START 7013770.1333

0044485

DOE/RL-96-16-c
Revision 0, Volume I
UC-630
Draft

Data for the Screening Assessment
Volume I: Text
Columbia River Comprehensive Impact Assessment

T. B. Miley
T. K. O'Neil
R. O. Gilbert
L. A. Klevgard
T. B. Walters

June 1996

JUN 1996
RECEIVED
EDMC

Prepared by the Pacific Northwest National Laboratory
In Consultation with Representatives of

U.S. Department of Energy
U.S. Environmental Protection Agency
Washington State Department of Ecology
Bechtel Hanford, Inc.
Dames & Moore
Confederated Tribes of the Umatilla Indian Reservation
Hanford Advisory Board
Nez Perce Tribe ERWM
Oregon State Department of Energy
Yakama Indian Nation

United States
Department of Energy
P.O. Box 550
Richland, Washington 99352

9613448.1534

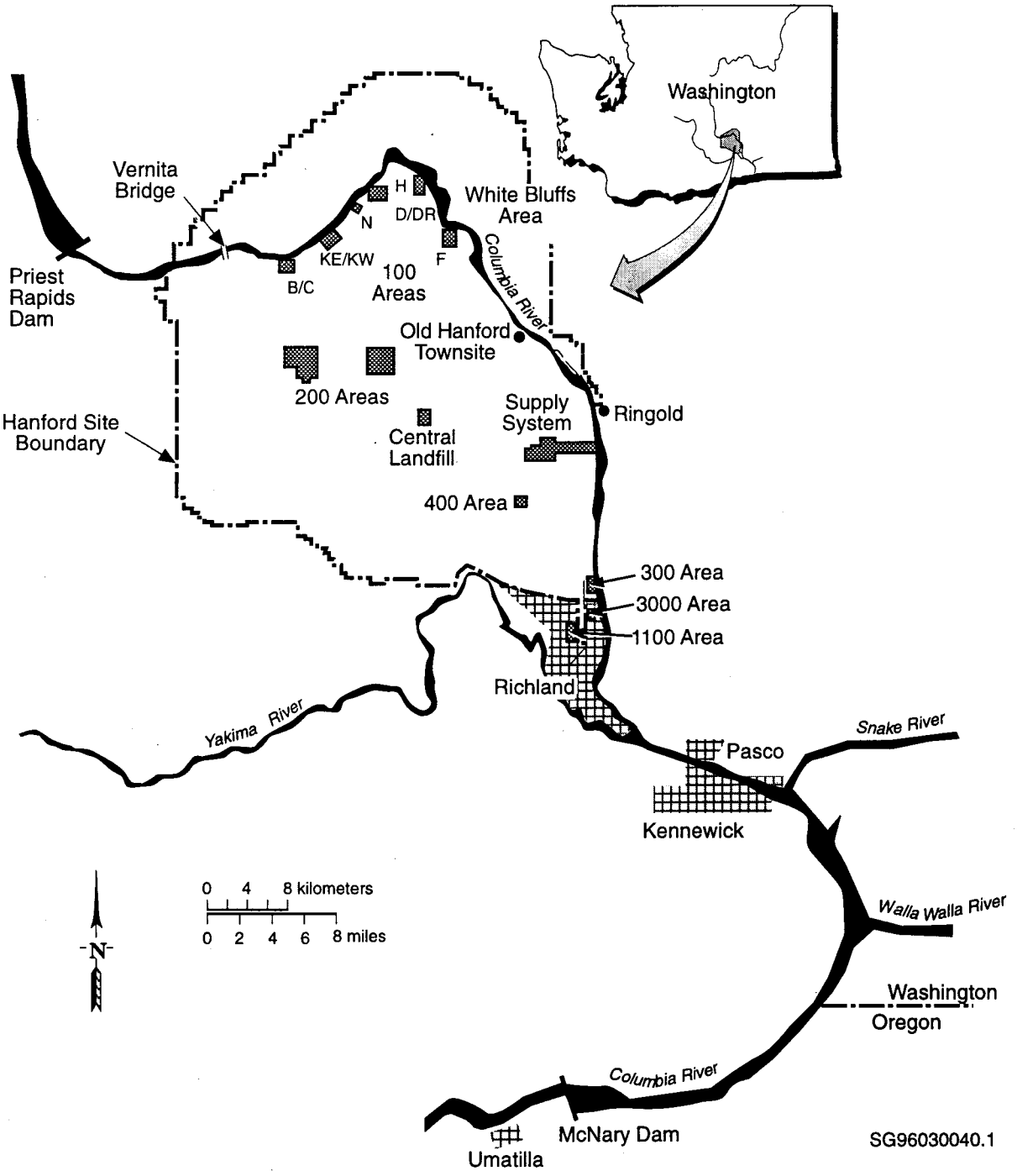


Figure P.1. Map of Screening Assessment Study Area: Vicinity of Priest Rapids Dam - McNary Dam

9613448.1535

Preface

The Columbia River is a critical resource for residents of the Pacific Northwest. It provides for basic needs and is interrelated with the life style and quality of life for Columbia Basin's many human and non-human residents. This resource drew the Manhattan Project's planners to the site now called Hanford to produce nuclear weapon materials. Production of those materials has left behind a legacy of chemical and radioactive contamination and materials that have, are, and will continue to pose a threat to the Columbia River for the foreseeable future.

To evaluate the impact to the river from this Hanford-derived contamination, the U.S. Department of Energy, U.S. Environmental Protection Agency, and State of Washington Department of Ecology (the Tri-Party agencies) initiated a study referred to as the Columbia River Comprehensive Impact Assessment (CRCIA). To address concerns about the scope and direction of CRCIA as well as enhance regulator, stakeholder, tribal, and public involvement, the CRCIA Management Team was formed in August 1995. The CRCIA Team meets to share information and provide input to decisions made by the Tri-Party agencies concerning CRCIA. Representatives from the Confederated Tribes of the Umatilla Indian Reservation, Hanford Advisory Board, Nez Perce Tribe, Oregon State Department of Energy, Yakama Indian Nation, Tri-Party agencies, and contractors are active participants on the team.

A major CRCIA Team decision was to organize CRCIA into phases, with additional phases to be identified as warranted after completion of the initial phase. The initial phase is comprised of two parts: 1) a screening assessment to evaluate the current impact to the river resulting from Hanford-derived contamination (see Figure P.1 for map of screening assessment area) and 2) identification of requirements considered necessary by the CRCIA Management Team for a comprehensive assessment of impact to the river.

This *Data for the Screening Assessment* report is the fourth in a series of reports which have been issued as part of the initial phase. Figure P.2 depicts the documents which have been and will be issued in the initial phase. After the data report and three previously published reports have been revised, they will be incorporated into a two-part report which will document the results of the two parts of the initial phase of CRCIA: the screening assessment results and the requirements for a comprehensive assessment.

Background

The Hanford Site occupies 1456 square kilometers (560 square miles) in the south central portion of the State of Washington. It is located northeast of the Tri-Cities of Richland, Kennewick, and Pasco. The site is partially bordered on the north and east by the Columbia River and includes a relatively narrow buffer zone north of the river referred to as the Wahluke or North Slope. The Hanford Site is located on land ceded in 1855 by treaties with the Confederated Tribes of the Umatilla Indian Reservation and the Yakama Indian Nation. The Nez Perce Tribe has treaty rights on the Columbia River. The

9613448.1536

Purpose and Scope of the Screening Assessment

The purpose of the screening assessment is to support cleanup decisions. The scope of the screening assessment is to evaluate the current risk to humans and the environment resulting from Hanford-derived contaminants. The screening assessment has the primary components of:

- identifying contaminants to be assessed
- identifying a variety of exposure scenarios to evaluate human contaminant exposure
- identifying a variety of other species to evaluate ecological contaminant exposure
- assessing risks posed by exposure of humans and other species to the contaminants

The study area for the screening assessment (see Figure P.1) was defined to extend from upstream of the Hanford Site in areas unaffected by Hanford Site operations down to McNary Dam, which is the first dam downstream of the Hanford Site. Historical data indicate that the concentrations of contaminants are as high or higher in this reach of the Columbia River than in areas downstream of McNary Dam. Other factors determining the study area include the availability of appropriate environmental data to conduct the screening assessment, the lack of such data downstream of McNary Dam, the known discharge of contaminants into the river (primarily via groundwater seepage) along the Hanford Site, and the resource constraints (time and dollars) originally imposed on the screening assessment. The parameters of the scope are:

Area:	Columbia River (vicinity of Priest Rapids Dam to McNary Dam), groundwater (up to 0.8 kilometer/0.5 mile in from the river), and adjacent riparian zone
Time:	January 1990 - present (date data were received for use in the screening assessment) with data gaps filled by earlier data where available
Contaminants:	Published in Napier et al. (1995) (to be modified in screening assessment report)
Scenarios:	Published in Napier et al. (1996) (to be modified in screening assessment report)
Receptor Species:	Published in Becker et al. (1996) (to be modified in screening assessment report)
Measured Media:	Groundwater, sediment, seeps, surface water, external radiation, biota, cobalt-60 particles, drive point groundwater, N Springs punch point water, and pore water

The primary contractor conducting the screening assessment is the Pacific Northwest National Laboratory. Bechtel Hanford, Inc. provides technical and public involvement coordination with environmental restoration activities. Technical peer reviewers are evaluating the work under the guidance of the Directors of the Oregon Water Resources Research Institute and State of Washington Water Research Center.

Table P.1. Documents in Initial Phase of Columbia River Comprehensive Impact Assessment

Title	Document No.	Publication Date	Status
Data Compendium for the Columbia River Comprehensive Impact Assessment (Eslinger et al. 1994)	PNL-9785	April 1994	Final publication
List of Currently Classified Documents Relative to Hanford Operations and of Potential Use in the Columbia River Comprehensive Impact Assessment January 1, 1973 - June 20, 1994 (Miley and Huesties 1995)	PNL-10459	February 1995	Final publication
Identification of Contaminants of Concern (Napier et al. 1995)	PNL-10400	January 1995	Published as a draft - Issued first in January 1995 for review, then again in January 1996; comments from both review periods will be addressed and report will be a section in the *Screening Assessment and Requirements for a Comprehensive Assessment* report
Human Scenarios for the Screening Assessment: Columbia River Comprehensive Impact Assessment (Napier et al. 1996)	DOE/RL-96-16-a Rev.0	March 1996	Published as a draft - Then comments will be addressed and report will be a section in the *Screening Assessment and Requirements for a Comprehensive Assessment* report
Species for the Screening Assessment: Columbia River Comprehensive Impact Assessment (Becker et al. 1996)	DOE/RL-96-16-b Rev. 0	March 1996	Published as a draft - Then comments will be addressed and report will be a section in the *Screening Assessment and Requirements for a Comprehensive Assessment* report
***Data for the Screening Assessment: Columbia River Comprehensive Impact Assessment* (Miley et al. 1996)**	**DOE/RL-96-16-c Rev.0**	**June 1996**	**Published as a draft - Then comments will be addressed and report will be a section in the *Screening Assessment and Requirements for a Comprehensive Assessment* report**
Screening Assessment and Requirements for a Comprehensive Assessment: Columbia River Comprehensive Impact Assessment	DOE/RL-96-16 Rev.0	December 1996	To be published as a draft - Will incorporate all previous draft publications (not those published as final) plus sections on site characterization, screening assessment of risk, and CRCIA Team statement of work to be done after the initial phase
Screening Assessment and Requirements for a Comprehensive Assessment: Columbia River Comprehensive Impact Assessment	DOE/RL-96-16 Rev.1	April 1997	To be published final - Will incorporate responses to comments and minority opinions should any comments not be reconciled

Summary

The initial phase of the Columbia River Comprehensive Impact Assessment (CRCIA) is a screening assessment of risk to humans and the environment. To assess risk, monitoring data of contaminant concentrations are needed. The data task provides measurements of contaminant concentrations in various media for use in the human health and ecological screening assessments. This report is divided into two volumes. *Volume I: Text* describes the data gathering and data selection processes. *Volume II: Appendices* presents the 1) final data sets (media files) to be used in the screening assessments, 2) the raw data from which the data sets were derived, and 3) the raw data values for media for which other calculation methods will be used. (For a copy of Volume II with 500 pages plus 9 diskettes, contact S. D. Cannon at 509-372-6210.) The data task for CRCIA is being conducted under the guidance of the CRCIA Management Team. All defining decisions for the task were made with CRCIA Team concurrence

The scope of the data task is to compile data collected since January 1990 by the various monitoring programs for the contaminants of interest. The contaminants of interest for the screening assessment were originally defined in Napier et al. (1995) and have been revised based on comments received on that draft document.

The media for which concentration data are needed for the human health and ecological screening assessment calculations are groundwater, sediment, seeps, surface water, and external radiation. These media files along with the original raw data files are presented in this report. In addition, contaminant concentrations in biota, cobalt-60 particles, drive point groundwater data for chromium, N Springs punch point water data, and pore water data for chromium will be evaluated in the screening assessment. These raw data values are also presented in this report. However, because the availability of data applicable to the screening assessment is limited, other calculation methods will be used in the screening assessment for biota, cobalt-60 particles, drive point groundwater, N Springs punch point water, and pore water. Therefore, no media files needed to be prepared for these data.

The first step in the data gathering process was to identify sources of environmental data. A data compendium (Eslinger et al. 1994) provided a collection of references. Other sources of environmental data were identified by the CRCIA Team. In addition, a meeting was called with data managers and environmental leads at the Hanford Site who are familiar with river sampling activities. The purpose of this meeting was to summarize the data that had been gathered and to identify additional sources of data. This meeting was also used to determine which programs' data were stored in the Hanford Environmental Information System (HEIS).

Data for all media were initially gathered from a corridor up to 0.8 kilometer (½ mile) on either side of the Columbia River. For sediment, seeps, surface water, and external radiation, all data within 0.8 kilometer of the river were used. For the groundwater data, it was necessary to use only the portion of these data that would be relevant to estimating the contaminant concentrations entering the Columbia River from the Hanford Site. This was done by assigning a groundwater corridor width to

9613448.1539

Glossary

100 Areas	site of the Hanford production reactors, which include B, C, D, DR, F, H, KE, KW, and N Reactors; see Figure P.1
300 Area	site of the research, development and fuel-fabrication operations; see Figure P.1
biota	plants and animals
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980 as Amended* (42 USC 9601 et seq. as amended)
concentration	amount of substance in a given quantity of material (for example, micrograms of chromium per liter of groundwater)
CRCIA	Columbia River Comprehensive Impact Assessment
CRCIA Team	Columbia River Comprehensive Impact Assessment Management Team
deterministic analysis	single calculation performed with a single value selected for each parameter, such as the concentrations of contaminants entering the river; see stochastic analysis
DOE	U.S. Department of Energy
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERC	Environmental Restoration Contractor (Bechtel Hanford, Inc.; CH2M Hill Hanford, Inc.; IT Hanford, Inc.; Thermo Hanford, Inc.)
Geographic Information System	computerized system designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information
geometric mean	see "mean" for definition.

pdf	probability density function; set of all possible values of a parameter and their associated likelihoods
plume	volume of air, water, or soil containing contaminants released from a contaminant source
PNNL	Pacific Northwest National Laboratory
production operations	activities connected with the production reactors in the 100 Areas (B, C, D, DR, F, H, KE, KW, or N reactors) in which uranium or other fuel was irradiated with neutrons to produce radioactive materials; used primarily at Hanford to produce plutonium for weapons; used also for research
radionuclide	radioactive isotope of an element
RCRA	*Resource Conservation and Recovery Act of 1976* (42 USC 6901 et seq. as amended)
risk assessment	estimation of the severity and likelihood of harm to human health or the environment occurring from exposure to a particular substance or activity
screening assessment of risk	risk assessment with limited scope; for example, the initial phase of CRCIA is a screening assessment of risk because it is restricted to 1) current conditions, 2) the area between Priest Rapids Dam and McNary Dam, 3) a limited number of contaminants, 4) a few selected receptor species, and 5) a limited amount of monitoring data; the objective of the screening assessment of risk is to identify areas where significant potential exists for adverse effects on humans or the environment
SD	sediment
seeps	locations where groundwater oozes to the surface
SESP	Surface Environmental Surveillance Project
SP	seeps
stochastic analysis	set of calculations performed over the range of some of the input parameters; see deterministic analysis

9613448.1541

Contents

Volume I

Preface v

Summary xi

Glossary xiii

1.0 Introduction 1.1

1.1 Scope 1.1

1.2 Approach 1.2

1.2.1 Segmentation 1.3

1.2.2 Thiessen Polygon Analysis 1.5

1.2.3 Corridor 1.5

2.0 Data Gathering 2.1

2.1 Description of the Data Gathering Process 2.1

2.1.1 Identification of Data Sources 2.1

2.1.2 Data Assimilation 2.1

2.1.3 Identification of Sampling Locations and Their Segments 2.1

2.2 Non-Hanford Data Sources Contacted 2.2

2.2.1 City of Richland 2.2

2.2.2 City of Umatilla 2.2

2.2.3 City of Hermiston 2.2

2.2.4 Port of Umatilla 2.3

2.2.5 Washington Public Power Supply System 2.3

2.2.6 Oregon Department of Energy 2.3

2.2.7 U.S. Army Corp of Engineers - Walla Walla and Seattle 2.3

9613448.1542

3.4.3 Compute the Segment Maximum 3.6

3.4.4 Compute Stochastic Parameters 3.7

4.0 Final Data Sets 4.1

5.0 References 5.1

Figures

P.1 Map of Screening Assessment Study Area: Vicinity of Priest Rapids Dam - McNary Dam iii

P.2 Publications in the Initial Phase of the Columbia River Comprehensive Impact Assessment iv

1.1 Segmentation of the Columbia River 1.4

1.2 Example of the Results of the Thiessen Analysis on Segmentation of the Columbia River 1.6

2.1 Sampling Locations for All Data Used in the Screening Assessment 2.13

2.2 Sampling Locations for Groundwater Data Used in the Screening Assessment 2.14

2.3 Sampling Locations for Sediment Data Used in the Screening Assessment 2.15

2.4 Sampling Locations for Seep Data Used in the Screening Assessment 2.16

2.5 Sampling Locations for Surface Water Data Used in the Screening Assessment 2.17

2.6 Sampling Locations for External Radiation Data Used in the Screening Assessment ... 2.18

9613448.1543

1.0 Introduction

The initial phase of the Columbia River Comprehensive Impact Assessment (CRCIA) is a screening assessment of risk to humans and the environment. To assess risk, monitoring data of contaminant concentrations are needed. The data task provides measurements of contaminant concentrations in various media for use in the human health and ecological screening assessments. This report is divided into two volumes. *Volume I: Text* describes the data gathering and data selection processes. *Volume II: Appendices* presents the 1) final data sets (media files) to be used in the screening assessments, 2) the raw data from which the data sets were derived, and 3) the raw data values for media for which other calculation methods will be used. (For a copy of Volume II with 500 pages plus 9 diskettes, contact S. D. Cannon at 509-372-6210.)

1.1 Scope

The Columbia River has been the focus of environmental monitoring programs over the years. The scope of the data task is to compile data collected since January 1990 by the various monitoring programs for the contaminants of interest. The contaminants of interest for the screening assessment were originally defined in Napier et al. (1995) and have been revised based on comments received on that draft document. The revised list of contaminants is given in Table 1.1.

Table 1.1. List of Identified Contaminants of Interest[a]

Radionuclides	Metals	Other Compounds
Carbon-14	Chromium	Ammonia
Cesium-137	Copper	Benzene
Cobalt-60	Lead	Cyanide
Europium-152	Mercury	Diesel oil
Europium-154	Nickel	Kerosene
Iodine-129	Zinc	Nitrate
Neptunium-237		Nitrite
Strontium-90		Phosphates
Technetium-99		Sulfates
Tritium		Xylenes
Uranium-234		
Uranium-238		

(a) Direct irradiation and discrete radioactive particles will also be evaluated.

Table 1.2. (contd)

Date	Decision
2/20/96	The set of representative data in each segment for each medium will be assumed to be lognormally distributed. The parameters for the lognormal distribution will be estimated from the representative data. Log-probability plots will be provided.
2/20/96	Both filtered and unfiltered data will be used in the identification of representative data and in determining the parameters for the lognormal distribution.
2/27/96	Dixon's test will be used to eliminate, at most, a single outlier data point in each data set. In the data section of the final report, every data point that is eliminated will be explained.
2/27/96	For the elimination of outliers, log transformation of the data will be used.

A Geographic Information System was used to assist in implementing the processing of the data for the screening assessment. The Geographic Information System is a computerized system designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information. Many software packages exist that perform basic Geographic Information System functions. Arc/Info Rev. 7.0.2 was used for the data task (ESRI 1994).

1.2.1 Segmentation

The human health and ecological screening assessments calculate risk based on contributions from multiple pathways affected by contaminant concentrations in multiple media. These contaminant concentrations were not usually measured in a fashion that would allow a complete assessment at every sampling site. To provide data for the assessments, it was necessary to aggregate data to represent concentrations in areas rather than at points. This was done through the technique of river segmentation.

Staff from the Pacific Northwest National Laboratory (PNNL), U.S. Environmental Protection Agency (EPA), and Washington State Department of Ecology (Ecology) defined 27 segments within the study area from Priest Rapids Dam down to McNary Dam (see Figure 1.1). A segment is a section of the river over which contaminant conditions can be expected to be similar and which captures the major influences to the Columbia River. The major resources used to decide how to most appropriately segment the river were a groundwater well location map (Dresel et al. 1995), the radiological and chemical contaminant plume maps from the 1994 Hanford Site groundwater monitoring report (Dresel et al. 1995), the Surface Environmental Surveillance Project spring monitoring locations information, the maps of sampling locations for the special chromium studies being conducted by the Environmental Restoration Contractor at the 100-H Area (Hope and Peterson 1995) and 100-D Area (from an unpublished document by S. J. Hope and R. E. Peterson), and the Ecology and EPA staff knowledge of the contaminant sources.

Because many contaminant sources are located in the reactor areas, each reactor area was examined to determine if a single segment could be designed around it or whether it should be further divided. When this decision was made, the resources listed above were used to determine the upstream and

downstream cutoff points for these segments. This process was continued for other major features of the river, such as the sloughs and the confluence points of the Yakima, Snake, and Walla Walla Rivers. The final step in the segmentation process was to look at the areas between known areas of interest and determine how to define segments in these generally data sparse areas.

1.2.2 Thiessen Polygon Analysis

A Thiessen polygon analysis was used to define the area of influence of the data from a groundwater well and, thereby, refine the segmentation of the river. Thiessen analyses apportion points into polygonal regions such that each region contains only one point. Each region has the unique property that any location within a region is closer to the region's point than to any other point (Thiessen and Alter 1911). In this study, the points used for the analysis are the groundwater well locations. An example of the results of the Thiessen analysis are shown in Figure 1.2. The example shows a portion of the study area where segment boundaries were adjusted based on the Thiessen results.

Adjustments to segment boundaries were based on the Thiessen analysis for two reasons. First, it was desirable for the polygons within a segment to be of similar size so that each well is used to represent the contaminant concentration over an area of similar size. When polygon sizes became large relative to the other polygons in the segment, then the large polygon was clipped and the space was added to neighboring segments. This phenomenon occurs with the outer most wells in a data dense area when the data dense area borders an area with few or no wells. Therefore, the additional space was added to a data sparse segment. Second, the original segment boundaries were drawn perpendicular to the river shore. To better reflect the areas of well influence, the polygon lines were used to represent the segment boundaries. Examples of this type of adjustment can be seen on Figure 1.2 for both the upstream and downstream boundaries of segment 3.

1.2.3 Corridor

Data for all media were initially gathered from a corridor up to 0.8 kilometer (½ mile) on either side of the Columbia River. For sediment, seeps, surface water, and external radiation, all data within 0.8 kilometer of the river were used. For the groundwater data, it was necessary to use only the portion of these data that would be relevant to estimating the contaminant concentrations entering the Columbia River from the Hanford Site. This was done by assigning a groundwater corridor width to the Hanford side of each segment. The corridor width was based on having sufficient groundwater data to characterize the contamination within a segment. These corridor width decisions were made by staff from Ecology, EPA, and PNNL with concurrence by the CRCIA Team. The corridor widths for groundwater data are as follows. Segments 2 (100-B/C Area), 5 (116-K-2 trench in 100-K Area), 6 (100-N Area), 7 and 8 (100-D Area), 10 (100-H Area), 13 (100-F Area), and 20 (300 Area) have a 0.8-kilometer (1/4-mile) corridor width. Segment 4 (100-K Area) has a 0.6-kilometer (3/8-mile) corridor width. All other segments have a 0.8-kilometer (1/2-mile) width (Figure 1.1). These groundwater corridor widths are measured from the Columbia River shoreline inland onto the Hanford Site.

2.0 Data Gathering

Many data have been collected that are relevant to the Columbia River environment and the CRCIA. The data task gathered the existing data that fell within the scope of the geographical area and time period of the screening assessment.

2.1 Description of the Data Gathering Process

The data gathering process involved identifying sources of environmental data, assimilating that data, and identifying the appropriate river segment to which the data applied.

2.1.1 Identification of Data Sources

The first step of the data gathering process was to identify sources of environmental data. A data compendium (Eslinger et al. 1994) was produced for CRCIA and was the initial step to identify existing environmental data sources associated with the Columbia River that may be of potential interest to CRCIA. The data compendium provides a collection of references as well as a discussion of data sources, descriptions of the physical format of the data, and descriptions of the search process used to identify data. Other sources of environmental data were identified by the CRCIA Team. In addition, a meeting was called with data managers and environmental leads at the Hanford Site who are familiar with river sampling activities. The purpose of this meeting was to summarize the data that had been gathered and to identify additional sources of data. This meeting was also used to determine which programs' data were stored in the Hanford Environmental Information System (HEIS).

2.1.2 Data Assimilation

Once the sources of environmental data were identified, data were collected for January 1990 to the date the data were received. The data were reviewed with the environmental leads for the respective data sources to categorize the data appropriate for the media of interest. The data were then cross referenced with the contaminants of interest. Once the data of the independent programs had been selected as appropriate for use within the scope of the screening assessment, the various data sets within a medium were combined into a single database.

2.1.3 Identification of Sampling Locations and Their Segments

Before the data can be processed by segment into usable input files for the human health and ecological screening assessments, the coordinates of the sampling location must be identified and accurate. Many environmental sampling projects on the Hanford Site identify their sampling locations in the Geographic Information System. Other programs document their sampling locations on a map in a report but do not provide coordinates. Data received from HEIS generally had coordinates associated with the data and were easily downloaded into the Geographic Information System. Downloading data

2.2.4 Port of Umatilla

The Port of Umatilla does not have an environmental sampling program and relies on the U.S. Army Corp of Engineers in Walla Walla for information. No data were collected from the Port of Umatilla for input into the screening assessment.

2.2.5 Washington Public Power Supply System

The Washington Public Power Supply System (WPPSS) has an environmental monitoring program which consists of the 1) Radiological Environmental Monitoring Program and 2) Non-Radiological Environmental Monitoring Program. Both of these programs produce annual reports. The data are collected quarterly, and the constituents analyzed for are limited to those of interest to WPPSS. The Radiological Environmental Monitoring Program provided data collected from 1990-1994 for use in the current screening assessment for radionuclides in the following media:

- External radiation
- Fish
- Plants/vegetables
- Sediment
- Surface water

WPPSS is no longer required to monitor for non-radiological contaminants, and the data from previous years when monitoring was required have not been maintained in a database. Non-radiological monitoring reports for 1990-1995 were provided by WPPSS for data input into the screening assessment.

2.2.6 Oregon Department of Energy

The Oregon Department of Energy had no environmental sampling data along the Columbia River within the scope of the screening assessment (Priest Rapids to McNary Dams and 1990-present). No data were collected from the Oregon Department of Energy for input into the screening assessment.

2.2.7 U.S. Army Corps of Engineers - Walla Walla and Seattle

The Corps of Engineers conducted sediment sampling along the Columbia River in the early 1980s. The purpose of the sampling was to analyze grain size. Contaminant concentrations were not measured. Currently, the Army Corps is not conducting environmental sampling within the scope of the current study area for the screening assessment from the vicinity of Priest Rapids Dam to McNary Dam.

2.2.8 Washington Department of Health

The Environmental Radiation Program within the Washington Department of Health collects environmental data and produces annual reports containing that data. Data were requested from the

2.3 Hanford Data Sources

The following Hanford resources were contacted to obtain environmental sampling data along the Columbia River for input into the screening assessment.

2.3.1 Environmental Restoration Contractors

The Environmental Restoration Contractors (ERC - Bechtel Hanford, Inc.; CH2M Hill Hanford, Inc.; IT Hanford, Inc.; Thermo Hanford, Inc.) queried the HEIS database for environmental data relevant to the screening assessment. ERC also provided environmental data from a special chromium study along the 100-D (unpublished report by S. J. Hope and R. E. Peterson) and 100-H (Hope and Peterson 1995) Areas of the Hanford Site.

2.3.2 Hanford Environmental Information System

The purpose of HEIS is to provide computer-based access to Hanford Site environmental sample data (Brulotte 1994). Some of the programs that store data in HEIS are the PNNL Groundwater Monitoring Program, ERC's CERCLA remedial investigation/feasibility study programs, and the Westinghouse Hanford Company (WHC) Environmental Monitoring program. Many special studies also place their data in the HEIS system.

The functions of HEIS are the following:

- Assignment of sample numbers
- Scheduling and tracking samples
- Data storage
- Database query and report generation

The types of data found in HEIS are:

- Atmospheric
- Biota
- Constituents
- Groundwater
- Locations
- Samples
- Soils (surface and geologic)
- Waste site
- Water levels
- Wells

The procedures for computer access to HEIS are found in Schreck (1993). There are nine volumes organized by subject and area.

2.3.3 Pacific Northwest National Laboratory

Data collected by PNNL through the Ground Water Surveillance Project and the Surface Environmental Surveillance Project (SESP) were provided for the screening assessment. In addition to the ongoing monitoring data provided by SESP, environmental data from special studies were provided for the screening assessment.

2.4.1 Raw Data Files

The raw data from all sources were combined into a single Microsoft Access database for each medium. Access is a Windows™-based database management system that stores and retrieves data, presents information, and automates repetitive tasks. Diskettes of the raw data are included as part of Appendix A in Volume II of this report. The content of the raw data is described in Appendix A. Volume II (over 500 pages plus 9 diskettes) is available by calling S. D. Cannon at 509-372-6210.

2.4.2 Raw Data Summary

The raw data are summarized by segment to show the sample coverage across the media. This summary is presented in Table 2.1. For each segment, the major feature of the segment is identified, and the number of samples for each medium is given. For the groundwater, the corridor width and the number of wells used are also presented.

Table 2.2 presents a further breakdown of the sample counts by media into the number of analyses in each medium by contaminant of interest.

2.4.3 Data Sampling Locations

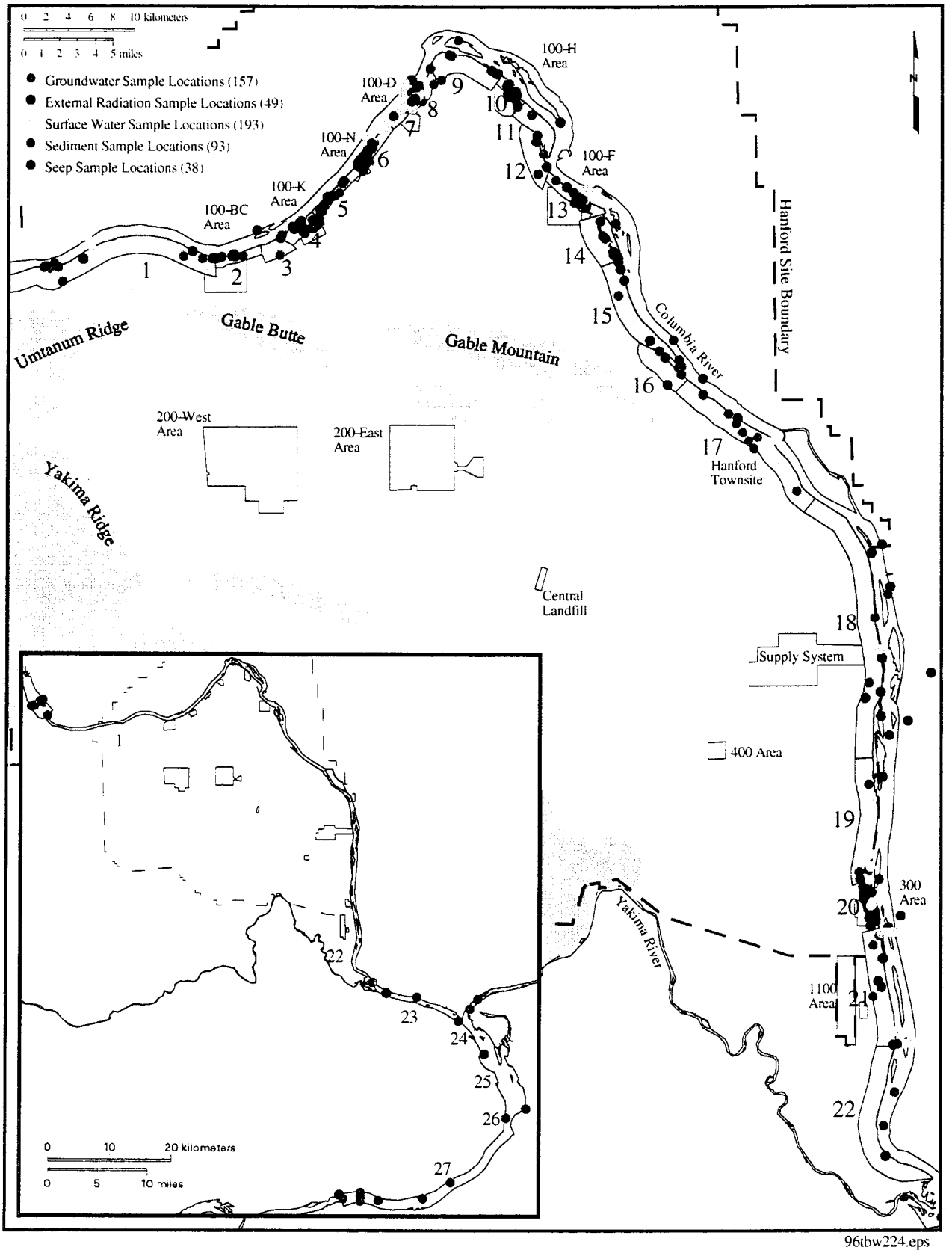
Each media database was queried to identify the set of unique sample locations for the data used for that medium. The coordinates for these sample locations were fed into the Geographic Information System for plotting on a map. Figure 2.1 shows all of the sampling locations used in the screening assessment for all of the media. Because of concurrent sampling (for example, for seeps and sediment) in some of the locations, not all locations are visible on the map. The media are listed in the legend in the order of plotting. The number of locations on the map is given in the legend for each medium. A map for each of the media sampling locations is also provided. These are Figure 2.2 for groundwater, Figure 2.3 for sediment, Figure 2.4 for seeps, Figure 2.5 for surface water, and Figure 2.6 for external radiation. Detailed maps with coordinate grids are provided in Appendix B of Volume II. Each map shows a single segment and the sample locations for all media in that segment. The coordinate grid is provided so that samples may be tracked from the coordinates provided in the raw data. For a copy of Volume II (over 500 pages plus 9 diskettes), call S. D. Cannon at 509-372-6210.

Table 2.2. Number of Raw Data Samples per Contaminant, Medium, and Segment

Segment	Medium	Ammonia	Benzene	Carbon-14	Cesium-137	Chromium	Cobalt-60	Copper	Cyanide	Diesel oil	Europium-152	Europium-154	Iodine-129	Kerosene	Lead	Mercury	Neptunium-237	Nickel	Nitrate	Nitrite	Phosphate	Strontium-90	Sulfate	Technetium-99	Tritium	Uranium-234	Uranium-238	Xylenes (total)	Zinc
1	GW	4	15	8	6	22	6	22	5	0	4	5	0	0	17	16	0	22	17	7	11	7	0	10	20	0	4	15	22
	SD	0	5	0	35	21	35	17	0	0	3	35	0	0	17	9	0	21	5	5	5	36	0	0	0	13	36	5	21
	SP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	SW	0	34	0	202	42	202	42	4	0	0	175	16	0	20	22	0	54	30	57	30	152	45	74	157	153	153	18	41
2	GW	12	28	26	16	51	16	51	12	0	12	12	1	0	48	47	0	51	30	3	12	23	0	31	27	0	12	28	51
	SD	0	0	0	7	8	7	8	0	0	3	4	0	0	5	5	0	8	0	0	0	7	0	0	0	0	4	0	8
	SP	0	0	0	8	8	8	8	0	0	0	5	0	0	2	2	0	8	3	3	4	9	4	5	9	5	5	0	8
	SW	5	0	0	34	10	34	10	0	0	0	28	0	0	2	2	0	10	4	4	5	34	0	5	35	5	5	0	10
3	GW	5	14	13	6	27	6	27	5	0	5	5	1	0	25	24	0	27	12	2	5	8	0	14	15	0	5	14	27
	SD	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1
	SP	0	0	0	1	2	1	2	0	0	0	0	0	0	0	0	0	2	1	1	1	1	1	0	1	0	0	0	2
	SW	2	0	0	2	4	2	4	0	0	0	0	0	0	0	0	0	4	2	2	2	2	0	0	2	0	0	0	4
4	GW	39	91	159	160	285	160	285	50	0	41	54	16	0	142	134	0	285	247	180	232	98	0	55	370	37	78	91	285
	SD	0	0	0	5	6	6	6	0	0	5	5	0	0	4	4	0	6	0	0	0	6	0	0	0	0	5	0	6
	SP	0	0	0	4	4	4	4	0	0	0	3	0	0	2	2	0	4	1	1	1	5	1	4	5	3	3	0	4
	SW	0	0	0	3	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0	0	3	0	3	3	3	3	0	0
5	GW	28	55	58	46	129	46	129	31	0	33	34	4	0	99	99	0	129	61	24	55	53	0	34	107	24	53	55	129
	SD	0	0	0	2	2	2	2	0	0	2	1	0	0	1	1	0	2	0	0	0	2	0	0	0	0	1	0	2
	SP	0	0	0	1	2	1	2	0	0	0	0	0	0	0	0	0	2	1	1	1	1	1	1	1	0	0	0	2
	SW	4	0	0	4	10	4	10	0	0	0	0	0	0	2	2	0	10	4	4	4	5	0	4	5	0	0	0	10
6	GW	74	39	4	193	464	194	464	1	7	25	33	7	4	340	297	0	464	298	261	277	210	0	8	235	10	10	39	464
	SD	0	0	0	5	5	5	5	0	0	3	0	0	0	0	0	0	5	0	0	0	5	0	0	0	0	0	0	5
	SP	0	0	0	9	10	9	10	0	0	0	4	0	0	0	0	0	10	5	5	5	9	5	9	9	4	4	0	10
	SW	10	30	0	54	39	54	39	0	0	0	44	0	0	10	0	0	39	30	30	30	64	10	54	64	52	52	20	39
7	GW	8	7	2	4	20	4	20	4	0	3	3	0	0	14	14	0	20	17	3	8	6	0	4	9	0	3	7	19
	SD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	SP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	SW	0	0	0	24	44	24	0	0	0	0	22	0	0	0	0	0	0	39	0	0	23	0	0	24	0	0	0	0

Table 2.2. (contd)

	Medium	Ammonia	Benzene	Carbon-14	Cesium-137	Chromium	Cobalt-60	Copper	Cyanide	Diesel oil	Europium-152	Europium-154	Iodine-129	Kerosene	Lead	Mercury	Neptunium-237	Nickel	Nitrate	Nitrite	Phosphate	Strontium-90	Sulfate	Technetium-99	Tritium	Uranium-234	Uranium-238	Xylenes (total)	Zinc
15	GW	0	6	0	1	6	1	6	0	0	0	1	0	0	1	0	0	6	6	5	6	0	0	1	7	0	0	6	6
	SD	0	0	0	4	4	4	4	0	0	4	0	0	0	0	0	0	4	0	0	0	4	0	0	0	0	0	0	4
	SP	0	0	0	4	9	4	9	0	0	0	0	0	0	0	0	0	9	4	4	4	4	4	0	4	0	0	0	9
	SW	8	0	0	8	16	8	16	0	0	0	0	0	0	0	0	0	16	8	8	8	8	0	0	8	0	0	0	16
16	GW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	SD	0	1	0	10	6	10	5	0	0	5	8	0	0	3	1	0	6	1	1	1	10	0	0	0	3	7	1	6
	SP	0	0	0	2	4	2	4	0	0	0	0	0	0	0	0	0	4	2	2	2	2	2	0	2	0	0	0	4
	SW	6	0	0	6	12	6	12	0	0	0	0	0	0	0	0	0	12	6	6	6	6	0	0	6	0	0	0	12
17	GW	0	20	0	8	19	8	19	0	0	0	5	8	0	6	0	0	19	29	22	29	0	0	34	69	0	0	20	19
	SD	0	1	0	8	8	8	8	0	0	7	7	0	0	5	5	0	8	1	1	1	8	0	0	0	1	6	1	8
	SP	0	0	0	6	2	6	2	0	0	0	5	2	0	0	0	0	2	1	1	1	6	1	5	6	5	5	0	2
	SW	0	30	0	31	20	31	20	0	0	0	31	3	0	10	0	0	20	20	20	20	35	10	53	63	60	61	20	20
18	GW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	SD	0	1	0	21	1	21	1	0	0	21	1	0	0	1	1	0	1	1	1	1	1	0	0	0	1	1	1	1
	SP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	SW	108	0	0	0	223	0	331	0	0	0	0	0	0	230	4	0	231	104	0	123	0	226	0	20	0	0	0	230
19	GW	13	31	0	32	54	32	54	3	0	3	7	7	1	49	44	0	54	49	39	38	12	0	19	50	9	16	31	54
	SD	0	1	0	1	1	1	1	0	0	1	1	0	0	1	1	0	1	1	1	1	1	0	0	0	1	1	1	1
	SP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	SW	8	8	0	8	16	8	16	0	0	8	8	0	0	16	16	0	16	0	0	8	8	0	8	8	0	8	8	16
20	GW	78	420	0	170	396	170	396	14	0	28	45	17	2	343	361	0	396	290	238	227	147	0	52	194	114	186	414	396
	SD	0	1	0	4	3	4	3	0	0	1	4	0	0	1	1	0	3	1	1	1	4	0	0	0	0	3	1	3
	SP	0	0	0	5	0	5	0	0	0	0	5	2	0	0	0	0	0	0	0	0	5	0	5	5	5	5	0	0
	SW	10	10	0	101	52	101	52	0	0	10	78	10	0	20	20	0	52	0	0	10	40	0	41	62	33	43	10	52
21	GW	10	29	0	30	38	30	38	7	0	4	9	4	0	25	23	0	38	43	31	37	10	0	21	36	7	13	29	38
	SD	0	1	0	8	4	8	3	0	0	1	8	0	0	3	1	0	4	1	1	1	8	0	0	0	4	8	1	4
	SP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	SW	0	111	0	188	131	188	111	20	0	0	161	16	0	40	39	0	111	121	141	121	291	77	74	313	291	292	61	111



96tbw224.eps

Figure 2.1. Sampling Locations for All Data Used in the Screening Assessment

9613448.1553

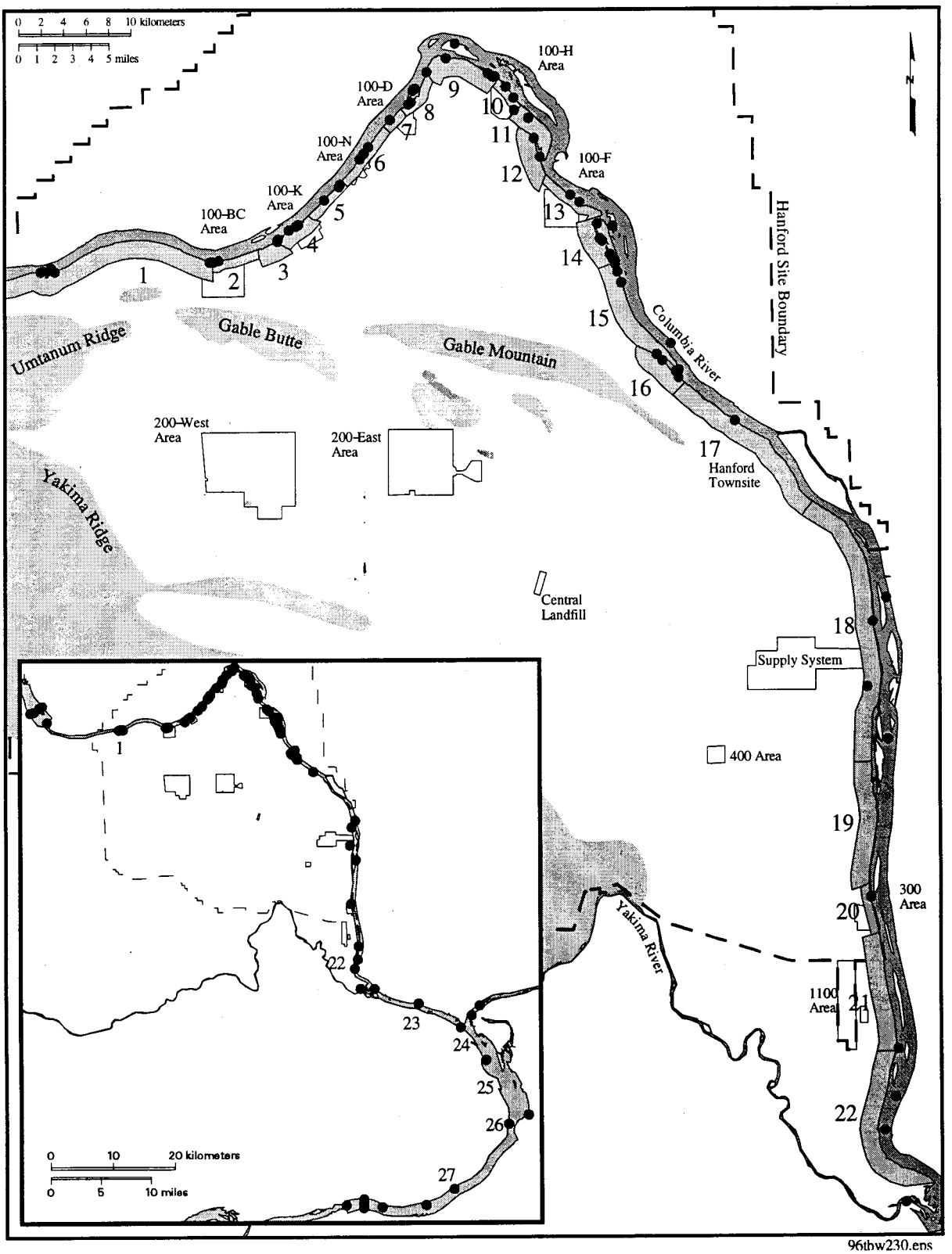


Figure 2.3. Sampling Locations for Sediment Data Used in the Screening Assessment

9613448.1554

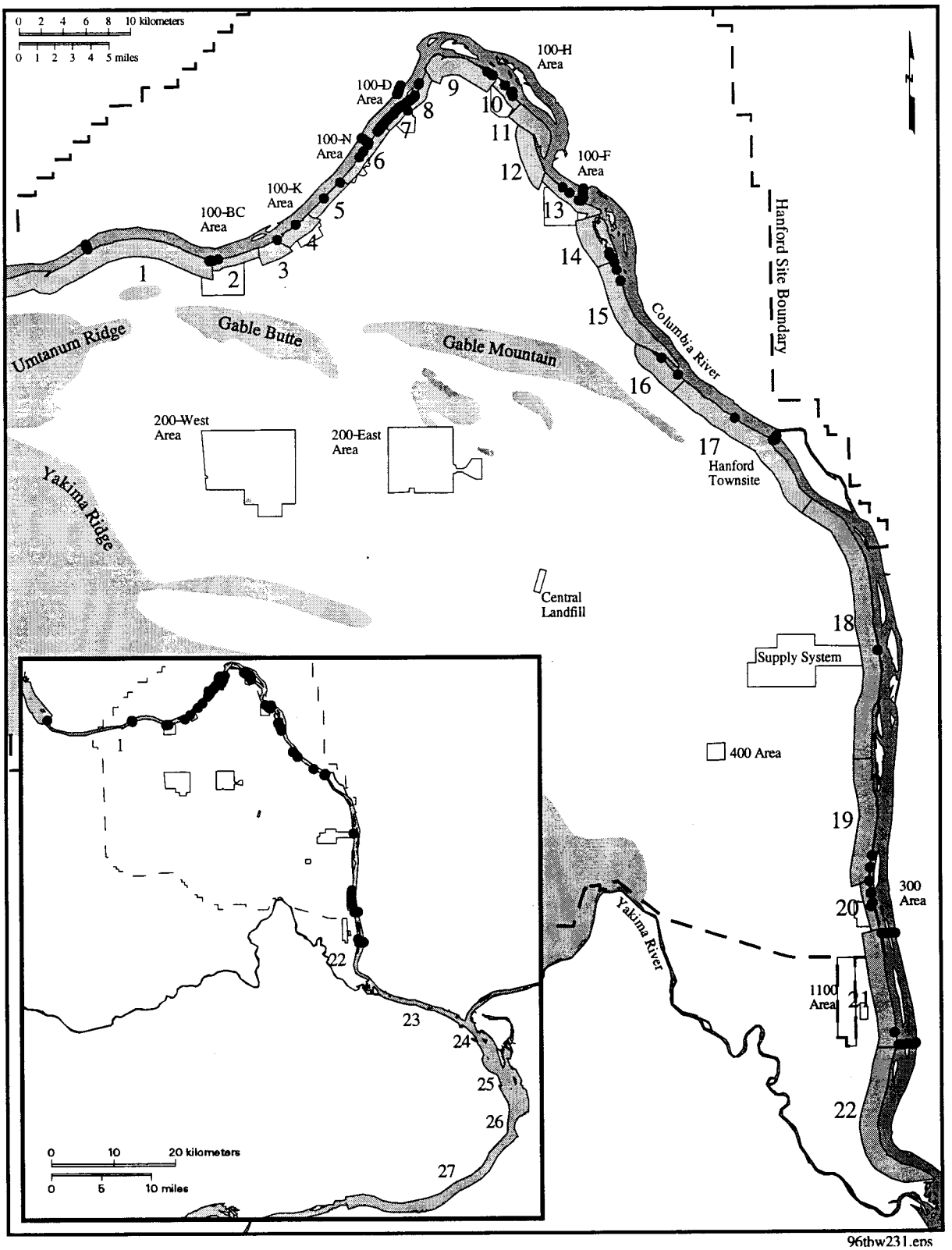


Figure 2.5. Sampling Locations for Surface Water Data Used in the Screening Assessment

3.0 Data Selection Process

This section describes the data analysis process used to obtain concentration inputs to the screening assessment models from the raw concentration data. This process was repeated for each segment and for each contaminant being evaluated. The process involved choosing a maximum representative value for the concentration of each contaminant for a deterministic run and calculating the parameters that define the concentration probability density function needed for the stochastic runs. The term "maximum representative value" is used to mean the highest concentration value that is considered representative of the sampling location.

Because of the volume of data, it was desirable to keep human intervention in the data selection process to a minimum. PNNL guided the development of computational techniques to select the data values to be used in the screening assessment. Graphical displays of the raw data were used to track the results of the computational techniques and identify needed modifications to final data files. The data plots are included as Appendix C in Volume II. For a copy of Volume II (over 500 pages plus 9 diskettes), contact S. D. Cannon at 509-372-6210.

The work of the data task did not include analyzing the quality of the data. Data quality objectives will be discussed in the report on the screening assessment and requirements for a comprehensive assessment.

3.1 Deterministic and Stochastic Analyses

To meet the needs of the screening assessment, data were prepared to support two types of analyses:

- A **deterministic analysis** wherein a single calculation is performed with a single value selected for each parameter, such as the concentrations of contaminants entering the river.

- A **stochastic analysis** wherein a set of calculations is performed over the range of some of the input parameters.

For the deterministic analysis, the maximum representative concentrations for each contaminant in each medium were used to represent the segment. For the stochastic analysis, a probability density function of the concentration parameter will be assumed to be a lognormal distribution truncated at the 99.9th percentile. The probability density function expresses the state of knowledge about alternative values for the parameter. The particular lognormal distribution assumed will be determined by specifying the geometric mean and geometric standard deviation that represents concentration data for each river segment for which impacts will be computed.

Table 3.1. Groundwater Wells Eliminated as Sources of Data for the Screening Assessment

Segment	Well Name
2	199-B2-12
2	199-B3-2P
4	199-K-32B
6	199-N-69
6	199-N-80
6	199-N-8P
8	199-D8-54B
8	199-D8-54B
10	199-H4-12C
10	199-H4-15C
10	199-H4-2
13	199-F5-43B
13	199-F5-43B
20	399-1-16C
20	399-1-17C
20	399-1-9
21	699-S29-E16C

3.3.2 Selection of Data

This section presents the data selection process for groundwater data. The process was followed for each contaminant and river segment.

3.3.2.1 Process the Raw Data for Inconsistencies

All groundwater data used in the assessment were from HEIS. ERC supplied a Microsoft Access macro to process the data for inconsistencies. The macro performed a series of queries designed to implement data standardization and to correct known errors. Soil results that reside in the groundwater area of HEIS were removed. Units of measurement were standardized for various contaminants. Known errors in constituent identification codes were corrected. Constituent names were standardized. Known errors in some of the nitrate analyses were corrected.

3.3.2.5 Choose a Representative Well Maximum

A representative maximum value is used for the deterministic analysis because the goal is to produce a conservative or worst case estimate of risk. For each groundwater well with non-trending data, the maximum concentration detected in the well is chosen for the representative maximum value. For upward trending data, the maximum concentration was more conservative than the maximum of the current time period, so the overall maximum was used. For downward trending data, the most recent detected measurement was used. If there is more than one detected measurement in the most recent sampling period (as in one filtered and one unfiltered), then the maximum of the measurements is chosen as the representative maximum value.

3.3.2.6 Choose a Representative Well Median

A representative median value was used in the calculation of stochastic parameters because the stochastic process requires that attention be focused on best-estimate parameter values rather than conservative (maximal) values. If an upward or downward trend was detected, the median of the most recent groundwater concentration measurements was used to represent the well. If a well does not have a trend, then no single data point is considered more representative of the well than any other point. In that case, the median of the data is the single most representative concentration value for the well. This approach leads to the most representative probability density function to describe the uncertainty about the concentration data for the river segment being studied.

3.3.2.7 Compute Segment Parameters

For the groundwater medium, the representative values for individual wells must be combined into parameters that are representative of the river segment because no single well is representative of the segment. Whereas the process for the wells combines the data over time into a single value at the various well locations, the segment process combines the values over space into representative data for the segment.

3.3.2.8 Compute the Segment Maximum

The segment maximum is the highest of the well representative maximum values. This value is the maximum of all the observed concentrations in any well in the segment. This value is used to represent the segment in the deterministic risk calculations.

