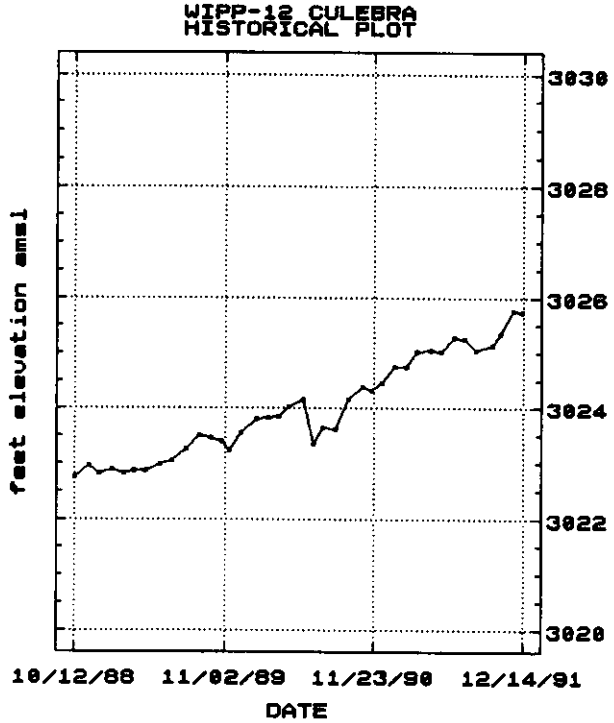


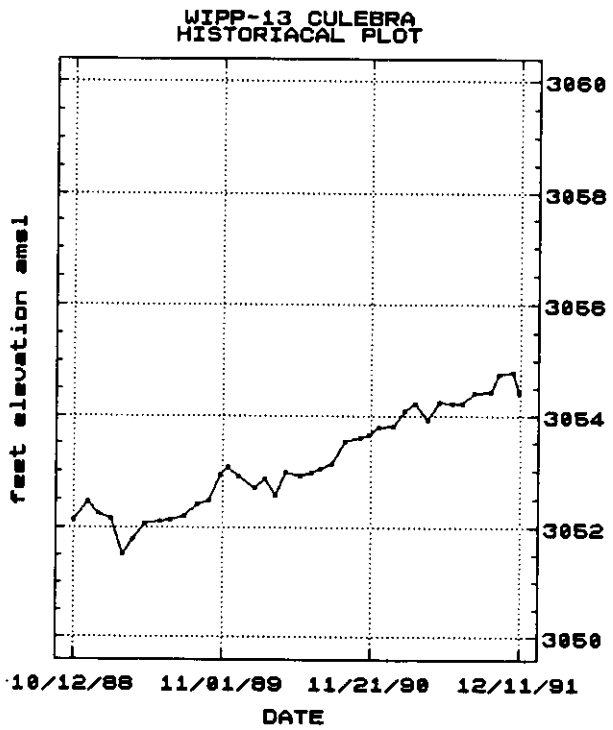


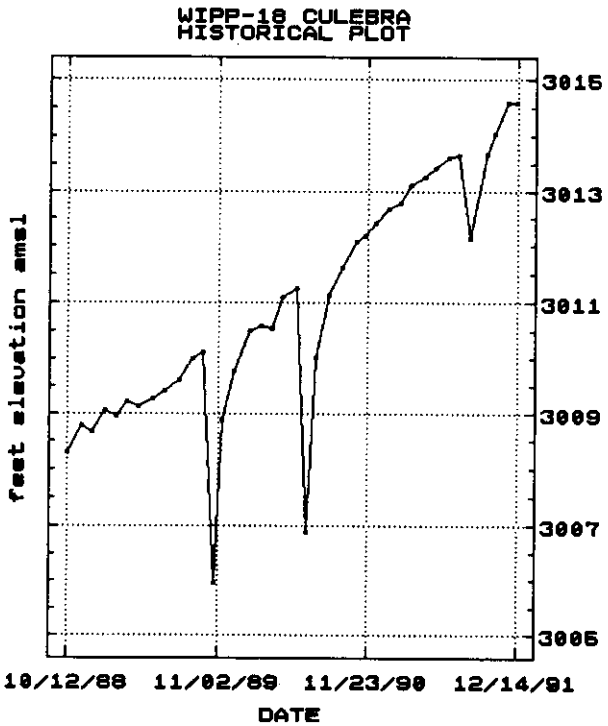


HISTORICAL GROUNDWATER LEVEL DATA