3.3.2.9 Compute Stochastic Parameters

The stochastic parameters (the geometric mean and geometric standard deviation) were calculated from the set of median (best-estimate) well values in the segment. The first step in calculating the geometric mean and geometric standard deviation was to take the natural logarithm of the median well values. The arithmetic mean of the log-transformed median values was calculated and then exponentiated to

3.4.4 Compute Stochastic Parameters

Calculate the geometric mean and geometric standard deviation of all measurements for the segment after outliers for the segment have been removed. The calculation of the geometric mean and geometric standard deviation are as described in section 3.3.2.5.2 in the groundwater process using winsorized data. The geometric mean and geometric standard deviation define the specific two-parameter lognormal distribution that will be used for the stochastic risk assessment calculations for the segment.

4.0 Final Data Sets

The final data sets produced for input to the human health and ecological screening assessments are the media files. The media files were derived from the Microsoft Access database of raw files (see Appendix A in Volume II). The media files are provided on diskette as Appendix D in Volume II. (For a copy of Volume II containing over 500 pages plus 9 diskettes, contact S. D. Cannon at 509-372-6210.) The media files are comma separated files that can be opened and read by Excel 5.0. Each medium is provided in a separate file. The media are groundwater (GW), sediment (SD), seeps (SP), surface water (SW), and external radiation (TLD).

Each media file contains a record for each contaminant in each segment. The records are sorted by contaminant first, then segment. For each medium, a file is constructed that contains the following information:

Media	Medium name
Segment_No	Segment number
Contaminant	Contaminant name
Units	Units of measurement
Max_Value	Maximum concentration
NA	Not available
Max_Samp_Num	Identifying number for the sample with the maximum concentration
Max_Samp_Date	Date of the sample with the maximum concentration
Max_Samp_Owner	Organization that has responsibility for the sample with the maximum concentration
GM	Geometric mean
GSD	Geometric standard deviation
Num_Obs	Number of records for that contaminant/medium combination

If there were no data for a contaminant and segment combination, there will be an "NA" in the media file for the pertinent record. This will be the case for the maximum and its associated information and for the geometric mean and geometric standard deviation. If data are marked as undetected (qualifier of "u") in segments with no detected values for the particular contaminant in question, a geometric mean and geometric standard deviation will be calculated on the detection limits reported (see Section 3.2), but the maximum value and its associated information will be reported as not available (NA).

5.0 References

42 USC 6901 et seq. (as amended). October 31, 1976. *Resource Conservation and Recovery Act of 1976.* Public Law 94-580.

42 USC 9601 et seq (as amended). December 11, 1980. *Comprehensive Environmental Response, Compensation, and Liability Act of 1980.* Public Law 96-510.

Barnett, V., and T. Lewis. 1994. *Outliers in Statistical Data.* Third edition, Wiley and Sons, New York.

Becker, J.M., C.A. Brandt, D.D. Dauble, A.D. Maughan, and T.K. O'Neil. 1996. *Species for the Screening Assessment: Columbia River Comprehensive Impact Assessment.* DOE/RL-96-16-b, U.S. Department of Energy, Richland, Washington.

Brulotte, P.J. 1994. *Tri-Party Agreement Databases, Access Mechanism and Procedures.* DOE/RL-93-69, U.S. Department of Energy, Richland, Washington.

Dixon, W.J., and J.W. Tukey. 1968. "Approximate Behavior of the Distribution of Winsorized *t*." *Technometrics*, 10:83-98.

DOE - U.S. Department of Energy. 1992. *Integrated Database for 1992: U.S. Spent Fuel and Radioactive Waste Inventories, Projects and Characteristics.* DOE/RW-006, Rev. 8, Oak Ridge, Tennessee.

DOE - U.S. Department of Energy. 1994. *Columbia River Impact Evaluation Plan.* DOE/RL-92-28, Rev. 1, Richland, Washington.

DOE - U.S. Department of Energy. 1995. *Hanford Site Risk Assessment Methodology.* DOE/RL-91-45, Rev. 3, Richland, Washington.

Dresel, P.E., P.D. Thorne, S.P. Luttrell, B.M. Gillespie, W.D. Webber, J.K. Merz, J.T. Rieger, M.A. Chamness, S.K. Wurstner, and B.E. Opitz. 1995. *Hanford Site Ground-Water Monitoring for 1994.* PNL-10698, Pacific Northwest Laboratory, Richland, Washington.

Ecology - Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy. 1994. *Hanford Federal Facility Agreement and Consent Order.* Document No. 89-10, Rev. 3 (The Tri-Party Agreement), Ecology, Olympia, Washington.

EPA - U.S. Environmental Protection Agency. 1990. *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part A).* EPA/540/1-89/002, Office of Emergency and Remedial Response, Washington, D.C.

Distribution

No. of Copies	
	Technical Peer Reviewers
2	Director, Technical Peer Reviewers W. H. Funk State of Washington Water Research Center Washington State University Pullman, WA 99164-3002
2	Director, Technical Peer Reviewers K. Williamson Oregon Water Resources Research Institute Oregon State University Strand Agricultural Hall 210 Corvallis, OR 97331-2208
	J. L. Creighton Creighton and Creighton Inc. Consultants P.O. Box 1030 Los Gatos, CA 95031-1030
	E. Faustman University of Washington 4225 Roosevelt Way NE Dept. of Environmental Health Room 208 Seattle, WA 98105-6099
	K. Goodman Enviros 25 Central Way, Suite 210 Kirkland, WA 98033
	K. A. Higley Oregon State University Dept. of Nuclear Engineering Radiation Center Corvallis, OR 97331-5902

No. of Copies	
	J. E. Hulla Dept. of Pharmacology and Toxicology Univ. of North Dakota School of Medicine P.O. Box 9037 Grand Forks, ND 58202-9037
	J. W. Massman Dept. of Civil Engineering University of Washington FX-10 MS 352700 Seattle, WA 98195
	M. H. O'Brien Environmental Research Foundation P.O. Box 12056 Eugene, OR 97440
	G. W. Suter II Oak Ridge National Laboratory Oak Ridge, TN 37831-6038
	F. R. Taub School of Fisheries Box 355100 University of Washington Seattle, WA 98195
	R. F. Weiner Dept. of Civil Engineering University of New Mexico Albuquerque, NM 87185-1341
	F. W. Whicker Dept. of Radiological Health Sciences Colorado State University 2954 Skimmerhorn Street Ft. Collins, CO 80526

No. of Copies

S. M. Alexander
Washington State Department of Ecology
1315 W. Fourth Avenue
Kennewick, WA 99336-6018

D. Baker
Hawley Hall, Room 228
Corvallis, OR 97331-1311

C. Beaverson
National Oceanic and Atmospheric Administration
c/o EPA Region X
Mail Stop HW-111
1200 Sixth Avenue
Seattle, WA 98101

D. Belsey
030 SW Ridge Drive
Portland, OR 97219-6566

S. Benz
600 S. Kent #71
Kennewick, WA 99336

L. Block
U.S. Fish and Wildlife Service
Moses Lake Field Office
P.O. Box 1157
Moses Lake, WA 98837

D. Bradshaw
Audobon Society of Portland
5151 Northwest Cornell Road
Portland, OR 97210

D. Campbell
Foster Wheeler Inc.
111 Union Valley Road
Oak Ridge, TN 37830

No. of Copies

J. Carleton
Washington Department of Fish and Wildlife
600 Capitol Way North
Olympia, WA 98501-1091

D. Cellarius
Sierra Club Northwest Office
1516 Melrose Avenue
Seattle, WA 98122

P. Cirone
EPA Region X
Mail Stop ES-098
1200 Sixth Avenue
Seattle, WA 98101

C. Cline
Washington State Dept. of Ecology
Mail Stop PV-11
P.O. Box 47651
Olympia, WA 98504-8711

J. P. Corley
2213 Torbett
Richland, WA 99352

D. Delistraty
Washington State Dept. of Ecology
N. 4601 Monroe, Suite 202
Spokane, WA 99205-1295

C. Denniston
Greenpeace
11815 - 20th SW
Seattle, WA 98146

B. Drost
USGS Water Resources Division
Washington District
1201 Pacific Avenue Suite 600
Tacoma, WA 98402

No. of Copies

R. Pixler
CRESP West Program
Department of Environmental Health
Box 354695
University of Washington
Seattle, Wa 98105

G. Pollet
Heart of America Northwest
1305 4th Avenue, 208
Seattle, WA 98101

S. Renn
5808 Lake Washington Boulevard NE
Kirkland, WA 98033

C. Ridolfi
Ridolfi Engineers and Associates
1001 Fourth Avenue, Suite 3105
Seattle, WA 98154

D. R. Sherwood
U.S. Environmental Protection Agency
712 Swift Boulevard, Suite 5
Richland, WA 99352-0539

P. Sleeger
U.S. Department of the Interior
500 NE Multnomah Street
Suite 600
Portland, OR 97232

R. Smith
U.S. Environmental Protection Agency
Region X
Mail Stop ECL-117
1200 Sixth Avenue
Seattle, WA 98101

J. Sommerset
Pacific Lutheran University
FOS Hall, Room 253
Tacoma, WA 98447

No. of Copies

M. L. Soscia
Columbia River Inter-Tribal
Fish Commission
79 NE Oregon, Suite 200
Portland, OR 97232

R. Stanley
Department of Ecology
P.O. Box 47600
Olympia, WA 98504-7600

L. Stembridge
HEAL
1408 West Broadway Avenue
Spokane, WA 99201-1902

C. Stephan
1520 Torthay Court
Richland, WA 99352

3 Oregon Department of Energy
625 Marion Street NE
Salem, OR 97310

G. Tallent
Washington Department of Ecology
P.O. Box 47600
Olympia, WA 98504

A. H. Thatcher
Department of Health
Division of Radiation Protection
P.O. Box 47827
Olympia, WA 98504-7827

J. P. Thomas
HHIN Resource Center
1719 Smith Tower
506 Second Avenue
Seattle, WA 98104

9613448.1564

DOE/RL-96-16-c
Revision 0, Volume II
UC-630
Draft

Data for the Screening Assessment
Volume II: Appendices
Columbia River Comprehensive Impact Assessment

T. B. Miley
T. K. O'Neil
R. O. Gilbert
L. A. Klevgard
T. B. Walters

June 1996

Prepared by the Pacific Northwest National Laboratory
In Consultation with Representatives of

U.S. Department of Energy
U.S. Environmental Protection Agency
Washington State Department of Ecology
Bechtel Hanford, Inc.
Dames & Moore
Confederated Tribes of the Umatilla Indian Reservation
Hanford Advisory Board
Nez Perce Tribe ERWM
Oregon State Department of Energy
Yakama Indian Nation

United States
Department of Energy
P.O. Box 550
Richland, Washington 99352

9613448.1565

Contents

Volume II

Appendix A - Raw Concentration Data **A.1**

Appendix B - Maps of Sampling Locations by Segment with Coordinates **B.1**

Appendix C - Plots of Raw Data and Maximum Representative Values for the Contaminants of Interest **C.1**

Appendix D - Media Files of Data for Use in the Screening Assessment of Risk to Human Health and the Environment **D.1**

Volume I

Preface v

Summary xi

Glossary xiii

1.0 Introduction 1.1

1.1 Scope 1.1

1.2 Approach 1.2

1.2.1 Segmentation 1.3

1.2.2 Thiessen Polygon Analysis 1.5

1.2.3 Corridor 1.5

2.0 Data Gathering 2.1

2.1 Description of the Data Gathering Process 2.1

2.1.1 Identification of Data Sources 2.1

2.1.2 Data Assimilation 2.1

2.1.3 Identification of Sampling Locations and Their Segments 2.1

2.2 Non-Hanford Data Sources Contacted 2.2

2.2.1 City of Richland 2.2

3.3 Process Used to Select Groundwater Data 3.2

3.3.1 Selection of Groundwater Wells 3.2

3.3.2 Selection of Data 3.3

3.4 Process Used to Select Data for Other Media 3.6

3.4.1 Process the Raw Data for Inconsistencies 3.6

3.4.2 Identify at Most One Outlier 3.6

3.4.3 Compute the Segment Maximum 3.6

3.4.4 Compute Stochastic Parameters 3.7

4.0 Final Data Sets 4.1

5.0 References 5.1

9613448.1567

Appendix A

Raw Concentration Data

Appendix A

Raw Concentration Data

The raw environmental data collected from all sources for use in the screening assessment were combined into a single Microsoft Access database for each medium. Access is a Windows™-based database management system that stores and retrieves data, presents information, and automates repetitive tasks. Diskettes of the raw data are available with this report. The raw data were downloaded from the media databases into comma separated files which can be opened and read by Excel 5.0.

Five diskettes contain the raw data that were used to develop the media files for use in the screening assessment of risk. (See Appendix D for the media files.) Three diskettes provided in this appendix contain the raw data values for biota, cobalt-60 particles, drive point groundwater, N Springs punch point water, and pore water. Because the availability of data applicable to the screening assessment is limited, other calculation methods will be used in the screening assessment for contaminant concentrations in biota, cobalt-60 particles, drive point groundwater, N Springs punch point water, and pore water. Therefore, no media files needed to be prepared for these data. The raw data values for biota, cobalt-60 particles, drive point groundwater, N Springs punch point water, and pore water are provided in this report for completeness.

Diskettes of Raw Data to Be Converted and Used in the Screening Assessment of Risk

- Diskette 1 contains seven files labeled gwseg**.csv, where ** is the two digit segment number. This diskette contains the groundwater raw data for segments 1-7.

- Diskette 2 contains eight files labeled gwseg**.csv, where ** is the two digit segment number. This diskette contains the groundwater raw data for segments 8-10, 12, 13, 15, 17, 19.

- Diskette 3 contains two files labeled gwseg**.csv, where ** is the two digit segment number. This diskette contains the groundwater raw data for segments 20 and 21.

  Note: No groundwater raw data are available for segments 11, 14, 16, 18, 22-27.

- Diskette 4 contains a file labeled swraw.csv, which is the surface water raw data for segments 1-10 and 13-21. No surface water raw data are available for segments 11, 12, and 22-27.

- Diskette 5 contains three files:

Depth	Depth from which sample was taken - not consistently used by programs
Detected	Flag to indicate if a radioactive sample should be considered as detected - not consistently used by programs
Dist_Class	Identifier used by SESP to indicate if the sample was taken on site or offsite
EW_Coord	East-west coordinate
Lab_Code	Code used to identify laboratory analyzing sample
LR Cr+6 ppm	Concentration results of lower range analysis for chromium in parts per million (milligrams per liter)
LR ND	Qualifier field for lower range chromium analysis
MDL	Minimum detection level
Media Type	Type of media sampled
NO3 ppm	Concentrations of nitrate in parts per million (milligrams per liter)
NS_Coord	North-south coordinate
Owner_ID	Organization that has responsibility for the sample
Qualifier	Laboratory qualifier code
Result_Com	Comment on the analysis result
Result Modification Flag	Flag to indicate if result has been modified - not used consistently by programs
Review_Flag	Flag to indicate if result has been reviewed - not used consistently by programs
RRN	A unique record identifier assigned by Access
Samp_Comment	Comment on the sample
Samp_Method	Method used to collect sample
Samp_Num	Sample number
Samp_Part	Portion of the medium that was sampled
Samp_Site-Desc	Description of the sampling site
Samp_Site_ID	Identification of sampling site
Samp_Site_Name	Name of sampling site
Samp_Size	Size of sample collected
Samp_Type	Type of sample; further identifies beyond medium; for example, transect
Sampled_Portion	Identification of portion of organism sampled
Segment	Segment from which sample was taken
Site_ID	Identification of sampling site
Status	Groundwater well use status
SV <	Qualifier field for adsorptive stripping voltametry chromium analysis
SV Cr+6 ppb	Adsorptive stripping voltametry concentration results for chromium in parts per billion (micrograms per liter)
Total_Anal_Error	Total analysis error
Value_rptd	The concentration value measured
Well_Name	Name of well from which sample taken

9613448.1570

Appendix B

Maps of Sampling Locations by Segment with Coordinates

9613448.1571

Appendix B

Maps of Sampling Locations by Segment with Coordinates

The 27 maps presented in this appendix depict the sampling locations for data that were used in developing the media files for each of the 27 segments. See Figure 1.1 for an overview of all 27 segments. Each map in this appendix shows a single segment and the sample locations for all media in that segment. The coordinate grid is provided so that samples may be tracked from the coordinates provided in the raw data. Because of concurrent sampling (for example, for seeps and sediment) in some of the same locations, not all locations are visible on the maps. The number of locations on the map is given in the legend for each medium.

9615448.1572

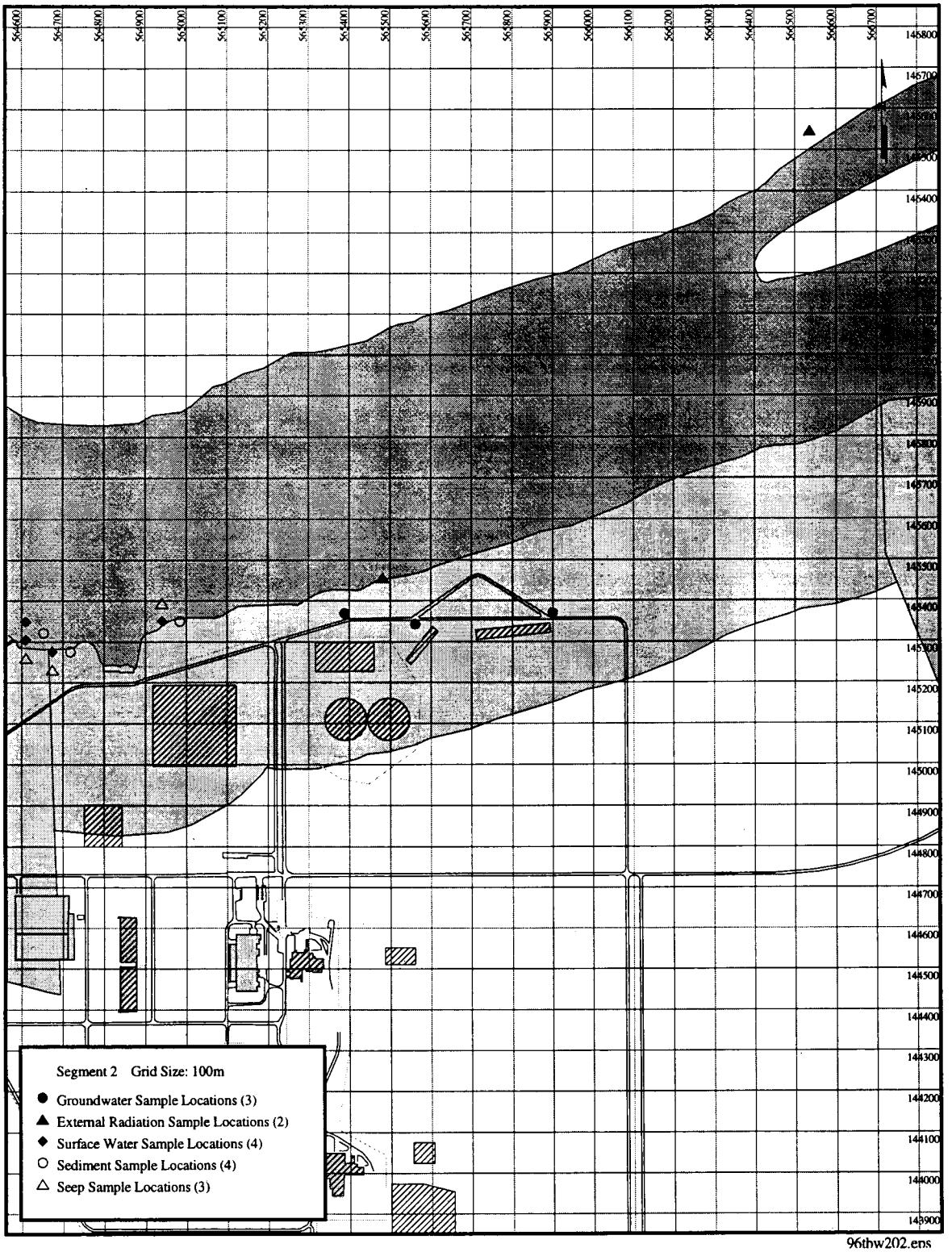


Figure B.2. Map of Sampling Locations for All Media in Segment 2

9613448.1573

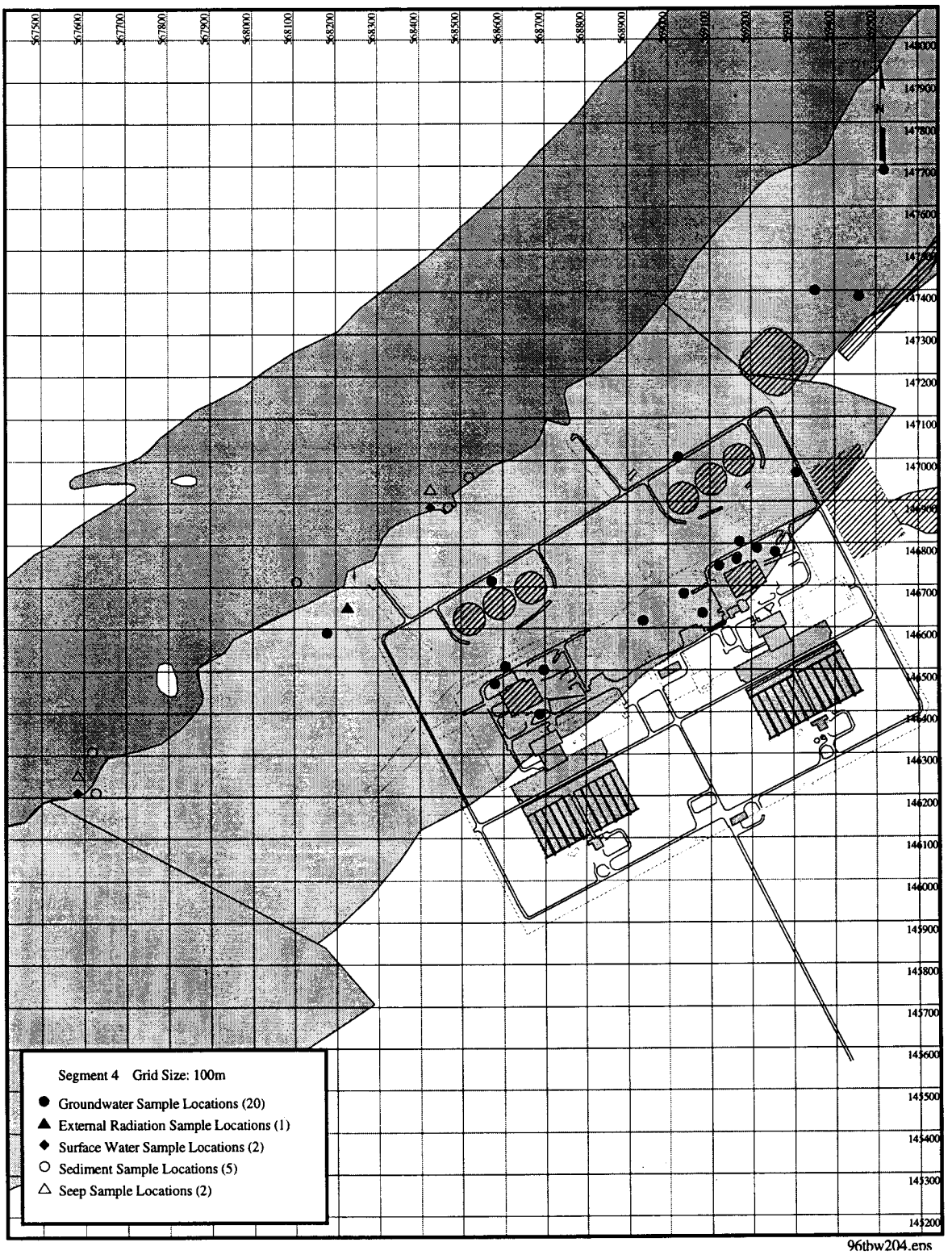


Figure B.4. Map of Sampling Locations for All Media in Segment 4

9613448.1574

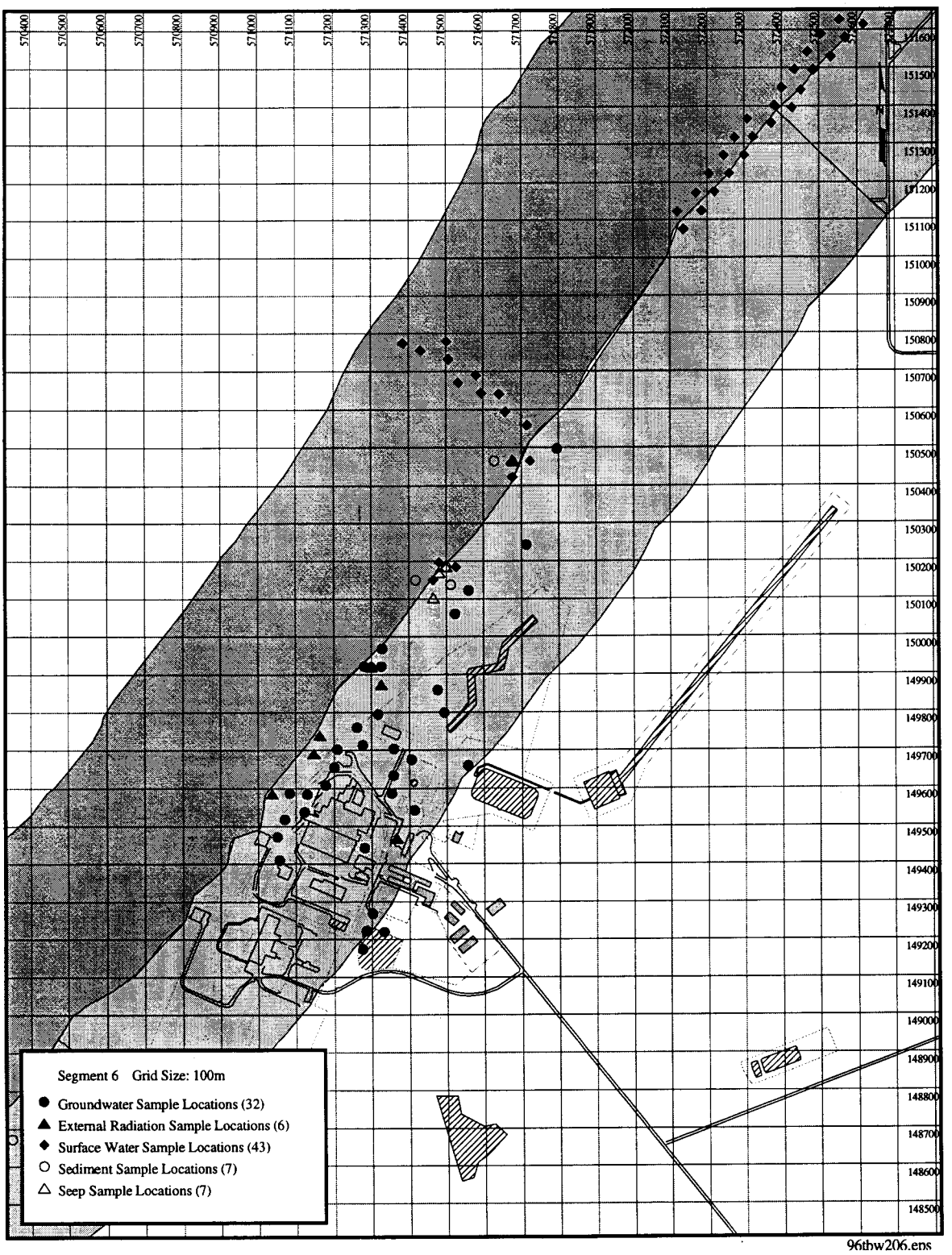


Figure B.6. Map of Sampling Locations for All Media in Segment 6

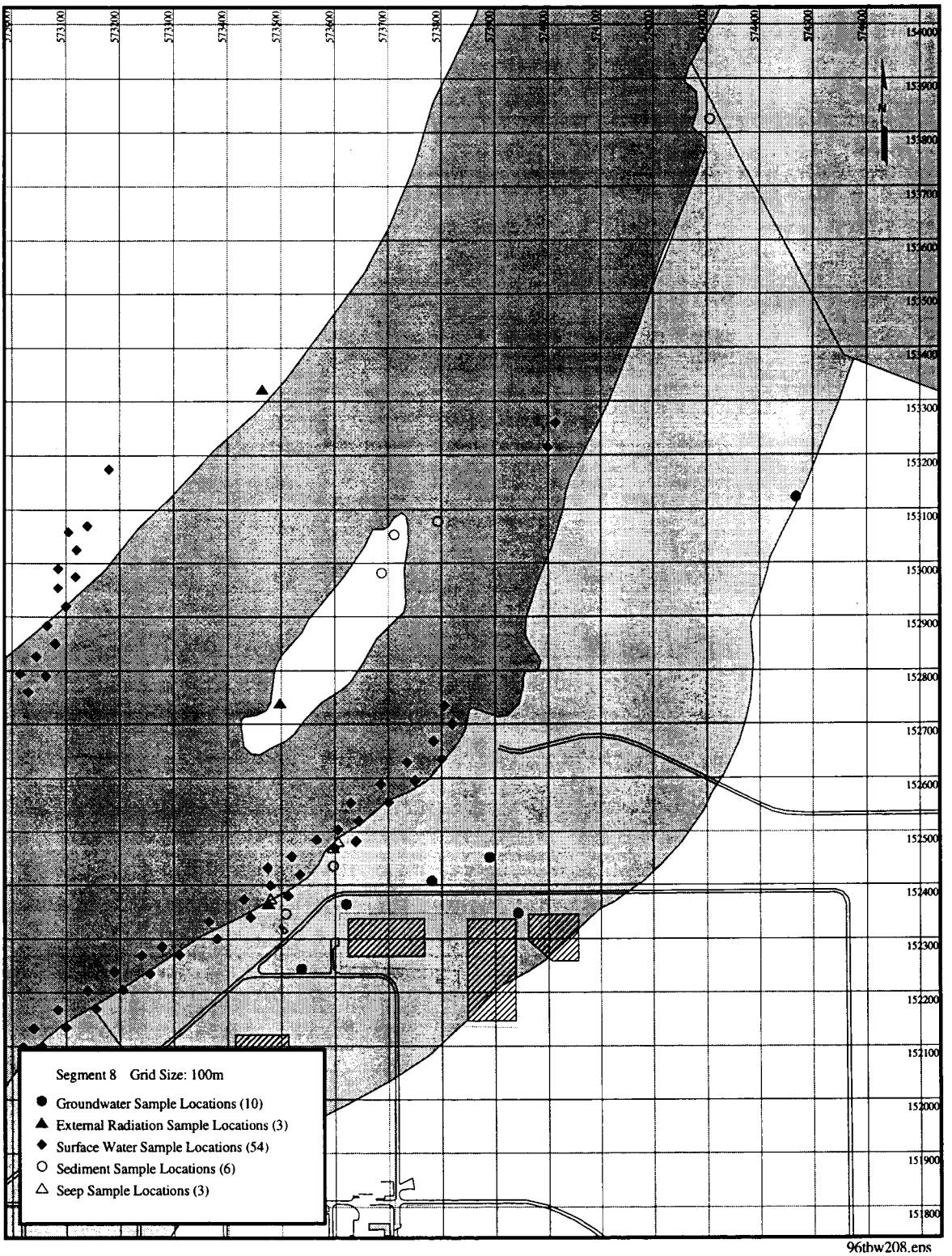


Figure B.8. Map of Sampling Locations for All Media in Segment 8

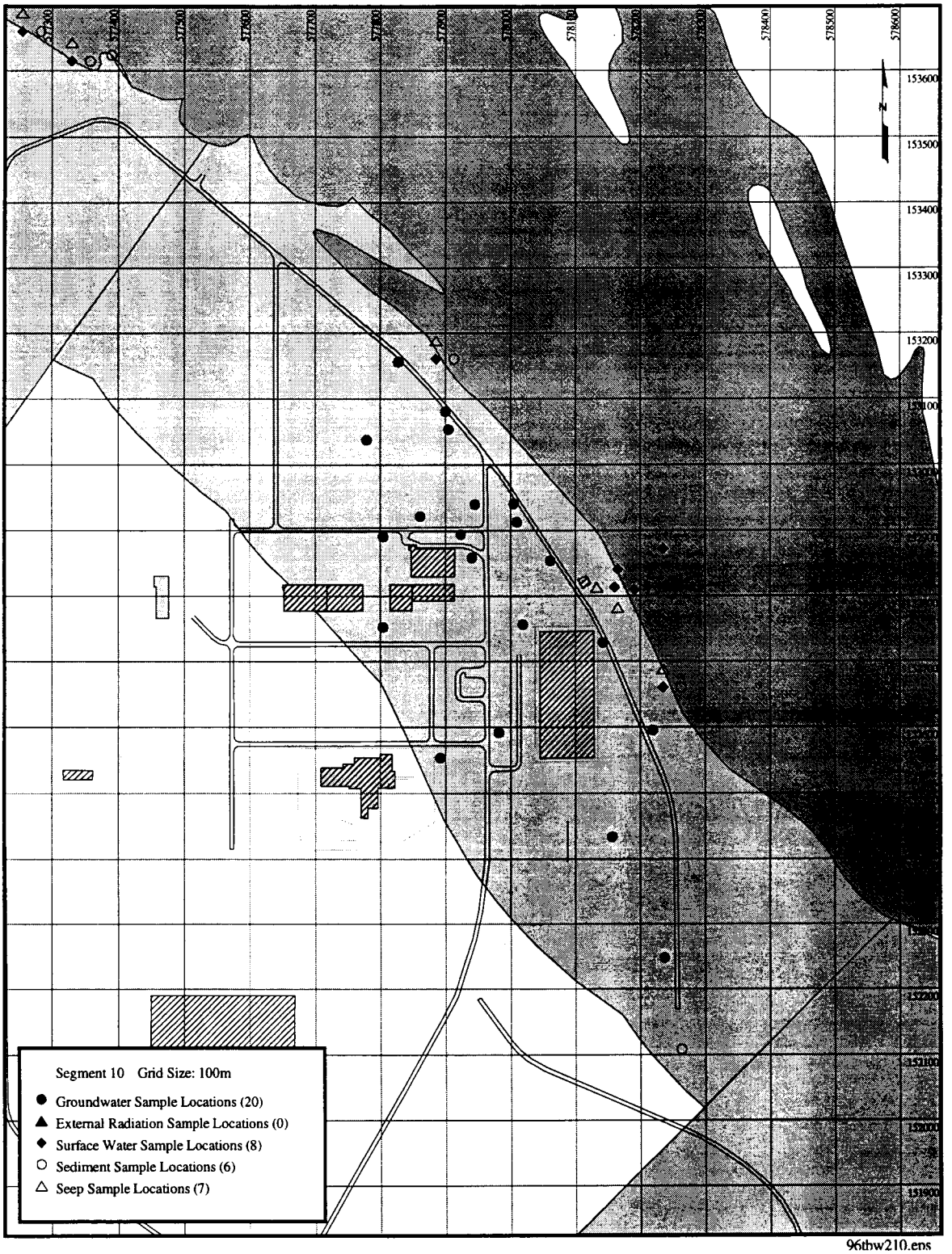


Figure B.10. Map of Sampling Locations for All Media in Segment 10

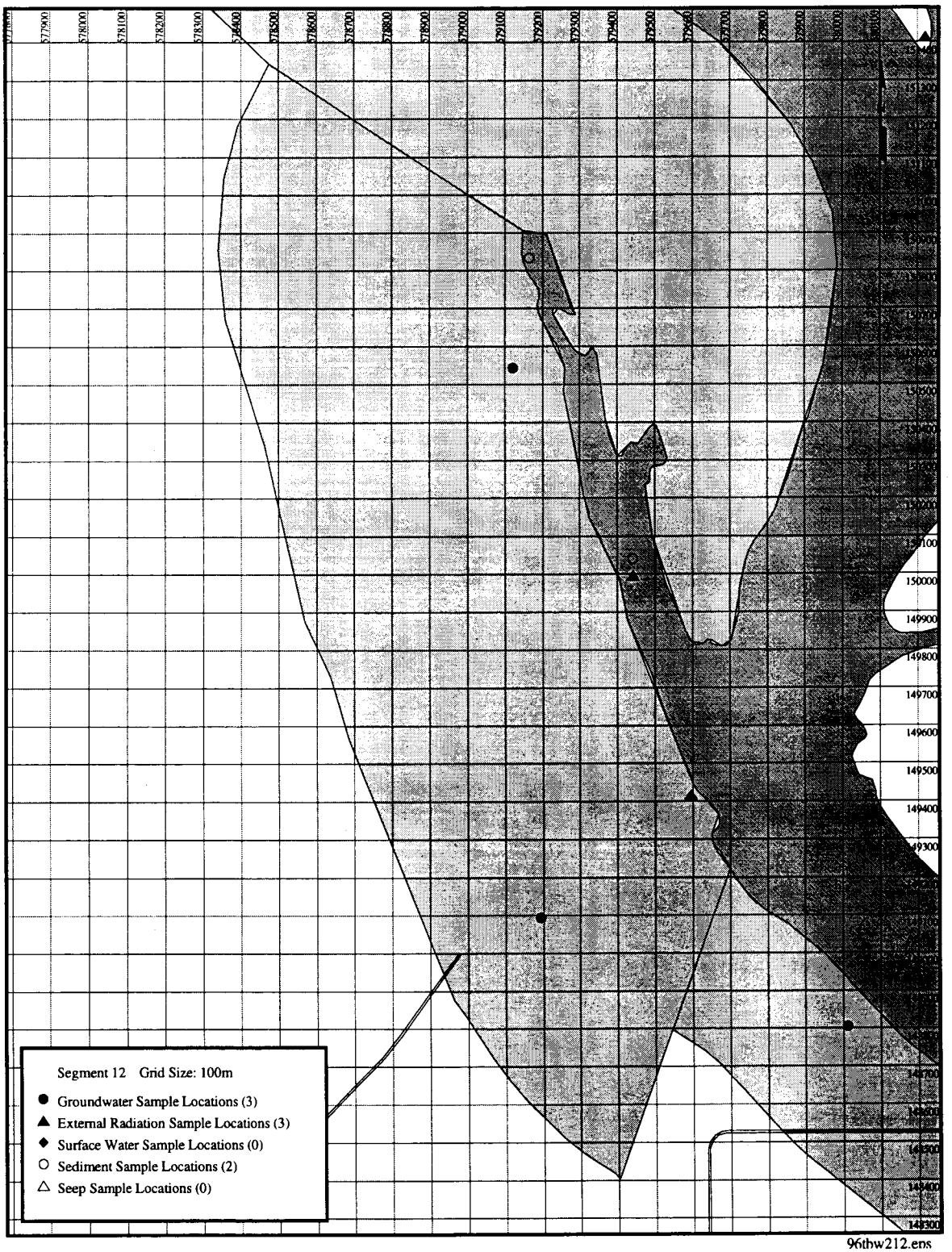


Figure B.12. Map of Sampling Locations for All Media in Segment 12

9613448.1578

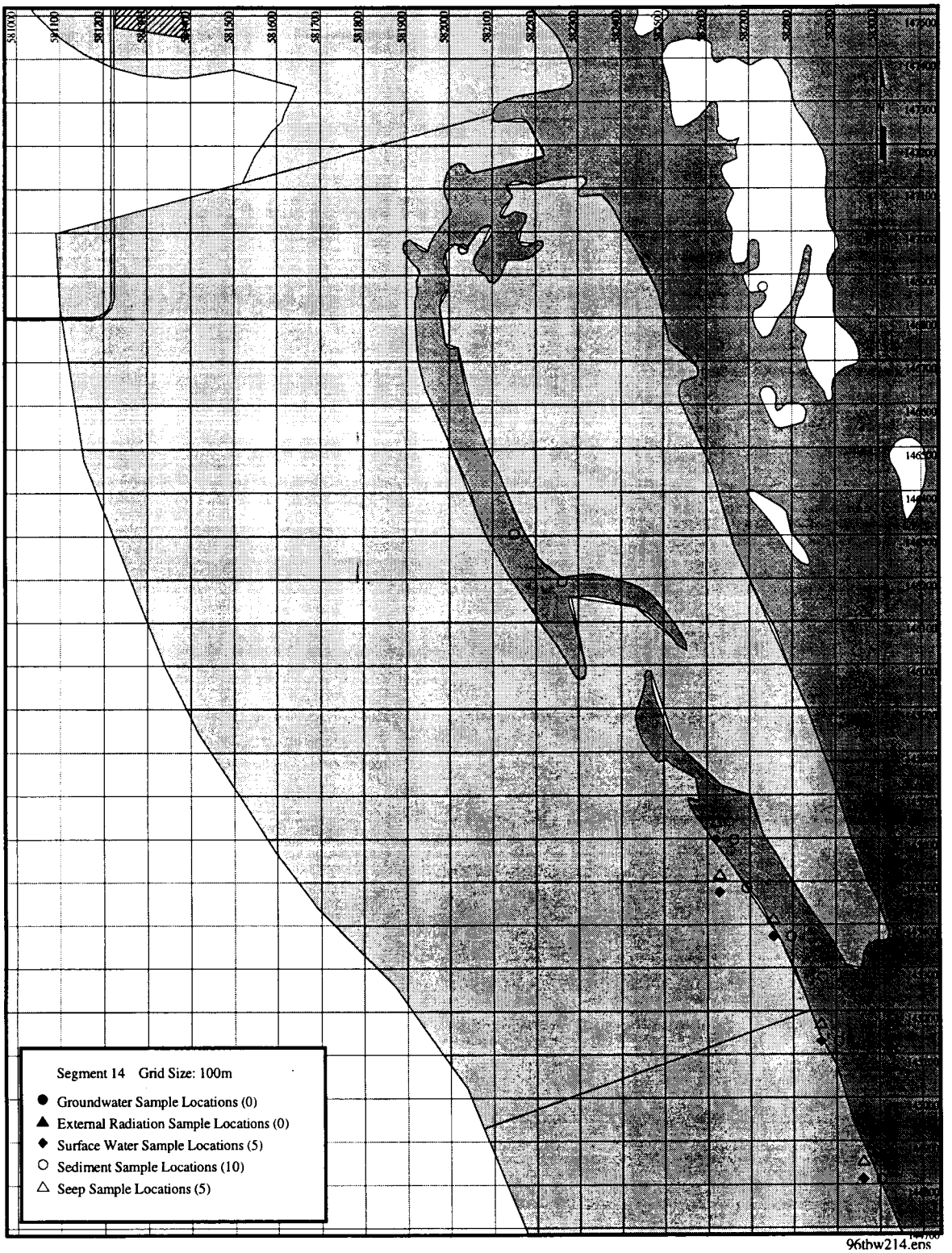


Figure B.14. Map of Sampling Locations for All Media in Segment 14

9613448.1579

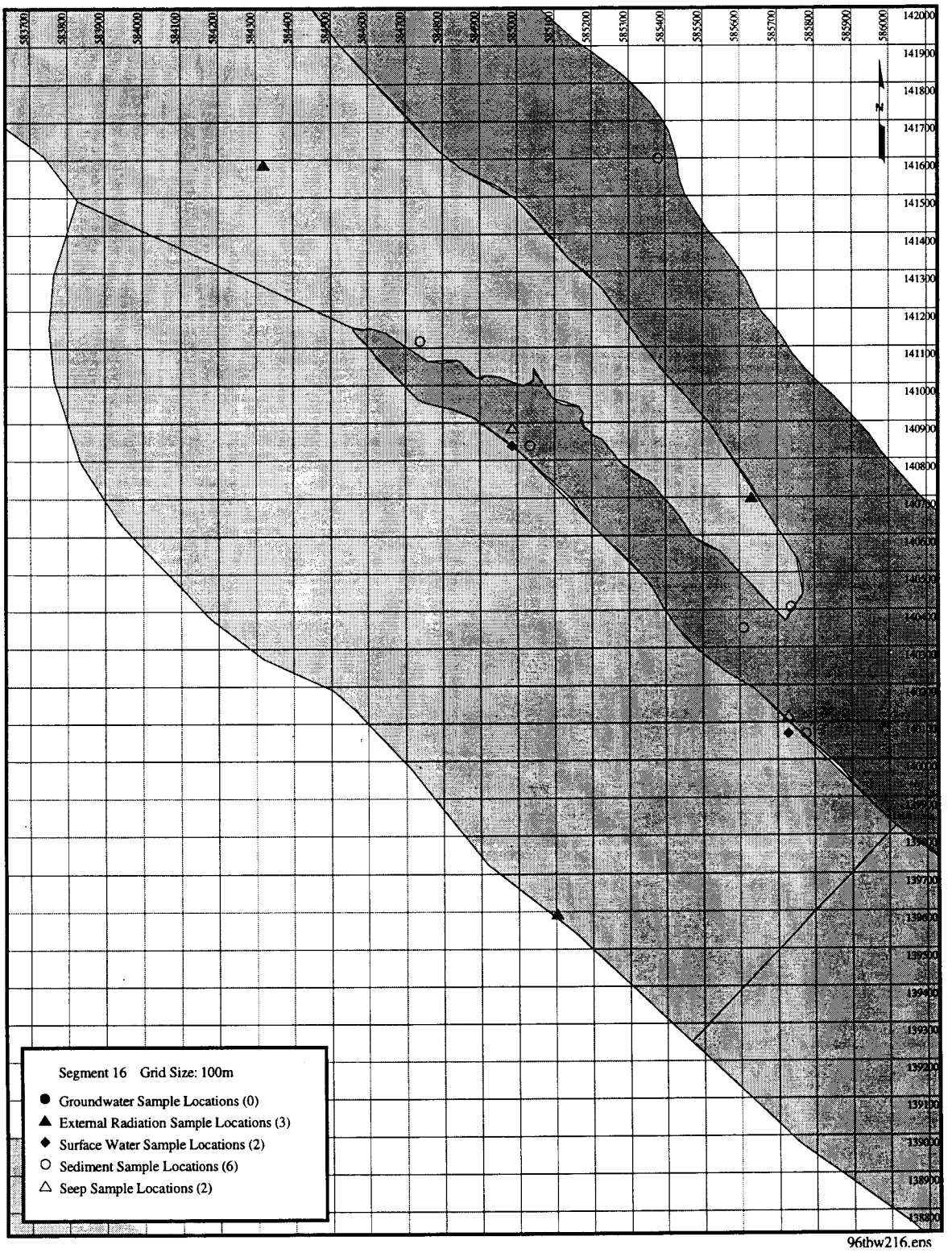


Figure B.16. Map of Sampling Locations for All Media in Segment 16

9613448.1590

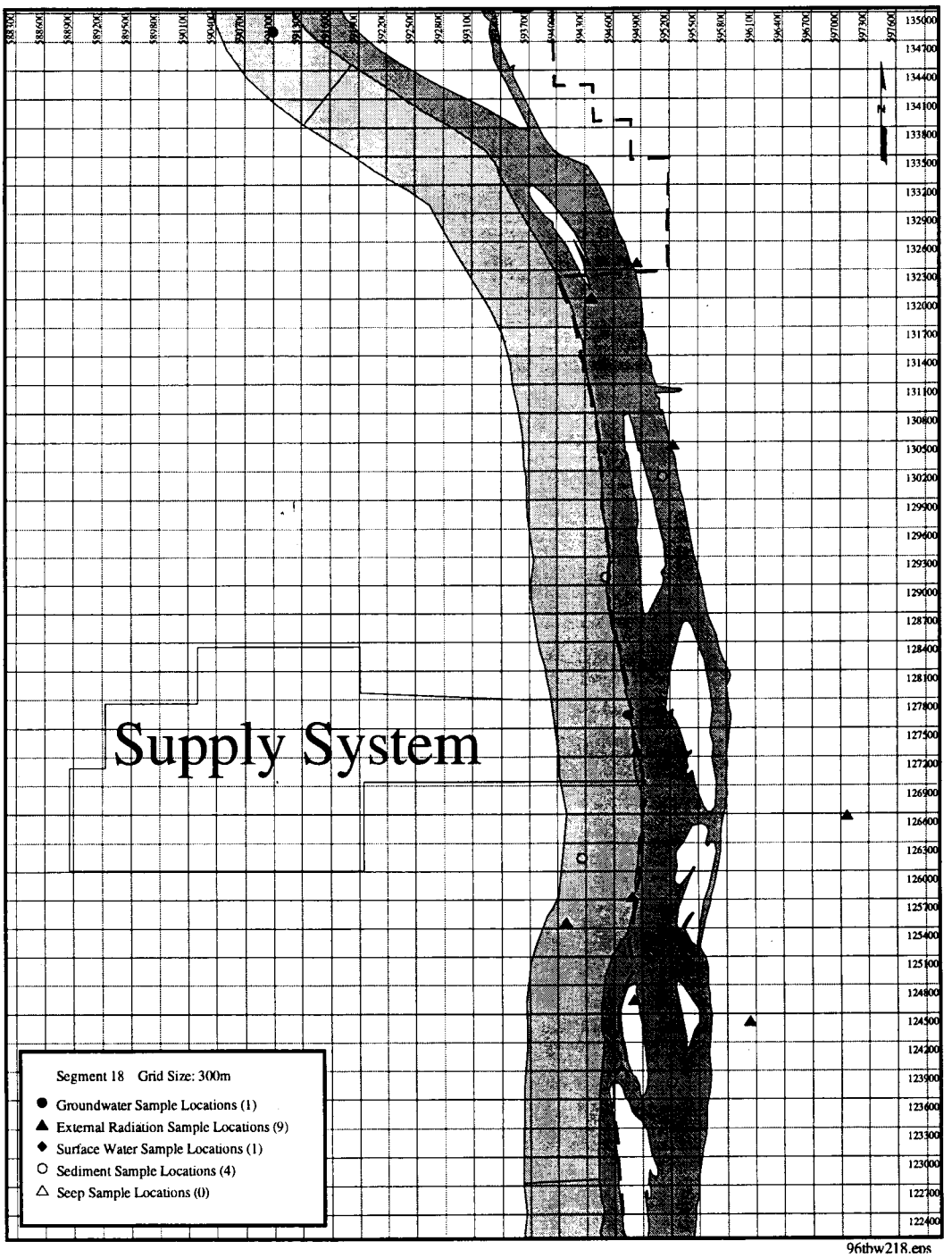


Figure B.18. Map of Sampling Locations for All Media in Segment 18

9613448.1531

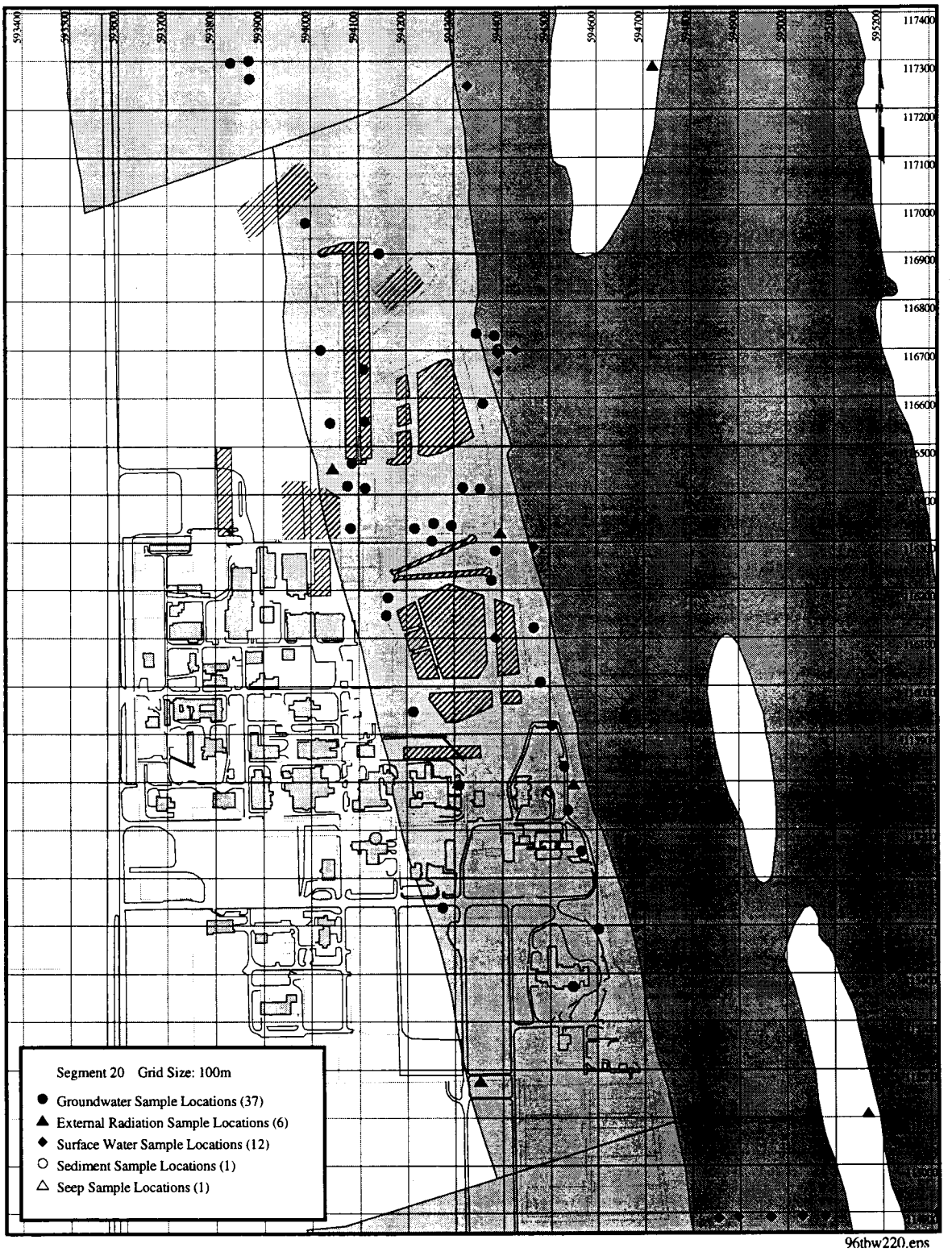


Figure B.20. Map of Sampling Locations for All Media in Segment 20

9613448.1532

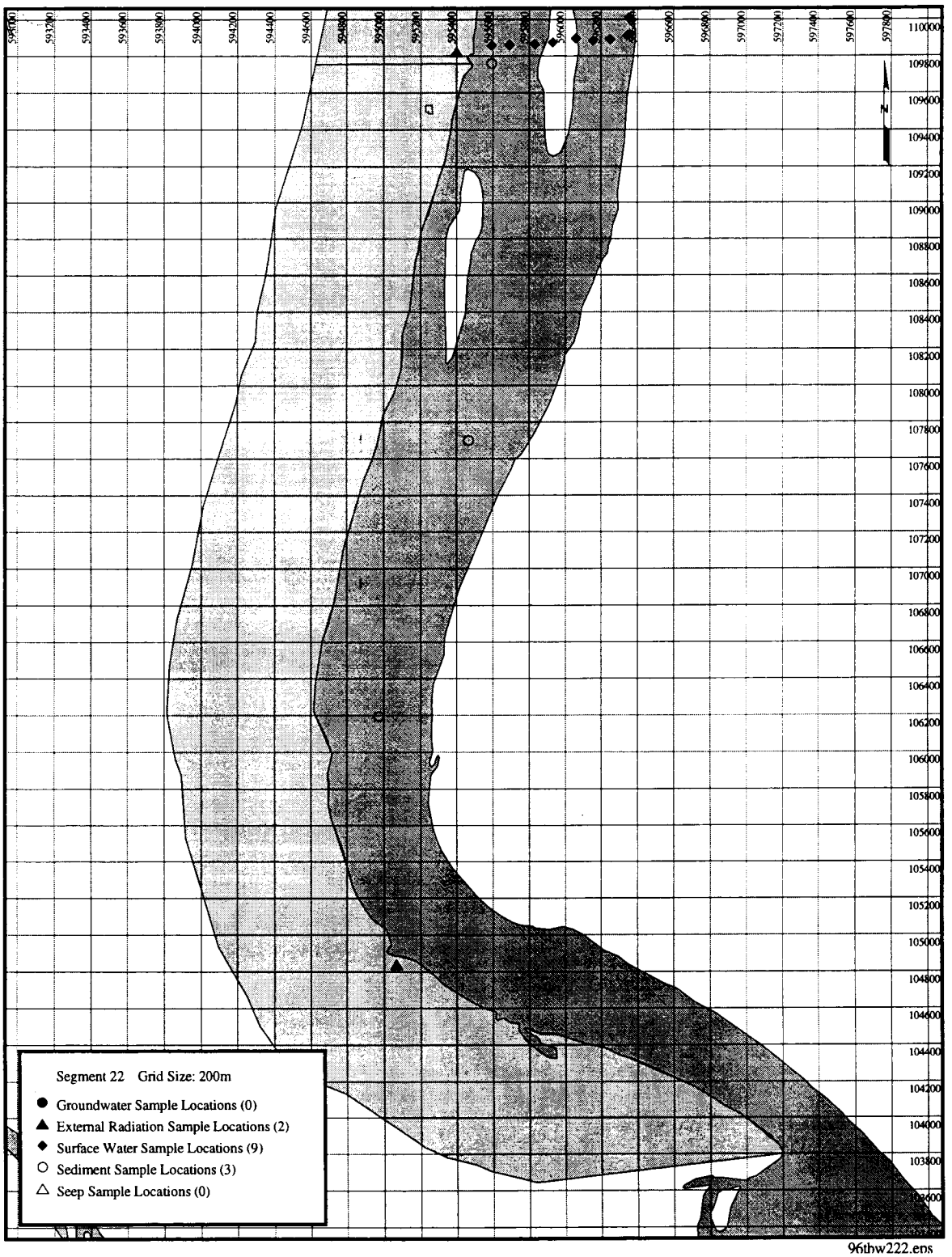


Figure B.22. Map of Sampling Locations for All Media in Segment 22

9613448.1593

Appendix C

Plots of Raw Data and Maximum Representative Values for the Contaminants of Interest

9613448.1584

Appendix C

Plots of Raw Data and Maximum Representative Values for the Contaminants of Interest

The data plots in this appendix are organized by media: groundwater, sediment, seeps, surface water, and external radiation. The data plots show the raw data points as well as the maximum representative values selected for each contaminant of interest. The maximum representative values will be used in the deterministic calculations for the screening assessment of risk to human health and the environment. For groundwater, the set of well medians in a segment were used to calculate the geometric mean and geometric standard deviation that will be used to determine the probability density function for the stochastic calculations in the screening assessment. The key for reading the plots is as follows:

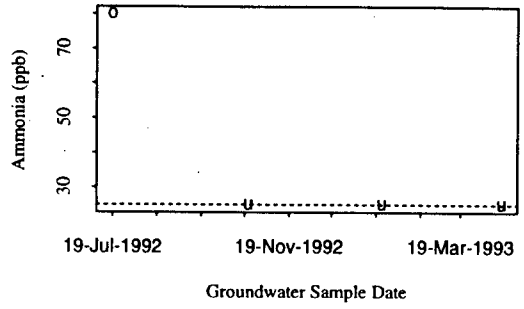
black dots	= raw data points
dashed horizontal line	= well median for groundwater
m	= maximum representative values for each medium; see Section 3.1
o	= outlier; data value determined by a statistical test to be outside the range of possible values in the given distribution
u	= undetected values; see Section 3.2

Not all plots contain raw data points. Those without raw data points have no maximum representative values defined.

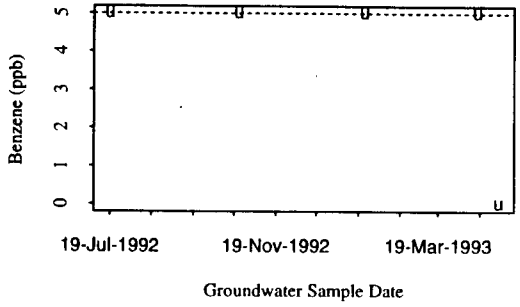
9613448.1535

Groundwater Plots and Maximum Representative Values for the Contaminants of Interest

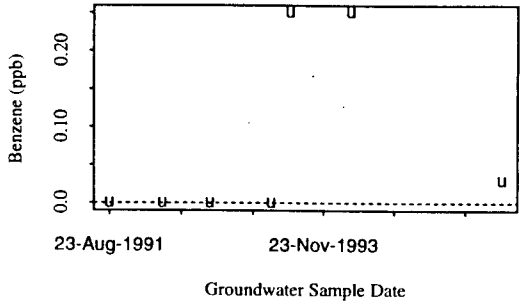
Segment 1-Ammonia
Well 199-B2-13



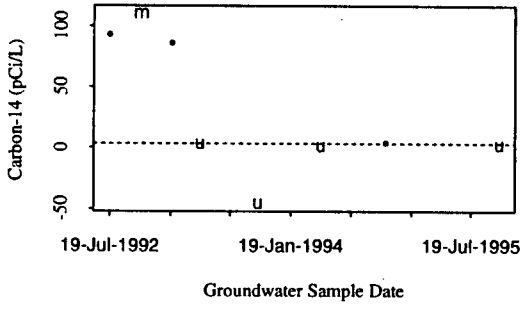
Segment 1-Benzene
Well 199-B2-13



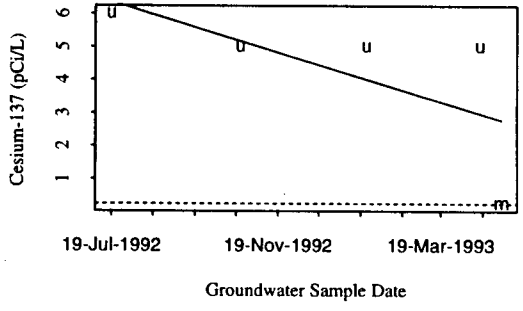
Segment 1-Benzene
Well 699-72-88



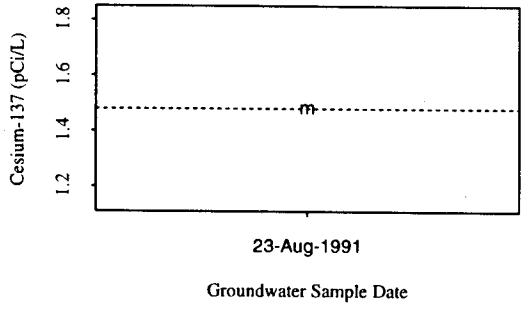
Segment 1-Carbon-14
Well 199-B2-13



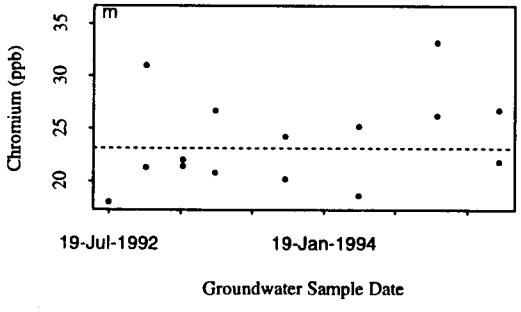
Segment 1-Cesium-137
Well 199-B2-13



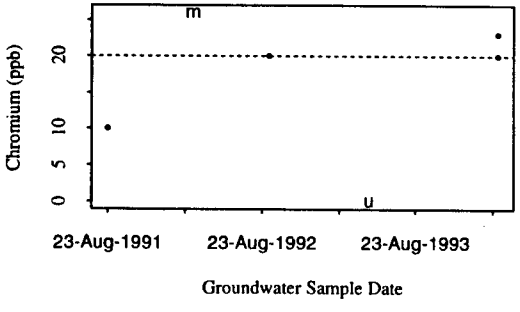
Segment 1-Cesium-137
Well 699-72-88



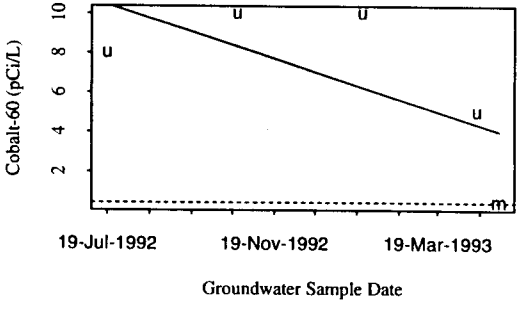
Segment 1-Chromium
Well 199-B2-13

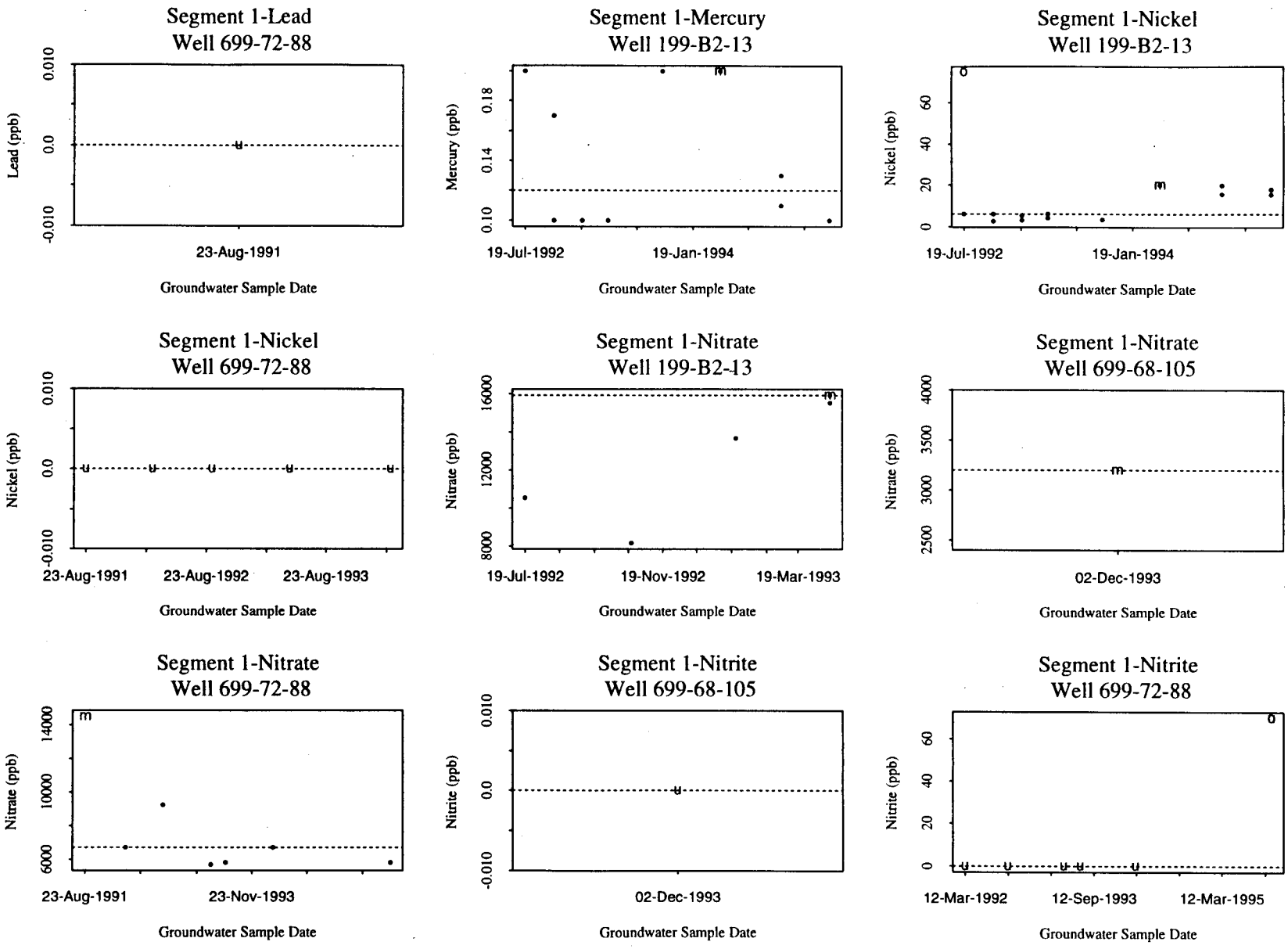


Segment 1-Chromium
Well 699-72-88



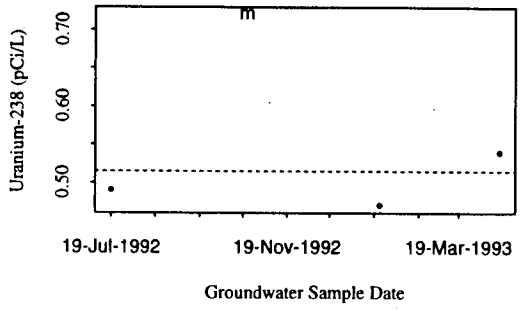
Segment 1-Cobalt-60
Well 199-B2-13



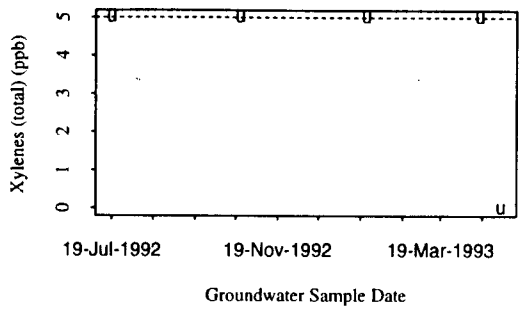


9613148.1537

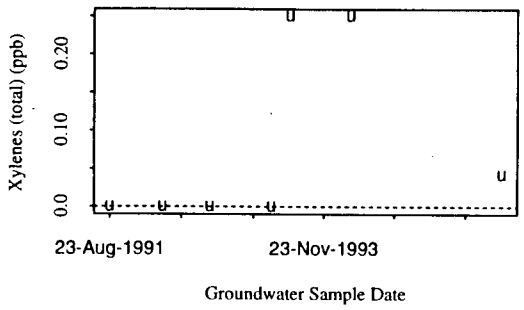
Segment 1-Uranium-238
Well 199-B2-13



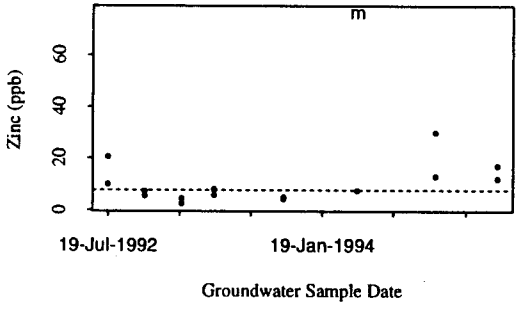
Segment 1-Xylenes (total)
Well 199-B2-13



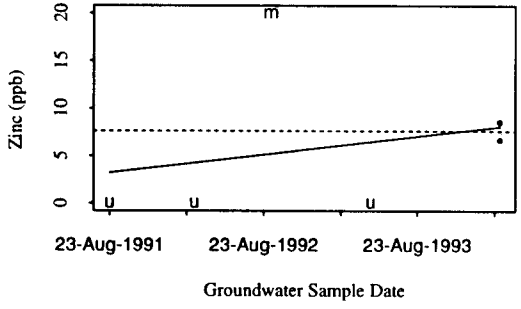
Segment 1-Xylenes (total)
Well 699-72-88



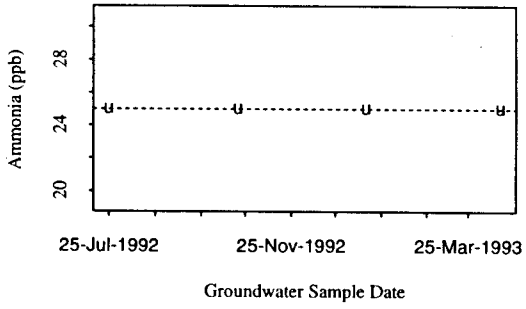
Segment 1-Zinc
Well 199-B2-13



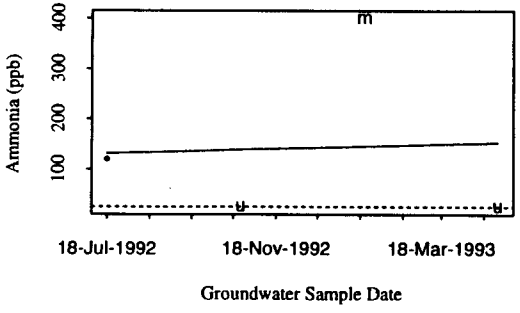
Segment 1-Zinc
Well 699-72-88



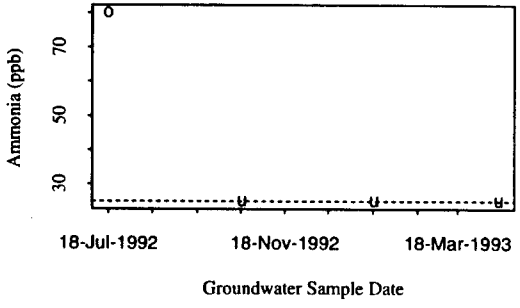
Segment 2-Ammonia
Well 199-B3-1



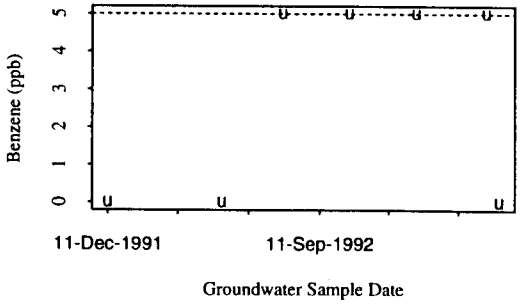
Segment 2-Ammonia
Well 199-B3-46



Segment 2-Ammonia
Well 199-B3-47

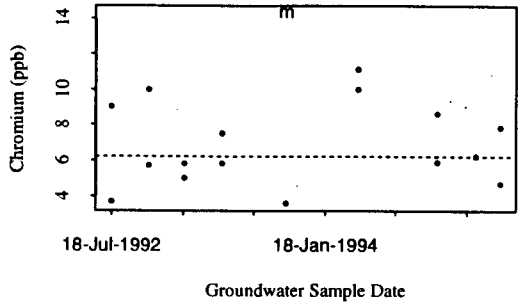


Segment 2-Benzene
Well 199-B3-1

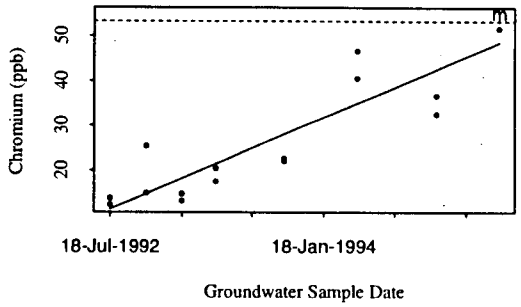


9613148.1588

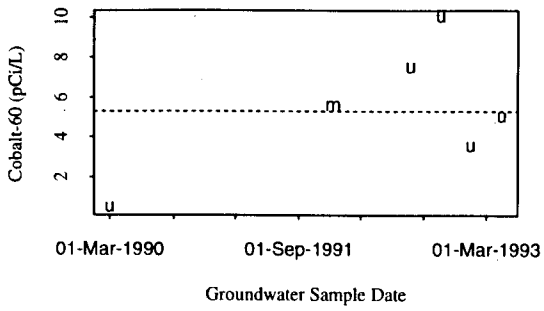
Segment 2-Chromium
Well 199-B3-46



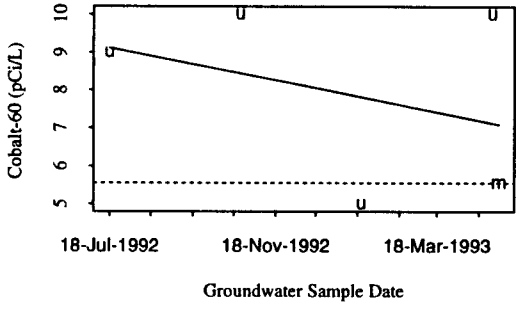
Segment 2-Chromium
Well 199-B3-47



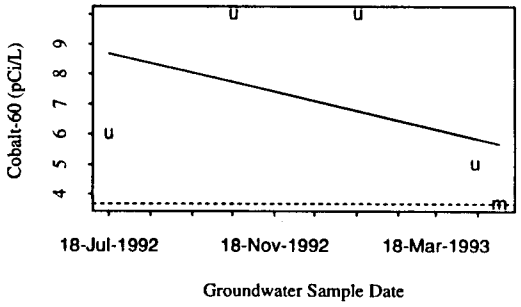
Segment 2-Cobalt-60
Well 199-B3-1



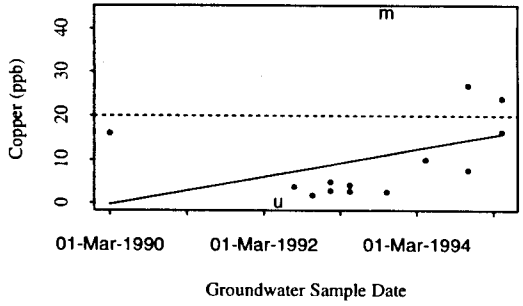
Segment 2-Cobalt-60
Well 199-B3-46



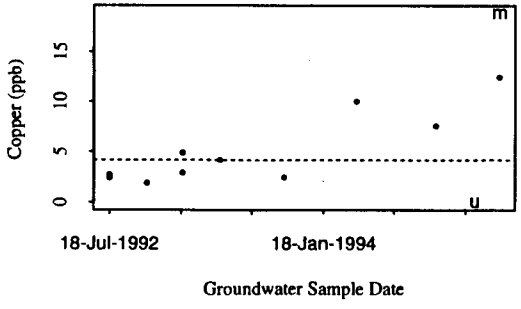
Segment 2-Cobalt-60
Well 199-B3-47



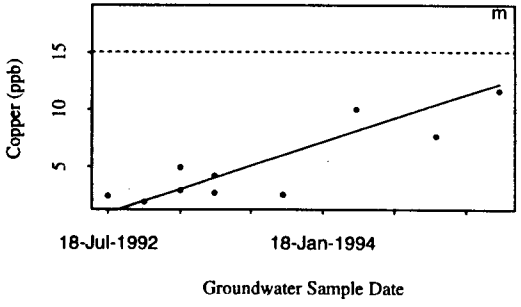
Segment 2-Copper
Well 199-B3-1



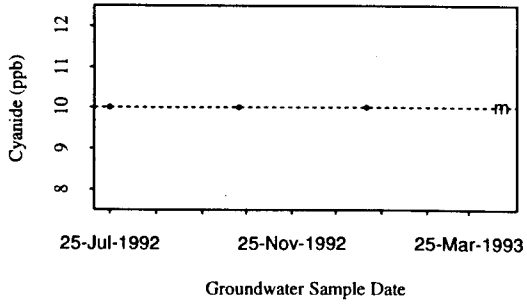
Segment 2-Copper
Well 199-B3-46



Segment 2-Copper
Well 199-B3-47

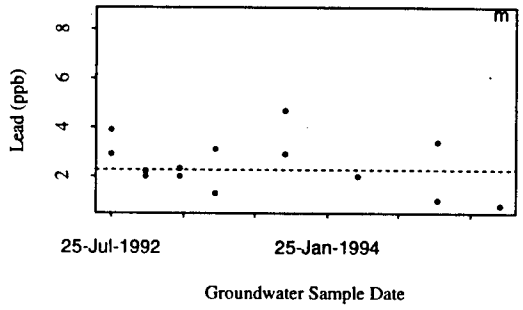


Segment 2-Cyanide
Well 199-B3-1

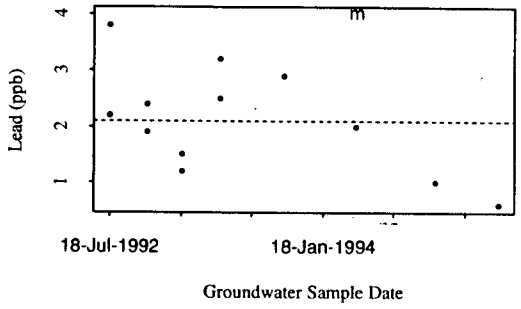


9613048.1589

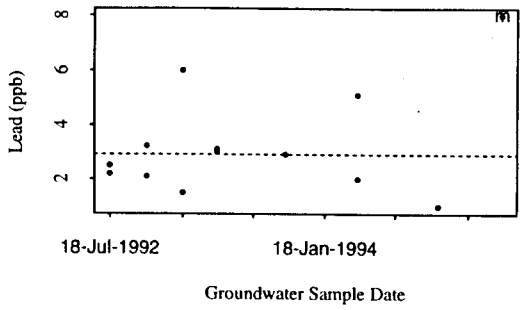
Segment 2-Lead
Well 199-B3-1



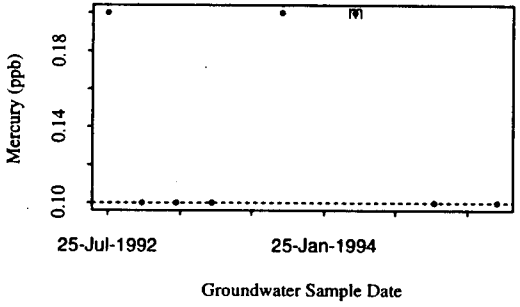
Segment 2-Lead
Well 199-B3-46



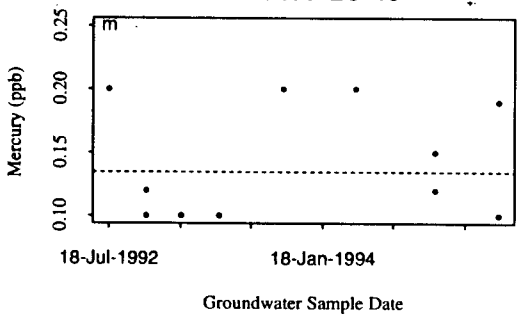
Segment 2-Lead
Well 199-B3-47



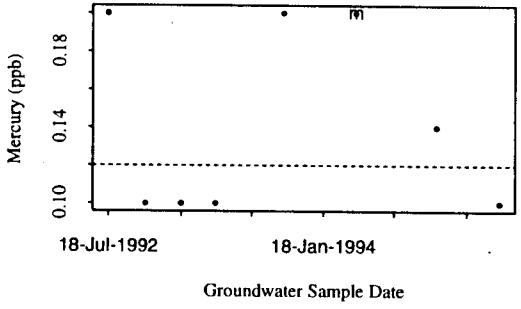
Segment 2-Mercury
Well 199-B3-1



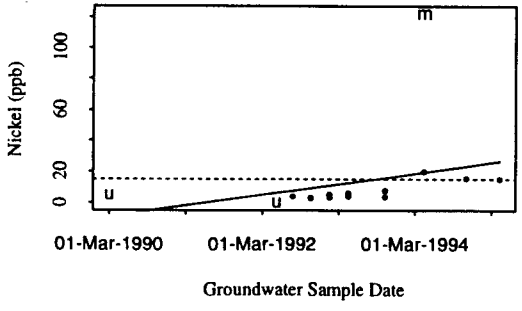
Segment 2-Mercury
Well 199-B3-46



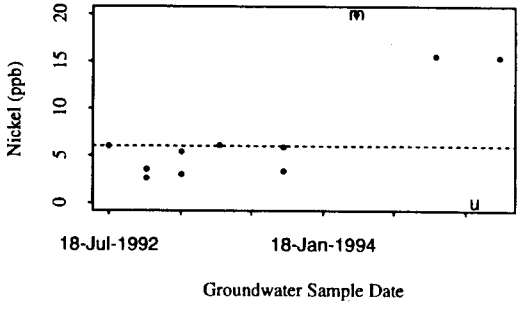
Segment 2-Mercury
Well 199-B3-47



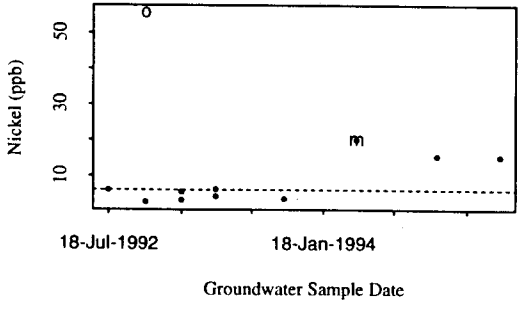
Segment 2-Nickel
Well 199-B3-1



Segment 2-Nickel
Well 199-B3-46

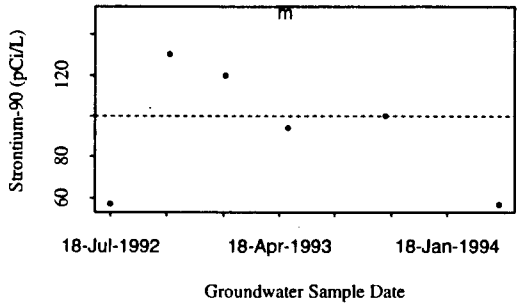


Segment 2-Nickel
Well 199-B3-47

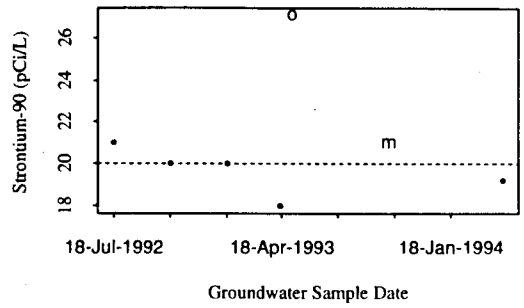


9516148.1590

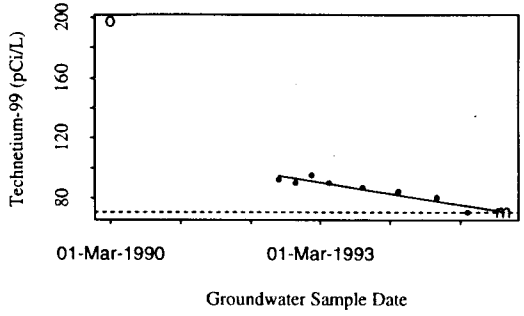
Segment 2-Strontium-90
Well 199-B3-46



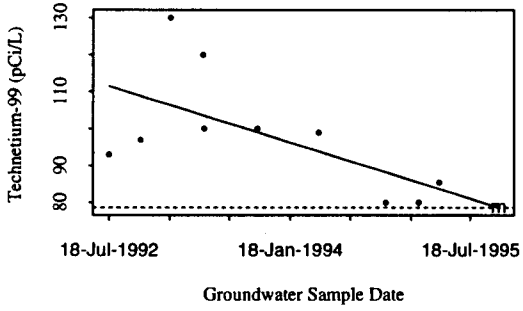
Segment 2-Strontium-90
Well 199-B3-47



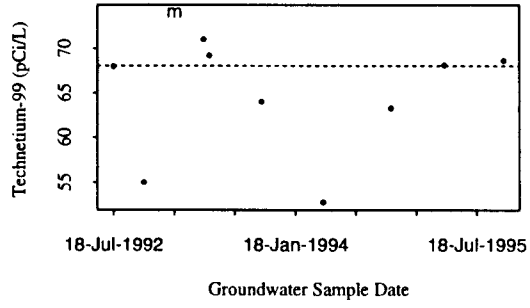
Segment 2-Technetium-99
Well 199-B3-1



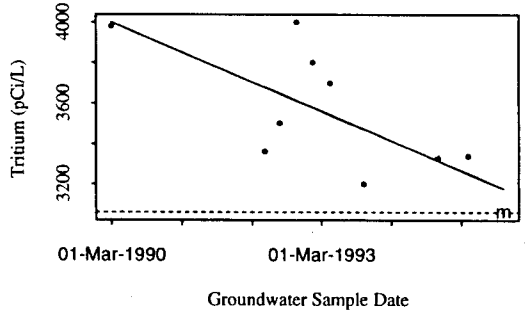
Segment 2-Technetium-99
Well 199-B3-46



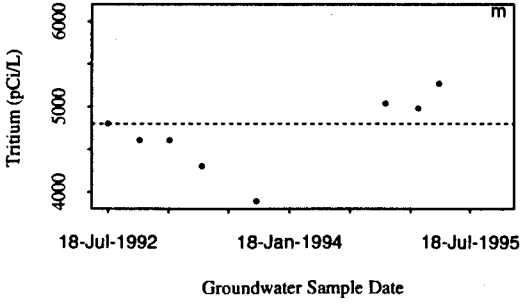
Segment 2-Technetium-99
Well 199-B3-47



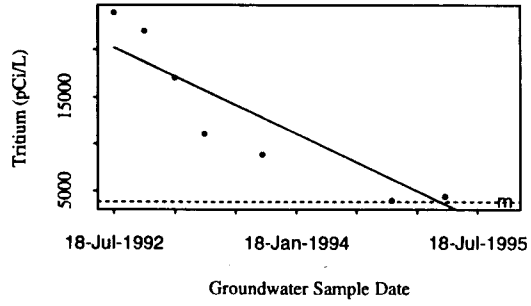
Segment 2-Tritium
Well 199-B3-1



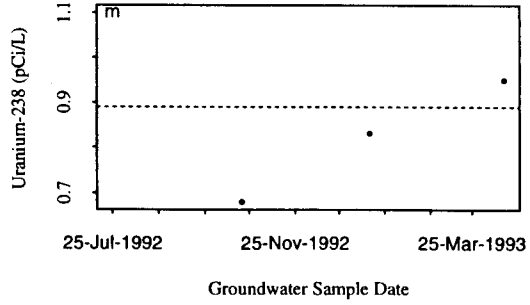
Segment 2-Tritium
Well 199-B3-46



Segment 2-Tritium
Well 199-B3-47

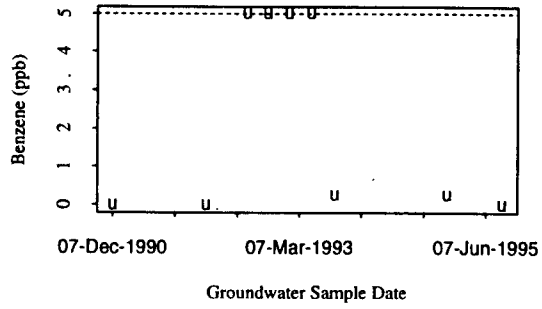


Segment 2-Uranium-238
Well 199-B3-1

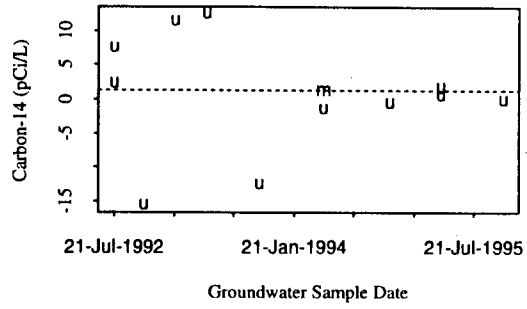


9513148.1597

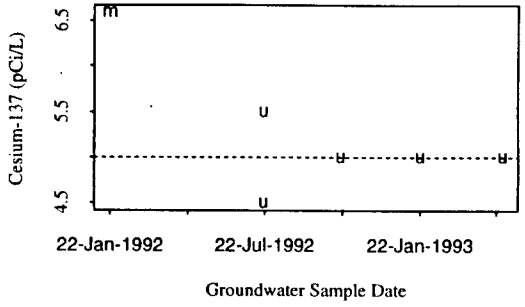
Segment 3-Benzene
Well 699-72-73



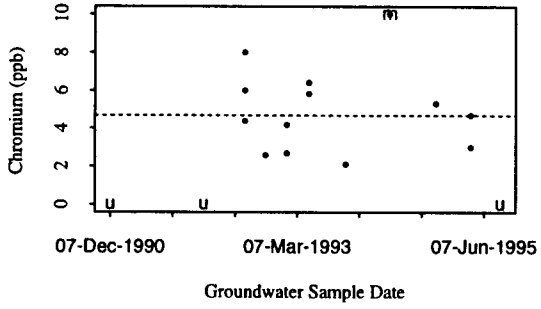
Segment 3-Carbon-14
Well 699-72-73



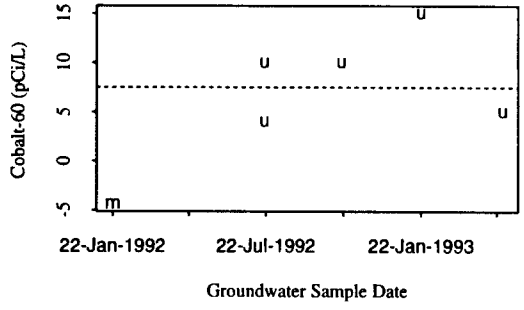
Segment 3-Cesium-137
Well 699-72-73



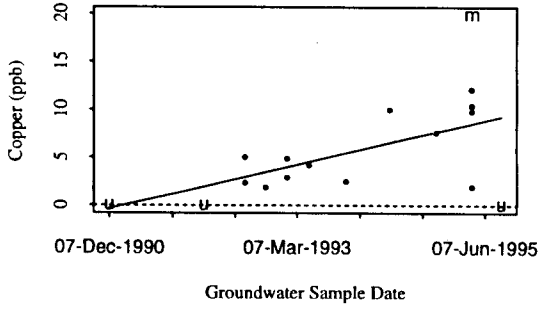
Segment 3-Chromium
Well 699-72-73



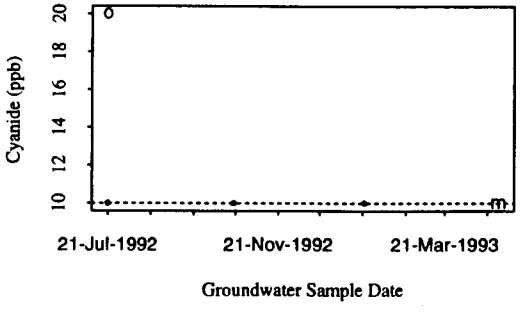
Segment 3-Cobalt-60
Well 699-72-73



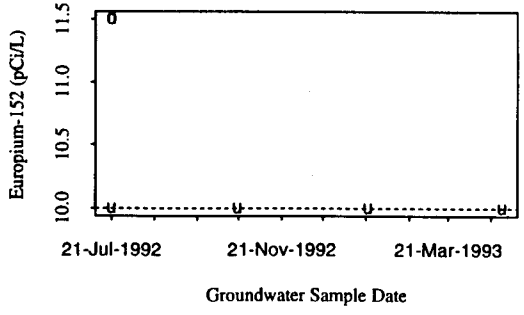
Segment 3-Copper
Well 699-72-73



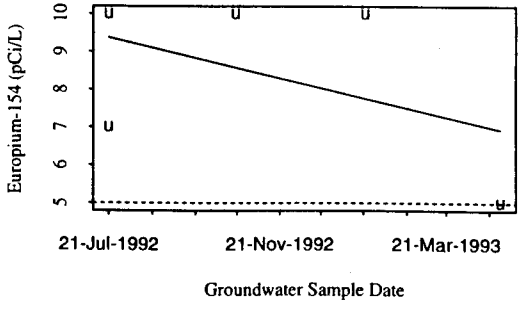
Segment 3-Cyanide
Well 699-72-73



Segment 3-Europium-152
Well 699-72-73

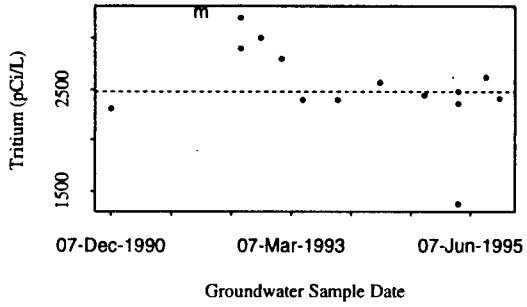


Segment 3-Europium-154
Well 699-72-73

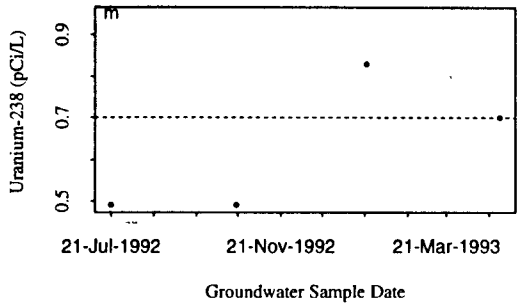


9613148.1592

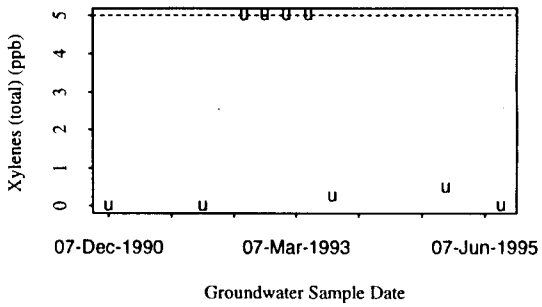
Segment 3-Tritium
Well 699-72-73



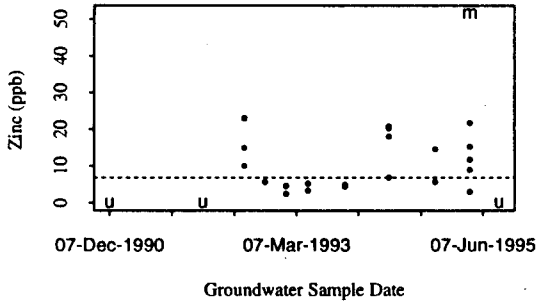
Segment 3-Uranium-238
Well 699-72-73



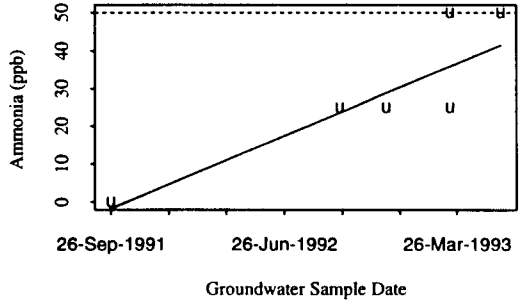
Segment 3-Xylenes (total)
Well 699-72-73