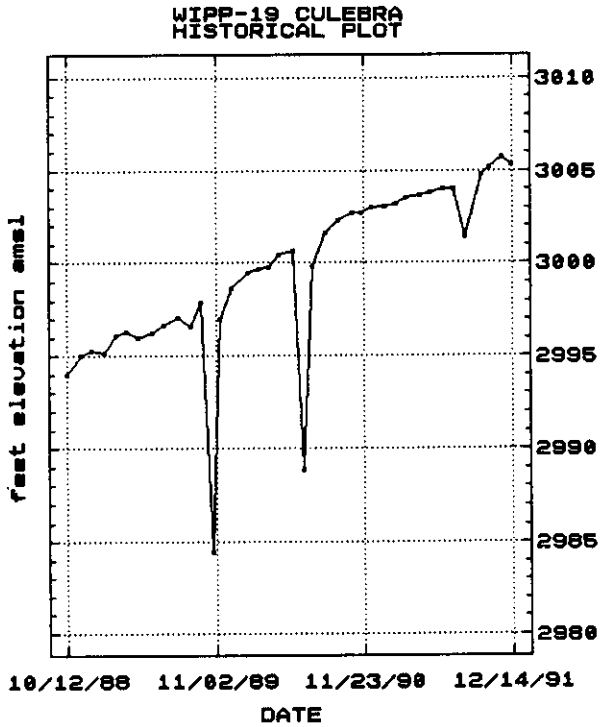


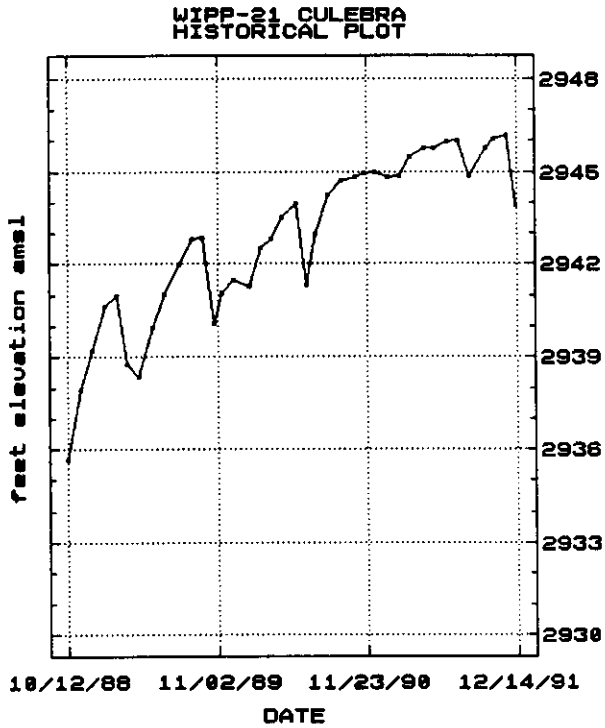


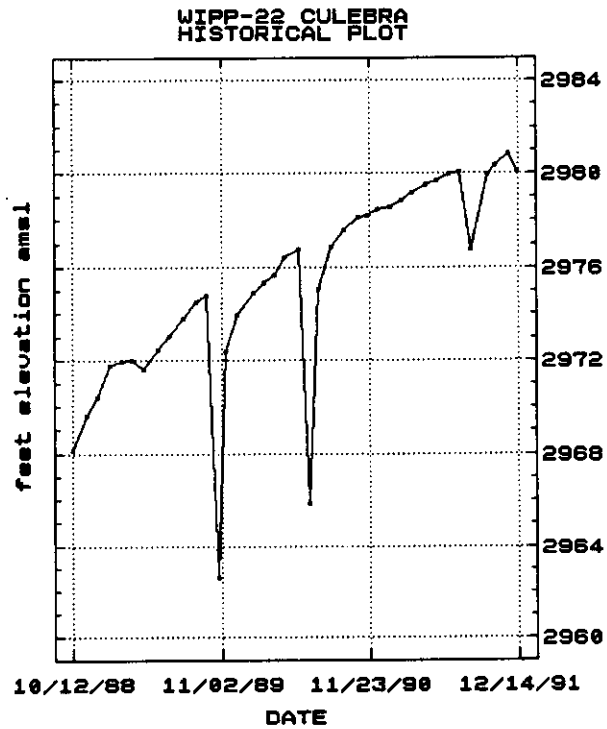