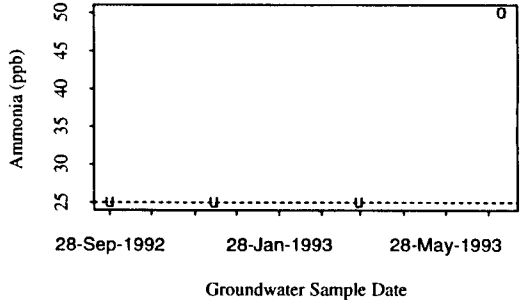
Segment 3-Zinc
Well 699-72-73



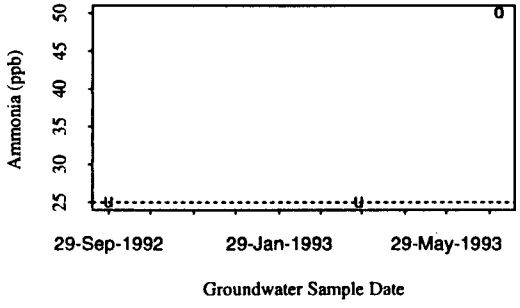
Segment 4-Ammonia
Well 199-K-11



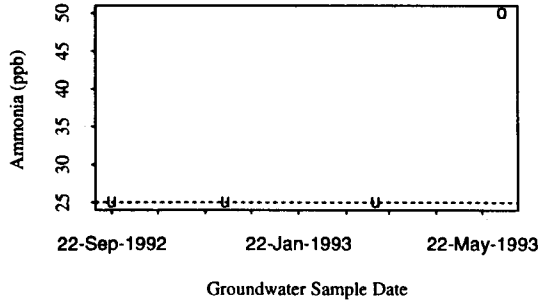
Segment 4-Ammonia
Well 199-K-13



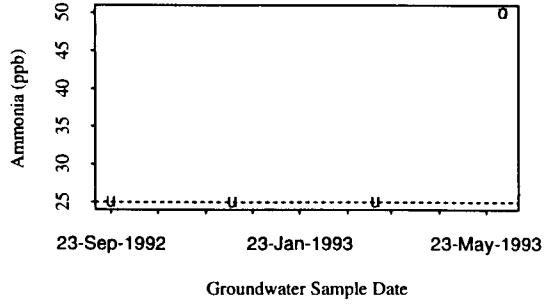
Segment 4-Ammonia
Well 199-K-23



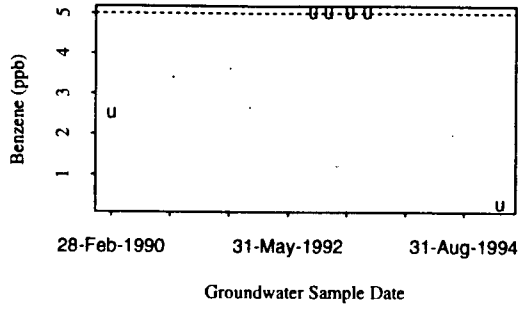
Segment 4-Ammonia
Well 199-K-27



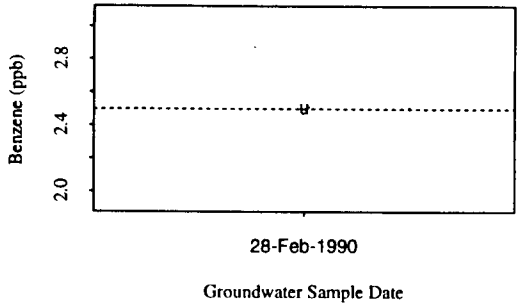
Segment 4-Ammonia
Well 199-K-30



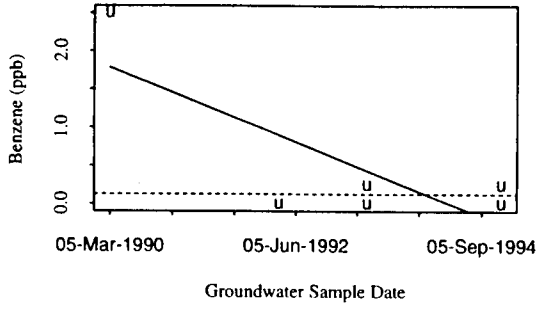
Segment 4-Benzene
Well 199-K-27



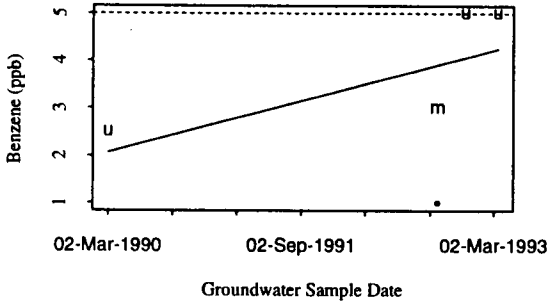
Segment 4-Benzene
Well 199-K-28



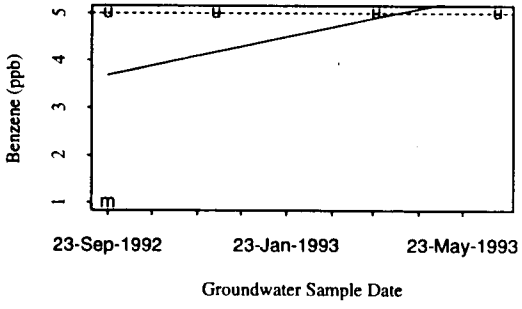
Segment 4-Benzene
Well 199-K-29



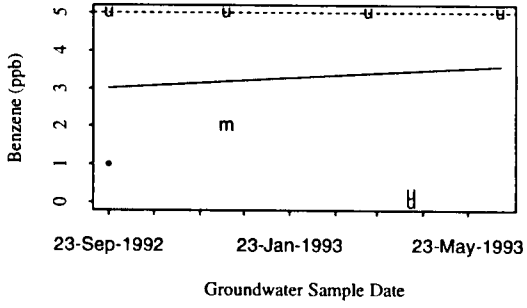
Segment 4-Benzene
Well 199-K-30



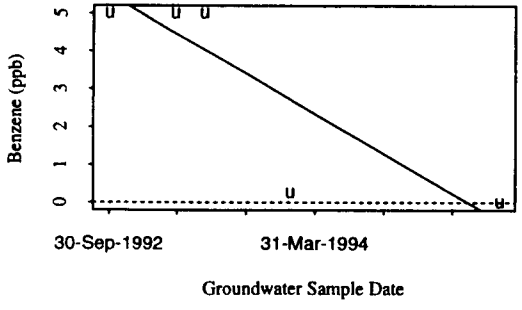
Segment 4-Benzene
Well 199-K-31



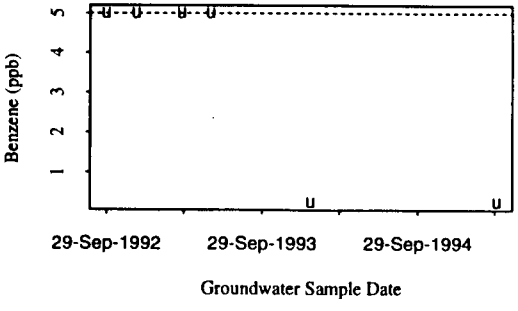
Segment 4-Benzene
Well 199-K-32A



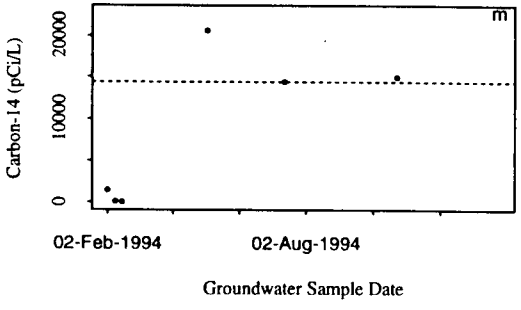
Segment 4-Benzene
Well 199-K-33



Segment 4-Benzene
Well 199-K-34

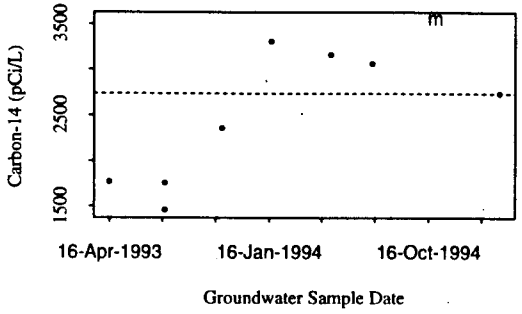


Segment 4-Carbon-14
Well 199-K-106A

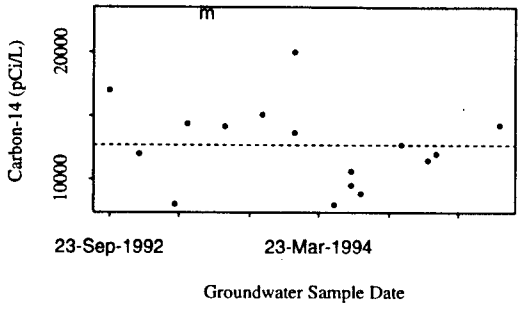


9513108.1594

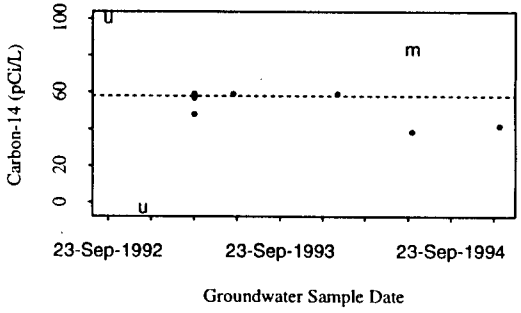
Segment 4-Carbon-14
Well 199-K-29



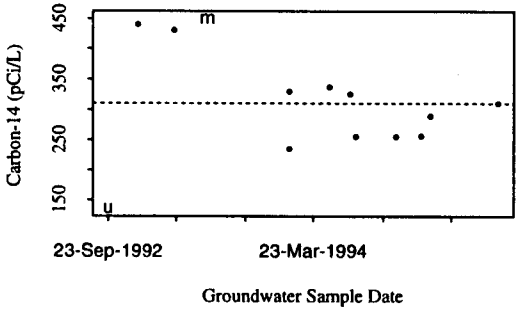
Segment 4-Carbon-14
Well 199-K-30



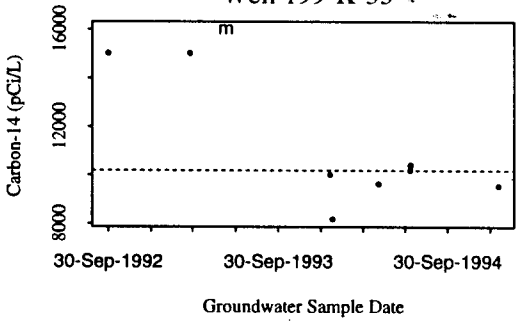
Segment 4-Carbon-14
Well 199-K-31



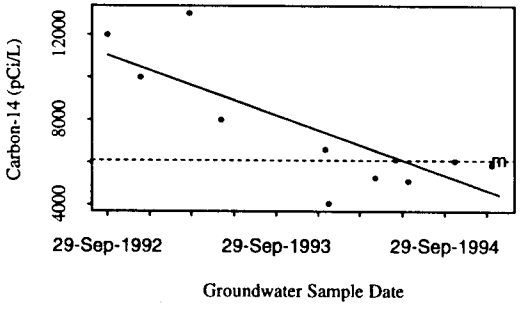
Segment 4-Carbon-14
Well 199-K-32A



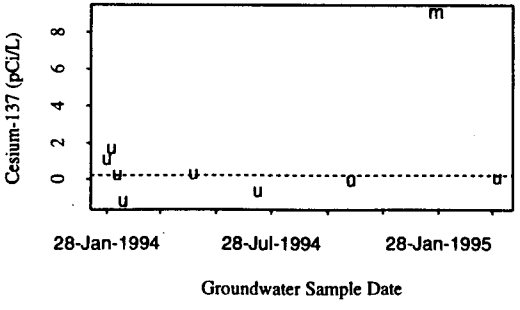
Segment 4-Carbon-14
Well 199-K-33



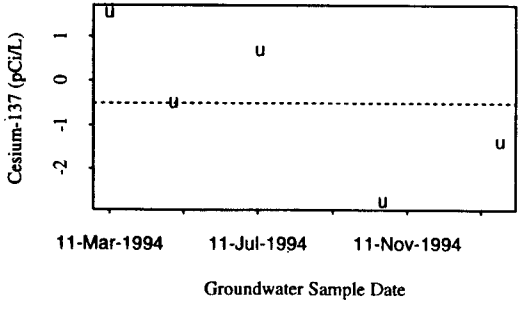
Segment 4-Carbon-14
Well 199-K-34



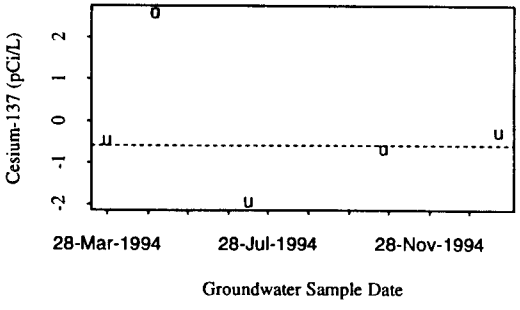
Segment 4-Cesium-137
Well 199-K-106A



Segment 4-Cesium-137
Well 199-K-107A

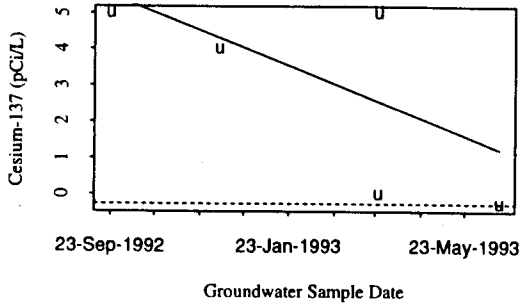


Segment 4-Cesium-137
Well 199-K-108A

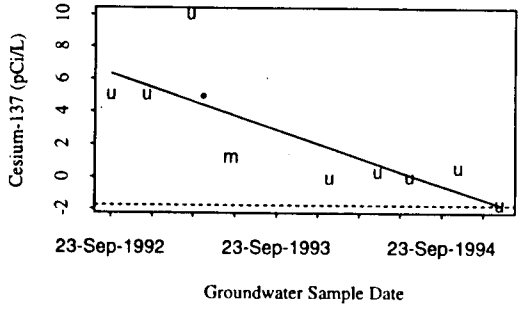


9513148.1595

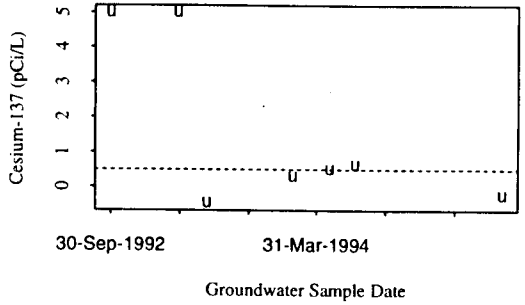
Segment 4-Cesium-137
Well 199-K-31



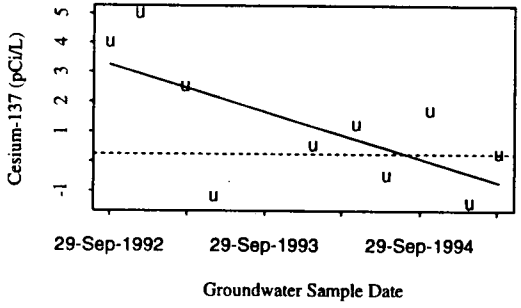
Segment 4-Cesium-137
Well 199-K-32A



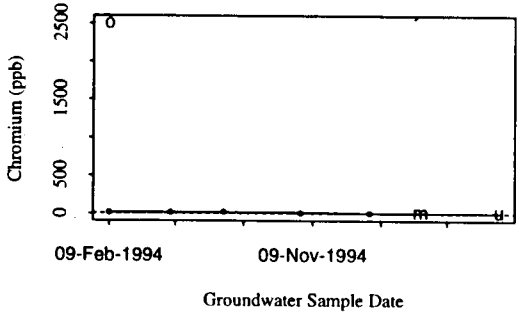
Segment 4-Cesium-137
Well 199-K-33



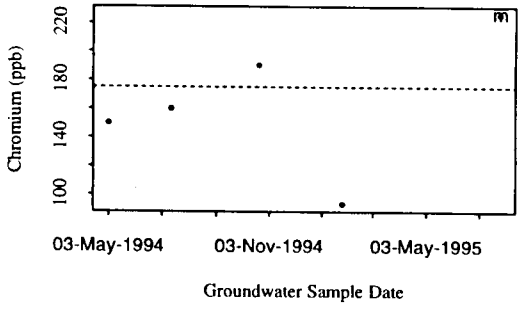
Segment 4-Cesium-137
Well 199-K-34



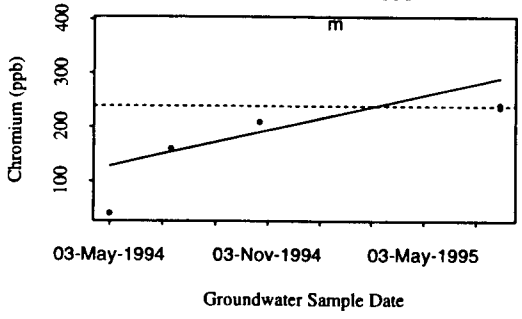
Segment 4-Chromium
Well 199-K-106A



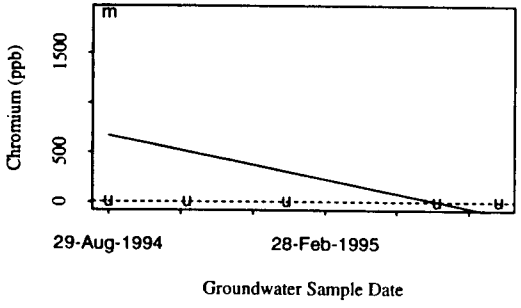
Segment 4-Chromium
Well 199-K-107A



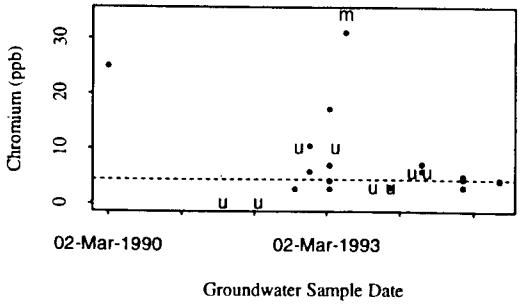
Segment 4-Chromium
Well 199-K-108A



Segment 4-Chromium
Well 199-K-109A

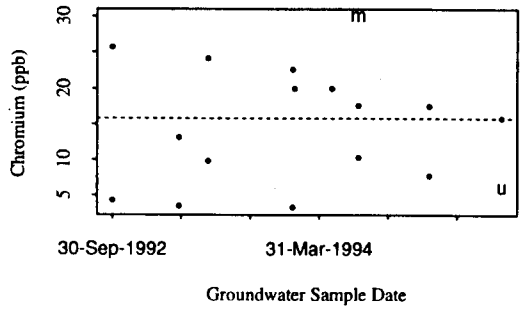


Segment 4-Chromium
Well 199-K-11

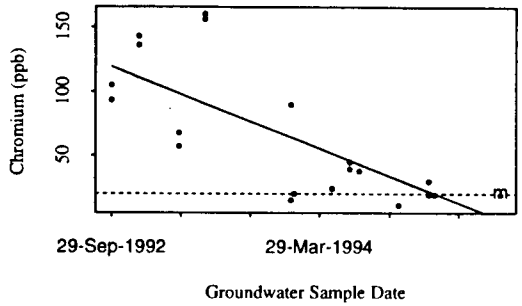


9513148.1596

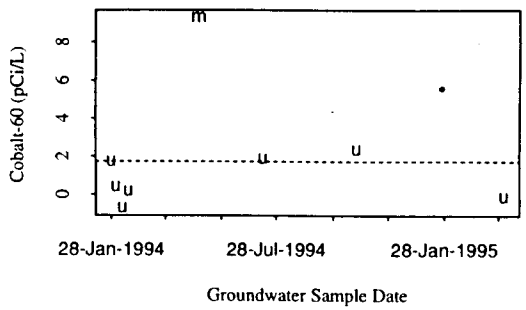
Segment 4-Chromium
Well 199-K-33



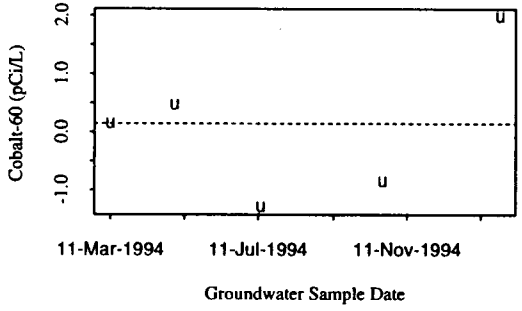
Segment 4-Chromium
Well 199-K-34



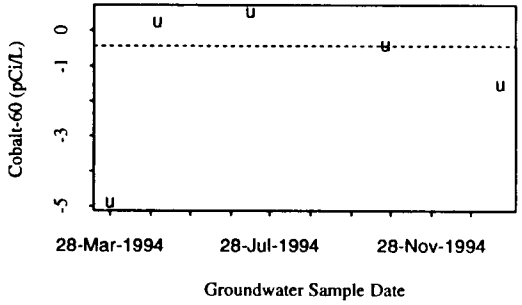
Segment 4-Cobalt-60
Well 199-K-106A



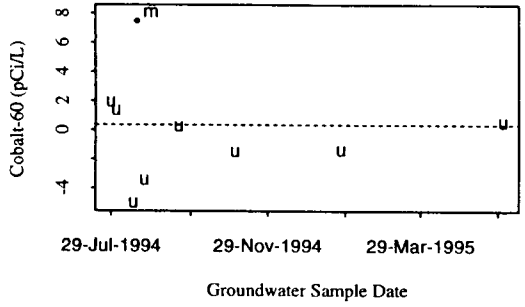
Segment 4-Cobalt-60
Well 199-K-107A



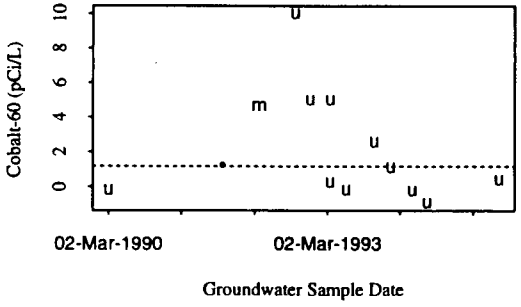
Segment 4-Cobalt-60
Well 199-K-108A



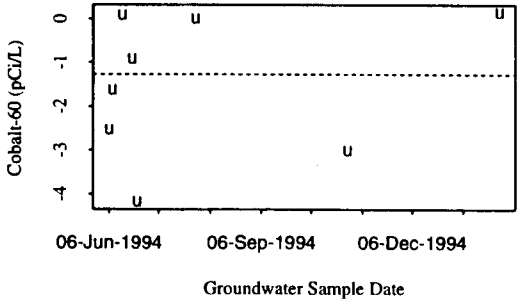
Segment 4-Cobalt-60
Well 199-K-109A



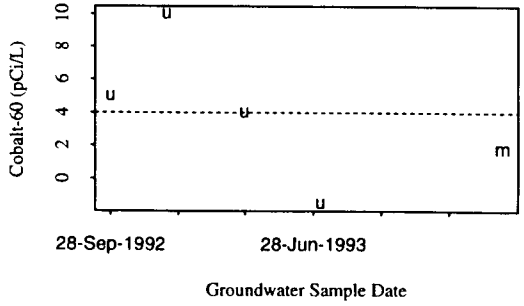
Segment 4-Cobalt-60
Well 199-K-11



Segment 4-Cobalt-60
Well 199-K-111A

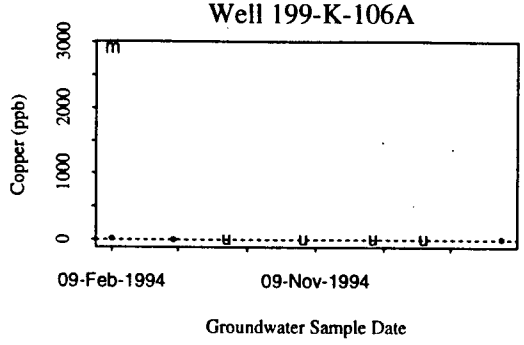


Segment 4-Cobalt-60
Well 199-K-13

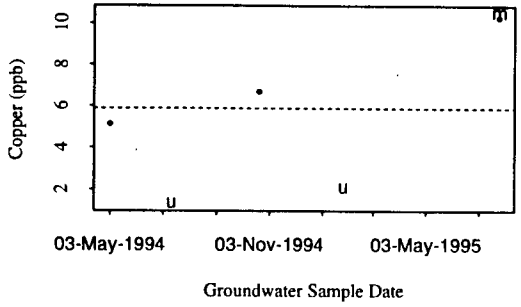


9413148.1697

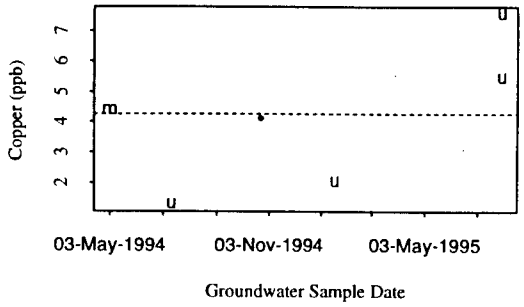
Segment 4-Copper
Well 199-K-106A



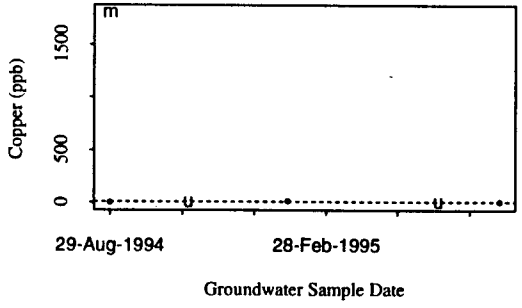
Segment 4-Copper
Well 199-K-107A



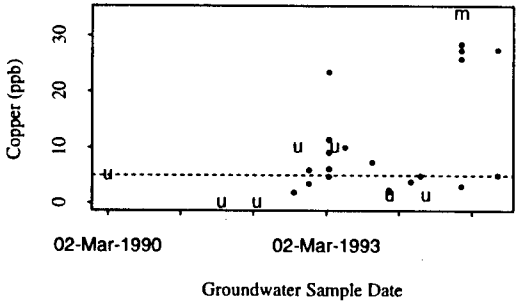
Segment 4-Copper
Well 199-K-108A



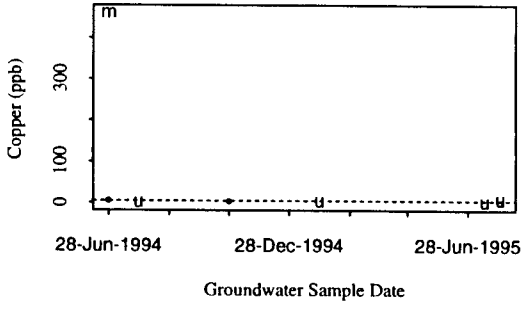
Segment 4-Copper
Well 199-K-109A



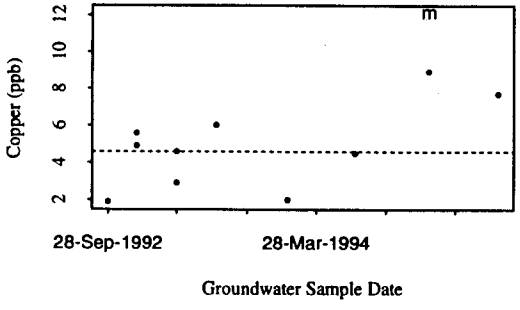
Segment 4-Copper
Well 199-K-11



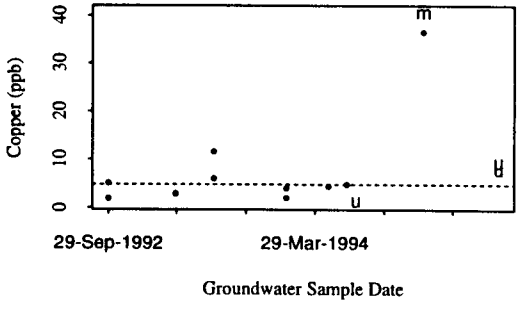
Segment 4-Copper
Well 199-K-111A



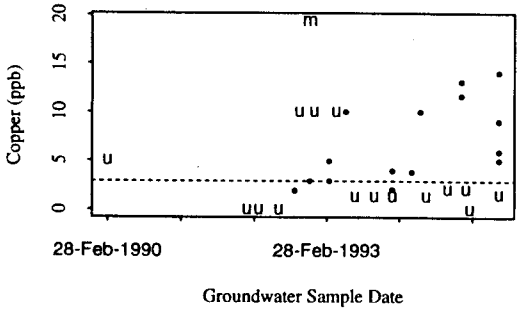
Segment 4-Copper
Well 199-K-13



Segment 4-Copper
Well 199-K-23

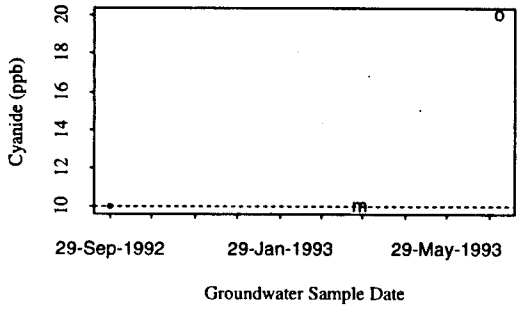


Segment 4-Copper
Well 199-K-27

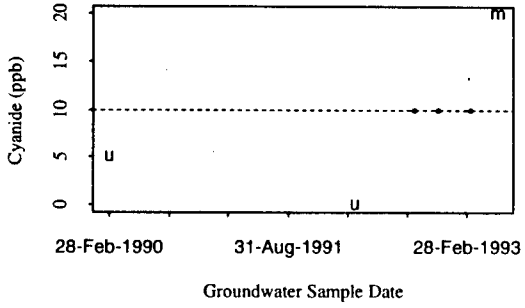


9513448.1598

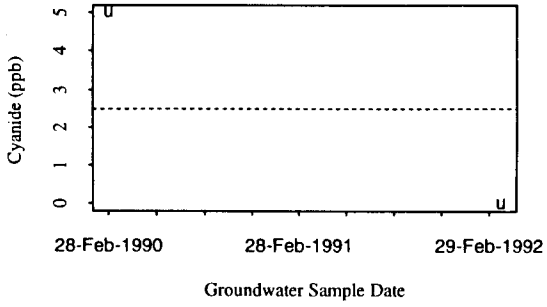
Segment 4-Cyanide
Well 199-K-23



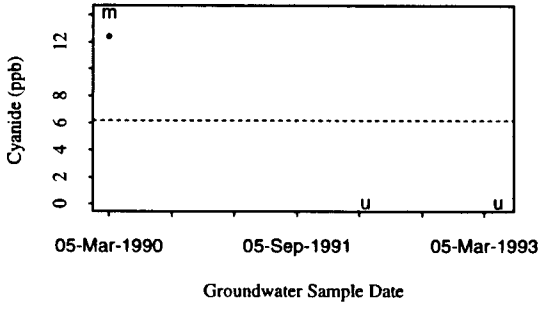
Segment 4-Cyanide
Well 199-K-27



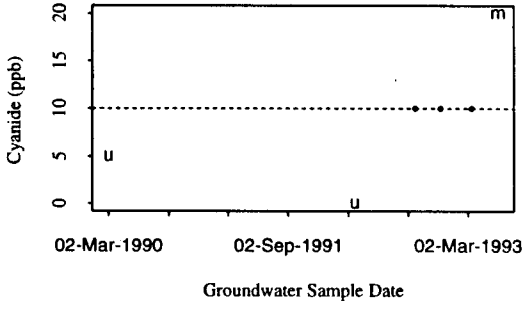
Segment 4-Cyanide
Well 199-K-28



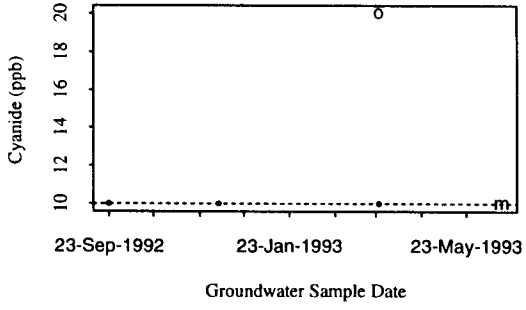
Segment 4-Cyanide
Well 199-K-29



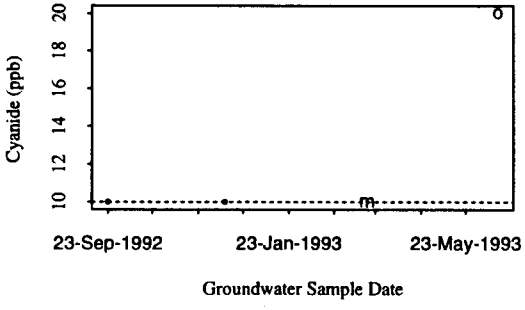
Segment 4-Cyanide
Well 199-K-30



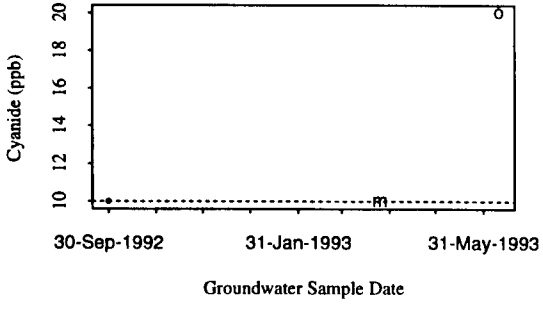
Segment 4-Cyanide
Well 199-K-31



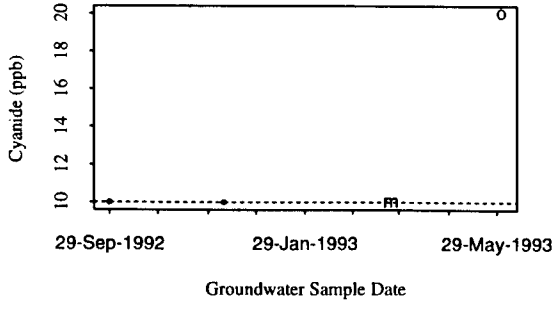
Segment 4-Cyanide
Well 199-K-32A



Segment 4-Cyanide
Well 199-K-33

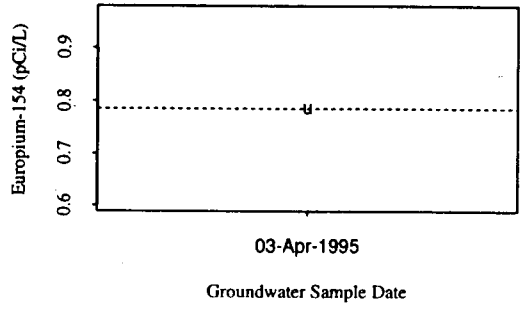


Segment 4-Cyanide
Well 199-K-34

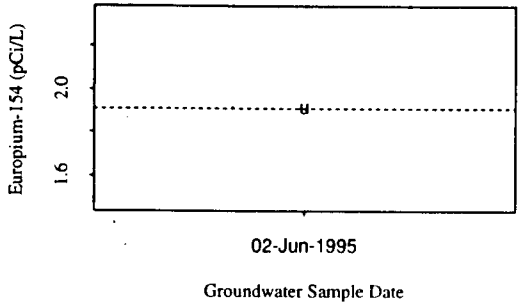


9413148.1599

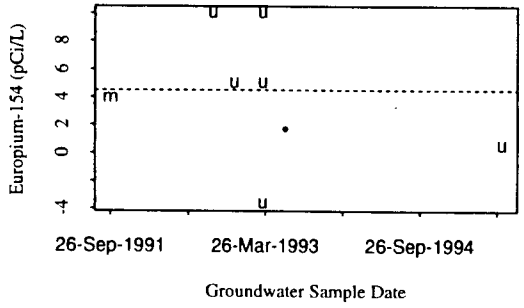
Segment 4-Europium-154
Well 199-K-106A



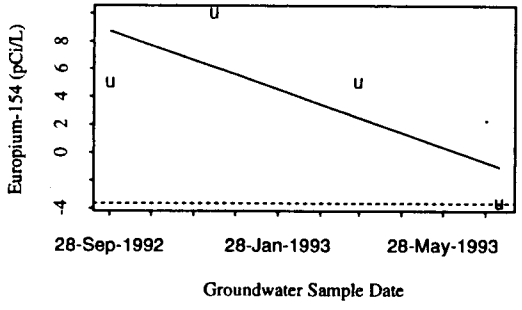
Segment 4-Europium-154
Well 199-K-109A



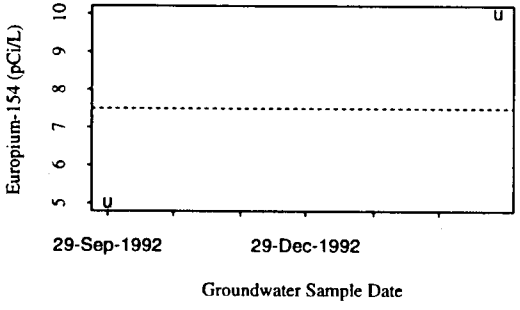
Segment 4-Europium-154
Well 199-K-11



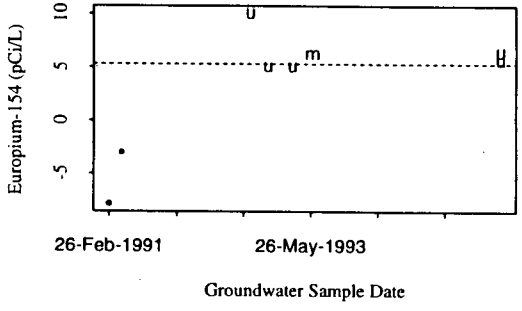
Segment 4-Europium-154
Well 199-K-13



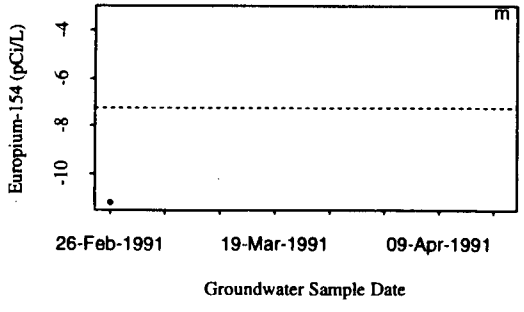
Segment 4-Europium-154
Well 199-K-23



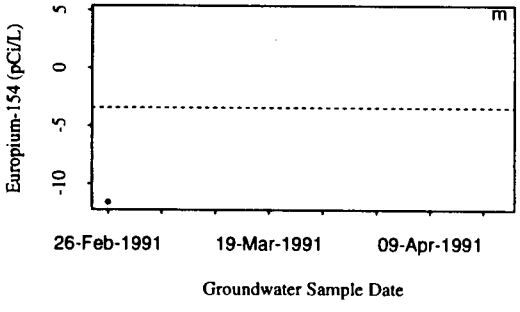
Segment 4-Europium-154
Well 199-K-27



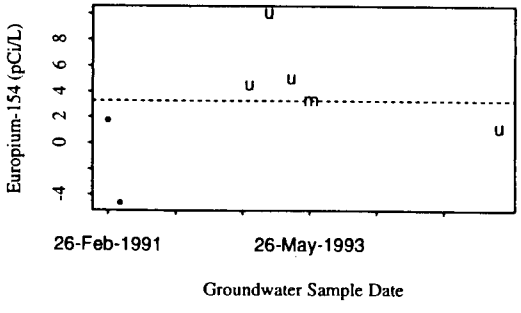
Segment 4-Europium-154
Well 199-K-28



Segment 4-Europium-154
Well 199-K-29

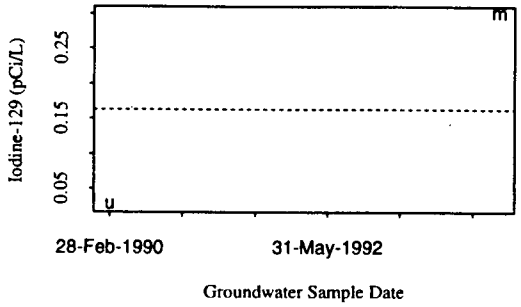


Segment 4-Europium-154
Well 199-K-30

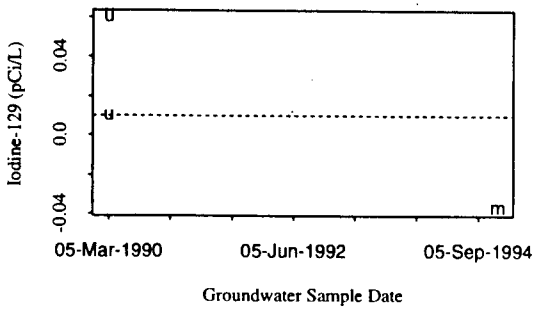


9413146.1600

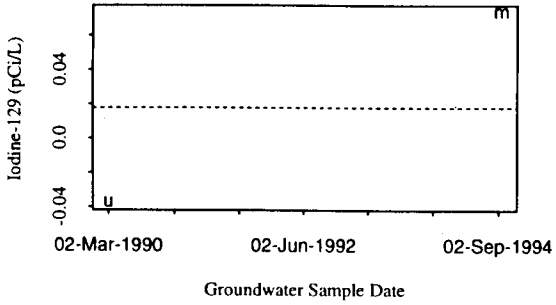
Segment 4-Iodine-129
Well 199-K-28



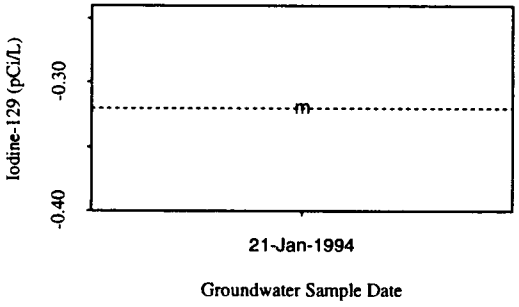
Segment 4-Iodine-129
Well 199-K-29



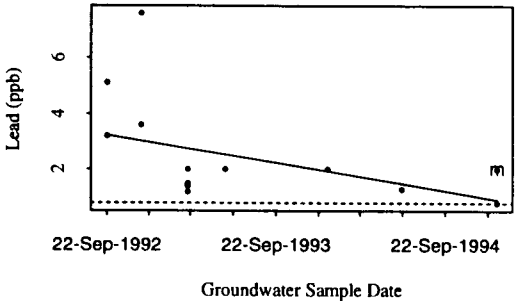
Segment 4-Iodine-129
Well 199-K-30



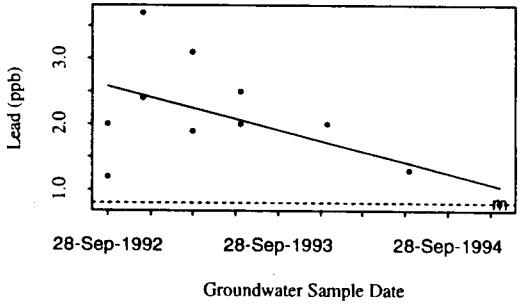
Segment 4-Iodine-129
Well 199-K-34



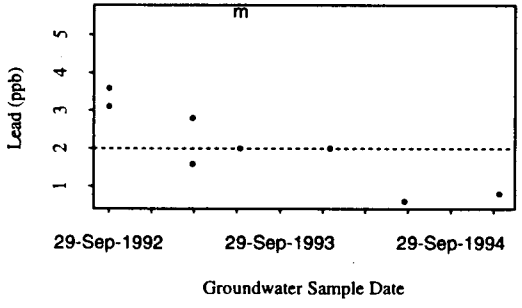
Segment 4-Lead
Well 199-K-11



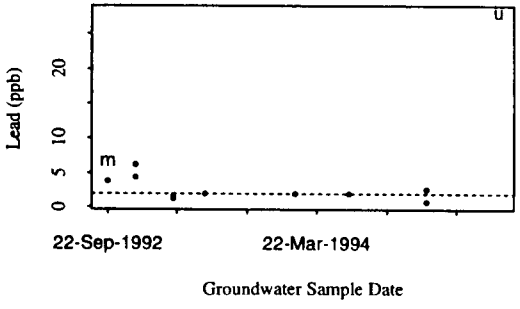
Segment 4-Lead
Well 199-K-13



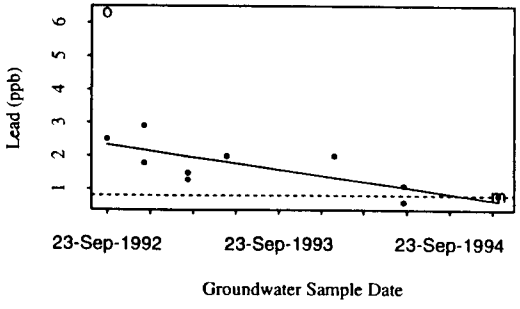
Segment 4-Lead
Well 199-K-23



Segment 4-Lead
Well 199-K-27

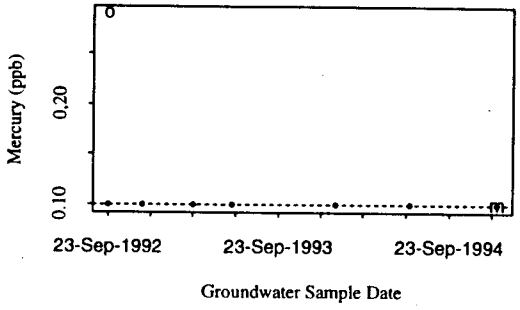


Segment 4-Lead
Well 199-K-30

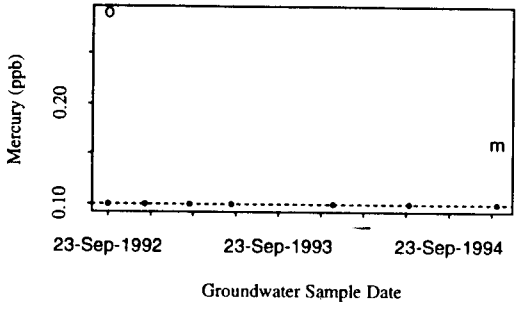


9413048.1601

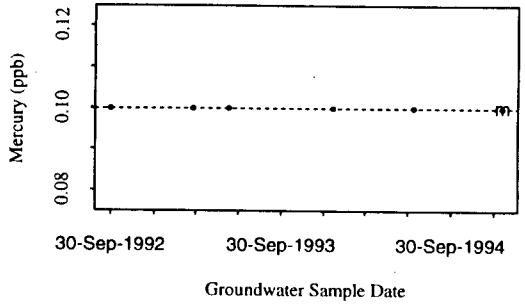
Segment 4-Mercury
Well 199-K-31



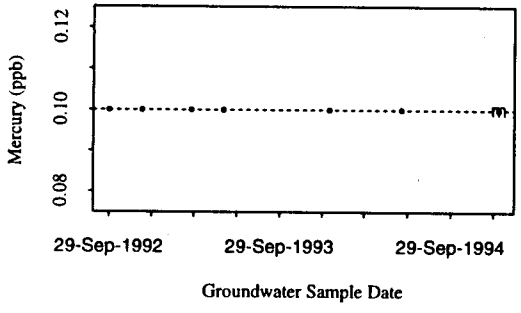
Segment 4-Mercury
Well 199-K-32A



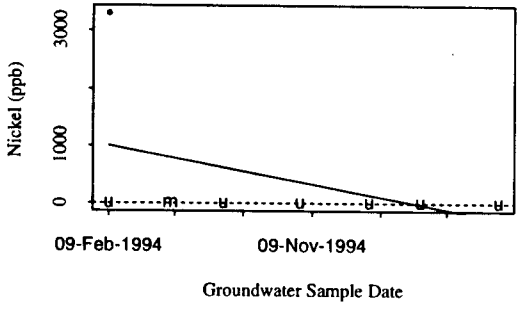
Segment 4-Mercury
Well 199-K-33



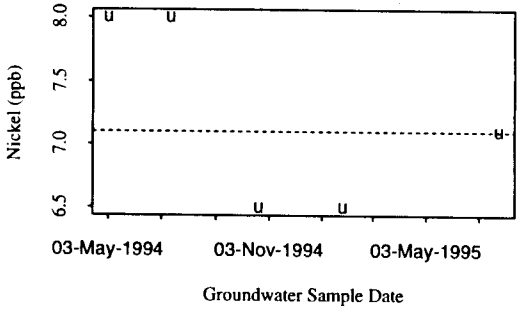
Segment 4-Mercury
Well 199-K-34



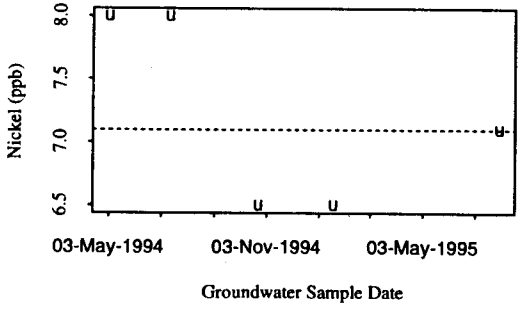
Segment 4-Nickel
Well 199-K-106A



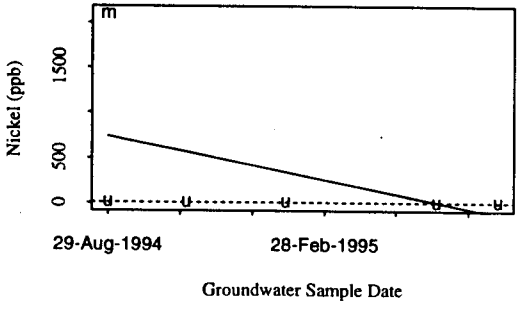
Segment 4-Nickel
Well 199-K-107A



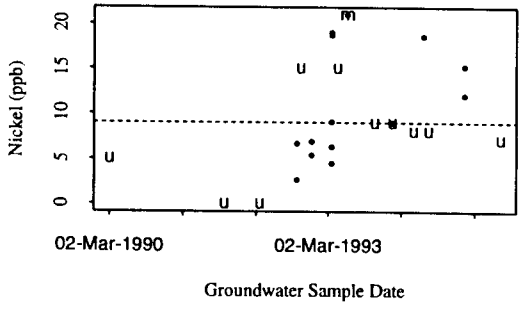
Segment 4-Nickel
Well 199-K-108A



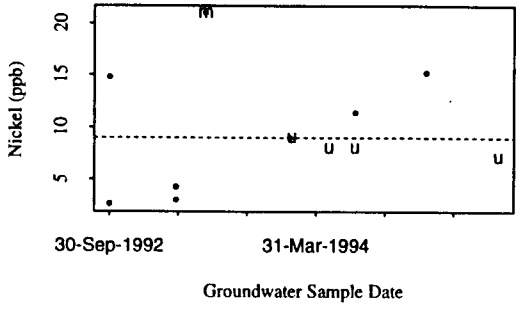
Segment 4-Nickel
Well 199-K-109A



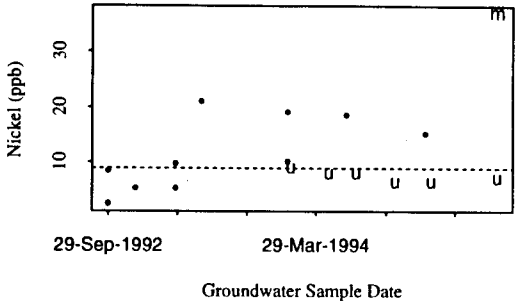
Segment 4-Nickel
Well 199-K-11



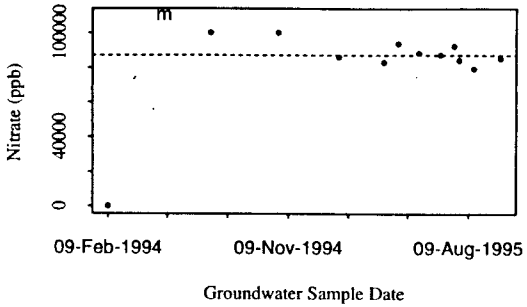
Segment 4-Nickel
Well 199-K-33



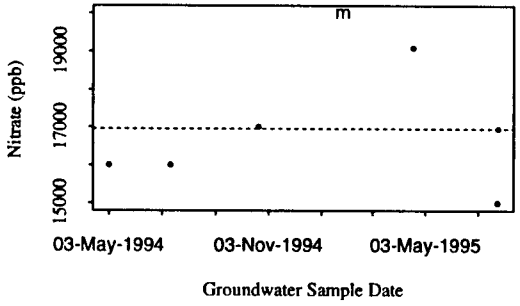
Segment 4-Nickel
Well 199-K-34



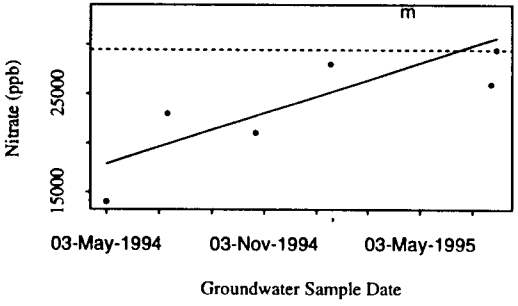
Segment 4-Nitrate
Well 199-K-106A



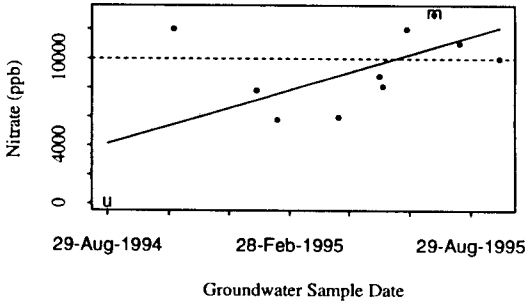
Segment 4-Nitrate
Well 199-K-107A



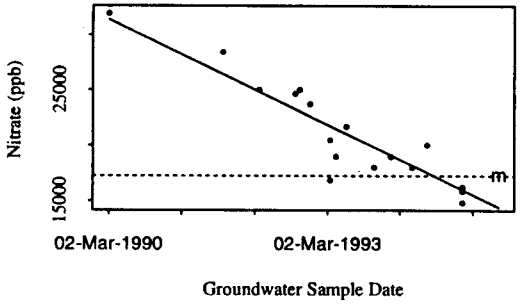
Segment 4-Nitrate
Well 199-K-108A



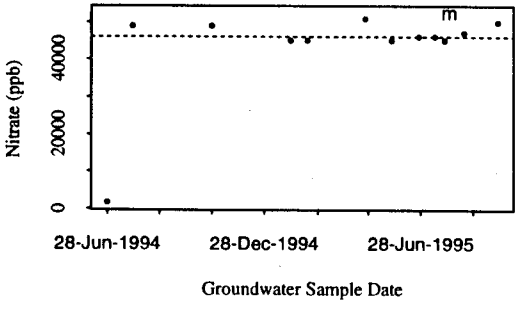
Segment 4-Nitrate
Well 199-K-109A



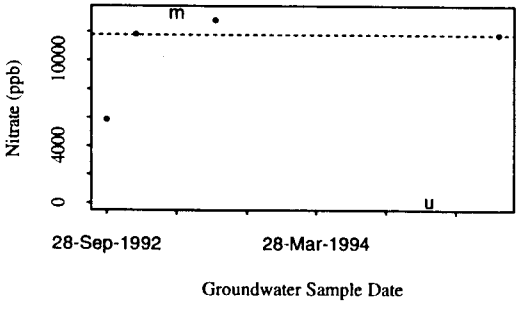
Segment 4-Nitrate
Well 199-K-11



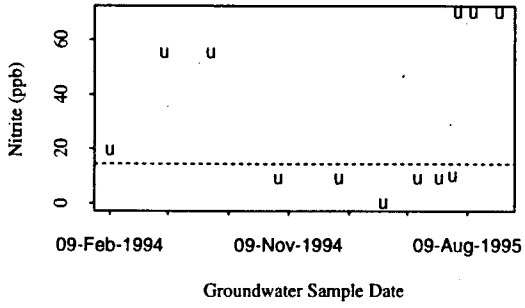
Segment 4-Nitrate
Well 199-K-111A



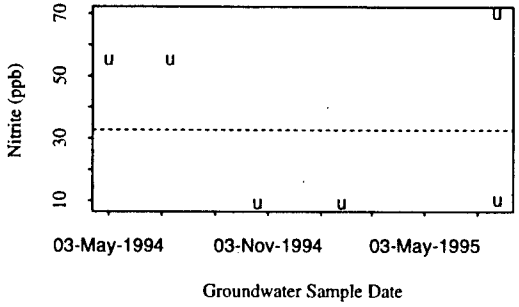
Segment 4-Nitrate
Well 199-K-13



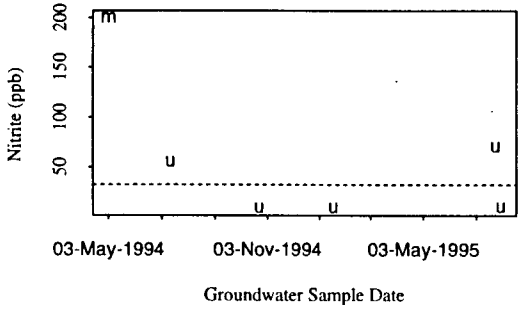
Segment 4-Nitrite
Well 199-K-106A



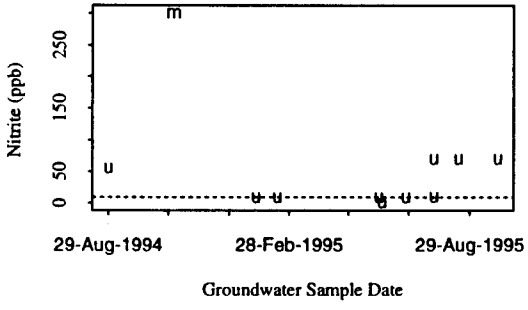
Segment 4-Nitrite
Well 199-K-107A



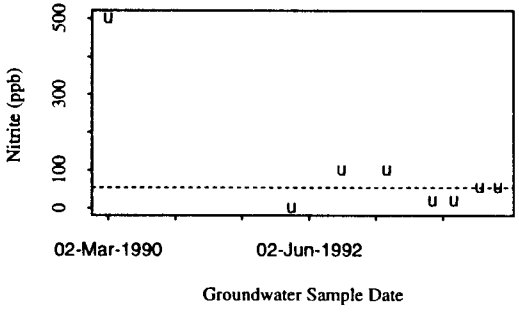
Segment 4-Nitrite
Well 199-K-108A



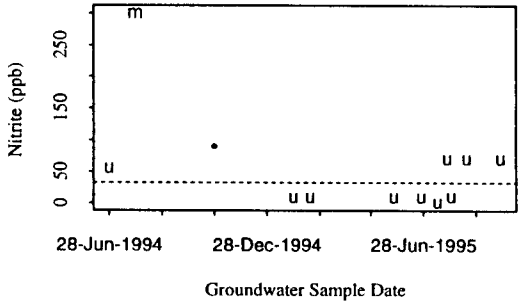
Segment 4-Nitrite
Well 199-K-109A



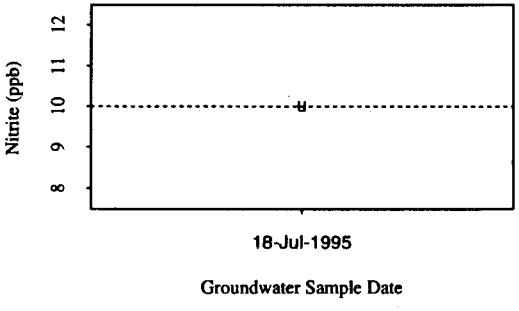
Segment 4-Nitrite
Well 199-K-11



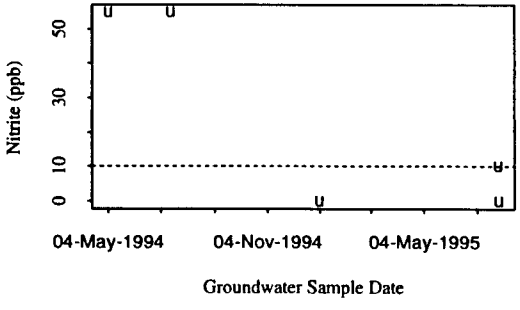
Segment 4-Nitrite
Well 199-K-111A



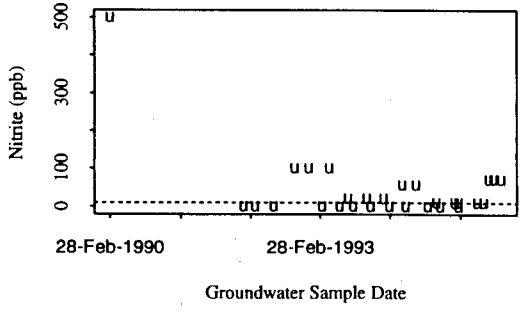
Segment 4-Nitrite
Well 199-K-13



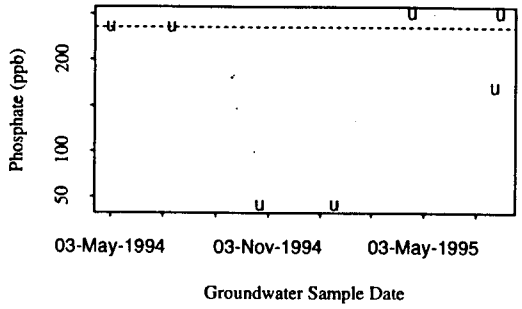
Segment 4-Nitrite
Well 199-K-23



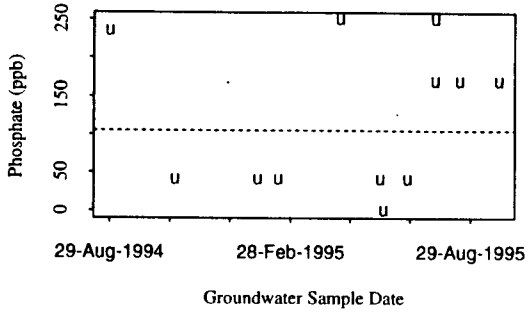
Segment 4-Nitrite
Well 199-K-27



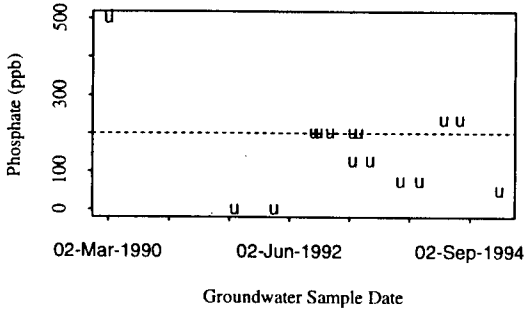
Segment 4-Phosphate
Well 199-K-108A



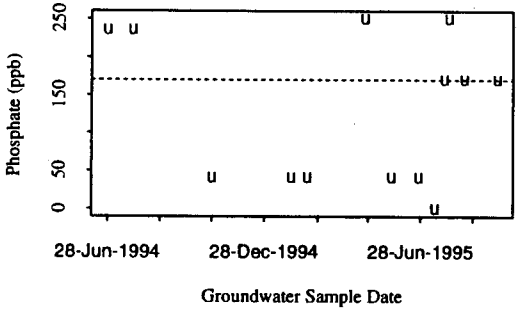
Segment 4-Phosphate
Well 199-K-109A



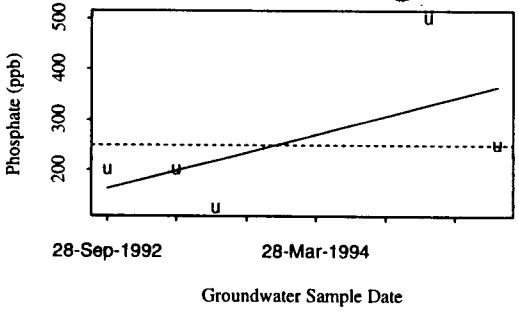
Segment 4-Phosphate
Well 199-K-11



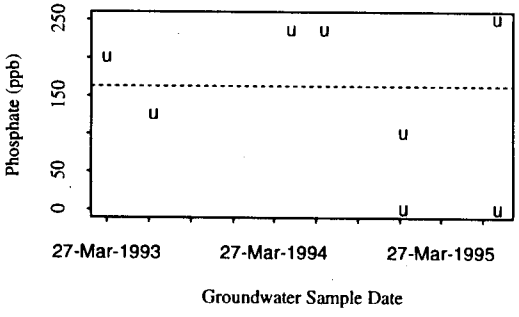
Segment 4-Phosphate
Well 199-K-111A



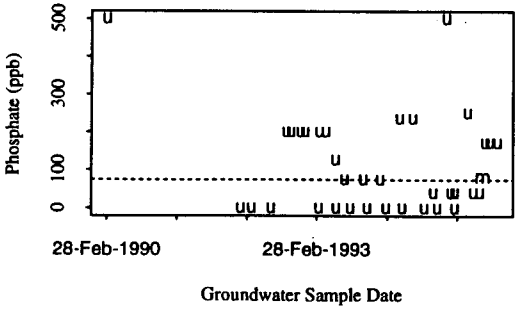
Segment 4-Phosphate
Well 199-K-13



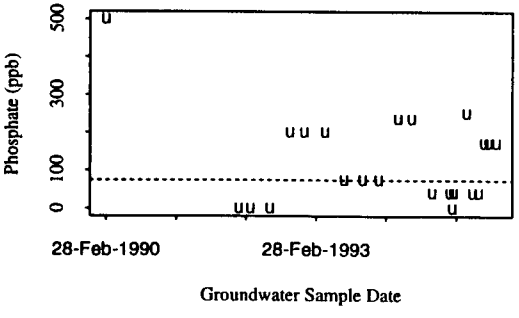
Segment 4-Phosphate
Well 199-K-23



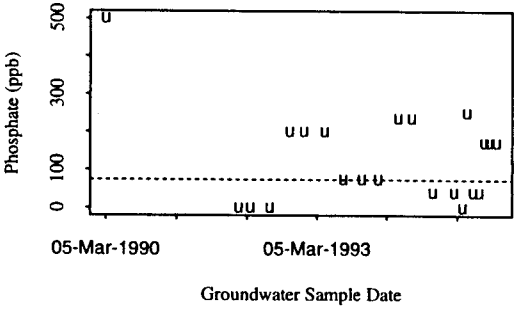
Segment 4-Phosphate
Well 199-K-27



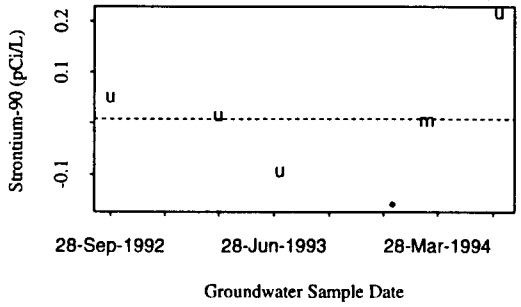
Segment 4-Phosphate
Well 199-K-28



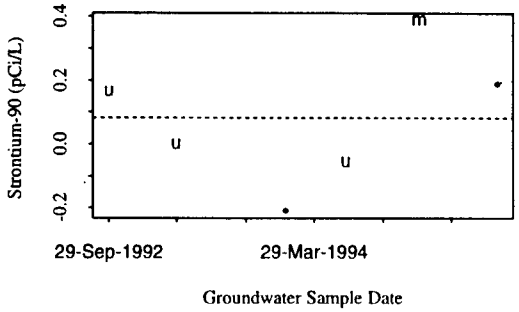
Segment 4-Phosphate
Well 199-K-29



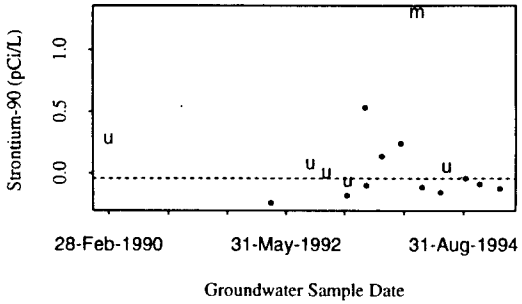
Segment 4-Strontium-90
Well 199-K-13



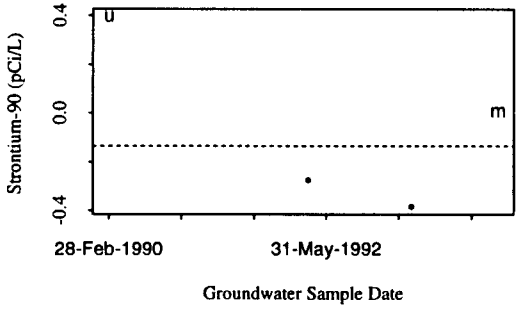
Segment 4-Strontium-90
Well 199-K-23



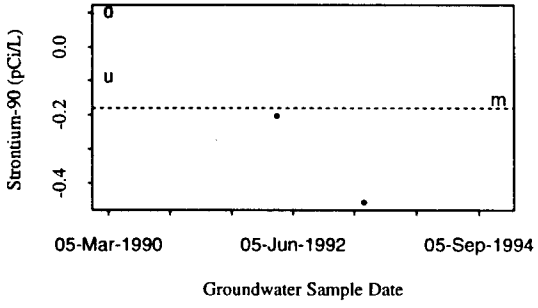
Segment 4-Strontium-90
Well 199-K-27



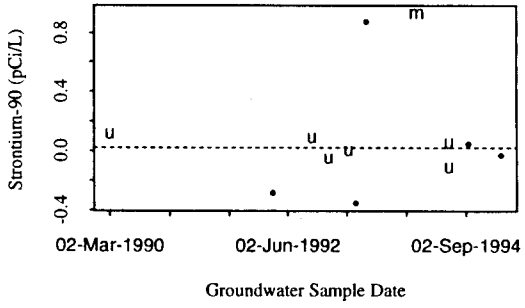
Segment 4-Strontium-90
Well 199-K-28



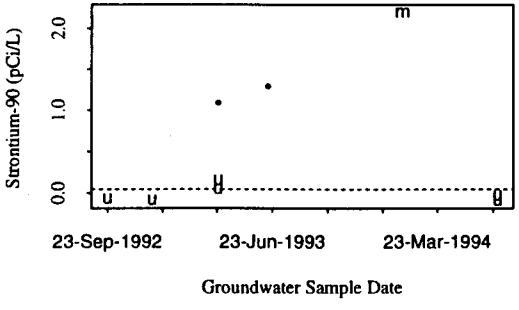
Segment 4-Strontium-90
Well 199-K-29



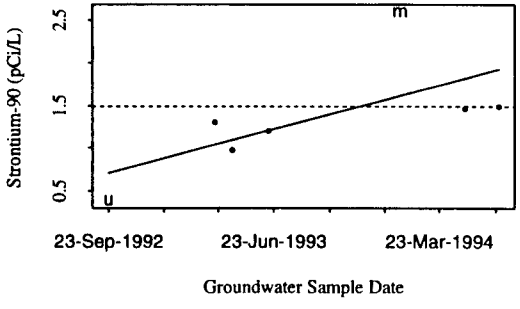
Segment 4-Strontium-90
Well 199-K-30



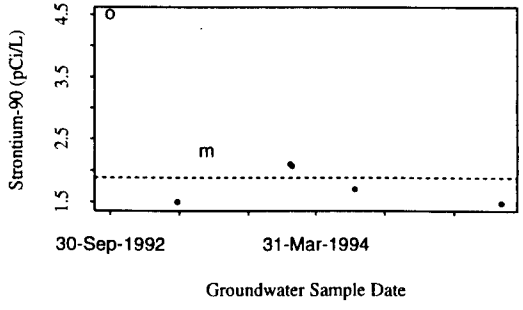
Segment 4-Strontium-90
Well 199-K-31



Segment 4-Strontium-90
Well 199-K-32A

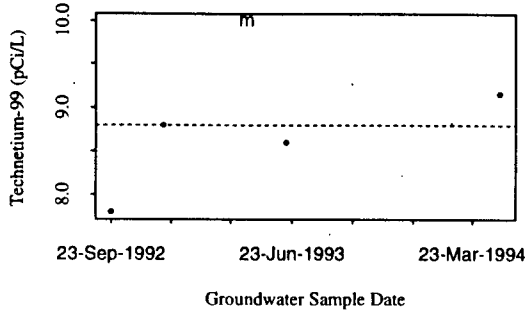


Segment 4-Strontium-90
Well 199-K-33

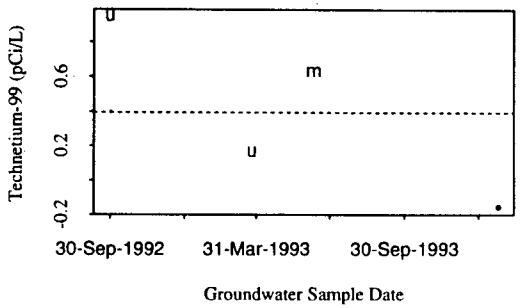


9513448.1606

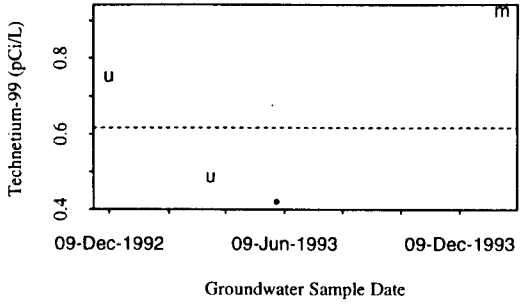
Segment 4-Technetium-99
Well 199-K-32A



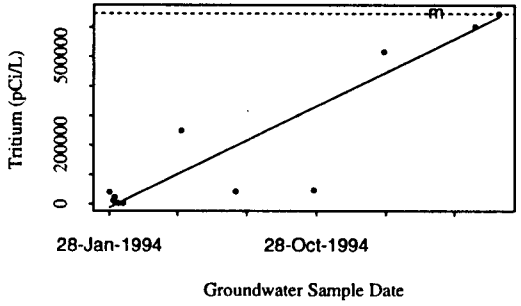
Segment 4-Technetium-99
Well 199-K-33



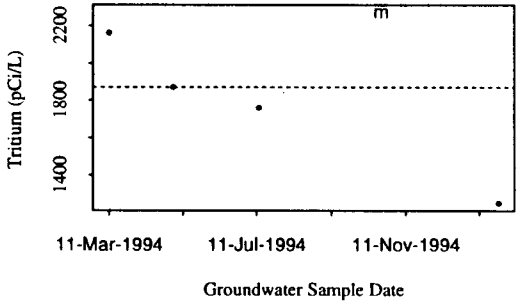
Segment 4-Technetium-99
Well 199-K-34



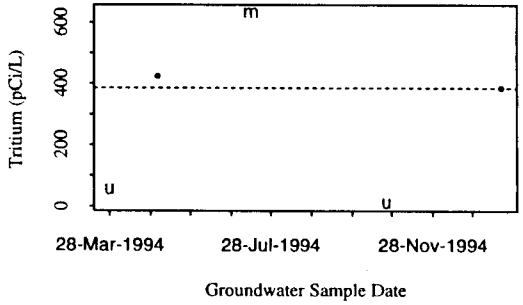
Segment 4-Tritium
Well 199-K-106A



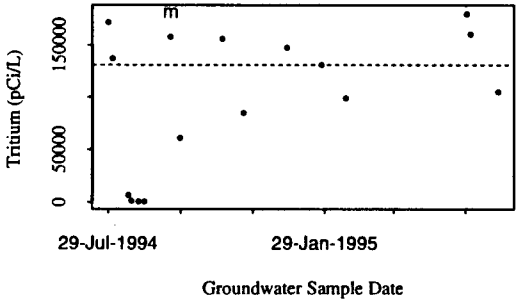
Segment 4-Tritium
Well 199-K-107A



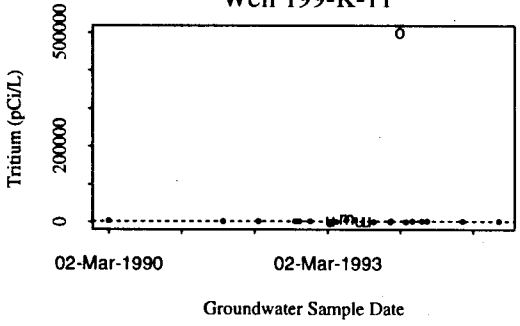
Segment 4-Tritium
Well 199-K-108A



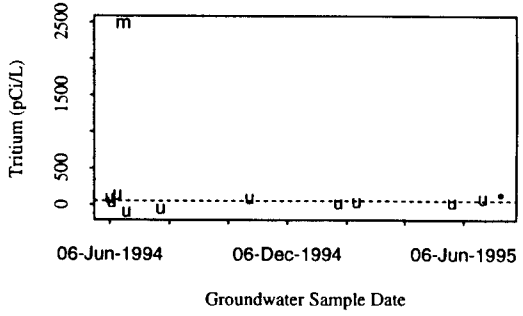
Segment 4-Tritium
Well 199-K-109A



Segment 4-Tritium
Well 199-K-11

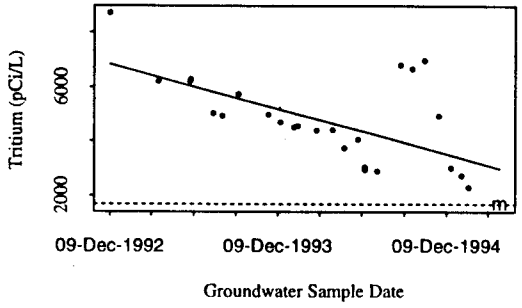


Segment 4-Tritium
Well 199-K-111A

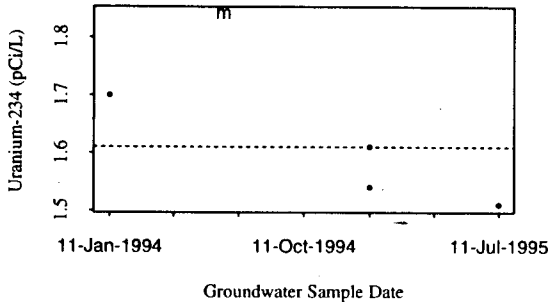


9413148.1607

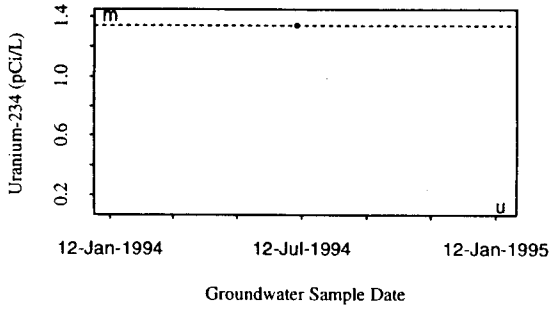
Segment 4-Tritium
Well 199-K-34



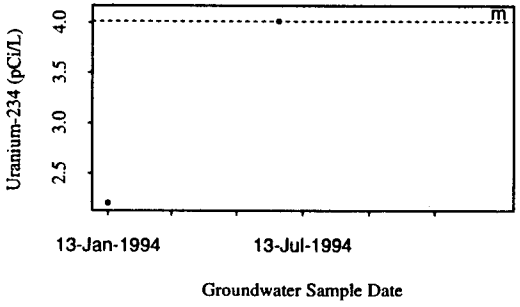
Segment 4-Uranium-234
Well 199-K-11



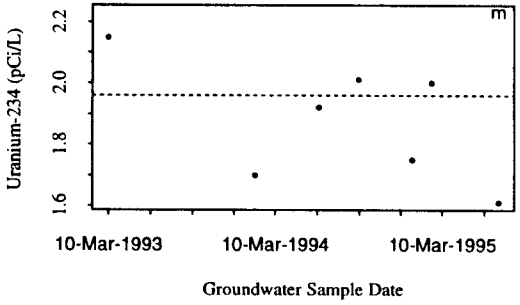
Segment 4-Uranium-234
Well 199-K-13



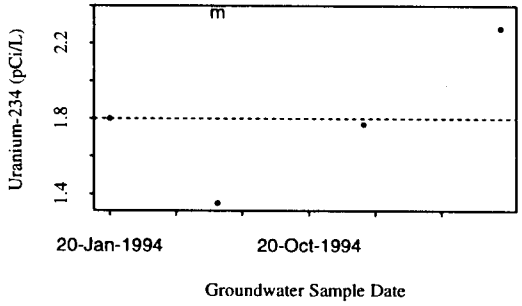
Segment 4-Uranium-234
Well 199-K-23



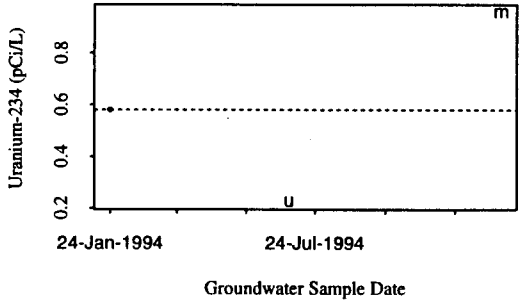
Segment 4-Uranium-234
Well 199-K-27



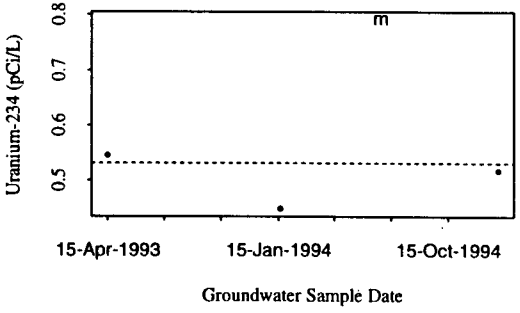
Segment 4-Uranium-234
Well 199-K-30



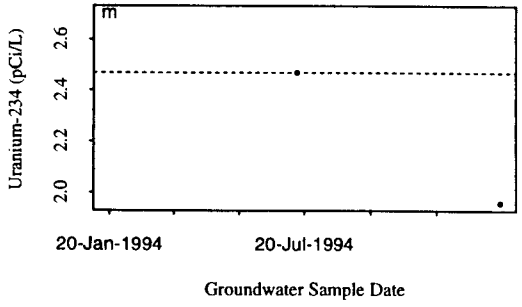
Segment 4-Uranium-234
Well 199-K-31



Segment 4-Uranium-234
Well 199-K-32A

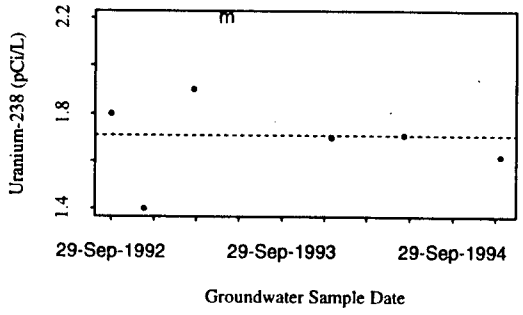


Segment 4-Uranium-234
Well 199-K-33

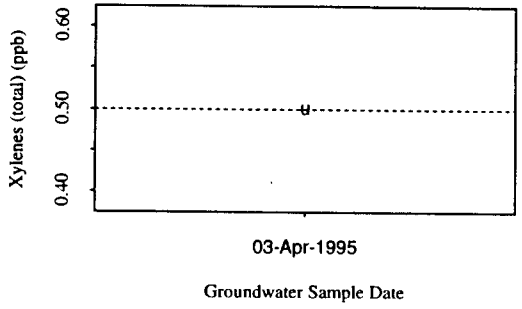


9613148.1658

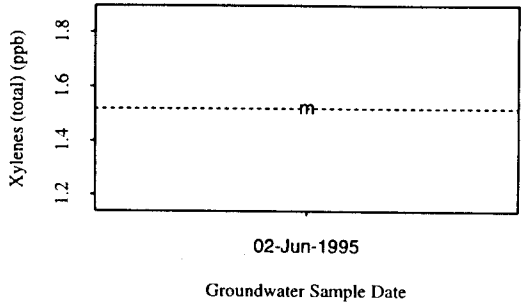
Segment 4-Uranium-238
Well 199-K-34



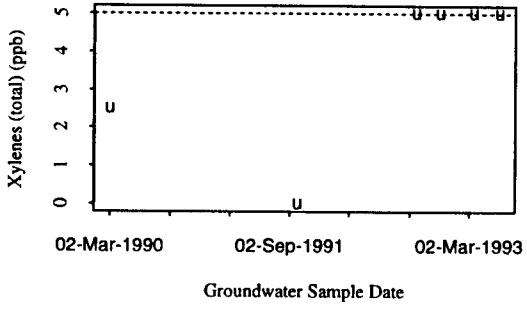
Segment 4-Xylenes (total)
Well 199-K-106A



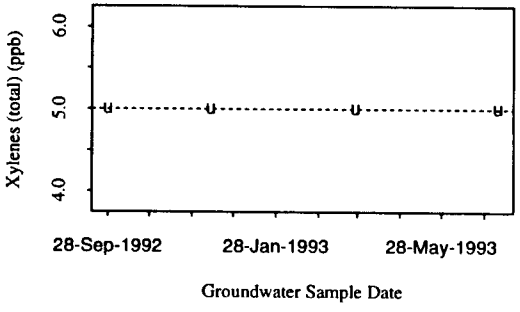
Segment 4-Xylenes (total)
Well 199-K-109A



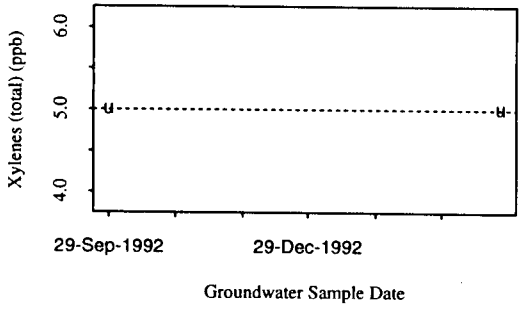
Segment 4-Xylenes (total)
Well 199-K-11



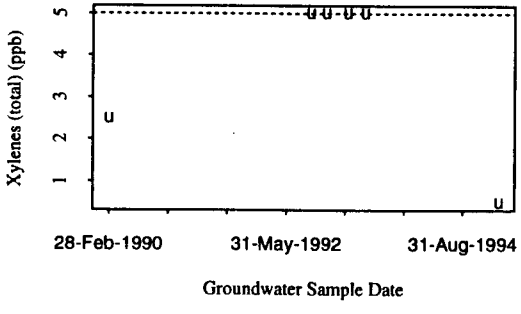
Segment 4-Xylenes (total)
Well 199-K-13



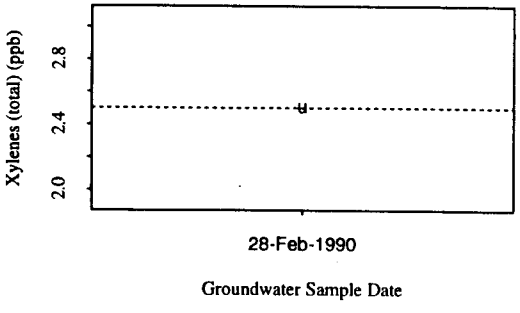
Segment 4-Xylenes (total)
Well 199-K-23



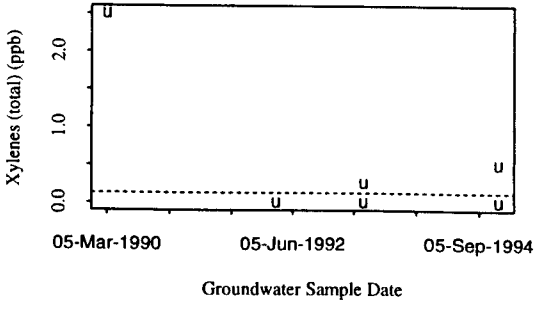
Segment 4-Xylenes (total)
Well 199-K-27



Segment 4-Xylenes (total)
Well 199-K-28

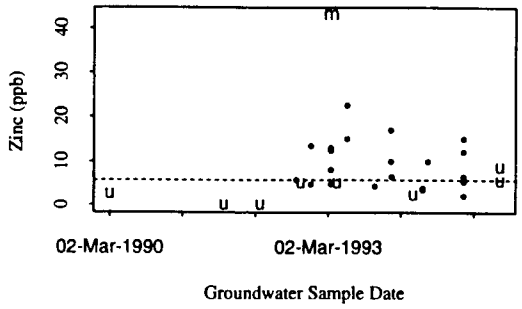


Segment 4-Xylenes (total)
Well 199-K-29

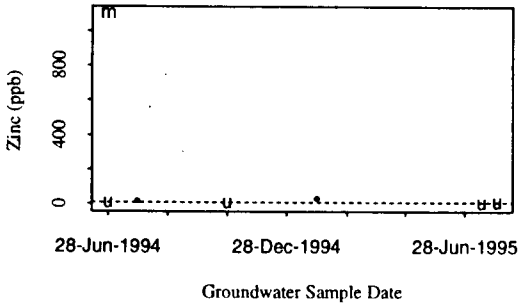


9518148.1609

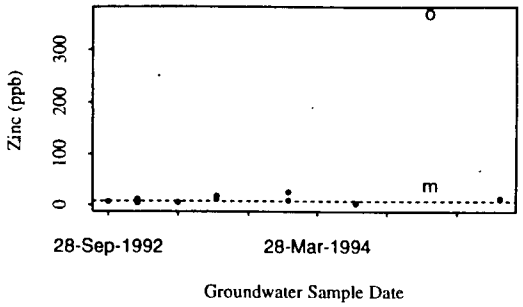
Segment 4-Zinc
Well 199-K-11



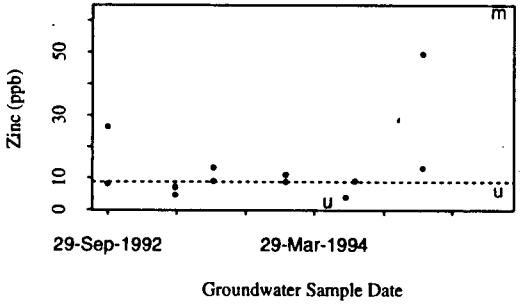
Segment 4-Zinc
Well 199-K-111A



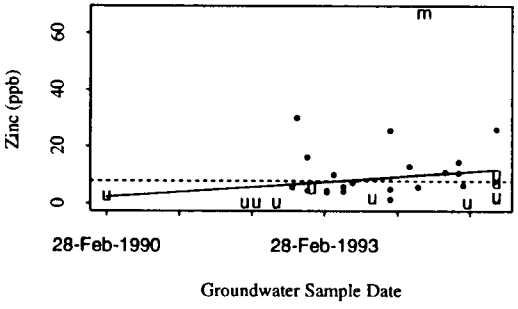
Segment 4-Zinc
Well 199-K-13



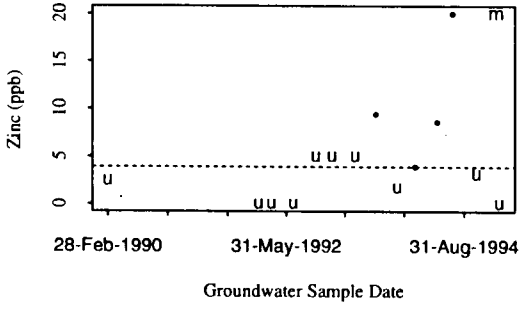
Segment 4-Zinc
Well 199-K-23



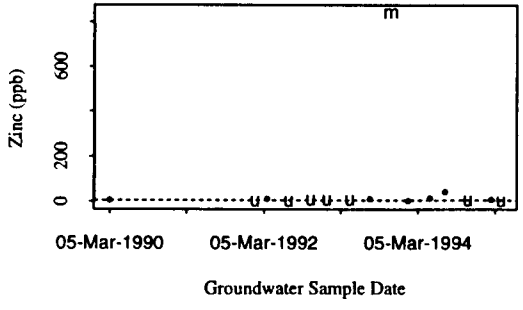
Segment 4-Zinc
Well 199-K-27



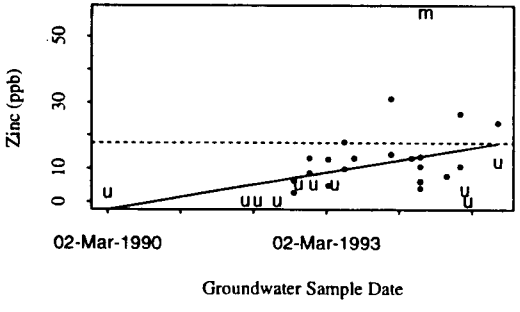
Segment 4-Zinc
Well 199-K-28



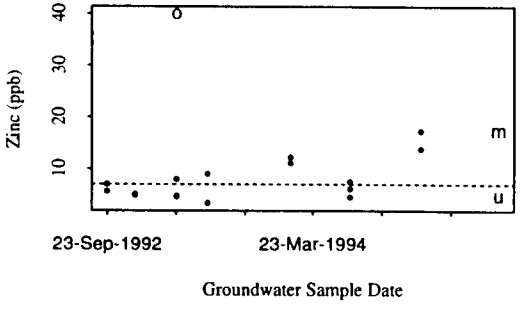
Segment 4-Zinc
Well 199-K-29



Segment 4-Zinc
Well 199-K-30

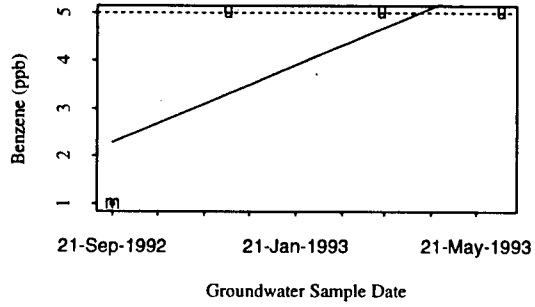


Segment 4-Zinc
Well 199-K-31

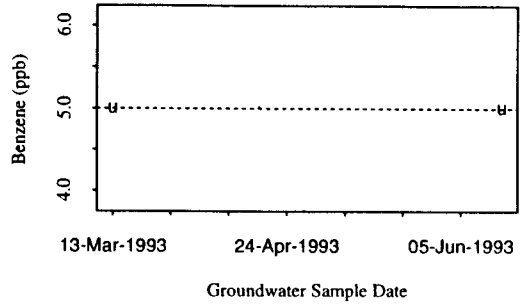


9615148.1610

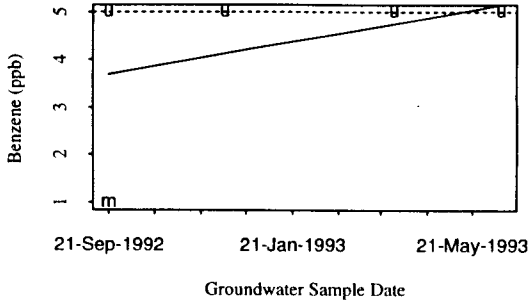
Segment 5-Benzene
Well 199-K-18



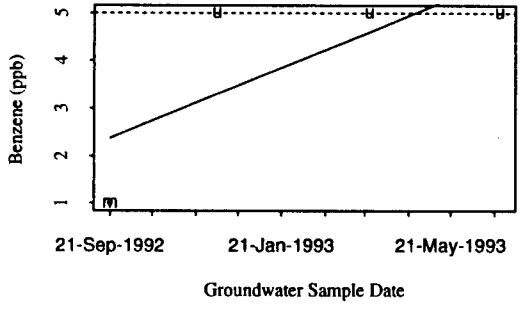
Segment 5-Benzene
Well 199-K-19



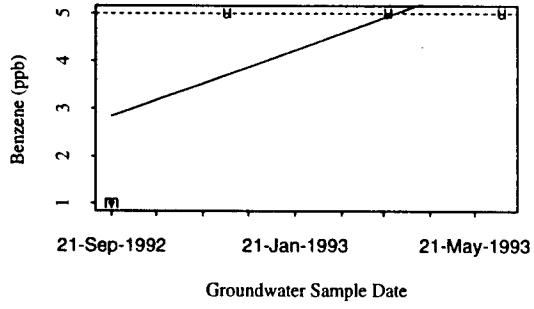
Segment 5-Benzene
Well 199-K-20



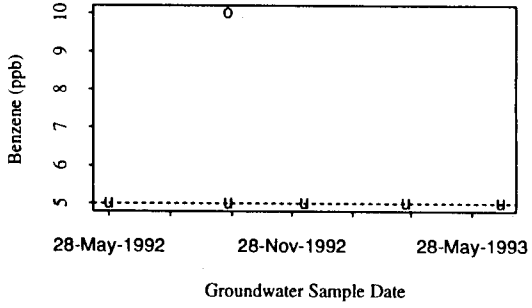
Segment 5-Benzene
Well 199-K-21



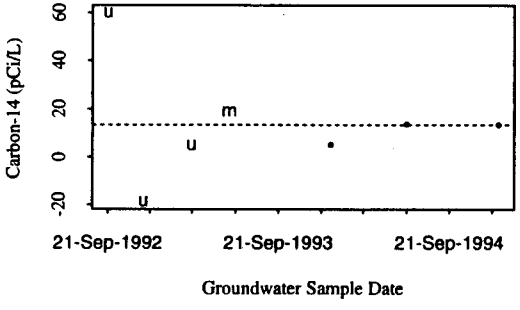
Segment 5-Benzene
Well 199-K-22



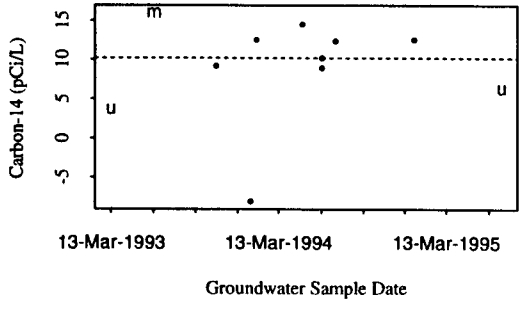
Segment 5-Benzene
Well 199-K-37



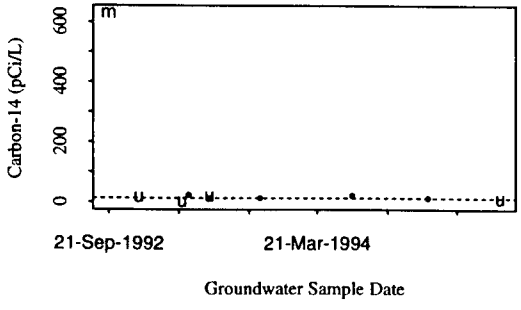
Segment 5-Carbon-14
Well 199-K-18



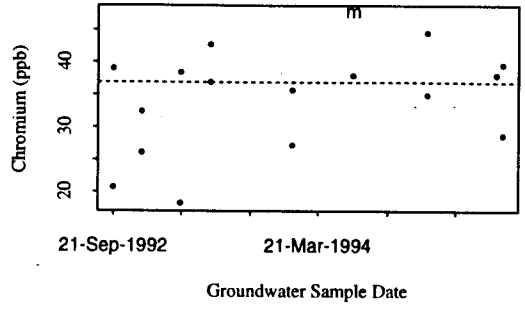
Segment 5-Carbon-14
Well 199-K-19



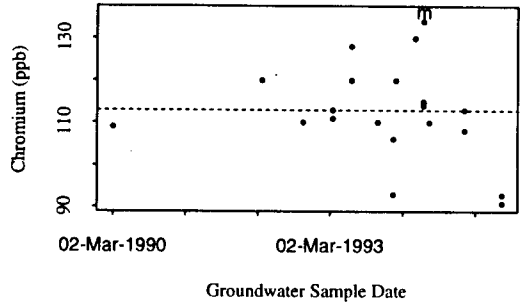
Segment 5-Carbon-14
Well 199-K-20



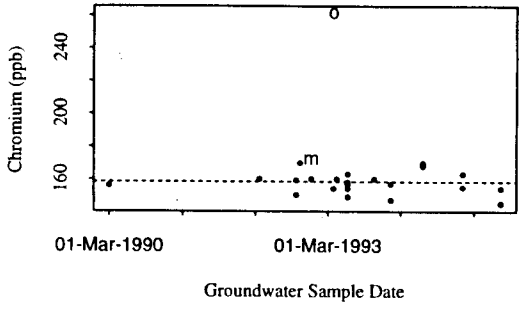
Segment 5-Chromium
Well 199-K-18



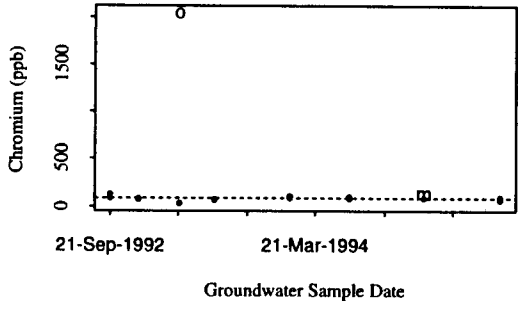
Segment 5-Chromium
Well 199-K-19



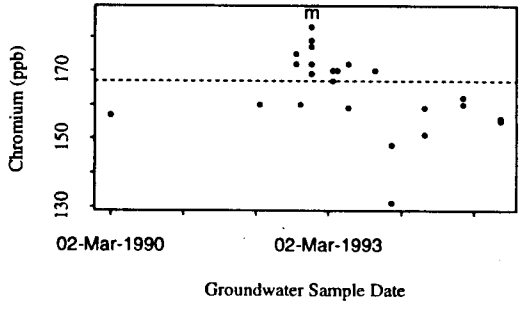
Segment 5-Chromium
Well 199-K-20



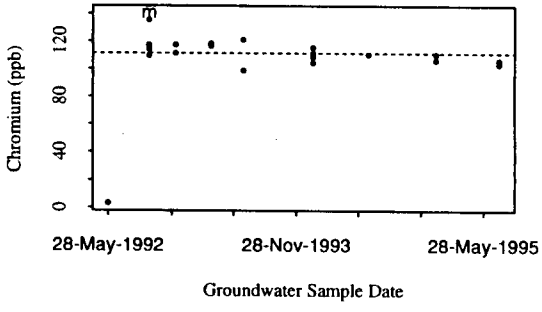
Segment 5-Chromium
Well 199-K-21



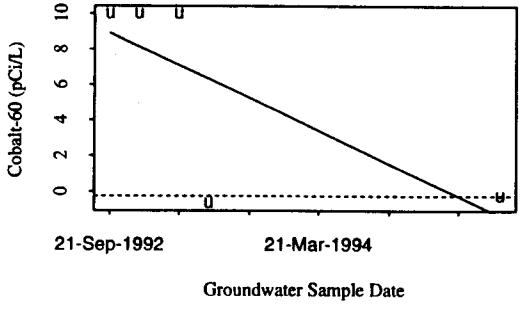
Segment 5-Chromium
Well 199-K-22



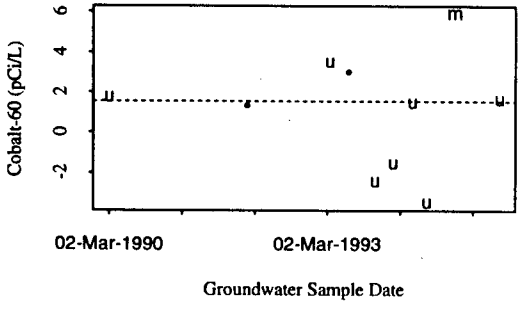
Segment 5-Chromium
Well 199-K-37



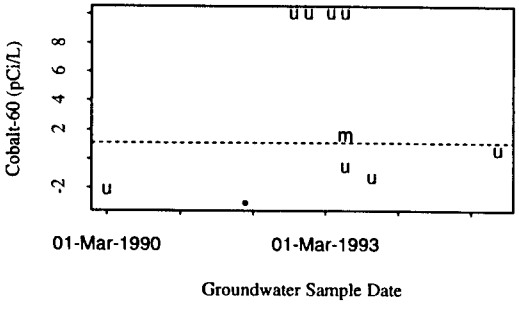
Segment 5-Cobalt-60
Well 199-K-18



Segment 5-Cobalt-60
Well 199-K-19

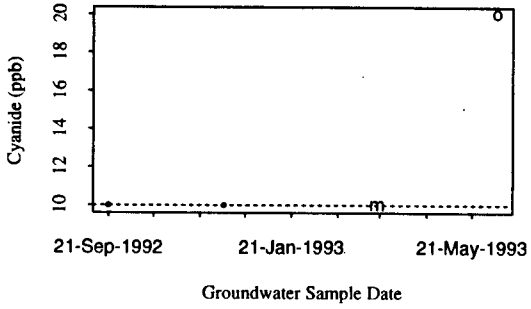


Segment 5-Cobalt-60
Well 199-K-20

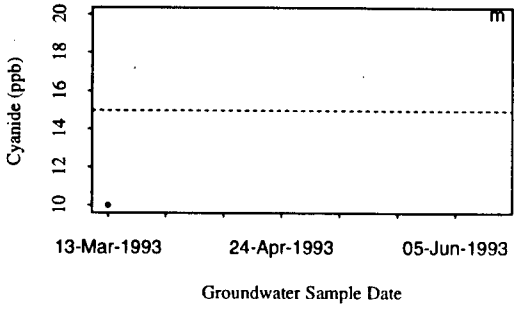


9618948.1612

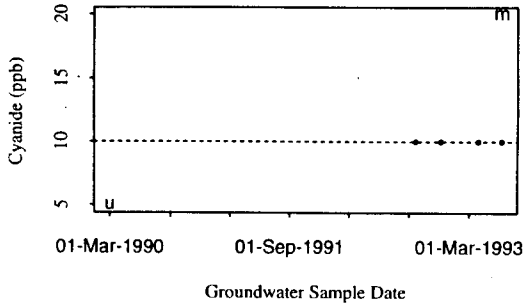
Segment 5-Cyanide
Well 199-K-18



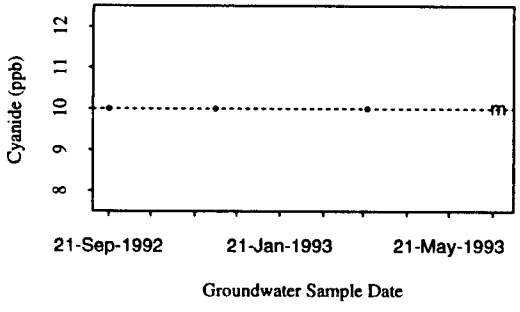
Segment 5-Cyanide
Well 199-K-19



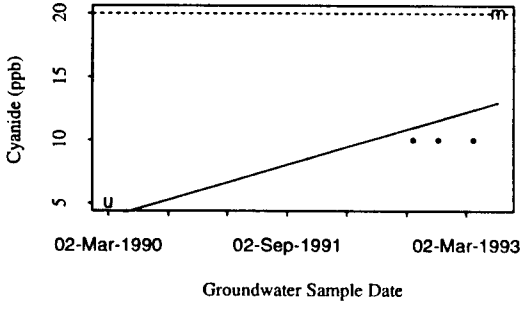
Segment 5-Cyanide
Well 199-K-20



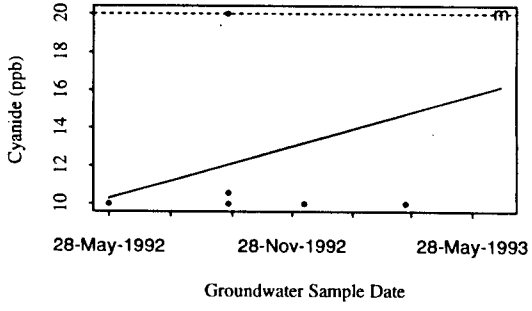
Segment 5-Cyanide
Well 199-K-21



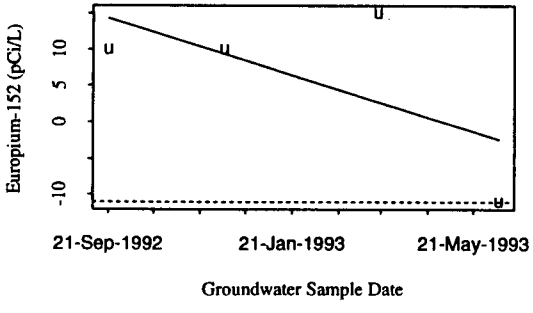
Segment 5-Cyanide
Well 199-K-22



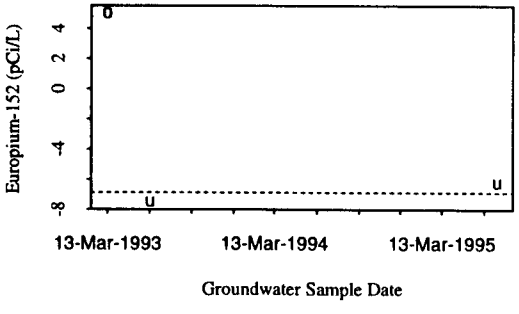
Segment 5-Cyanide
Well 199-K-37



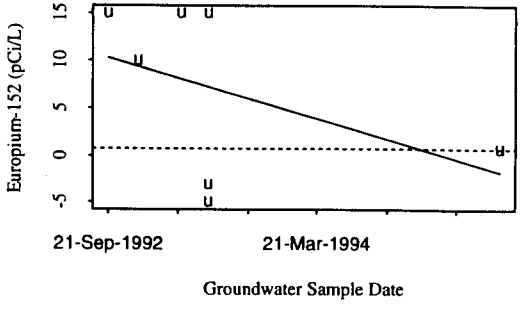
Segment 5-Europium-152
Well 199-K-18



Segment 5-Europium-152
Well 199-K-19

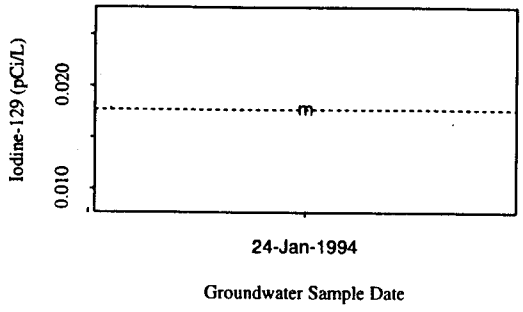


Segment 5-Europium-152
Well 199-K-20

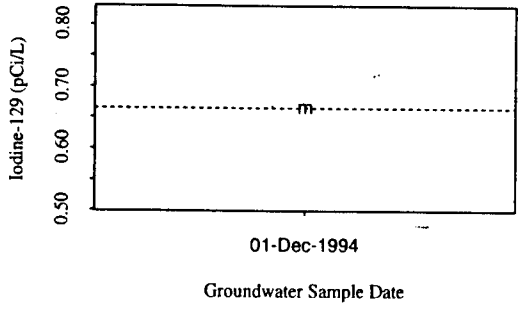


9413148.1612

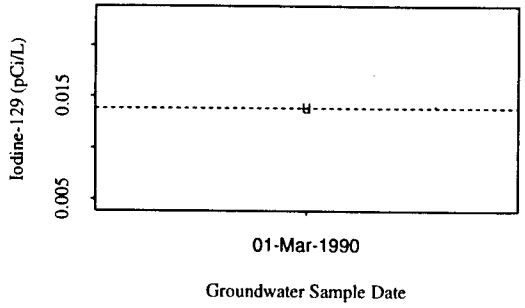
Segment 5-Iodine-129
Well 199-K-18



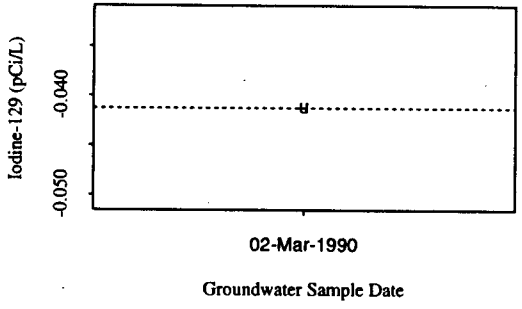
Segment 5-Iodine-129
Well 199-K-19



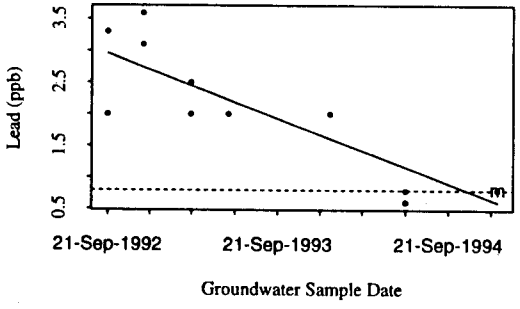
Segment 5-Iodine-129
Well 199-K-20



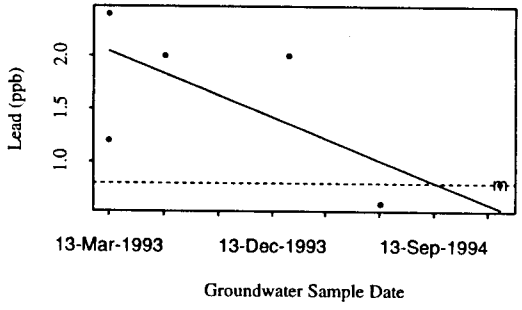
Segment 5-Iodine-129
Well 199-K-22



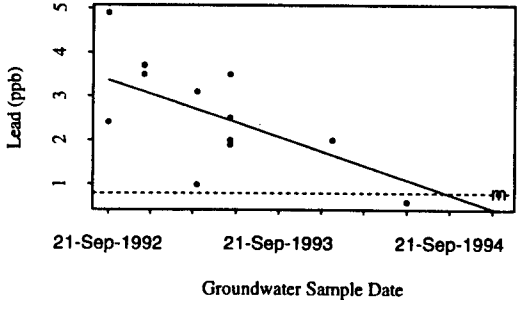
Segment 5-Lead
Well 199-K-18



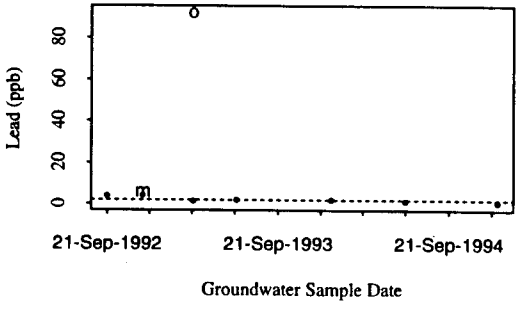
Segment 5-Lead
Well 199-K-19



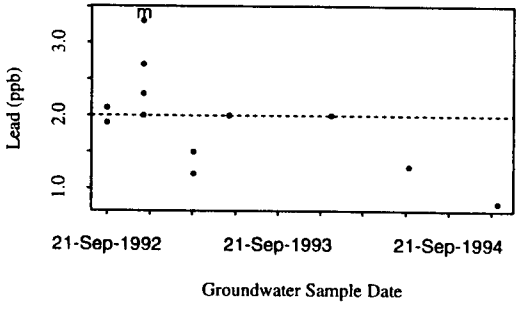
Segment 5-Lead
Well 199-K-20



Segment 5-Lead
Well 199-K-21

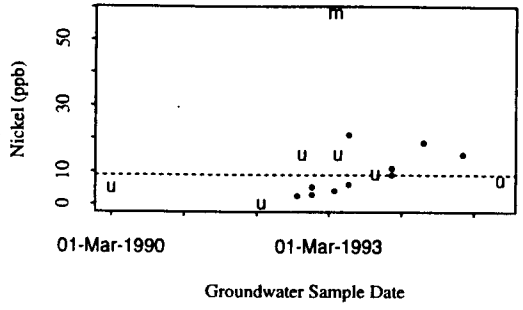


Segment 5-Lead
Well 199-K-22

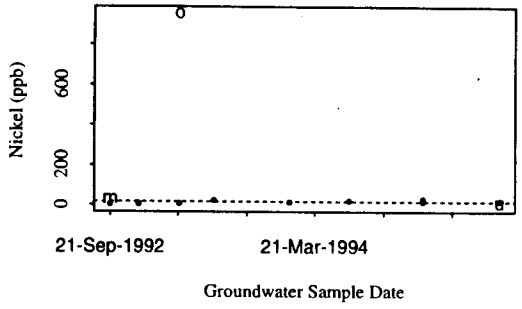


9613148.1614

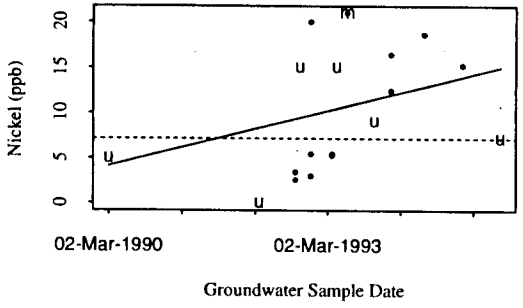
Segment 5-Nickel
Well 199-K-20



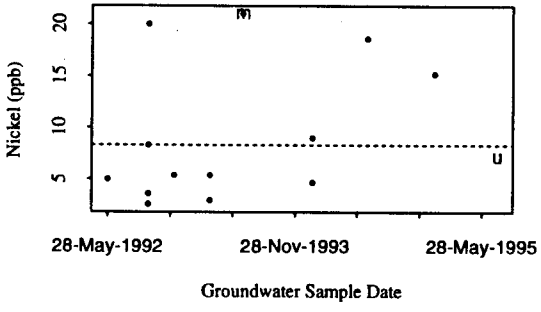
Segment 5-Nickel
Well 199-K-21



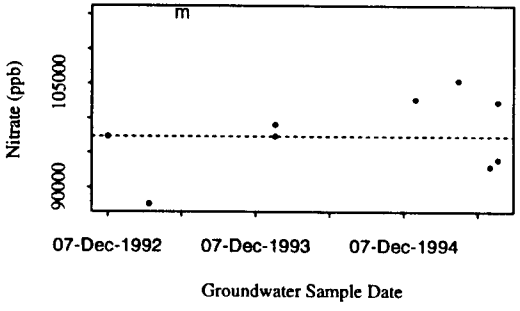
Segment 5-Nickel
Well 199-K-22



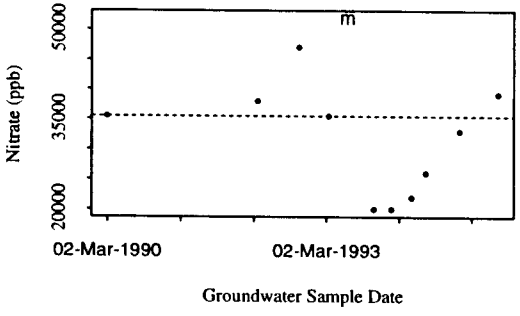
Segment 5-Nickel
Well 199-K-37



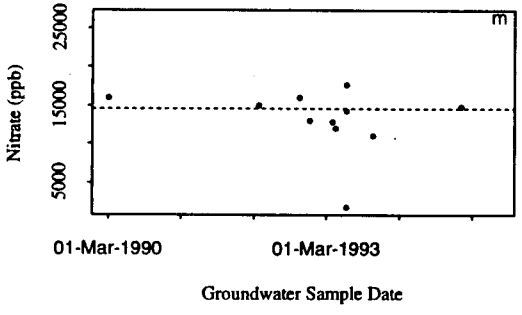
Segment 5-Nitrate
Well 199-K-18



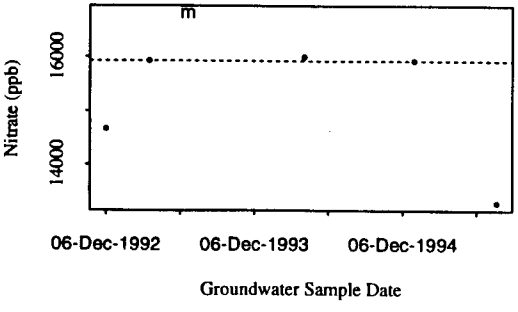
Segment 5-Nitrate
Well 199-K-19



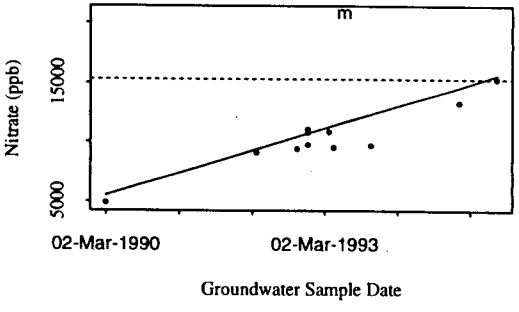
Segment 5-Nitrate
Well 199-K-20



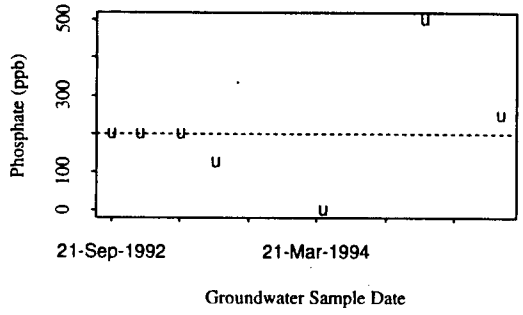
Segment 5-Nitrate
Well 199-K-21



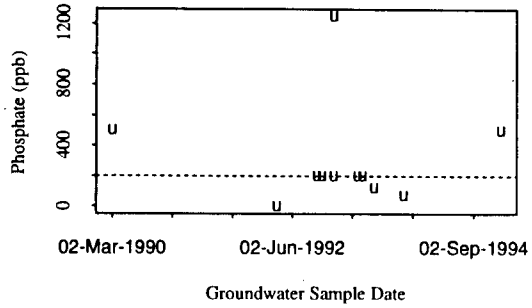
Segment 5-Nitrate
Well 199-K-22



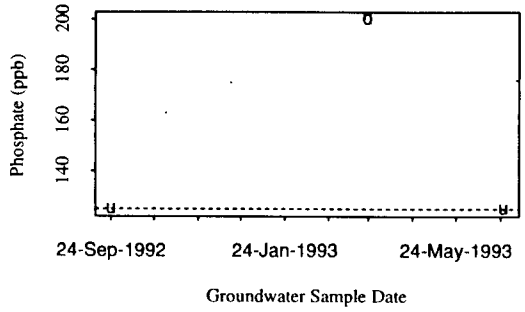
Segment 5-Phosphate
Well 199-K-21



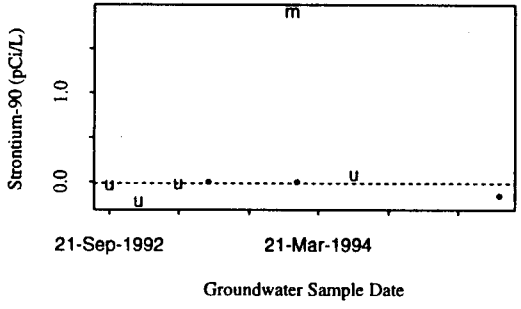
Segment 5-Phosphate
Well 199-K-22



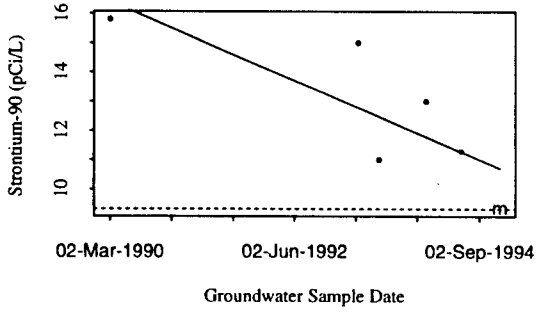
Segment 5-Phosphate
Well 199-K-37



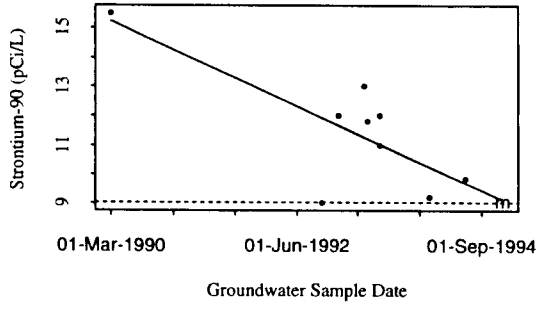
Segment 5-Strontium-90
Well 199-K-18



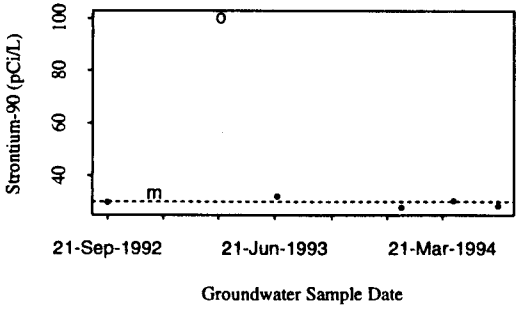
Segment 5-Strontium-90
Well 199-K-19



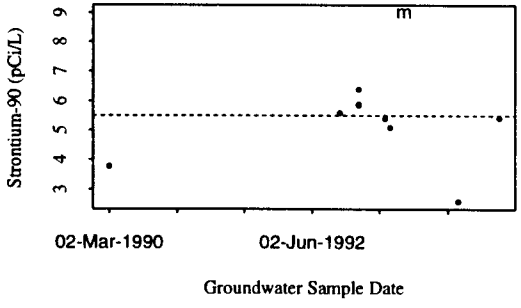
Segment 5-Strontium-90
Well 199-K-20



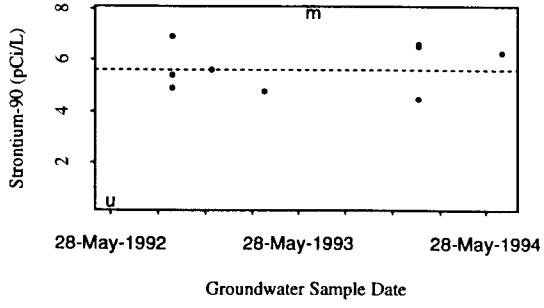
Segment 5-Strontium-90
Well 199-K-21



Segment 5-Strontium-90
Well 199-K-22

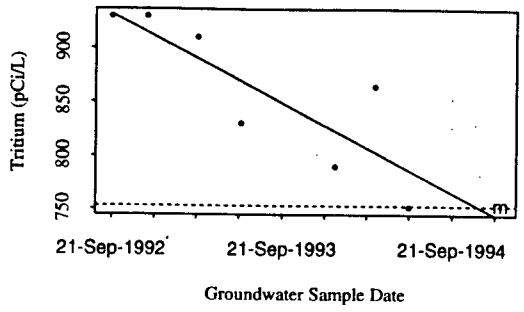


Segment 5-Strontium-90
Well 199-K-37

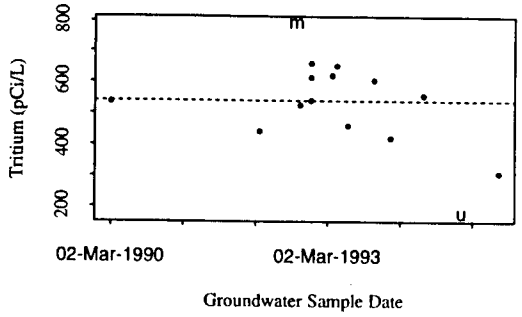


9413481.1616

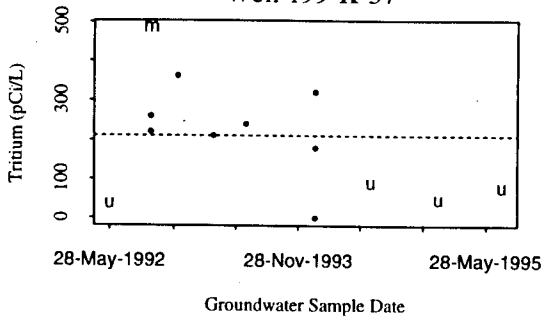
Segment 5-Tritium
Well 199-K-21



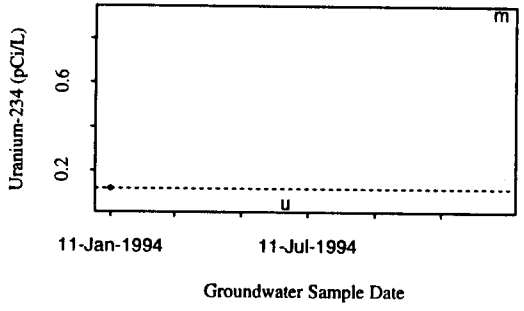
Segment 5-Tritium
Well 199-K-22



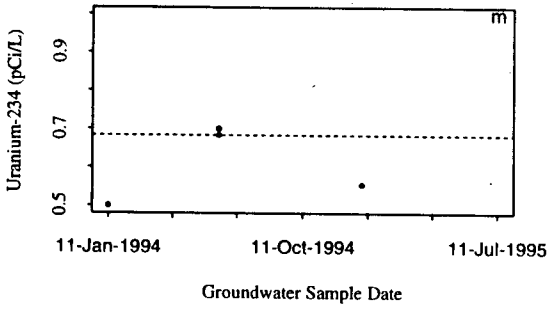
Segment 5-Tritium
Well 199-K-37



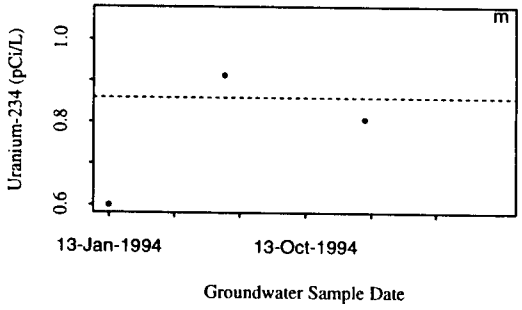
Segment 5-Uranium-234
Well 199-K-18



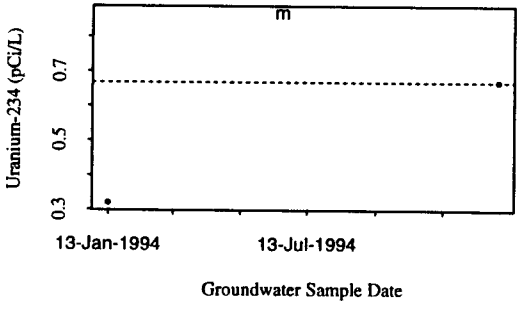
Segment 5-Uranium-234
Well 199-K-19



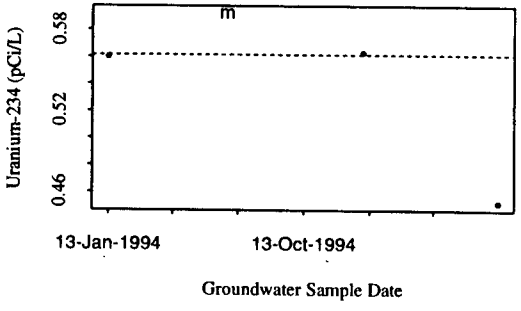
Segment 5-Uranium-234
Well 199-K-20



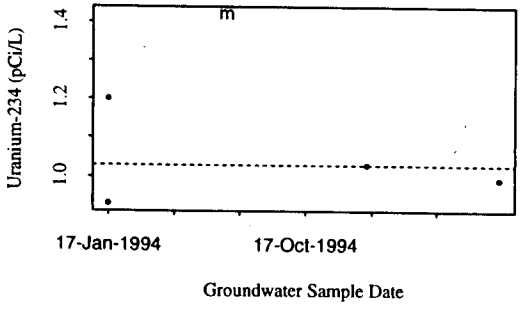
Segment 5-Uranium-234
Well 199-K-21



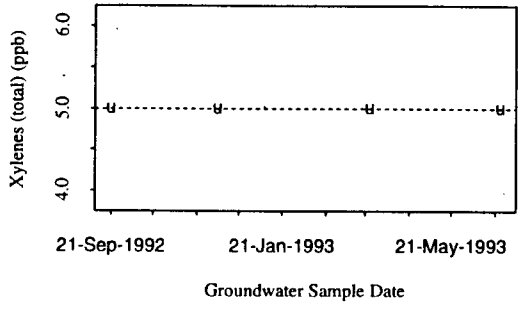
Segment 5-Uranium-234
Well 199-K-22



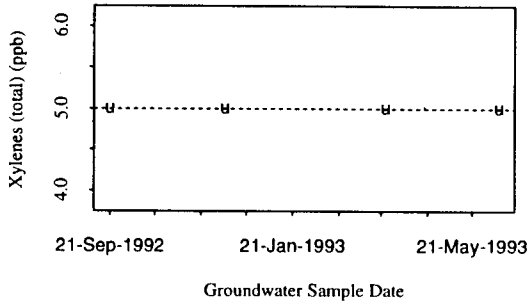
Segment 5-Uranium-234
Well 199-K-37



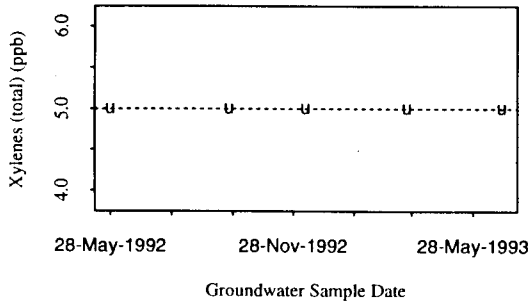
Segment 5-Xylenes (total)
Well 199-K-21



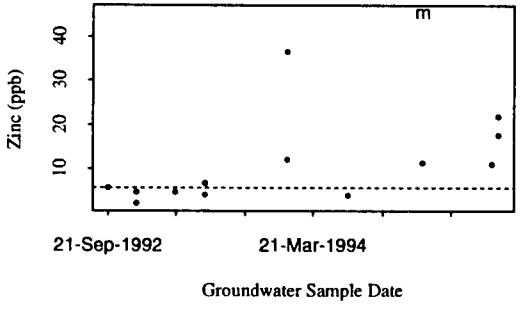
Segment 5-Xylenes (total)
Well 199-K-22



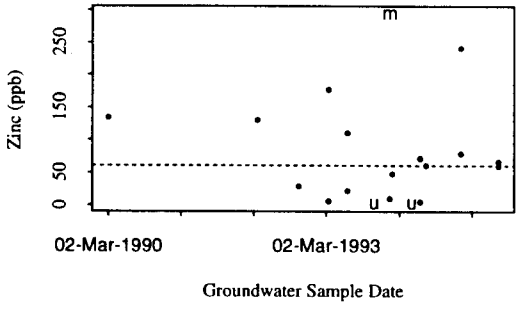
Segment 5-Xylenes (total)
Well 199-K-37



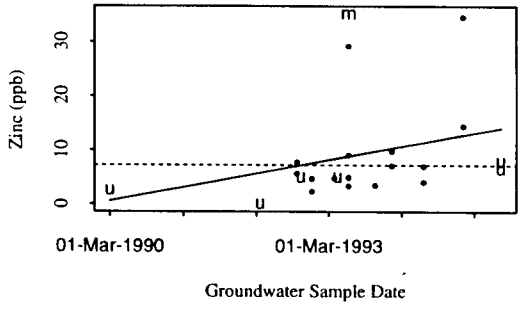
Segment 5-Zinc
Well 199-K-18



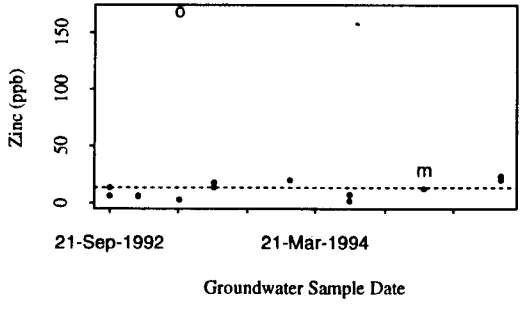
Segment 5-Zinc
Well 199-K-19



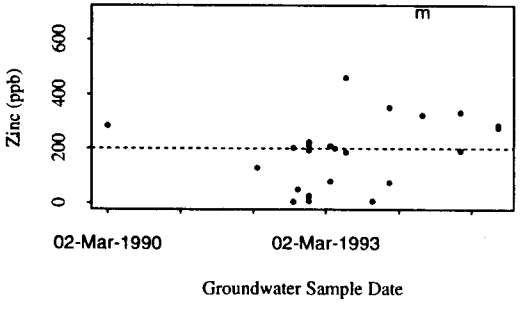
Segment 5-Zinc