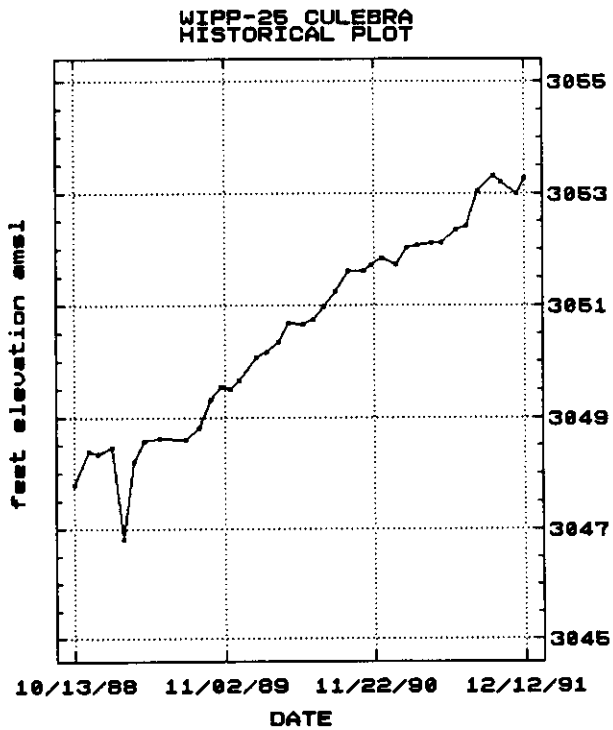


HISTORICAL GROUNDWATER LEVEL DATA

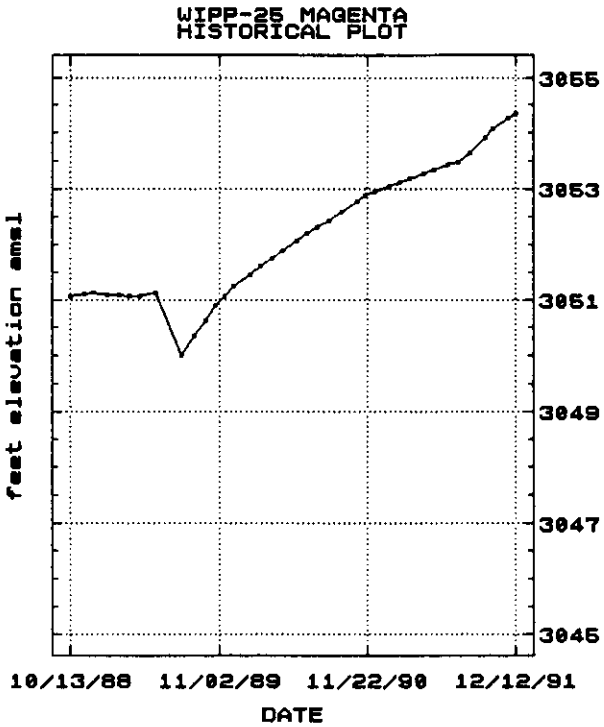


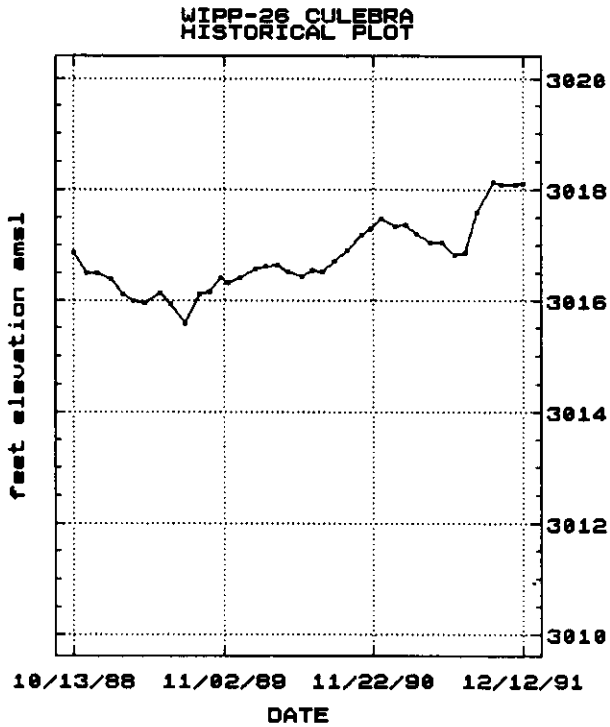