Well 199-K-20



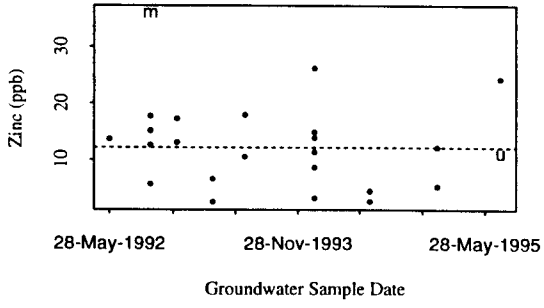
Segment 5-Zinc
Well 199-K-21



Segment 5-Zinc
Well 199-K-22

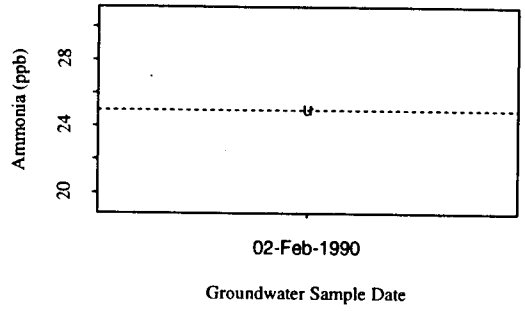


Segment 5-Zinc
Well 199-K-37

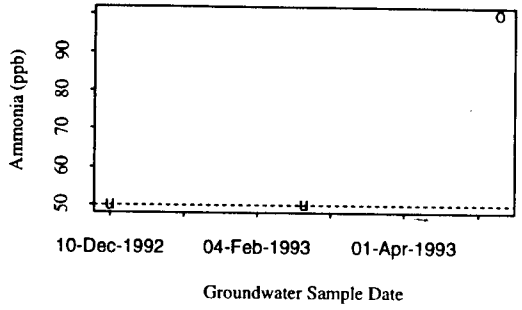


9312148.0168

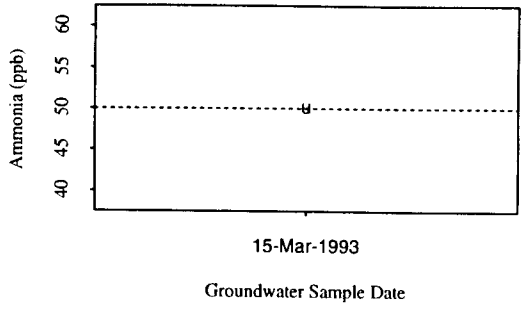
Segment 6-Ammonia
Well 199-N-4



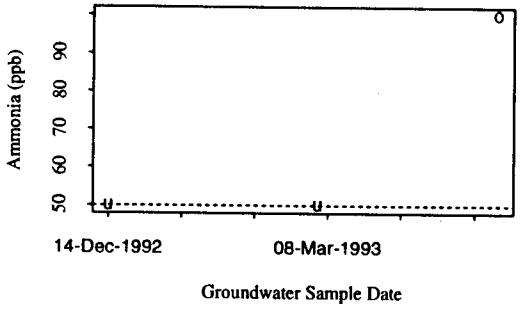
Segment 6-Ammonia
Well 199-N-47



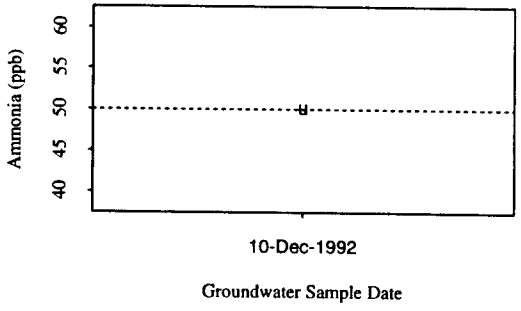
Segment 6-Ammonia
Well 199-N-51



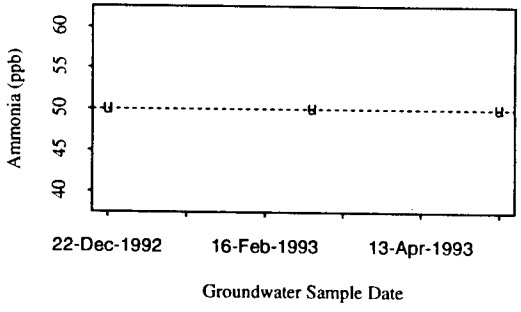
Segment 6-Ammonia
Well 199-N-54



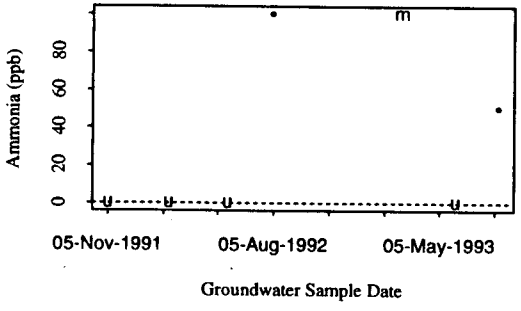
Segment 6-Ammonia
Well 199-N-55



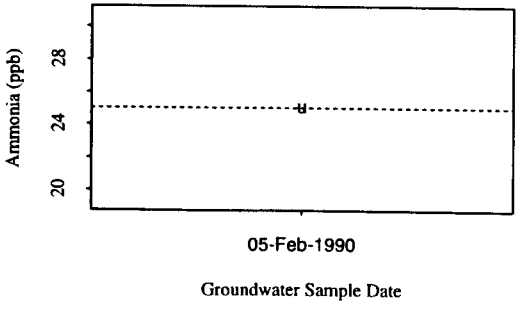
Segment 6-Ammonia
Well 199-N-56



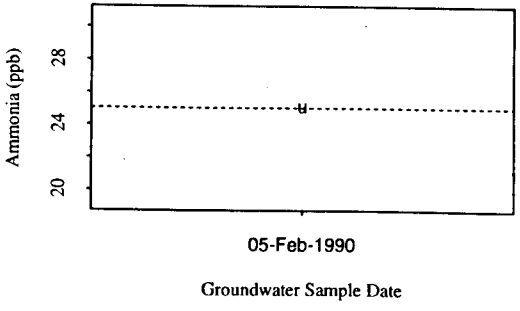
Segment 6-Ammonia
Well 199-N-57



Segment 6-Ammonia
Well 199-N-58

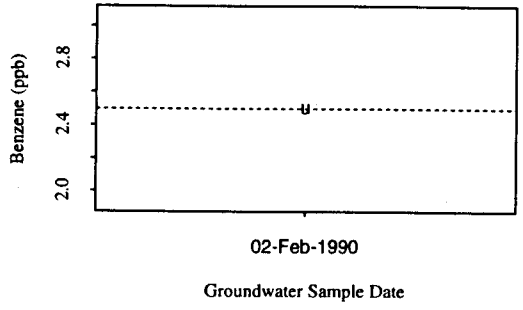


Segment 6-Ammonia
Well 199-N-60

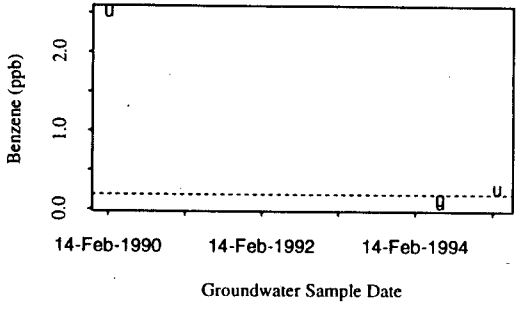


9613148.1069

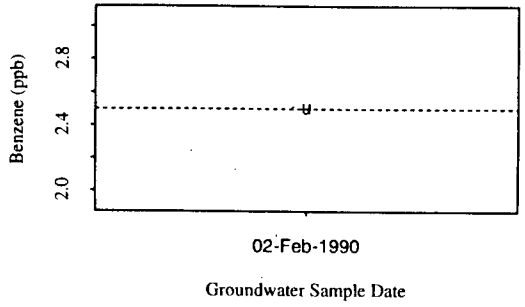
Segment 6-Benzene
Well 199-N-2



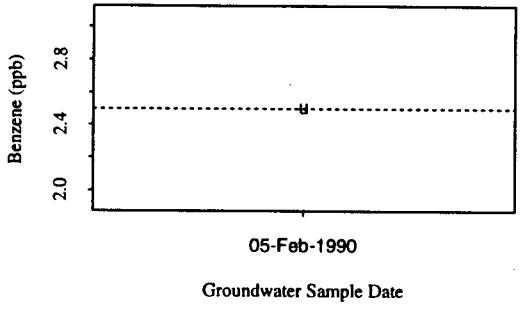
Segment 6-Benzene
Well 199-N-3



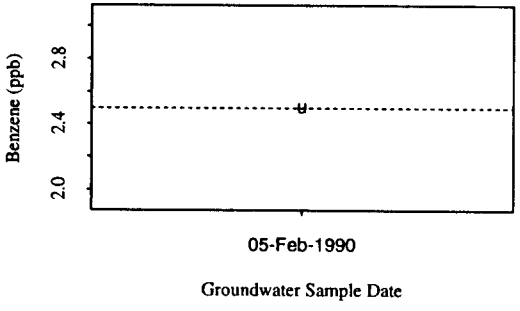
Segment 6-Benzene
Well 199-N-4



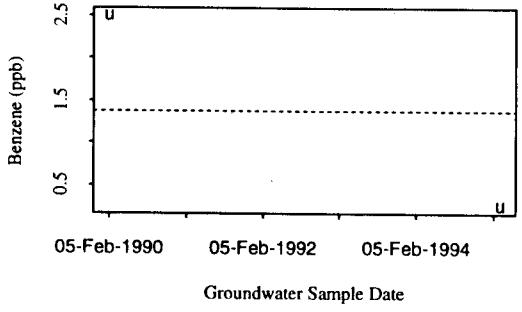
Segment 6-Benzene
Well 199-N-58



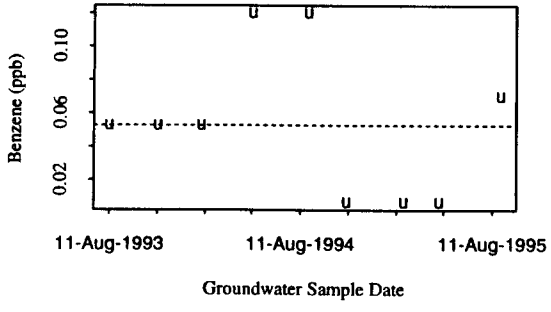
Segment 6-Benzene
Well 199-N-60



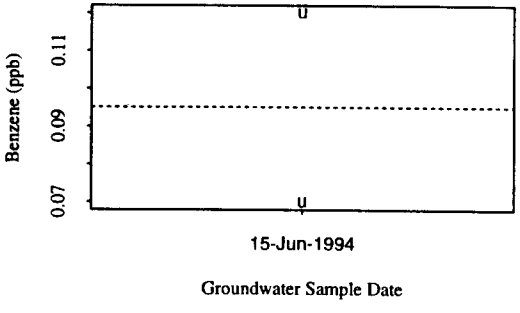
Segment 6-Benzene
Well 199-N-67



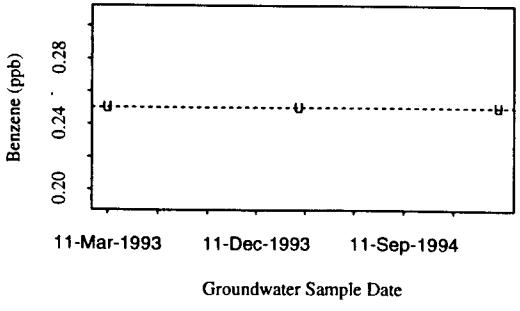
Segment 6-Benzene
Well 199-N-72



Segment 6-Benzene
Well 199-N-75

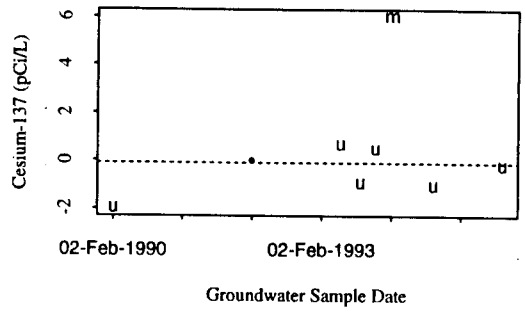


Segment 6-Benzene
Well 199-N-76

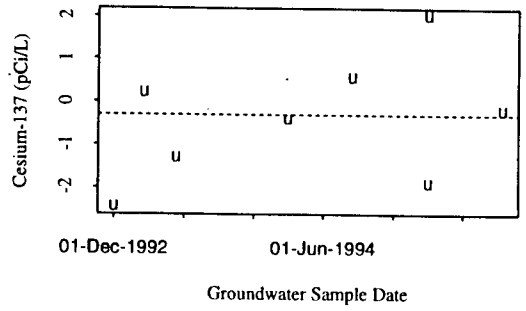


9513148.1020

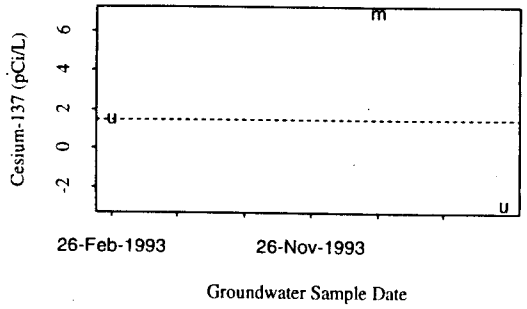
Segment 6-Cesium-137
Well 199-N-2



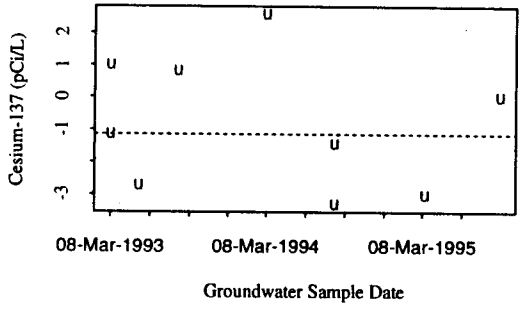
Segment 6-Cesium-137
Well 199-N-21



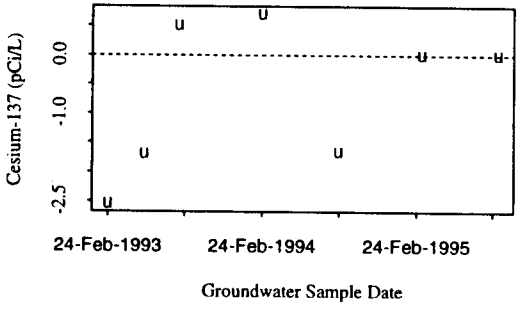
Segment 6-Cesium-137
Well 199-N-23



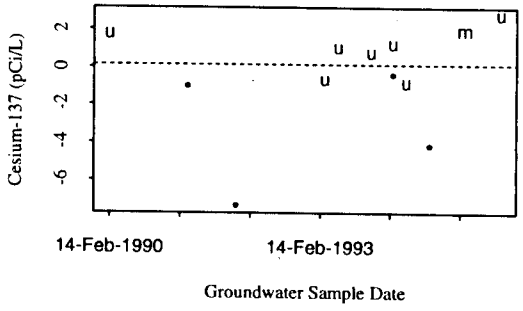
Segment 6-Cesium-137
Well 199-N-25



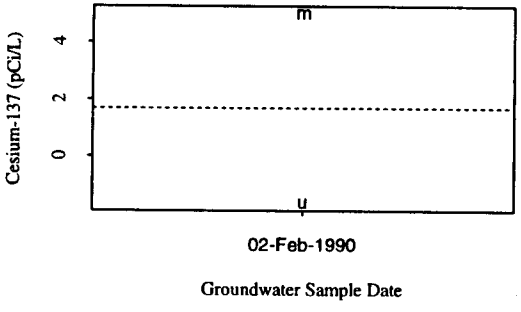
Segment 6-Cesium-137
Well 199-N-26



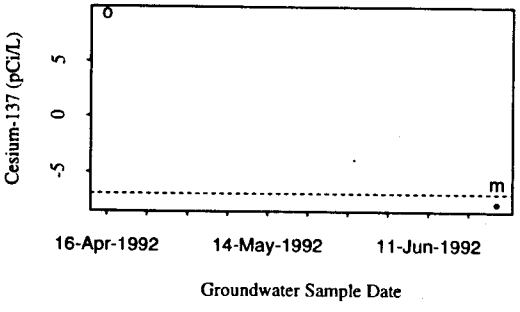
Segment 6-Cesium-137
Well 199-N-3



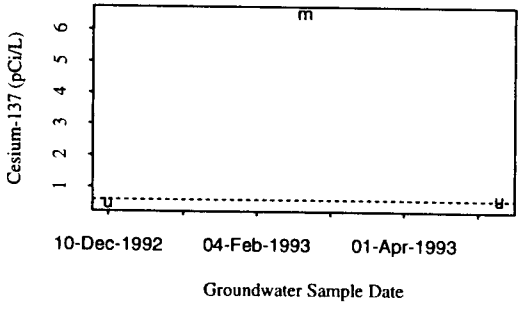
Segment 6-Cesium-137
Well 199-N-4



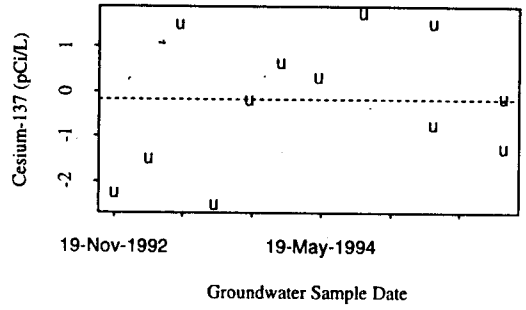
Segment 6-Cesium-137
Well 199-N-46



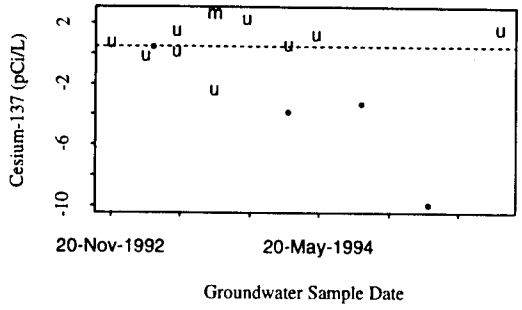
Segment 6-Cesium-137
Well 199-N-47



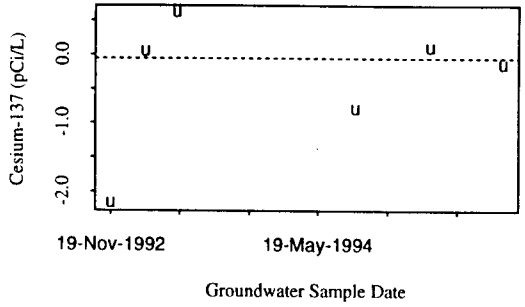
Segment 6-Cesium-137
Well 199-N-75



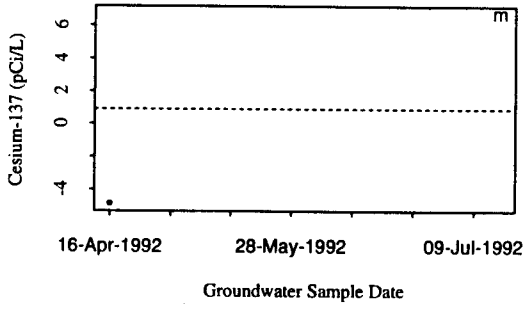
Segment 6-Cesium-137
Well 199-N-76



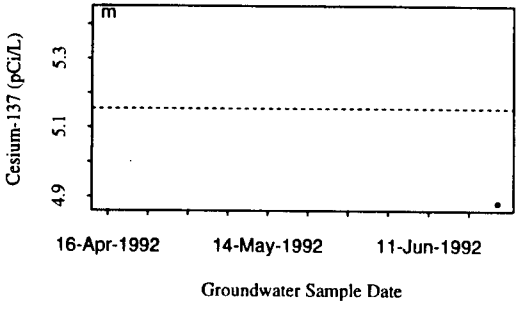
Segment 6-Cesium-137
Well 199-N-77



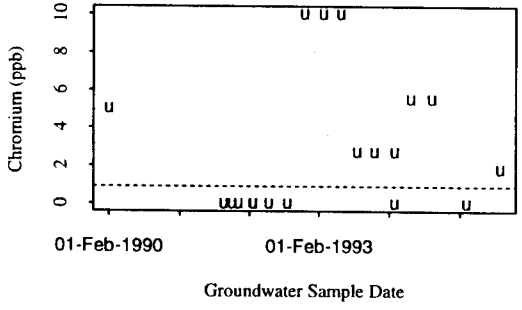
Segment 6-Cesium-137
Well 199-N-8S



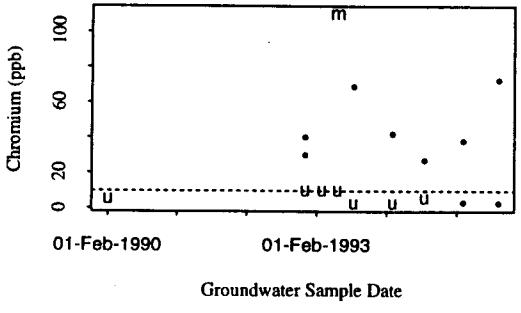
Segment 6-Cesium-137
Well 199-N-8T



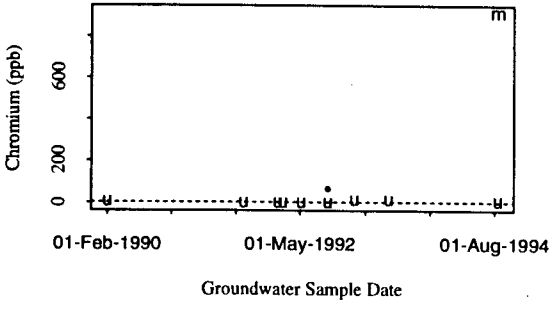
Segment 6-Chromium
Well 199-N-14



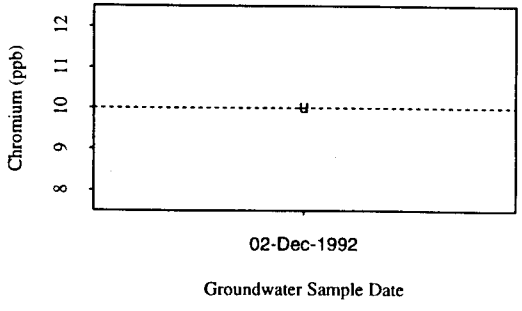
Segment 6-Chromium
Well 199-N-16



Segment 6-Chromium
Well 199-N-17

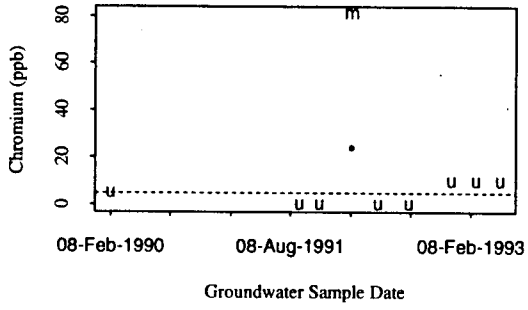


Segment 6-Chromium
Well 199-N-19

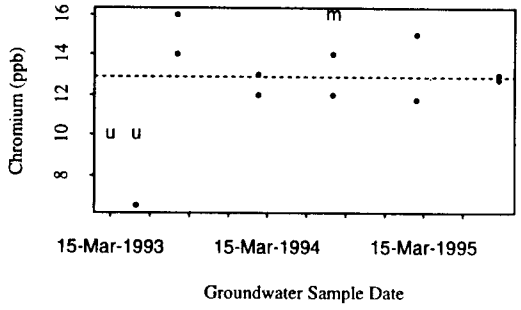


9413148.1022

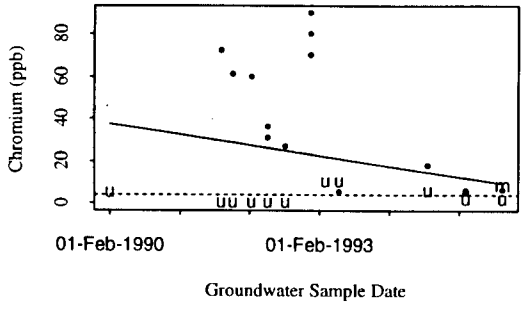
Segment 6-Chromium
Well 199-N-47



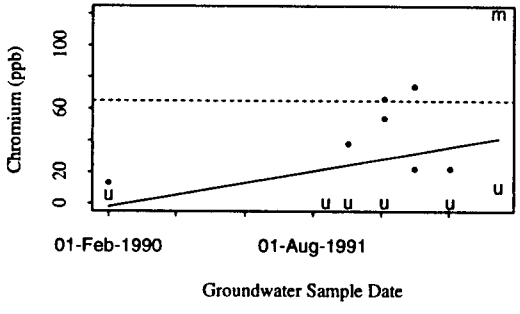
Segment 6-Chromium
Well 199-N-51



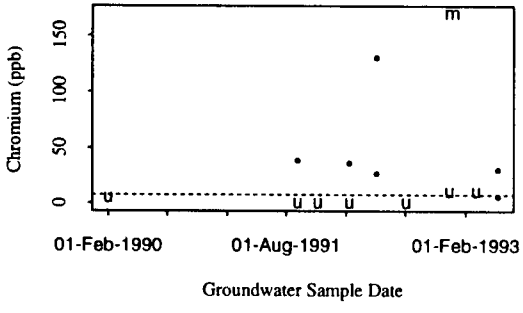
Segment 6-Chromium
Well 199-N-54



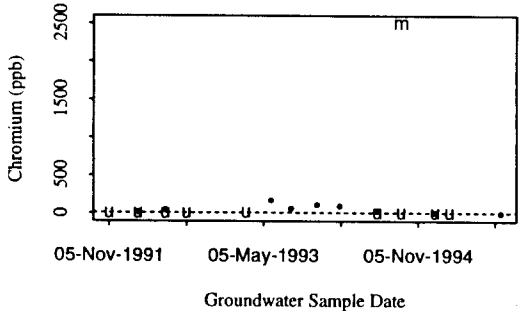
Segment 6-Chromium
Well 199-N-55



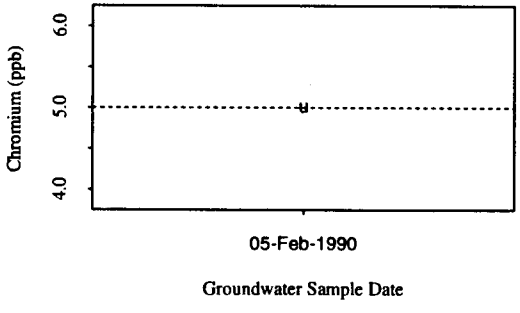
Segment 6-Chromium
Well 199-N-56



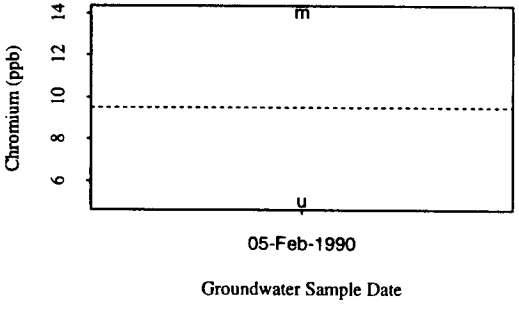
Segment 6-Chromium
Well 199-N-57



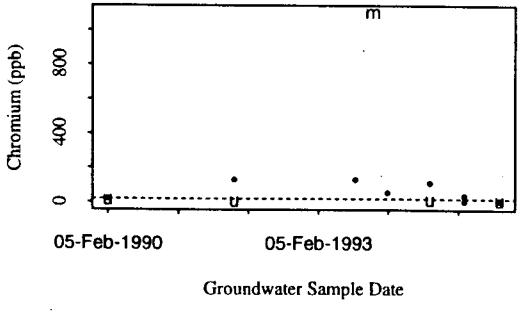
Segment 6-Chromium
Well 199-N-58



Segment 6-Chromium
Well 199-N-60

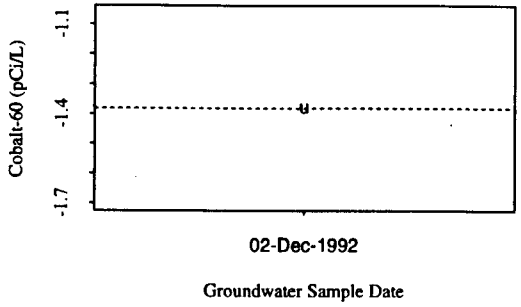


Segment 6-Chromium
Well 199-N-67

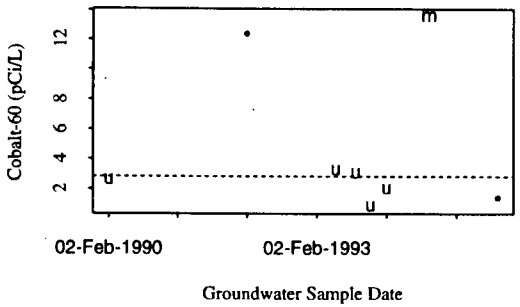


9513148.1623

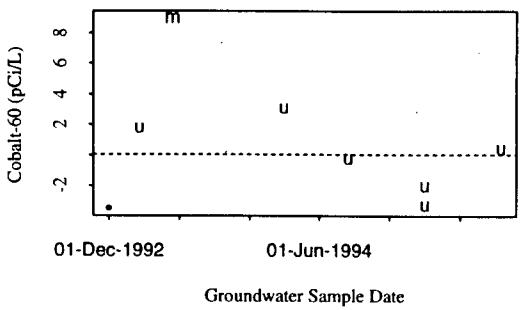
Segment 6-Cobalt-60
Well 199-N-19



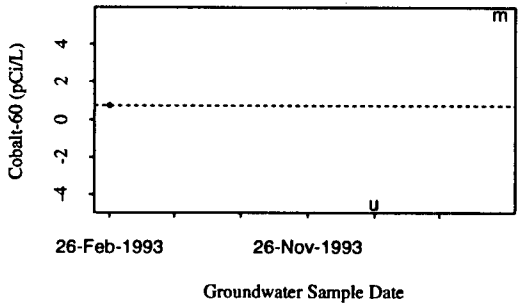
Segment 6-Cobalt-60
Well 199-N-2



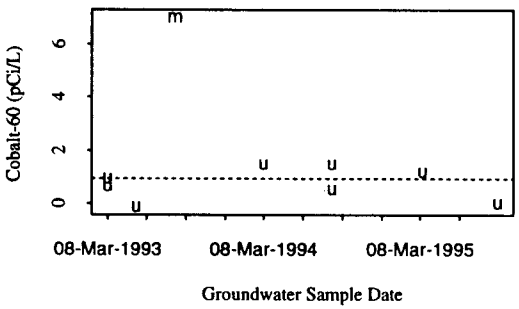
Segment 6-Cobalt-60
Well 199-N-21



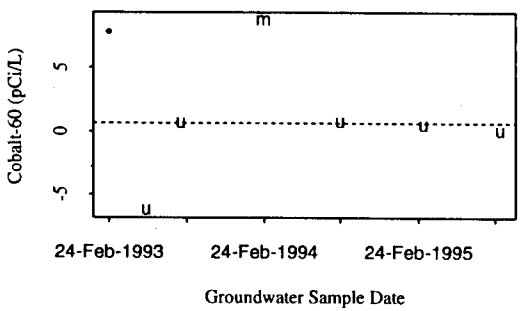
Segment 6-Cobalt-60
Well 199-N-23



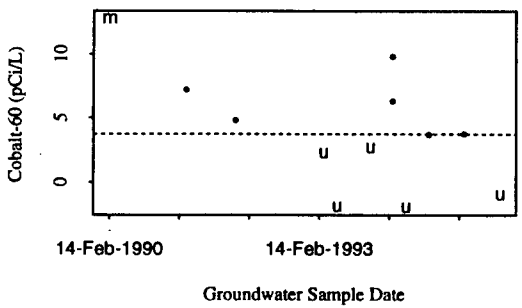
Segment 6-Cobalt-60
Well 199-N-25



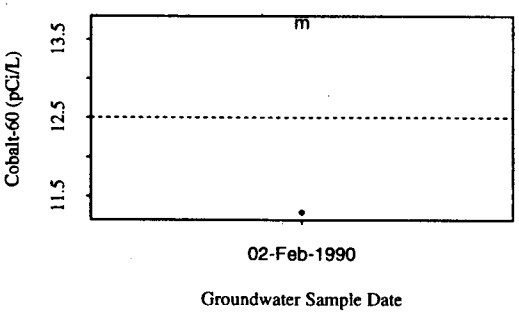
Segment 6-Cobalt-60
Well 199-N-26



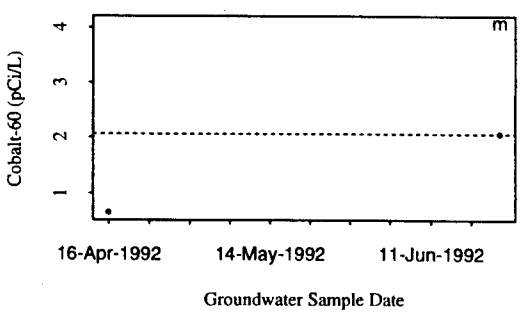
Segment 6-Cobalt-60
Well 199-N-3



Segment 6-Cobalt-60
Well 199-N-4

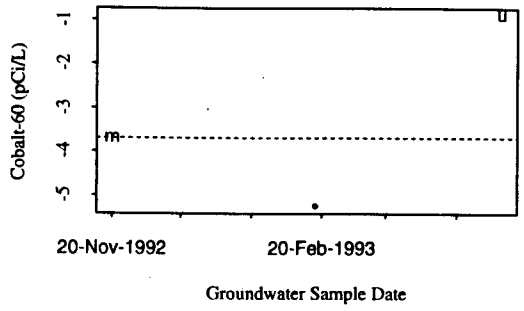


Segment 6-Cobalt-60
Well 199-N-46

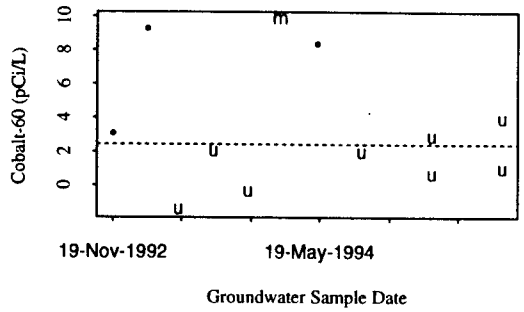


9513448.1629

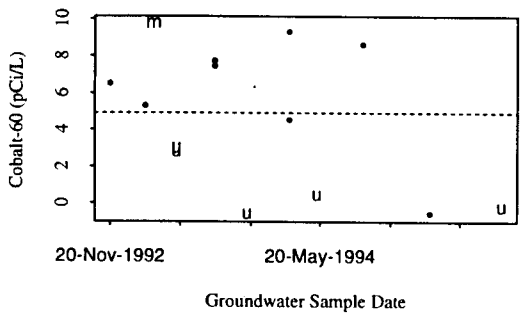
Segment 6-Cobalt-60
Well 199-N-72



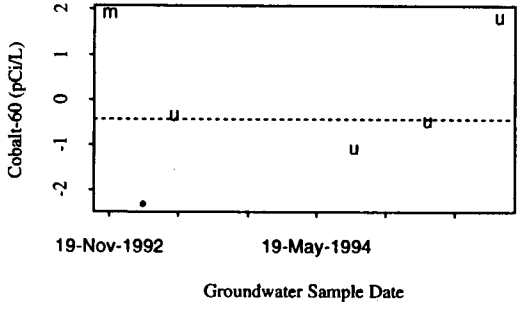
Segment 6-Cobalt-60
Well 199-N-75



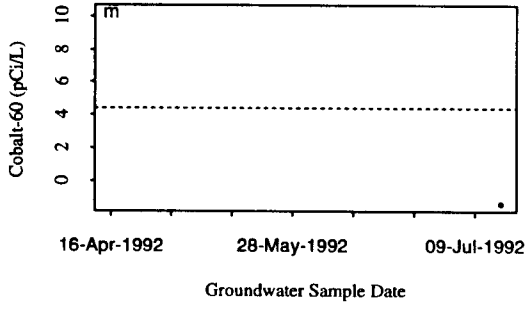
Segment 6-Cobalt-60
Well 199-N-76



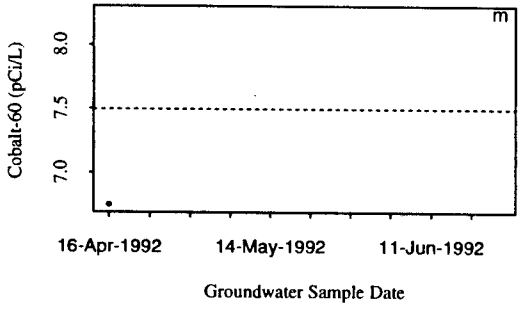
Segment 6-Cobalt-60
Well 199-N-77



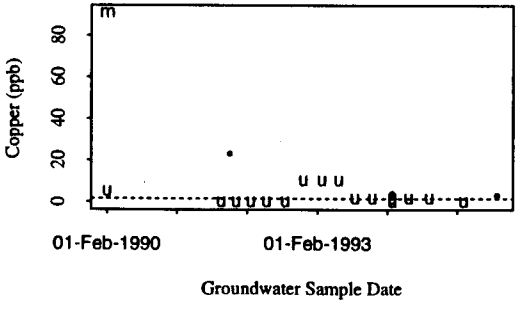
Segment 6-Cobalt-60
Well 199-N-8S



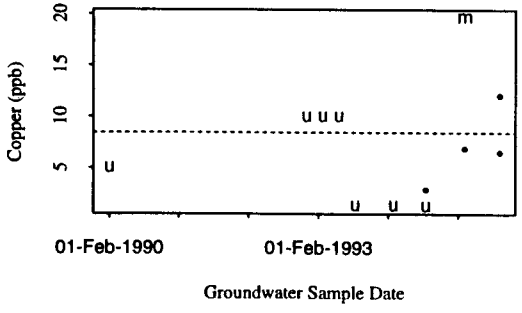
Segment 6-Cobalt-60
Well 199-N-8T



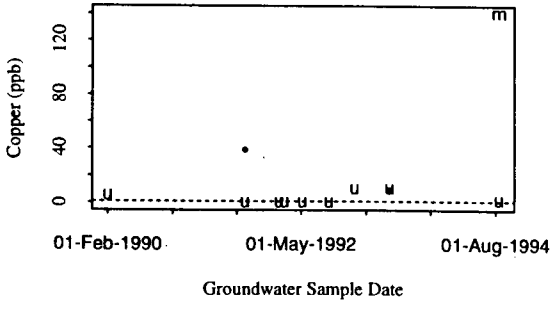
Segment 6-Copper
Well 199-N-14



Segment 6-Copper
Well 199-N-16

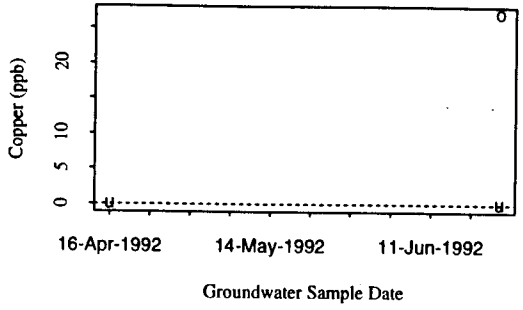


Segment 6-Copper
Well 199-N-17

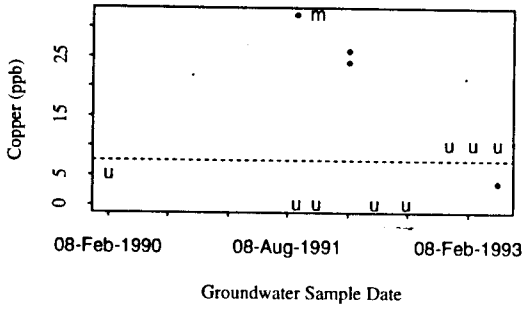


9513481625

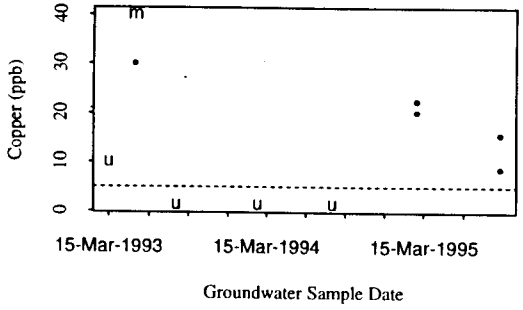
Segment 6-Copper
Well 199-N-46



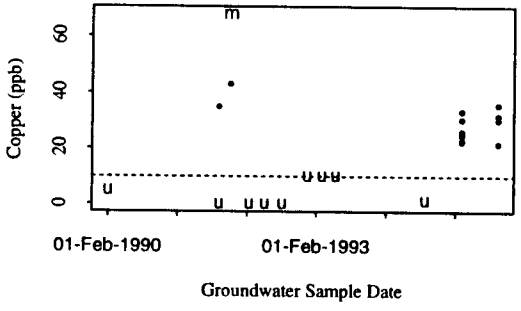
Segment 6-Copper
Well 199-N-47



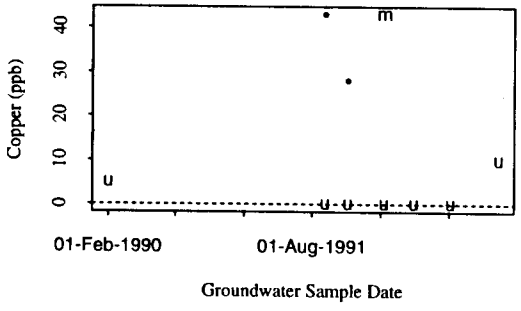
Segment 6-Copper
Well 199-N-51



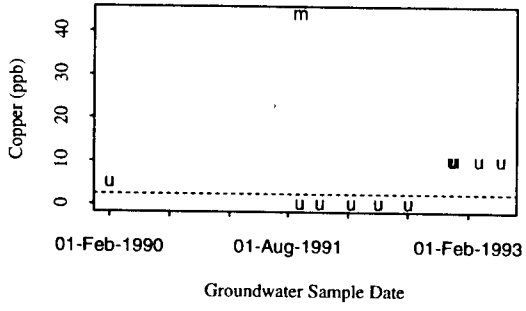
Segment 6-Copper
Well 199-N-54



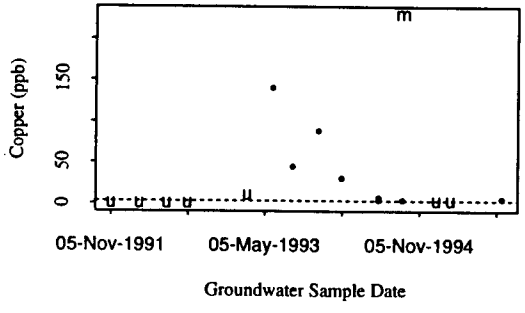
Segment 6-Copper
Well 199-N-55



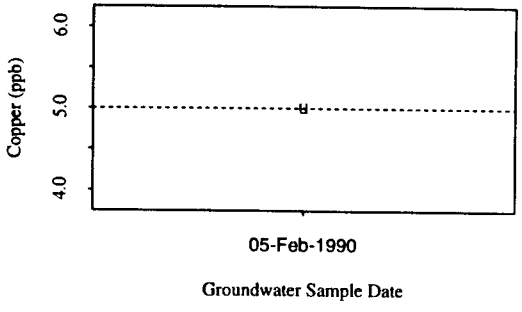
Segment 6-Copper
Well 199-N-56



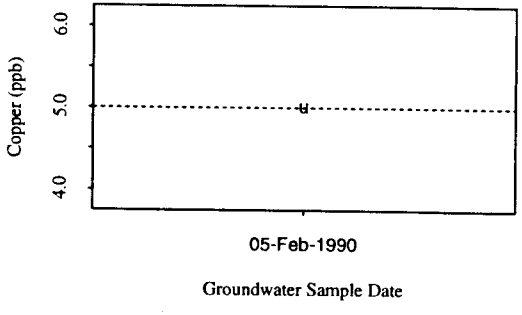
Segment 6-Copper
Well 199-N-57



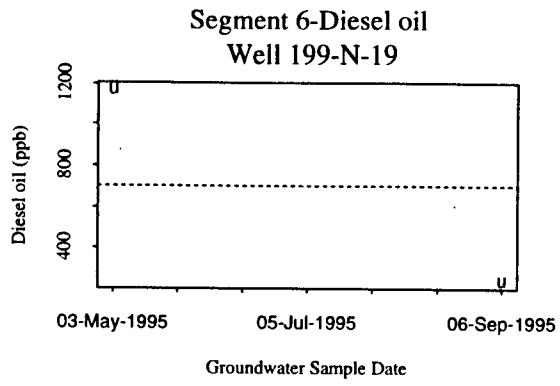
Segment 6-Copper
Well 199-N-58

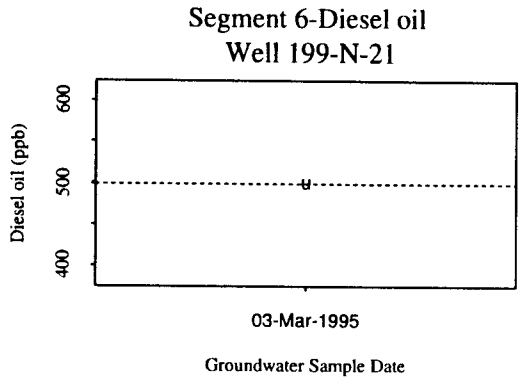


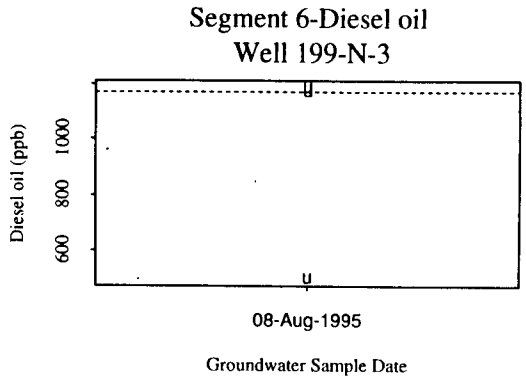
Segment 6-Copper
Well 199-N-60

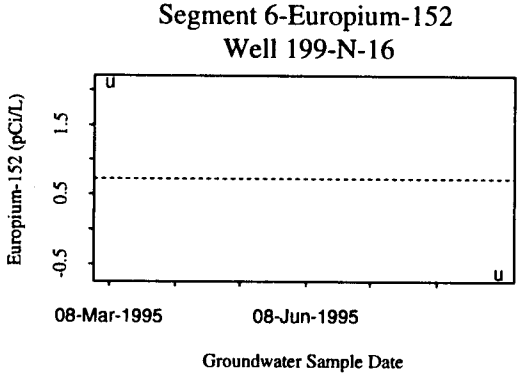


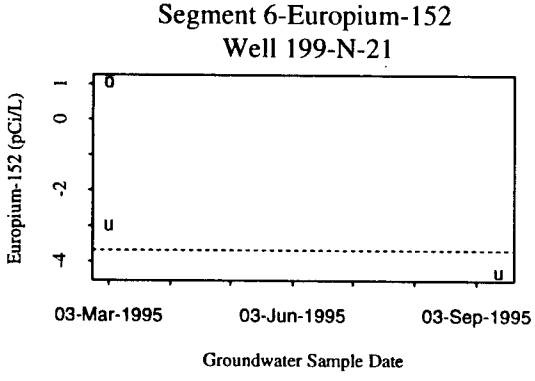
9313148.1626

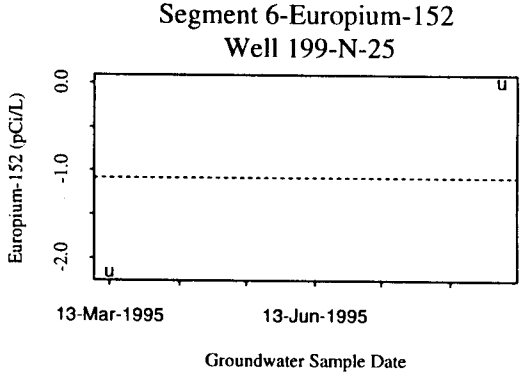


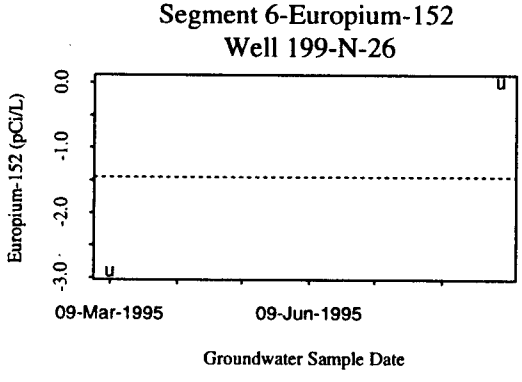


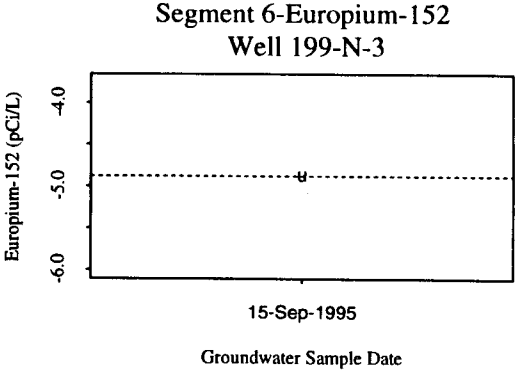


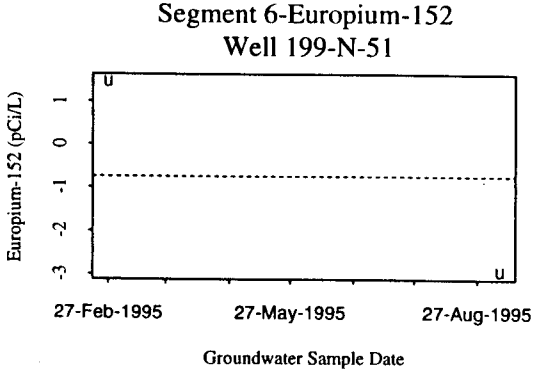






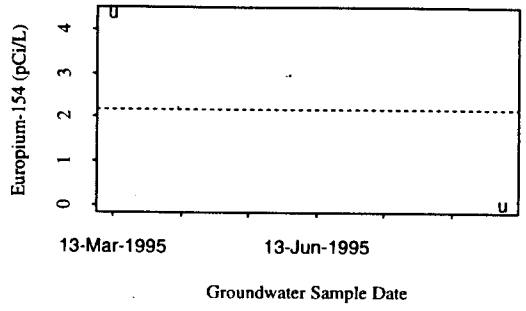




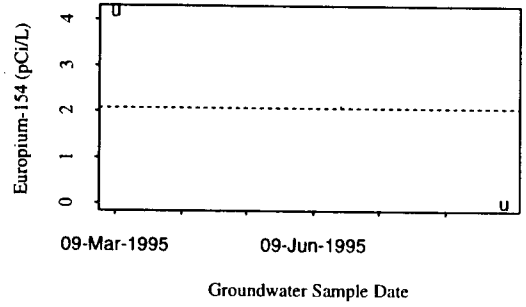


9513448.1627

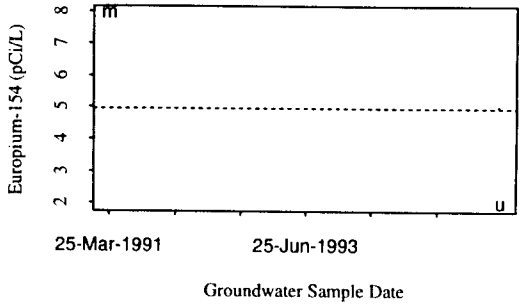
Segment 6-Europium-154
Well 199-N-25



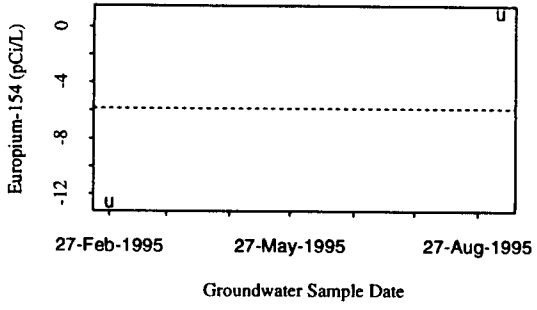
Segment 6-Europium-154
Well 199-N-26



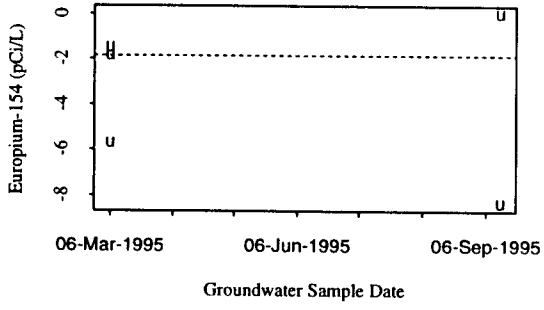
Segment 6-Europium-154
Well 199-N-3



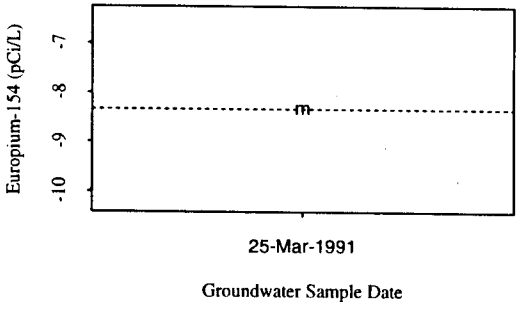
Segment 6-Europium-154
Well 199-N-51



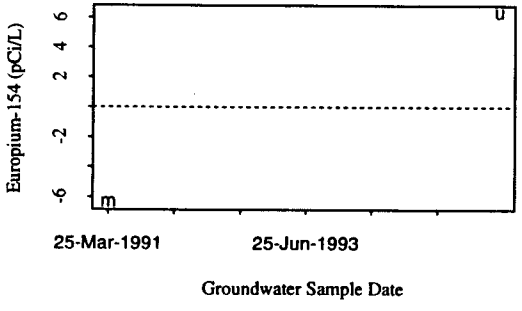
Segment 6-Europium-154
Well 199-N-54



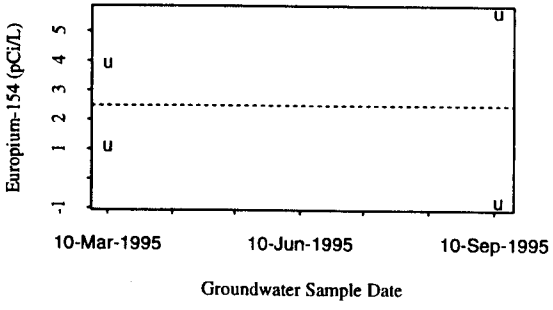
Segment 6-Europium-154
Well 199-N-57



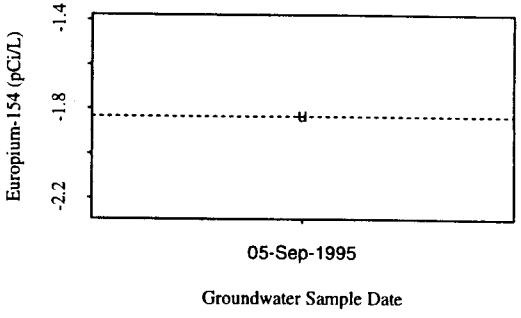
Segment 6-Europium-154
Well 199-N-67



Segment 6-Europium-154
Well 199-N-75

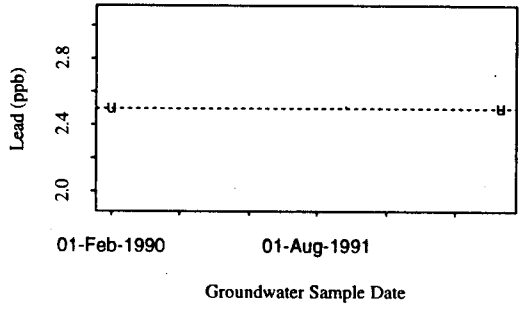


Segment 6-Europium-154
Well 199-N-76

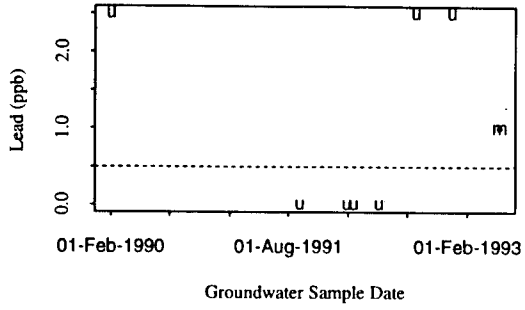


9513148.1628

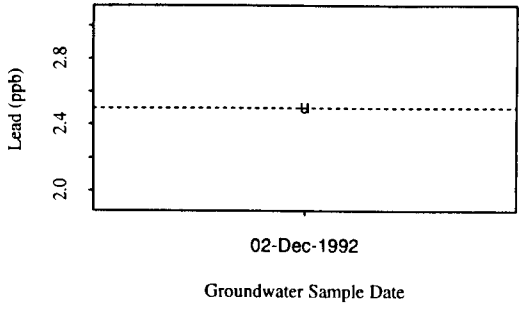
Segment 6-Lead
Well 199-N-16



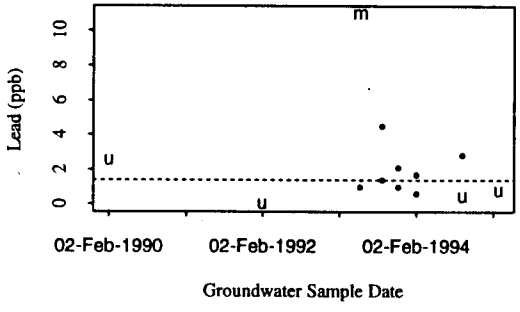
Segment 6-Lead
Well 199-N-17



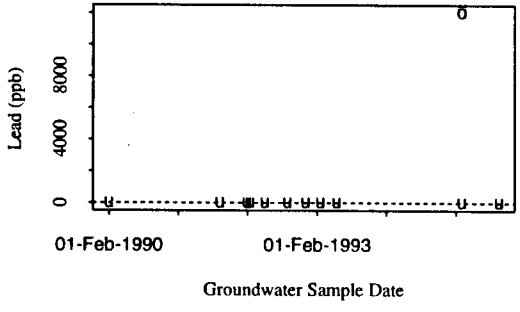
Segment 6-Lead
Well 199-N-19



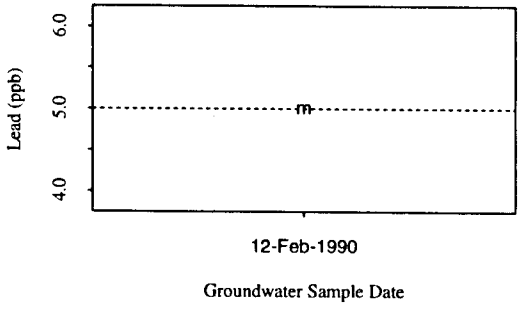
Segment 6-Lead
Well 199-N-2



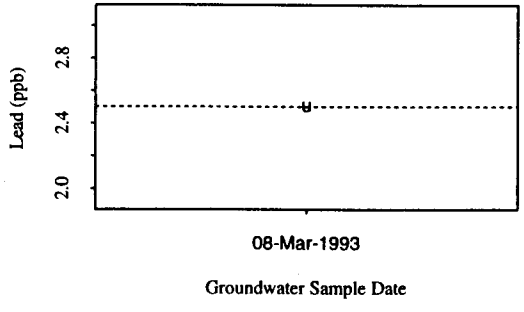
Segment 6-Lead
Well 199-N-21



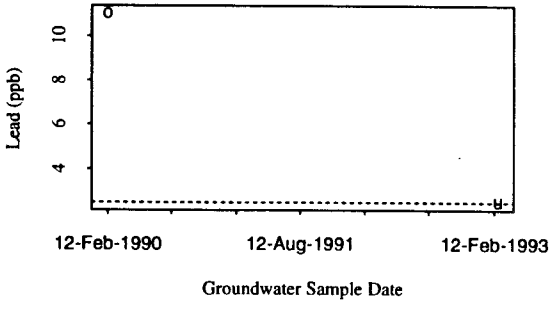
Segment 6-Lead
Well 199-N-24



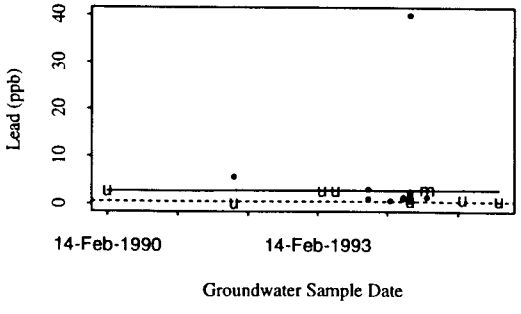
Segment 6-Lead
Well 199-N-25



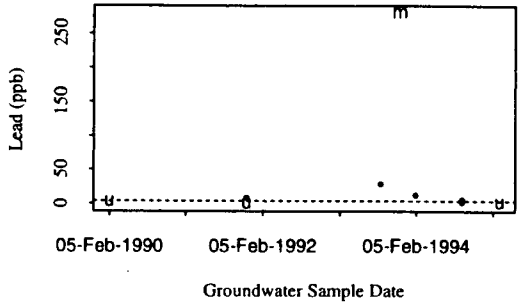
Segment 6-Lead
Well 199-N-26



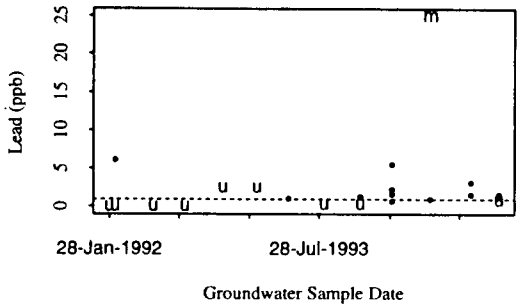
Segment 6-Lead
Well 199-N-3



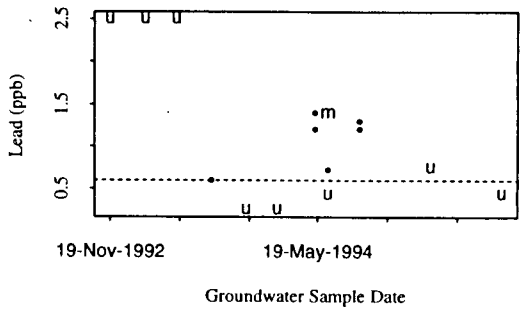
Segment 6-Lead
Well 199-N-67



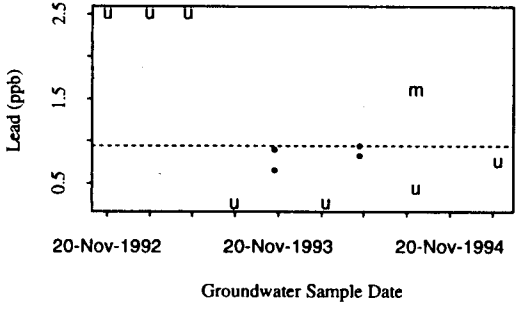
Segment 6-Lead
Well 199-N-72



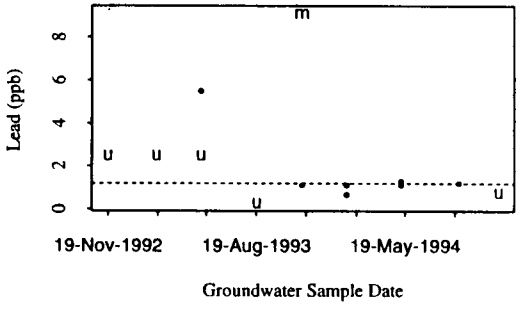
Segment 6-Lead
Well 199-N-75



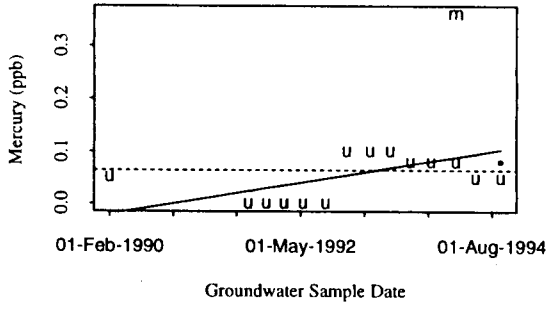
Segment 6-Lead
Well 199-N-76



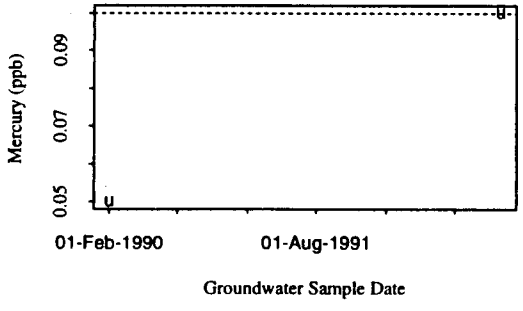
Segment 6-Lead
Well 199-N-77



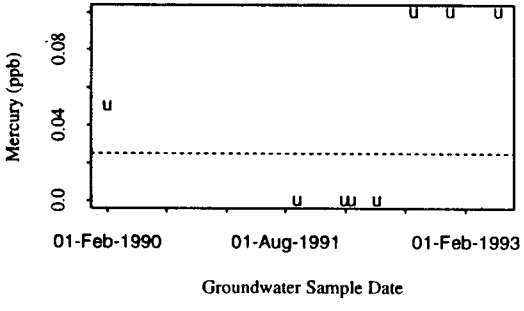
Segment 6-Mercury
Well 199-N-14



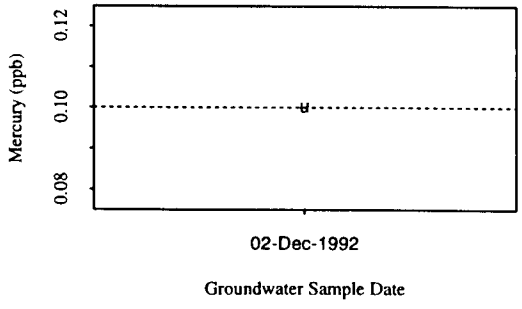
Segment 6-Mercury
Well 199-N-16



Segment 6-Mercury
Well 199-N-17

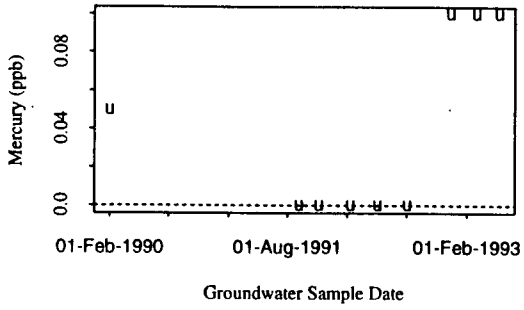


Segment 6-Mercury
Well 199-N-19

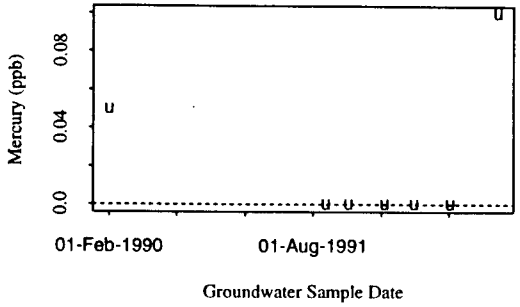


9513180.1630

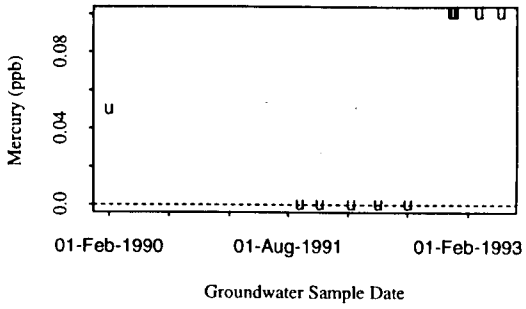
Segment 6-Mercury
Well 199-N-54



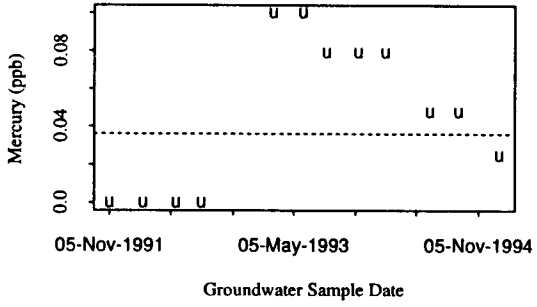
Segment 6-Mercury
Well 199-N-55



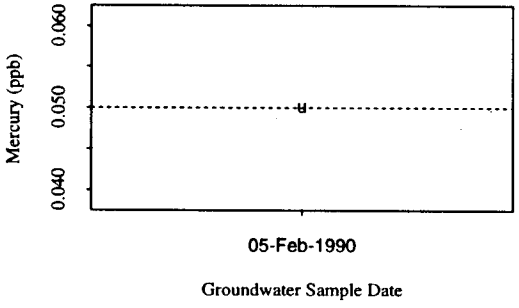
Segment 6-Mercury
Well 199-N-56



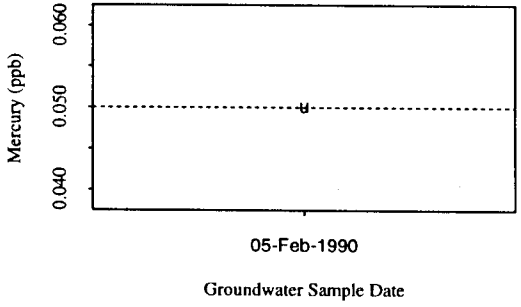
Segment 6-Mercury
Well 199-N-57



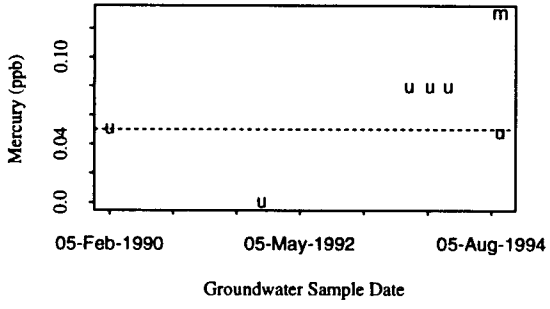
Segment 6-Mercury
Well 199-N-58



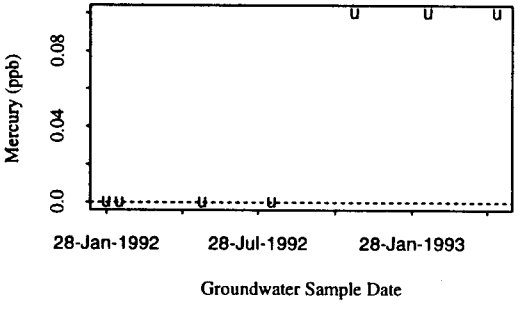
Segment 6-Mercury
Well 199-N-60



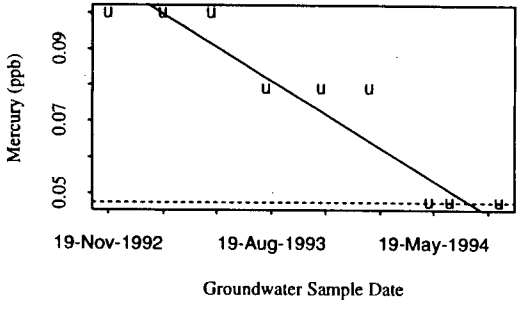
Segment 6-Mercury
Well 199-N-67



Segment 6-Mercury
Well 199-N-72

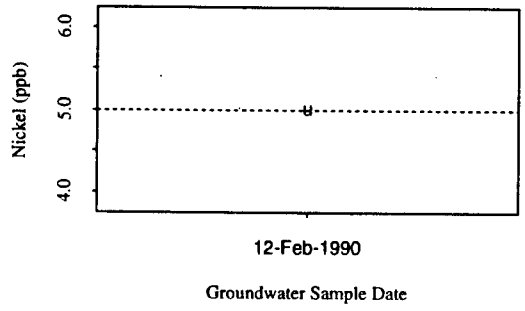


Segment 6-Mercury
Well 199-N-75

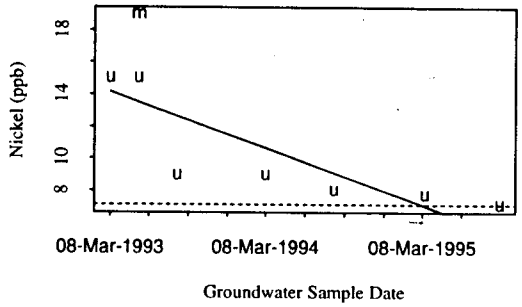


9513148.1463

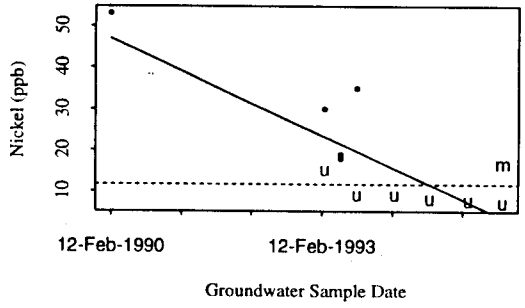
Segment 6-Nickel
Well 199-N-24



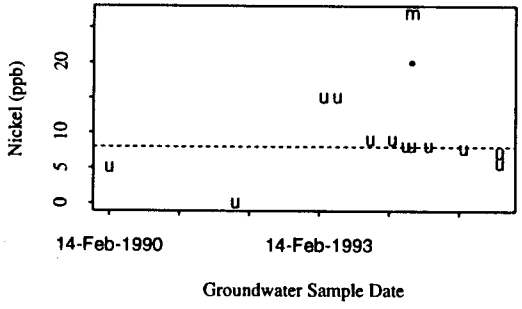
Segment 6-Nickel
Well 199-N-25



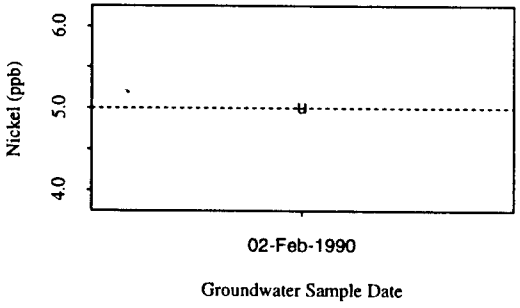
Segment 6-Nickel
Well 199-N-26



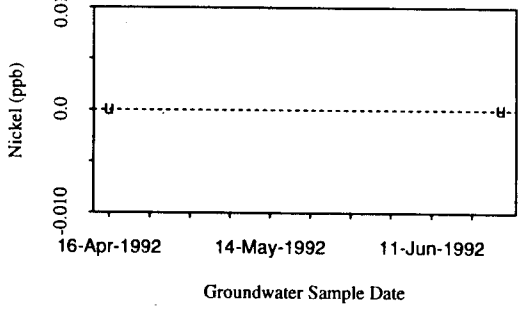
Segment 6-Nickel
Well 199-N-3



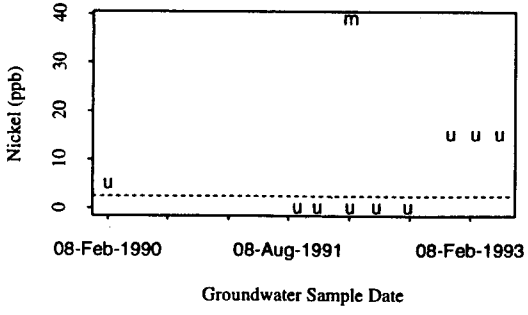
Segment 6-Nickel
Well 199-N-4



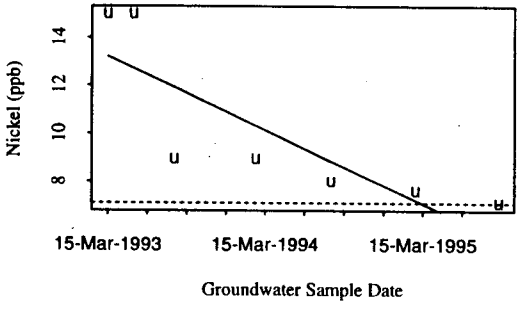
Segment 6-Nickel
Well 199-N-46



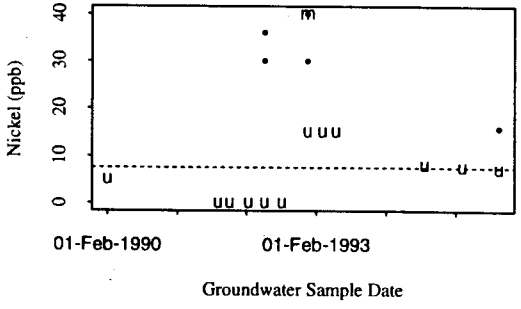
Segment 6-Nickel
Well 199-N-47



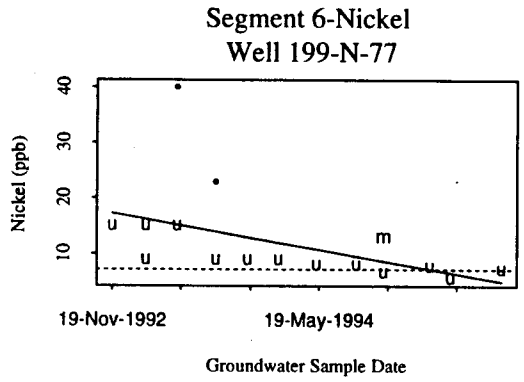
Segment 6-Nickel
Well 199-N-51

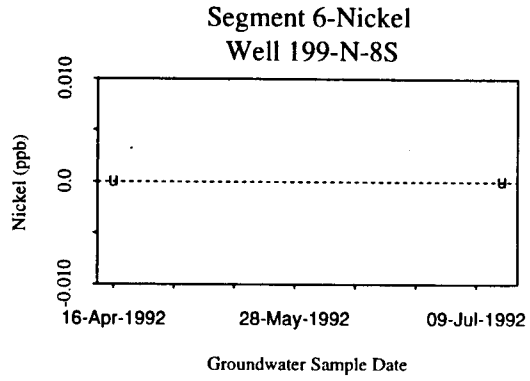


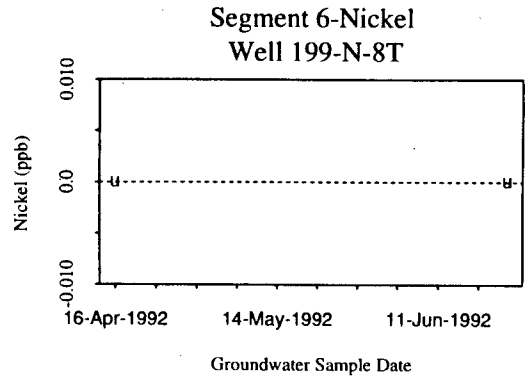
Segment 6-Nickel
Well 199-N-54

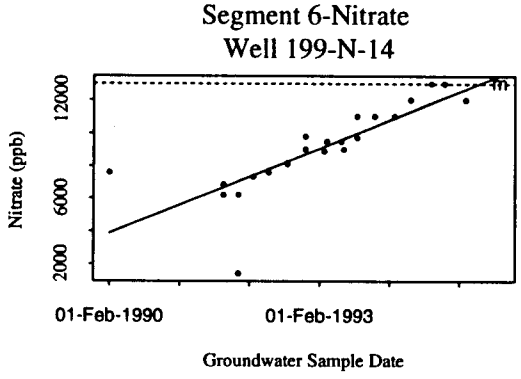


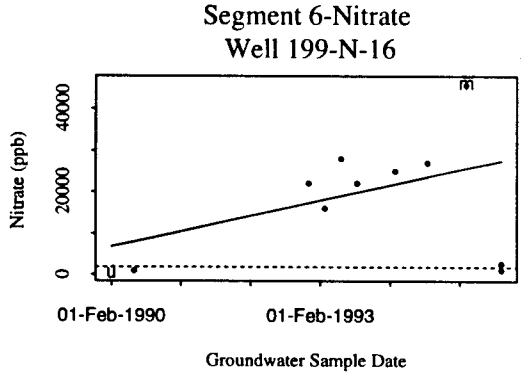
9618148.1602

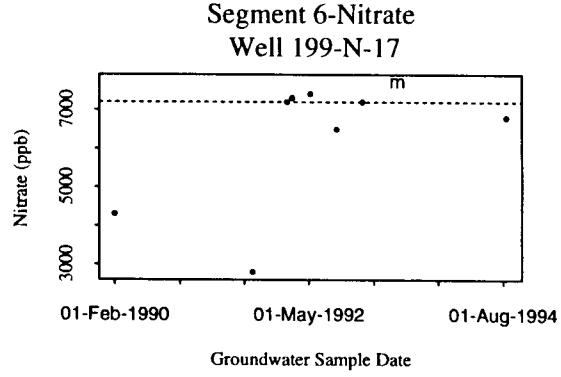

Segment 6-Nickel
Well 199-N-77
Nickel (ppb)
10
20
30
40
19-Nov-1992
19-May-1994
Groundwater Sample Date

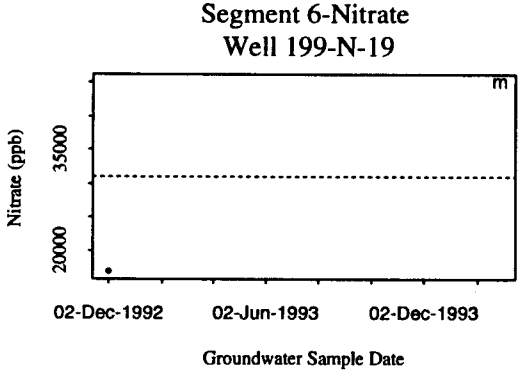

Segment 6-Nickel
Well 199-N-8S
Nickel (ppb)
-0.010
0.0
0.010
16-Apr-1992
28-May-1992
09-Jul-1992
Groundwater Sample Date

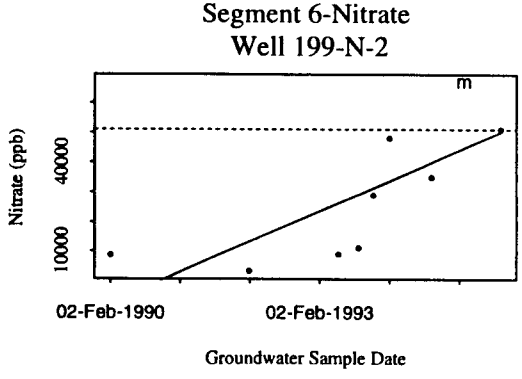

Segment 6-Nickel
Well 199-N-8T
Nickel (ppb)
-0.010
0.0
0.010
16-Apr-1992
14-May-1992
11-Jun-1992
Groundwater Sample Date

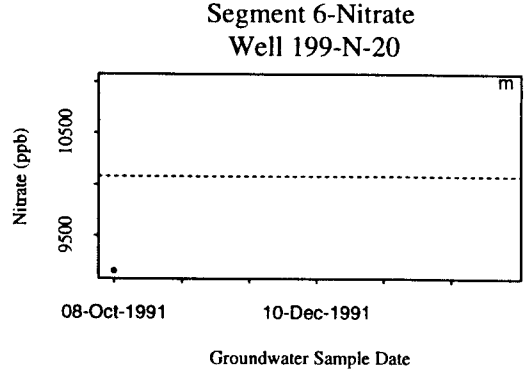

Segment 6-Nitrate
Well 199-N-14
Nitrate (ppb)
2000
6000
12000
01-Feb-1990
01-Feb-1993
Groundwater Sample Date

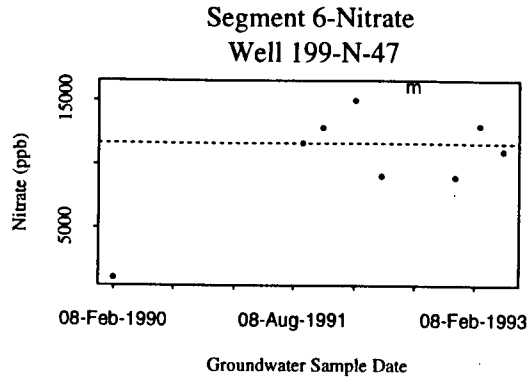

Segment 6-Nitrate
Well 199-N-16
Nitrate (ppb)
0
20000
40000
01-Feb-1990
01-Feb-1993
Groundwater Sample Date

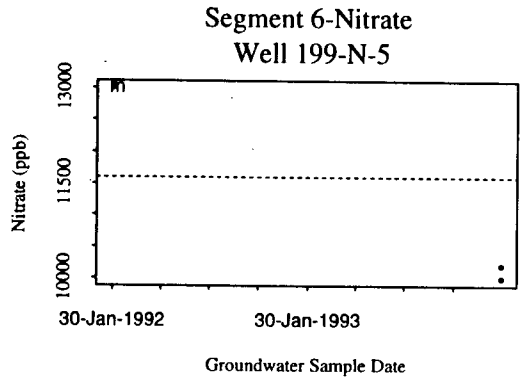

Segment 6-Nitrate
Well 199-N-17
Nitrate (ppb)
3000
5000
7000
01-Feb-1990
01-May-1992
01-Aug-1994
Groundwater Sample Date

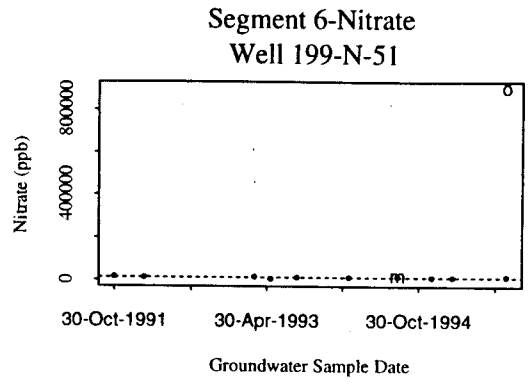

Segment 6-Nitrate
Well 199-N-19
Nitrate (ppb)
20000
35000
02-Dec-1992
02-Jun-1993
02-Dec-1993
Groundwater Sample Date

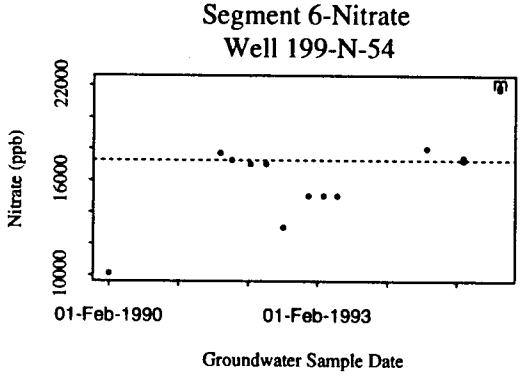

Segment 6-Nitrate
Well 199-N-2
Nitrate (ppb)
10000
40000
02-Feb-1990
02-Feb-1993
Groundwater Sample Date

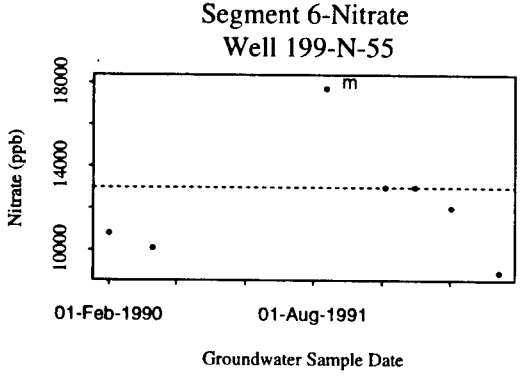

Segment 6-Nitrate
Well 199-N-20
Nitrate (ppb)
9500
10500
08-Oct-1991
10-Dec-1991
Groundwater Sample Date

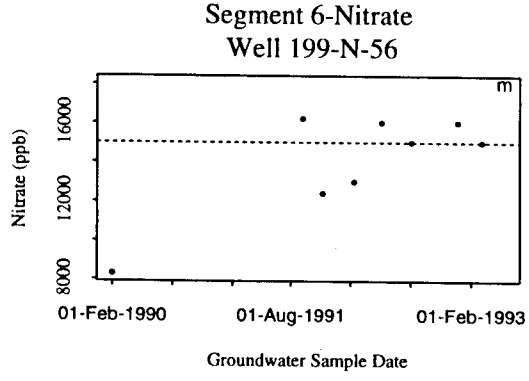

Segment 6-Nitrate
Well 199-N-47
Nitrate (ppb)
15000
5000
08-Feb-1990
08-Aug-1991
08-Feb-1993
Groundwater Sample Date

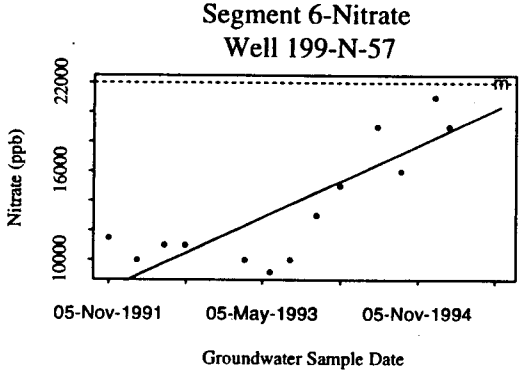

Segment 6-Nitrate
Well 199-N-5
Nitrate (ppb)
13000
11500
10000
30-Jan-1992
30-Jan-1993
Groundwater Sample Date

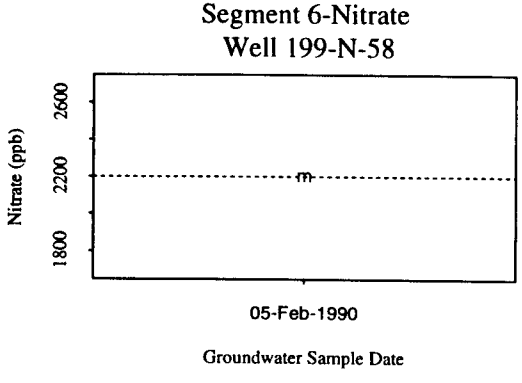

Segment 6-Nitrate
Well 199-N-51
Nitrate (ppb)
800000
400000
0
30-Oct-1991
30-Apr-1993
30-Oct-1994
Groundwater Sample Date

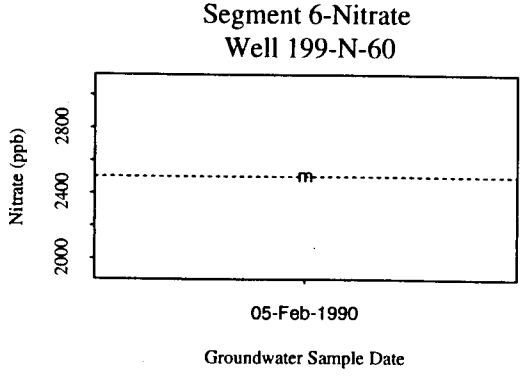

Segment 6-Nitrate
Well 199-N-54
Nitrate (ppb)
22000
16000
10000
01-Feb-1990
01-Feb-1993
Groundwater Sample Date

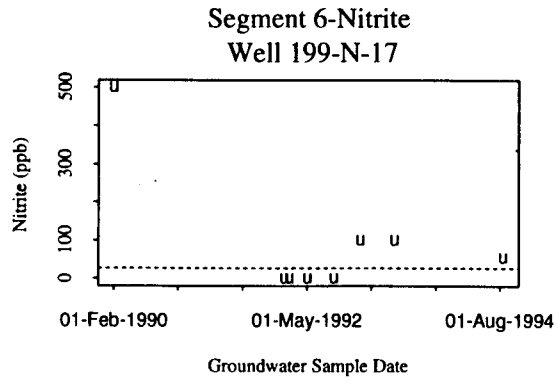

Segment 6-Nitrate
Well 199-N-55
Nitrate (ppb)
18000
14000
10000
01-Feb-1990
01-Aug-1991
Groundwater Sample Date

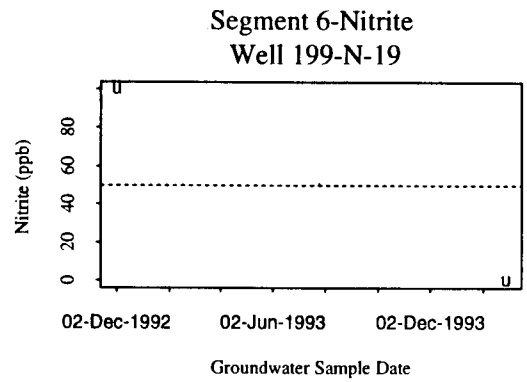

Segment 6-Nitrate
Well 199-N-56
Nitrate (ppb)
16000
12000
8000
01-Feb-1990
01-Aug-1991
01-Feb-1993
Groundwater Sample Date

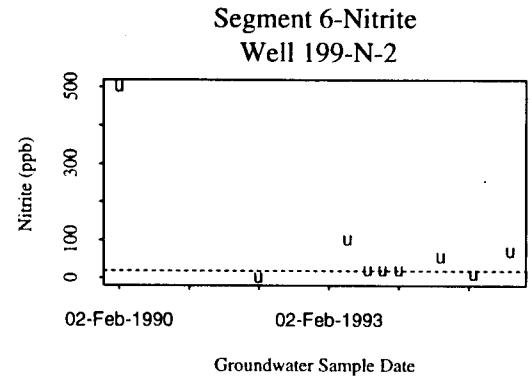

Segment 6-Nitrate
Well 199-N-57
Nitrate (ppb)
22000
16000
10000
05-Nov-1991
05-May-1993
05-Nov-1994
Groundwater Sample Date

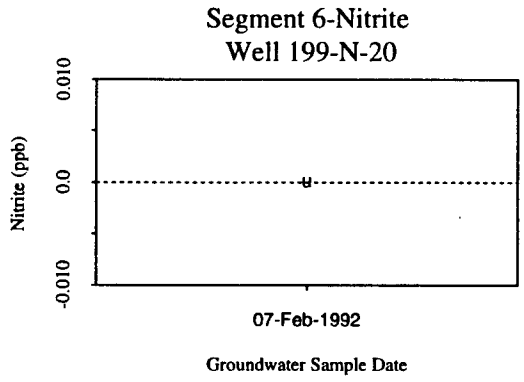

Segment 6-Nitrate
Well 199-N-58
Nitrate (ppb)
2600
2200
1800
05-Feb-1990
Groundwater Sample Date

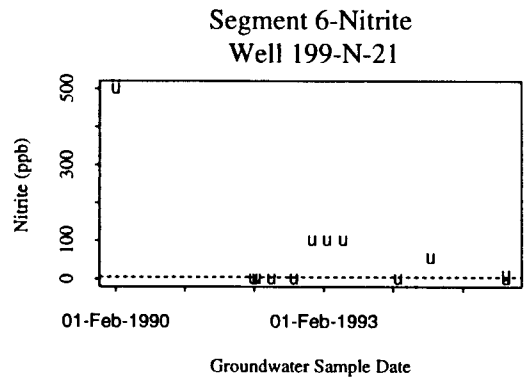

Segment 6-Nitrate
Well 199-N-60
Nitrate (ppb)
2800
2400
2000
05-Feb-1990
Groundwater Sample Date

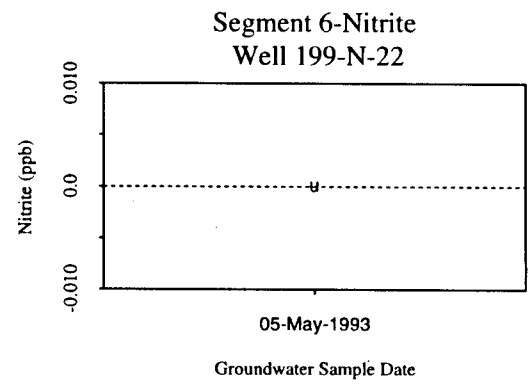

Segment 6-Nitrite
Well 199-N-17
Nitrite (ppb)
0
100
300
500
01-Feb-1990
01-May-1992
01-Aug-1994
Groundwater Sample Date

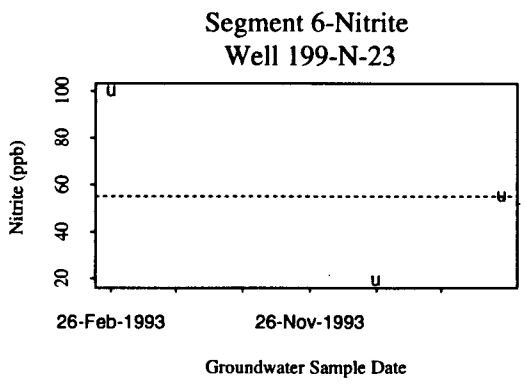

Segment 6-Nitrite
Well 199-N-19
Nitrite (ppb)
0
20
40
60
80
02-Dec-1992
02-Jun-1993
02-Dec-1993
Groundwater Sample Date

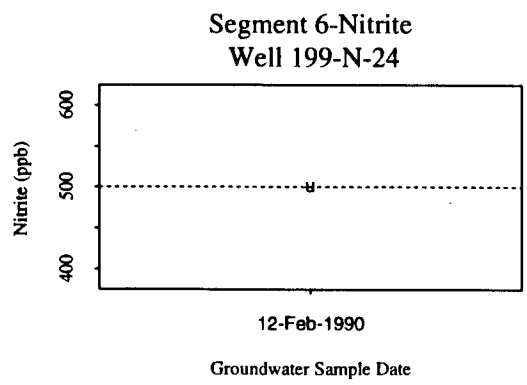

Segment 6-Nitrite
Well 199-N-2
Nitrite (ppb)
0
100
300
500
02-Feb-1990
02-Feb-1993
Groundwater Sample Date