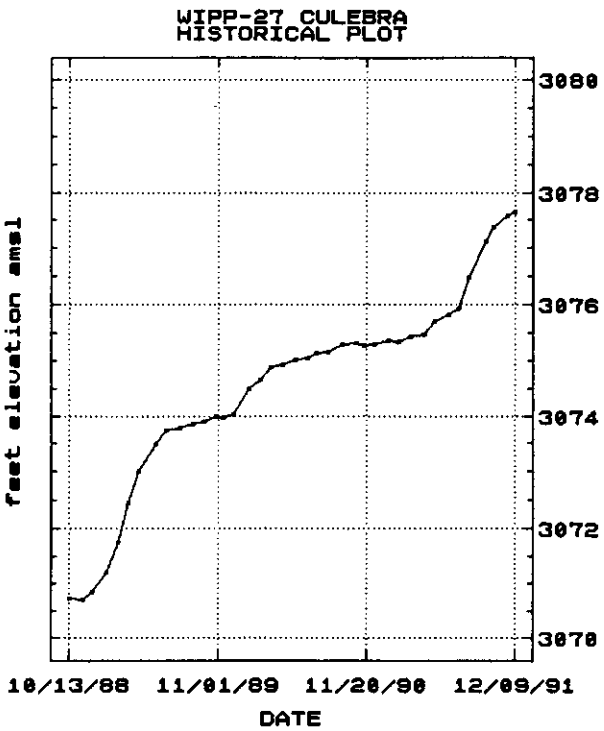


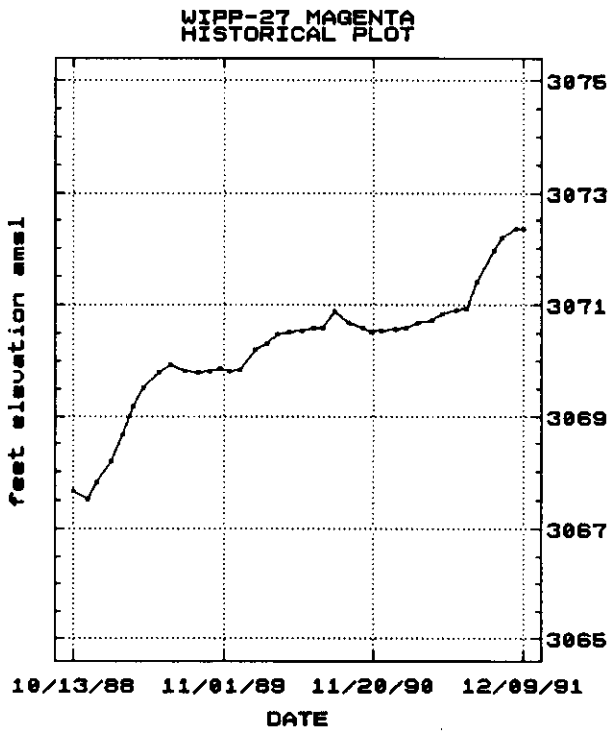
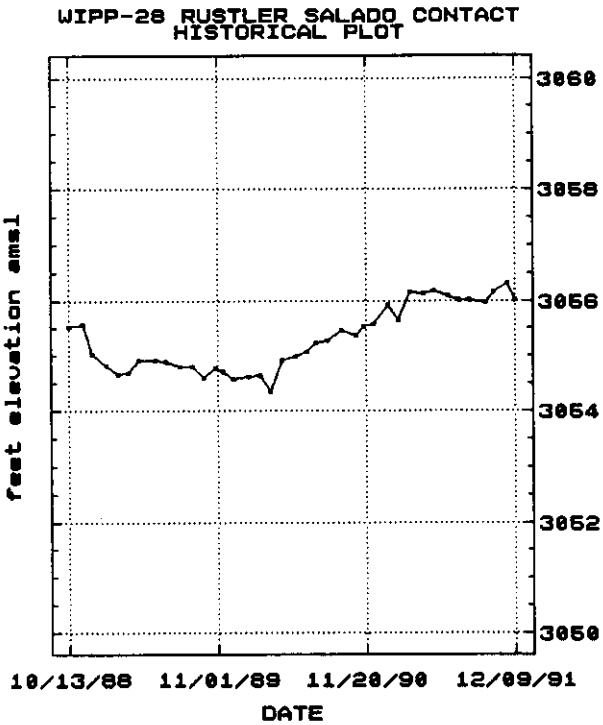
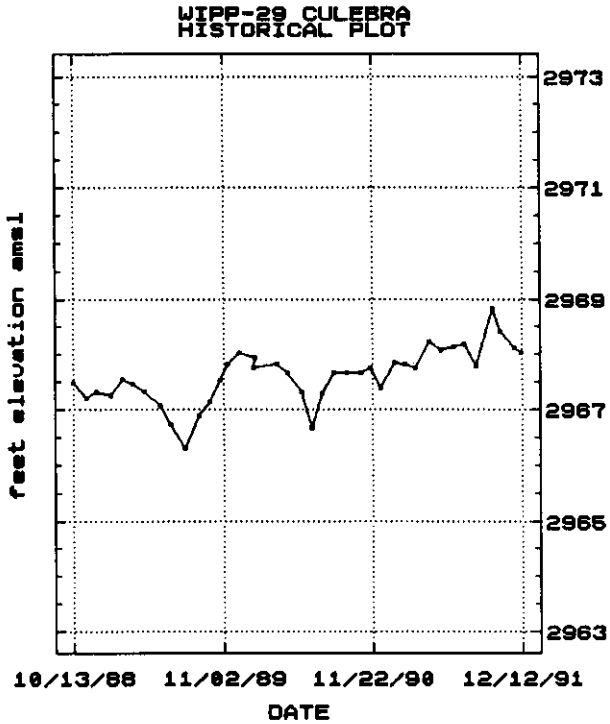
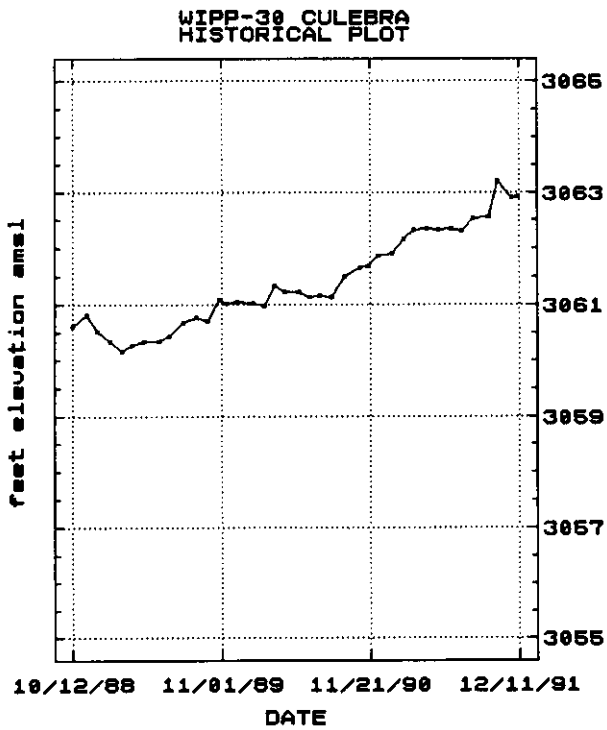
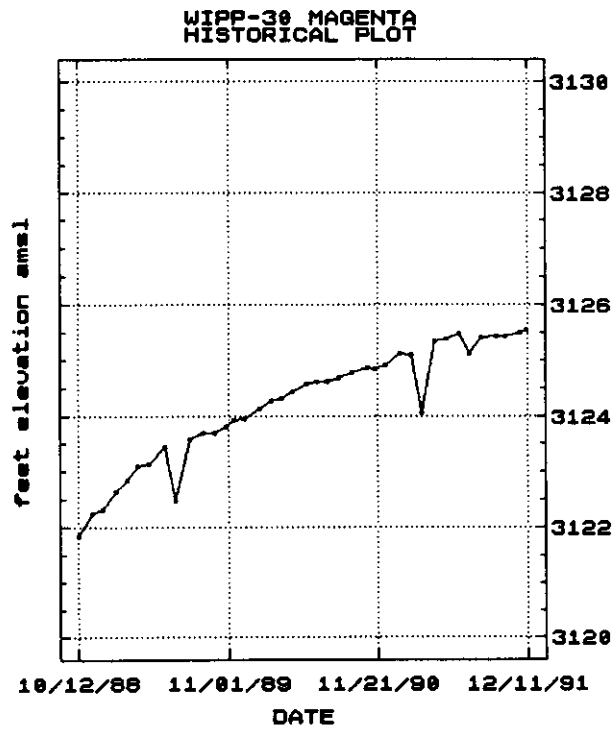


HISTORICAL GROUNDWATER LEVEL DATA









HISTORICAL GROUNDWATER LEVEL DATA