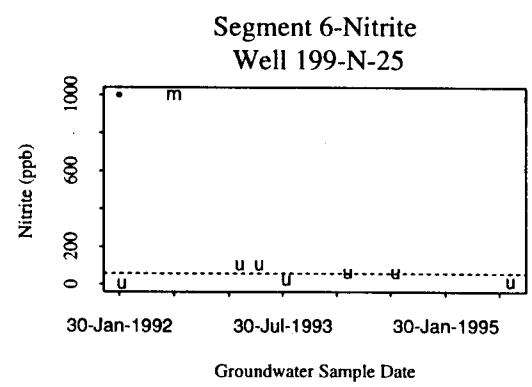

Segment 6-Nitrite
Well 199-N-20
Nitrite (ppb)
-0.010
0.0
0.010
07-Feb-1992
Groundwater Sample Date


Segment 6-Nitrite
Well 199-N-21
Nitrite (ppb)
0
100
300
500
01-Feb-1990
01-Feb-1993
Groundwater Sample Date

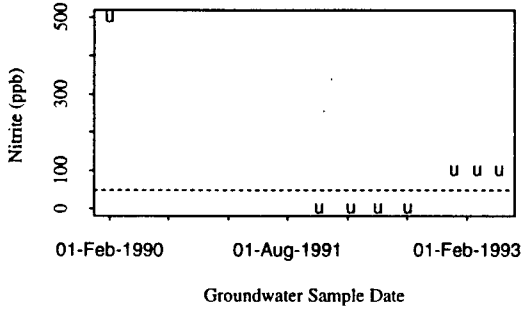

Segment 6-Nitrite
Well 199-N-22
Nitrite (ppb)
-0.010
0.0
0.010
05-May-1993
Groundwater Sample Date


Segment 6-Nitrite
Well 199-N-23
Nitrite (ppb)
20
40
60
80
100
26-Feb-1993
26-Nov-1993
Groundwater Sample Date

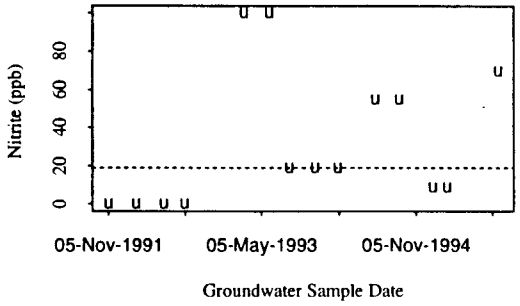

Segment 6-Nitrite
Well 199-N-24
Nitrite (ppb)
400
500
600
12-Feb-1990
Groundwater Sample Date


Segment 6-Nitrite
Well 199-N-25
Nitrite (ppb)
0
200
600
1000
30-Jan-1992
30-Jul-1993
30-Jan-1995
Groundwater Sample Date

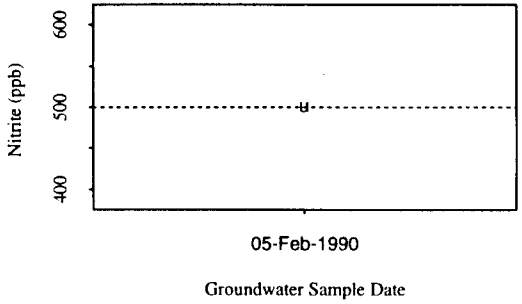
Segment 6-Nitrite
Well 199-N-56



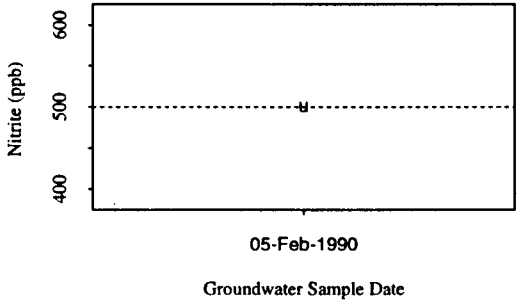
Segment 6-Nitrite
Well 199-N-57



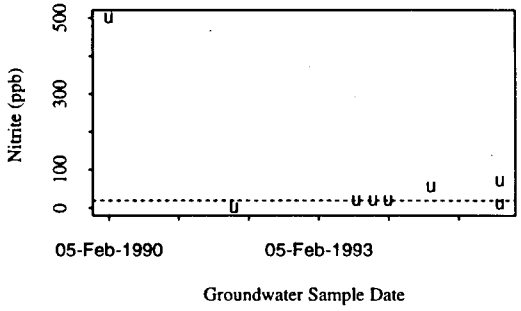
Segment 6-Nitrite
Well 199-N-58



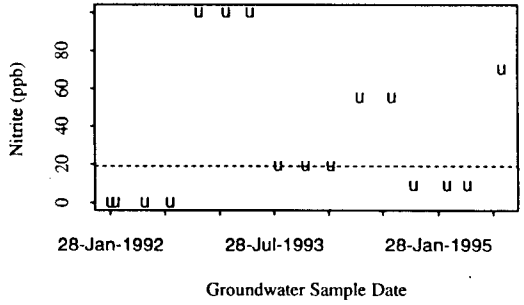
Segment 6-Nitrite
Well 199-N-60



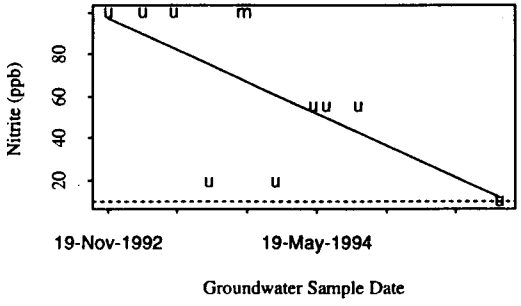
Segment 6-Nitrite
Well 199-N-67



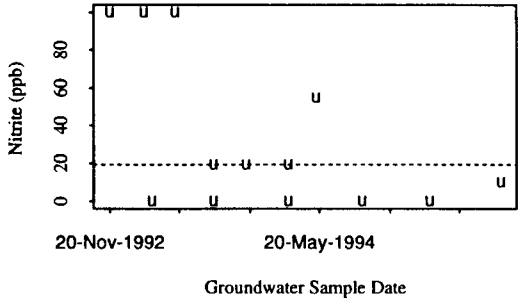
Segment 6-Nitrite
Well 199-N-72



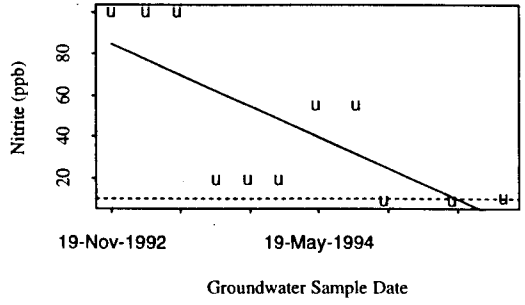
Segment 6-Nitrite
Well 199-N-75



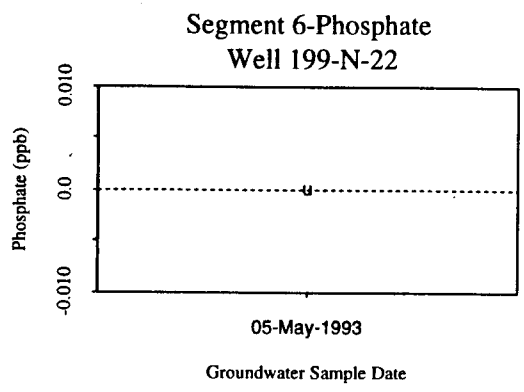
Segment 6-Nitrite
Well 199-N-76

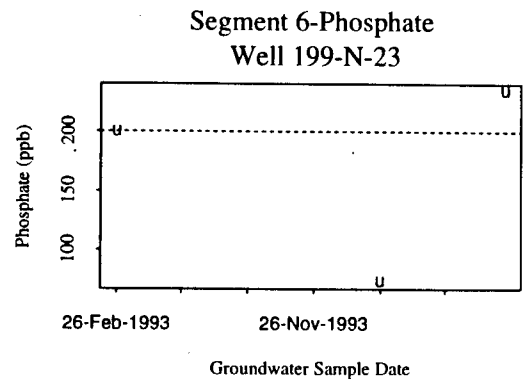


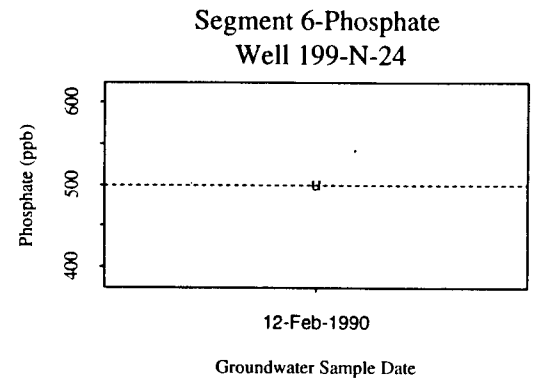
Segment 6-Nitrite
Well 199-N-77

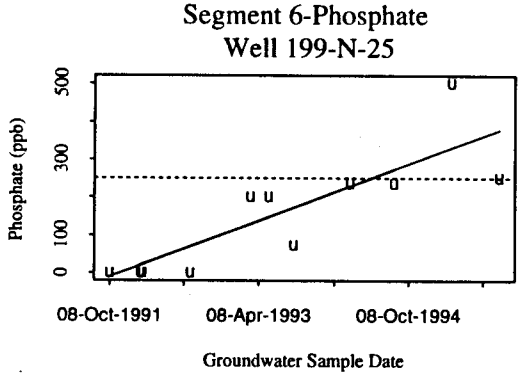


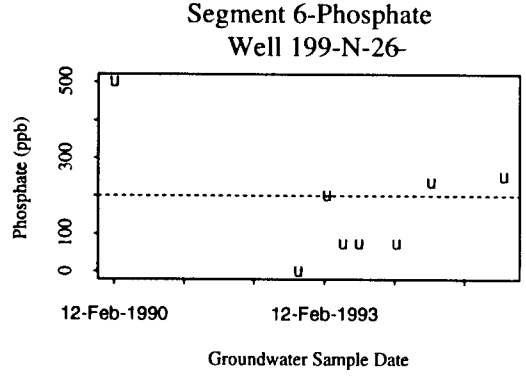
9618148.1636

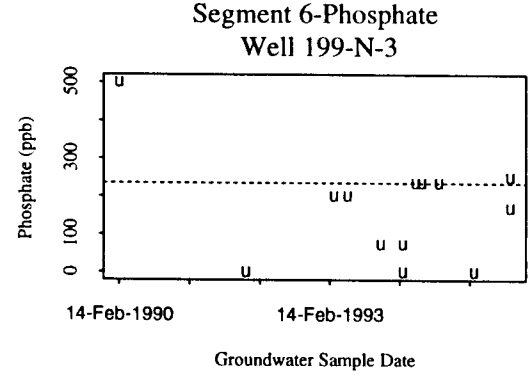

Segment 6-Phosphate
Well 199-N-22
Phosphate (ppb)
0.010
0.0
-0.010
05-May-1993
Groundwater Sample Date

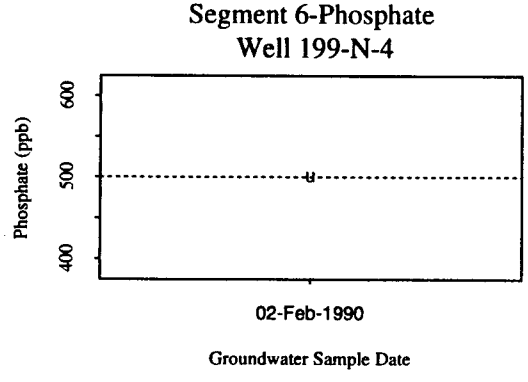

Segment 6-Phosphate
Well 199-N-23
Phosphate (ppb)
200
150
100
26-Feb-1993
26-Nov-1993
Groundwater Sample Date

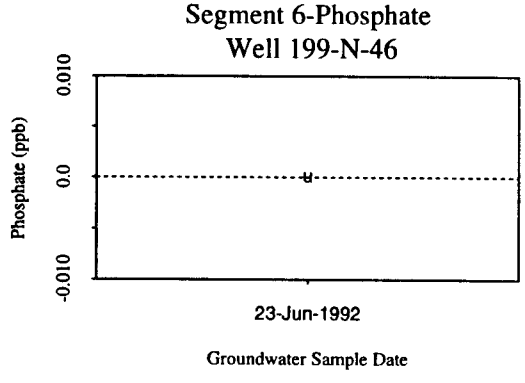

Segment 6-Phosphate
Well 199-N-24
Phosphate (ppb)
600
500
400
12-Feb-1990
Groundwater Sample Date

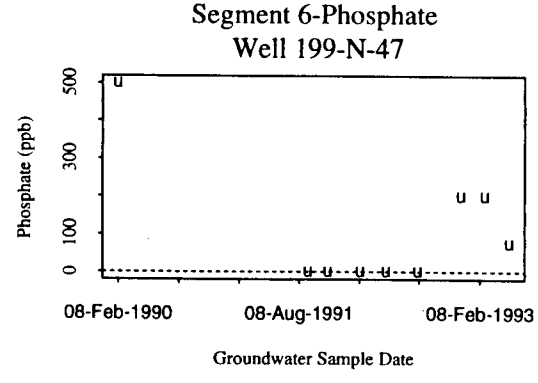

Segment 6-Phosphate
Well 199-N-25
Phosphate (ppb)
500
300
100
0
08-Oct-1991
08-Apr-1993
08-Oct-1994
Groundwater Sample Date


Segment 6-Phosphate
Well 199-N-26
Phosphate (ppb)
500
300
100
0
12-Feb-1990
12-Feb-1993
Groundwater Sample Date

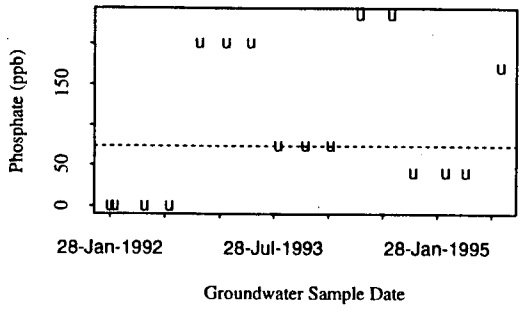

Segment 6-Phosphate
Well 199-N-3
Phosphate (ppb)
500
300
100
0
14-Feb-1990
14-Feb-1993
Groundwater Sample Date


Segment 6-Phosphate
Well 199-N-4
Phosphate (ppb)
600
500
400
02-Feb-1990
Groundwater Sample Date

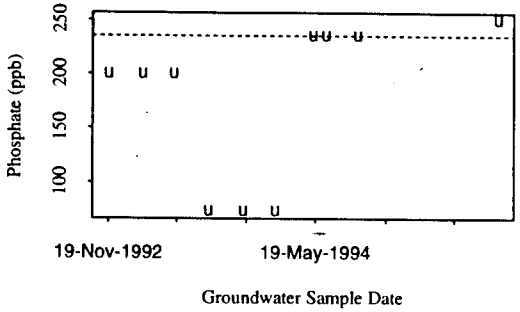

Segment 6-Phosphate
Well 199-N-46
Phosphate (ppb)
0.010
0.0
-0.010
23-Jun-1992
Groundwater Sample Date


Segment 6-Phosphate
Well 199-N-47
Phosphate (ppb)
500
300
100
0
08-Feb-1990
08-Aug-1991
08-Feb-1993
Groundwater Sample Date

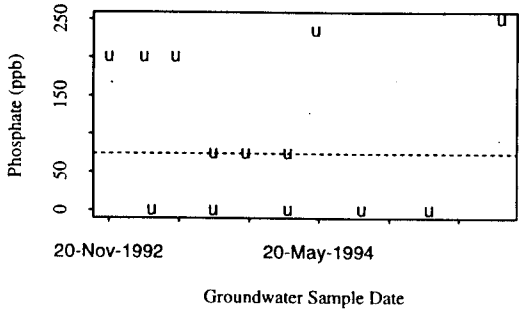
Segment 6-Phosphate
Well 199-N-72



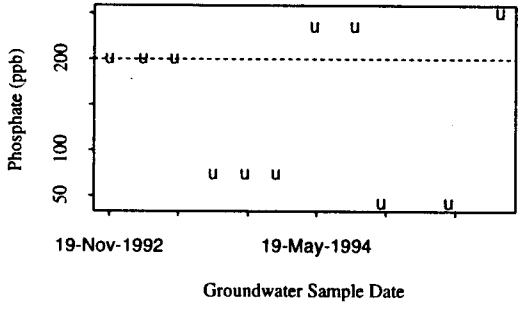
Segment 6-Phosphate
Well 199-N-75



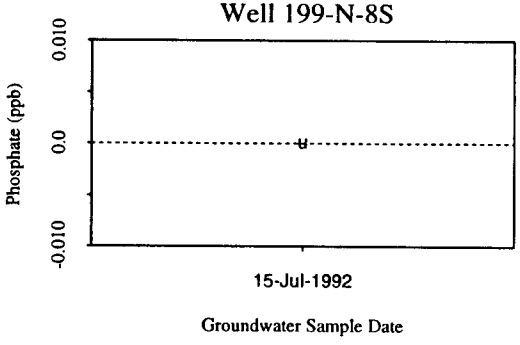
Segment 6-Phosphate
Well 199-N-76



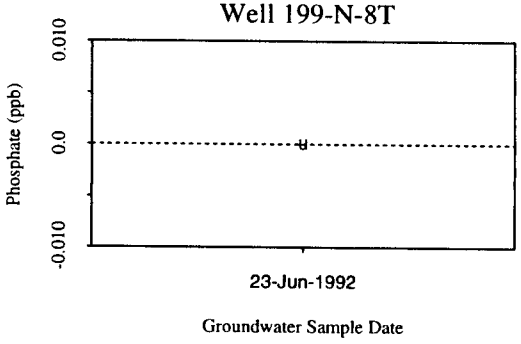
Segment 6-Phosphate
Well 199-N-77



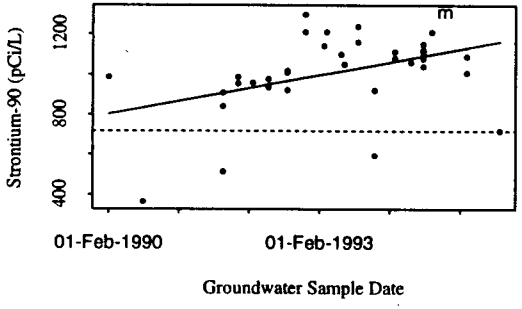
Segment 6-Phosphate
Well 199-N-8S



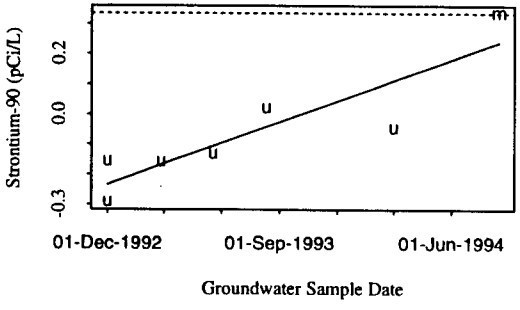
Segment 6-Phosphate
Well 199-N-8T



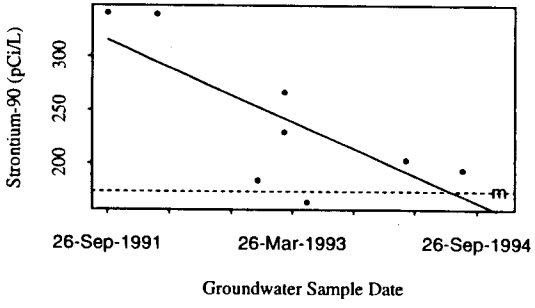
Segment 6-Strontium-90
Well 199-N-14



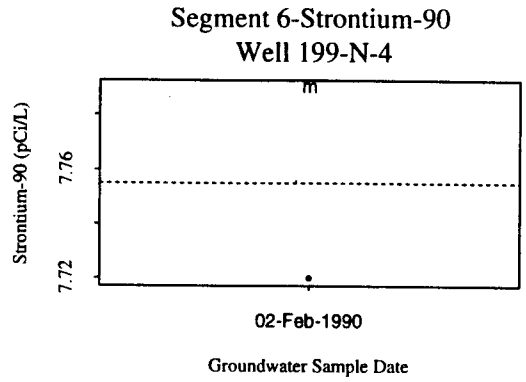
Segment 6-Strontium-90
Well 199-N-16

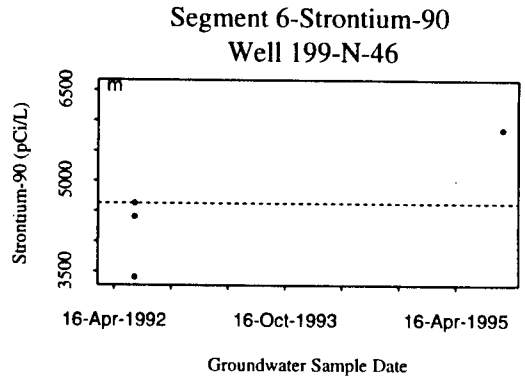


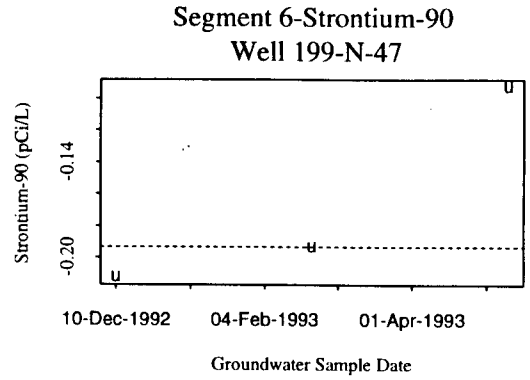
Segment 6-Strontium-90
Well 199-N-17

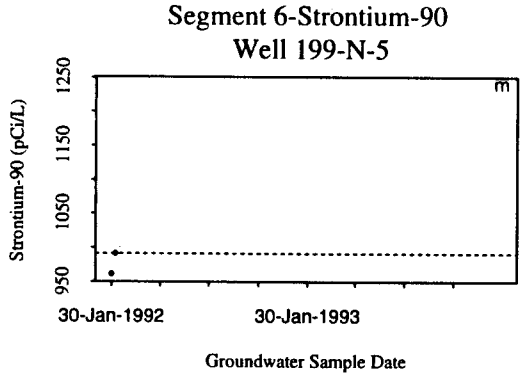


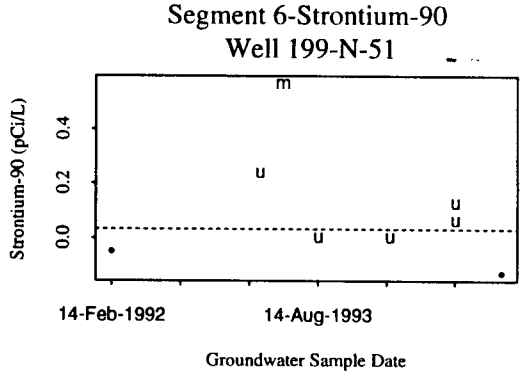
9615181.0608

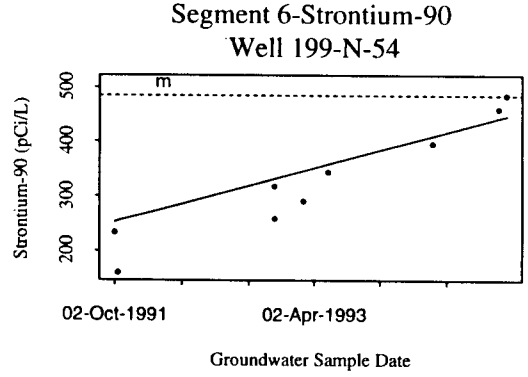


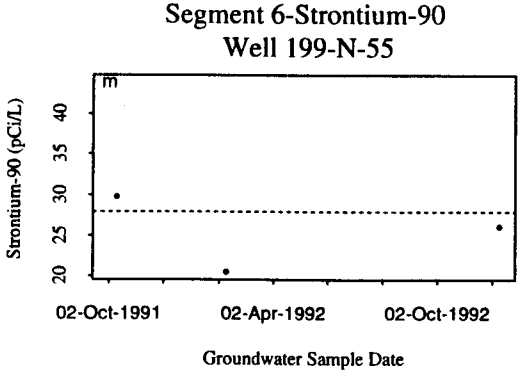


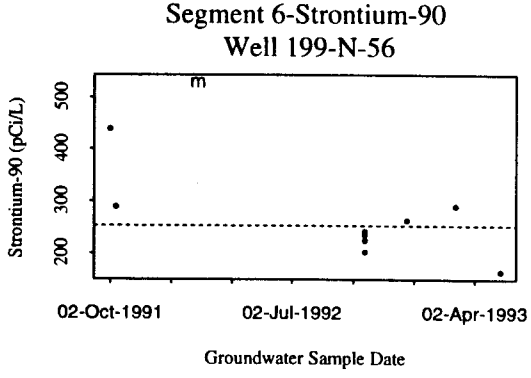


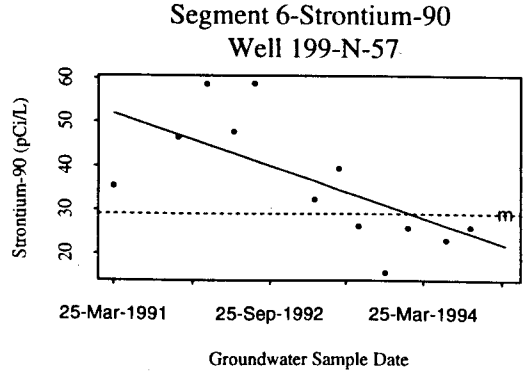






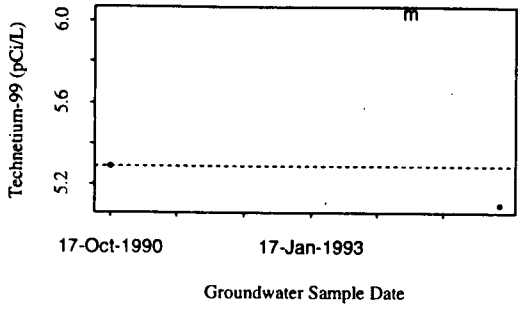




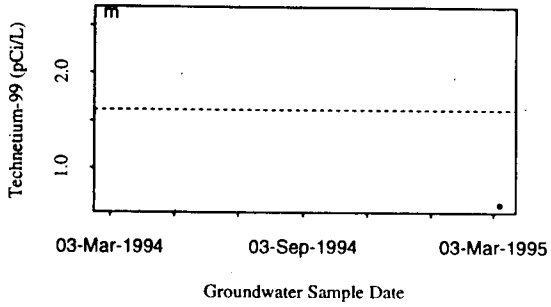


9619448.1609

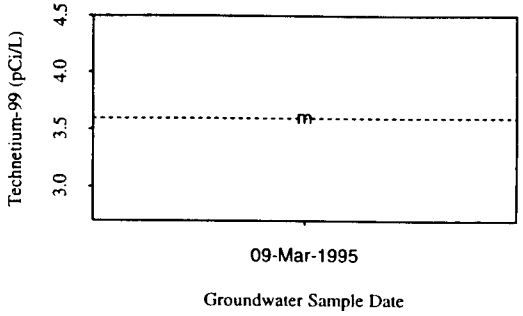
Segment 6-Technetium-99
Well 199-N-14



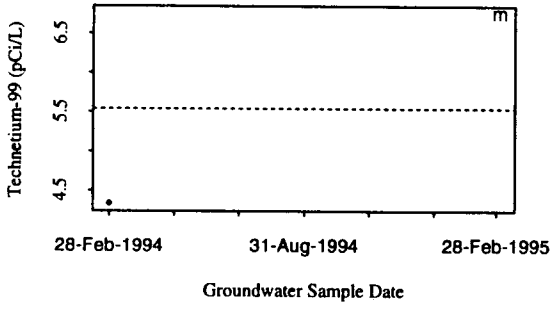
Segment 6-Technetium-99
Well 199-N-3



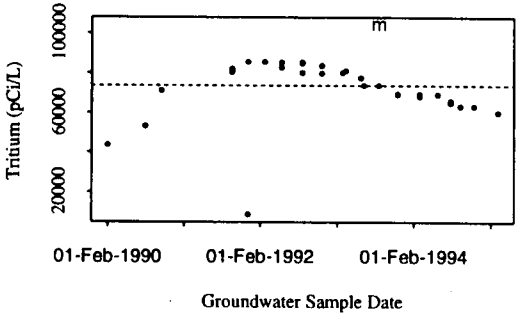
Segment 6-Technetium-99
Well 199-N-67



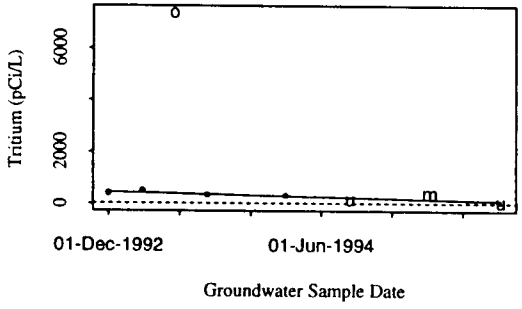
Segment 6-Technetium-99
Well 199-N-76



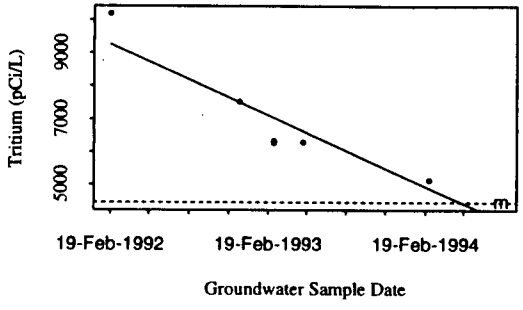
Segment 6-Tritium
Well 199-N-14



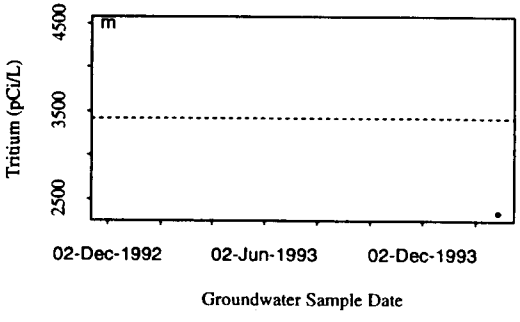
Segment 6-Tritium
Well 199-N-16



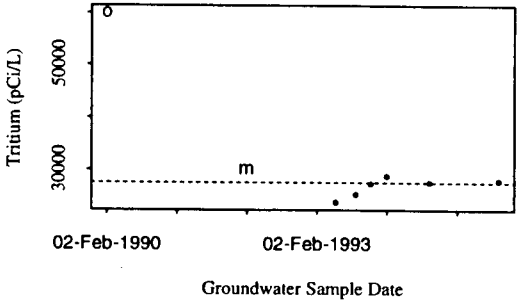
Segment 6-Tritium
Well 199-N-17



Segment 6-Tritium
Well 199-N-19

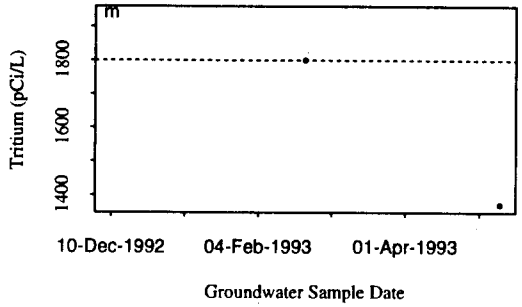


Segment 6-Tritium
Well 199-N-2

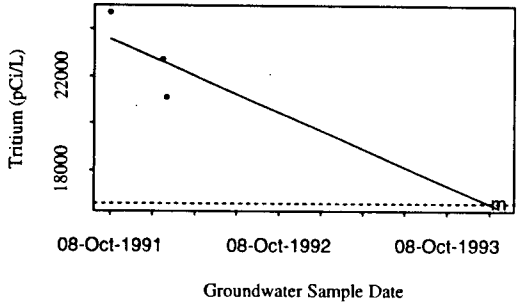


9613448.1670

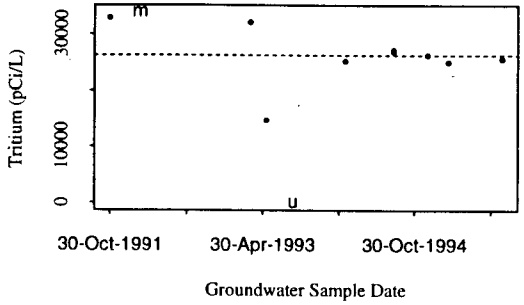
Segment 6-Tritium
Well 199-N-47



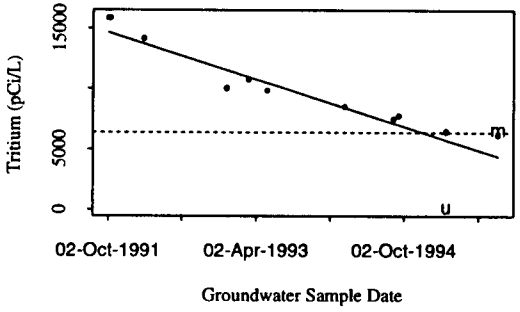
Segment 6-Tritium
Well 199-N-5



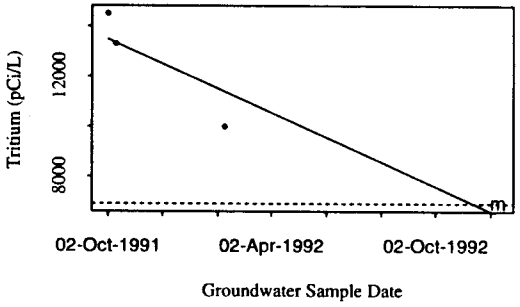
Segment 6-Tritium
Well 199-N-51



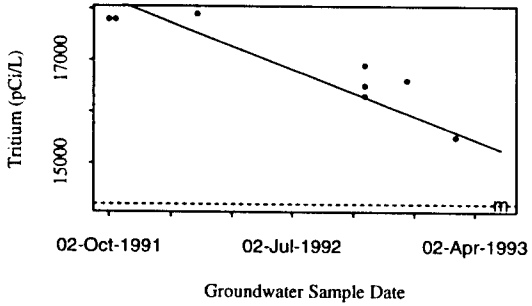
Segment 6-Tritium
Well 199-N-54



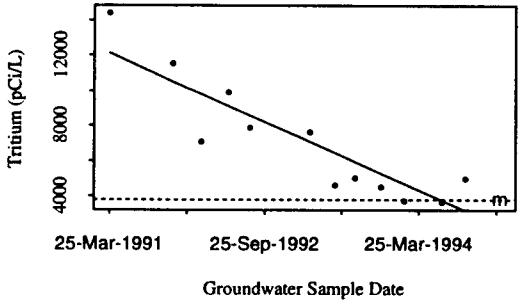
Segment 6-Tritium
Well 199-N-55



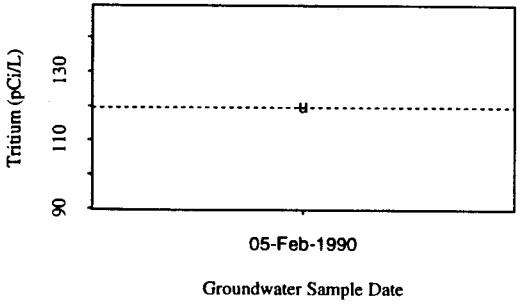
Segment 6-Tritium
Well 199-N-56



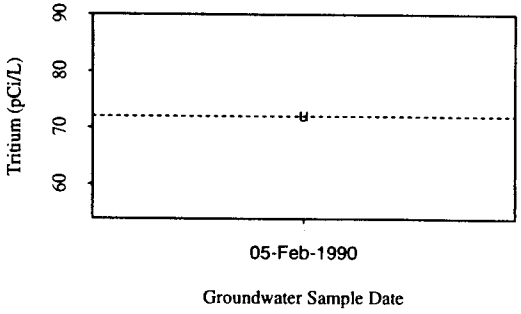
Segment 6-Tritium
Well 199-N-57



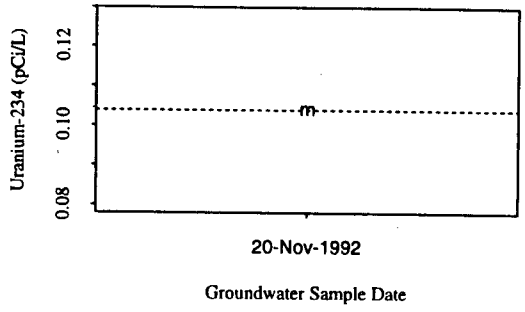
Segment 6-Tritium
Well 199-N-58



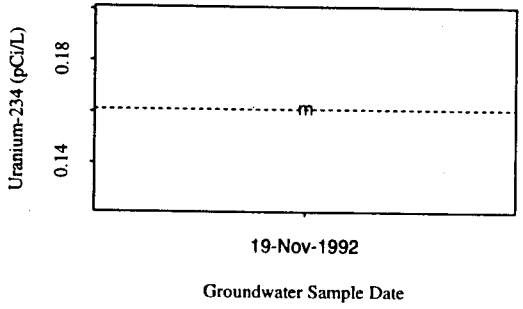
Segment 6-Tritium
Well 199-N-60



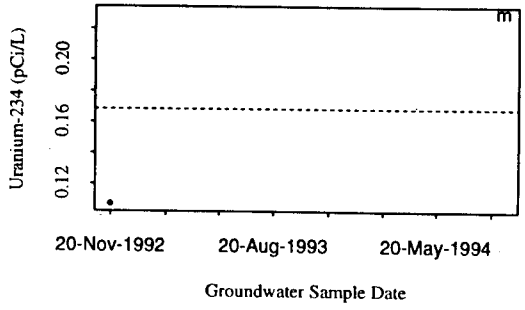
Segment 6-Uranium-234
Well 199-N-72



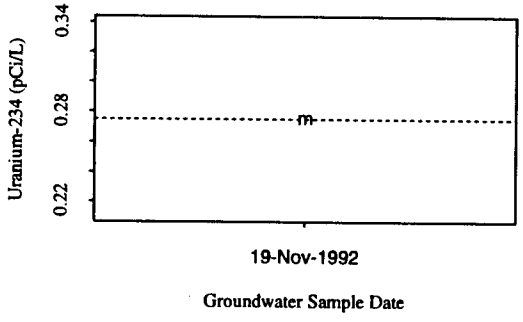
Segment 6-Uranium-234
Well 199-N-75



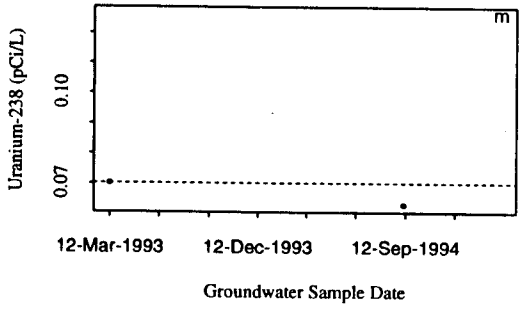
Segment 6-Uranium-234
Well 199-N-76



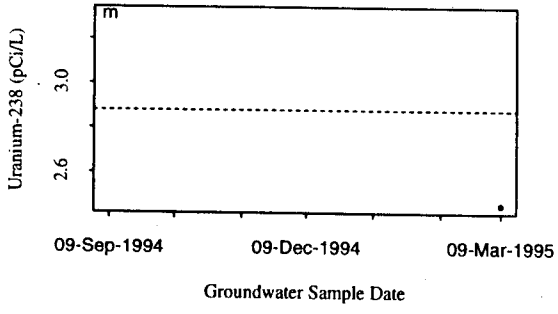
Segment 6-Uranium-234
Well 199-N-77



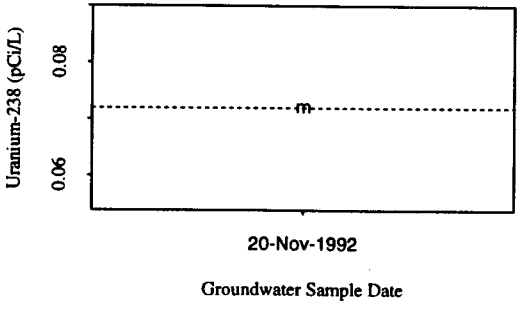
Segment 6-Uranium-238
Well 199-N-14



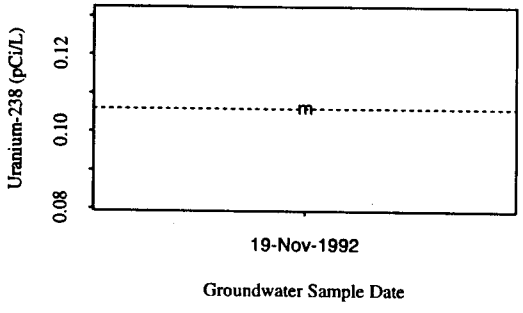
Segment 6-Uranium-238
Well 199-N-3



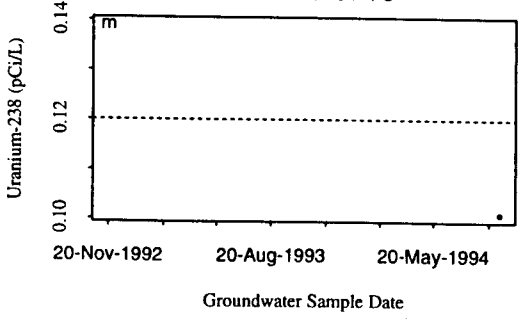
Segment 6-Uranium-238
Well 199-N-72



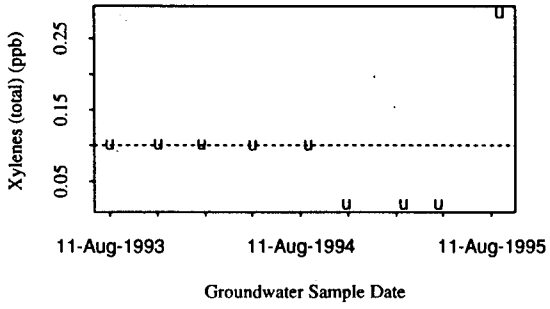
Segment 6-Uranium-238
Well 199-N-75



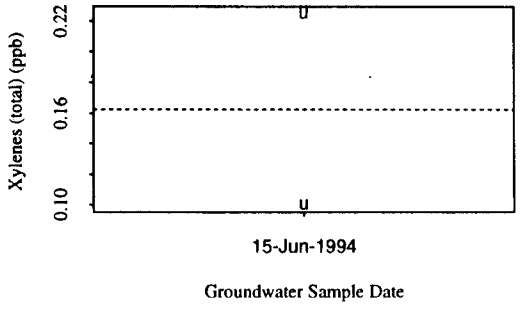
Segment 6-Uranium-238
Well 199-N-76



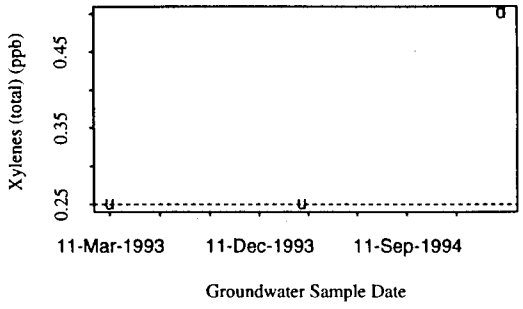
Segment 6-Xylenes (total)
Well 199-N-72



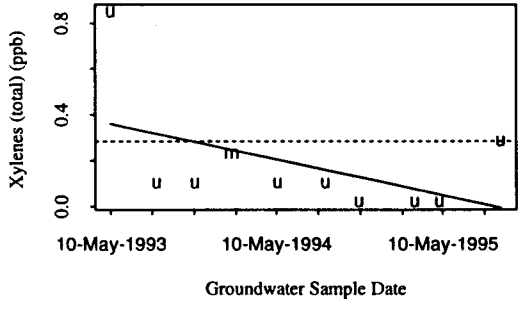
Segment 6-Xylenes (total)
Well 199-N-75



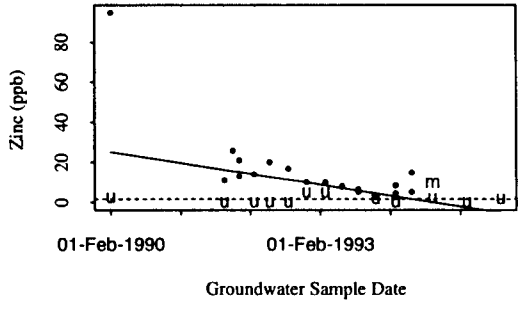
Segment 6-Xylenes (total)
Well 199-N-76



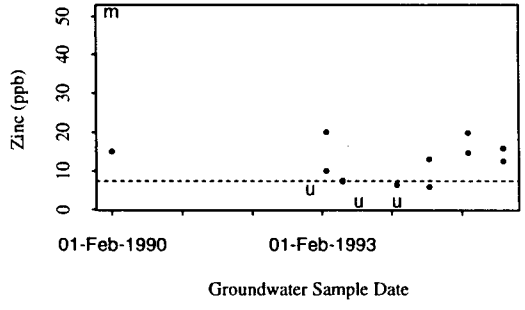
Segment 6-Xylenes (total)
Well 199-N-77



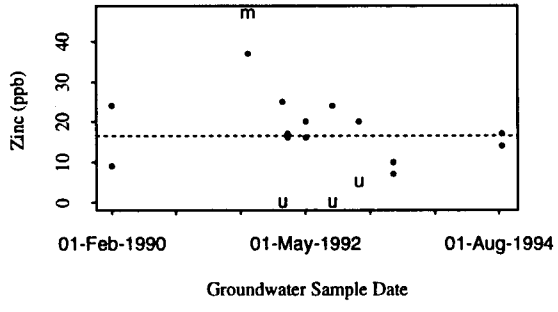
Segment 6-Zinc
Well 199-N-14



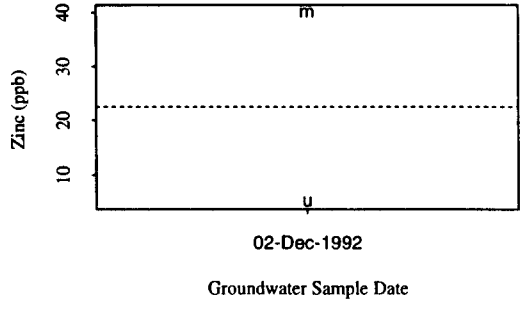
Segment 6-Zinc
Well 199-N-16



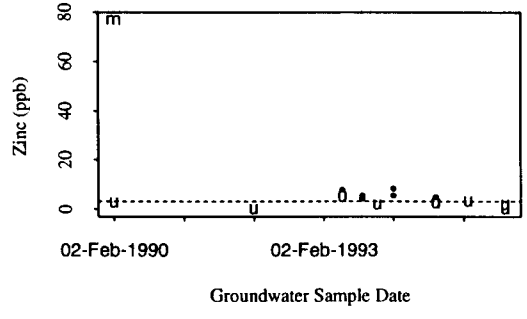
Segment 6-Zinc
Well 199-N-17



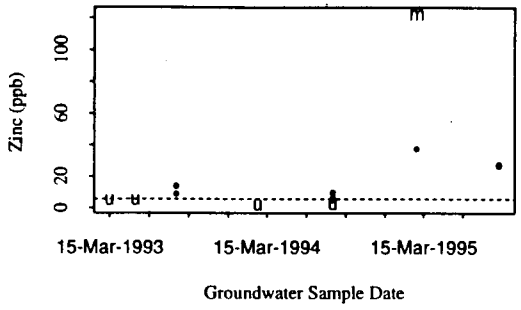
Segment 6-Zinc
Well 199-N-19



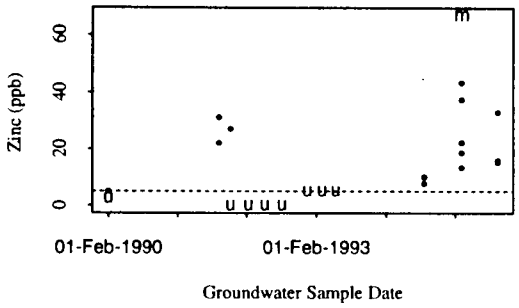
Segment 6-Zinc
Well 199-N-2



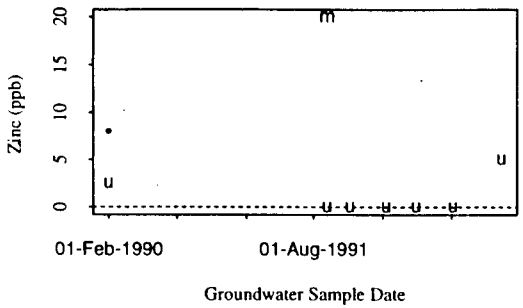
Segment 6-Zinc
Well 199-N-51



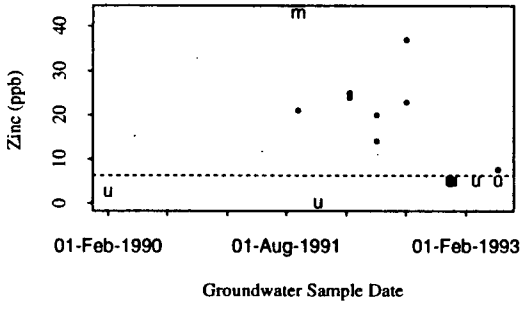
Segment 6-Zinc
Well 199-N-54



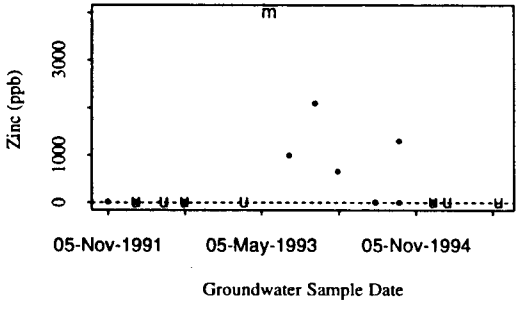
Segment 6-Zinc
Well 199-N-55



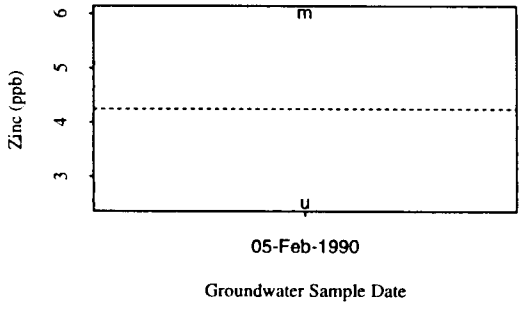
Segment 6-Zinc
Well 199-N-56



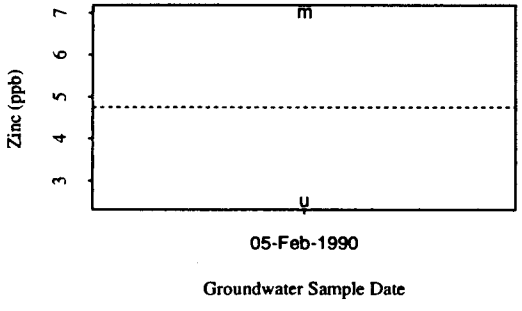
Segment 6-Zinc
Well 199-N-57



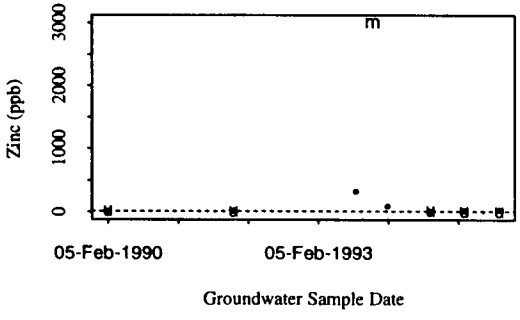
Segment 6-Zinc
Well 199-N-58



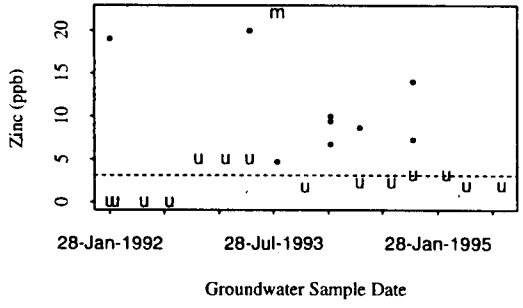
Segment 6-Zinc
Well 199-N-60



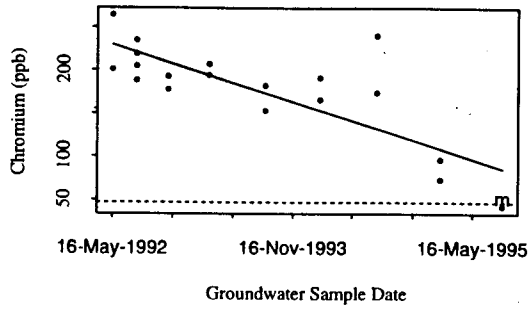
Segment 6-Zinc
Well 199-N-67



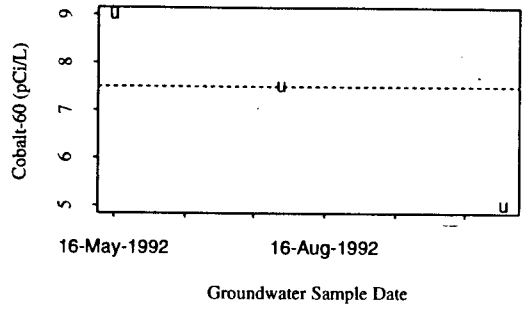
Segment 6-Zinc
Well 199-N-72



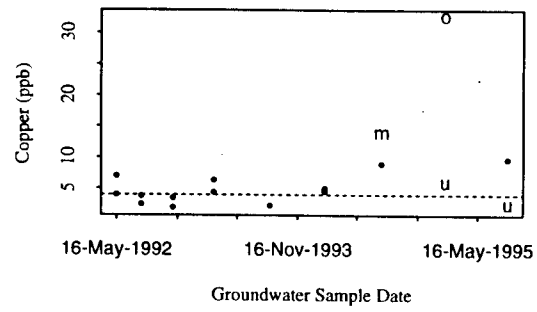
Segment 7-Chromium
Well 199-D5-20



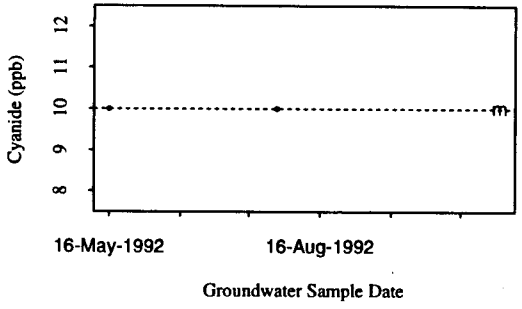
Segment 7-Cobalt-60
Well 199-D5-20



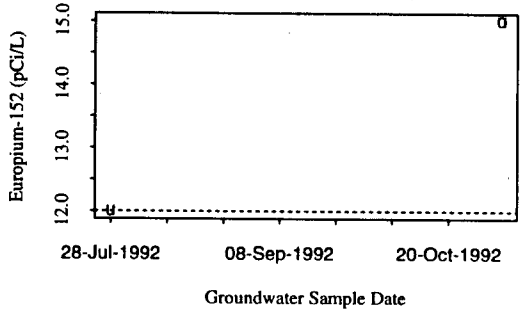
Segment 7-Copper
Well 199-D5-20



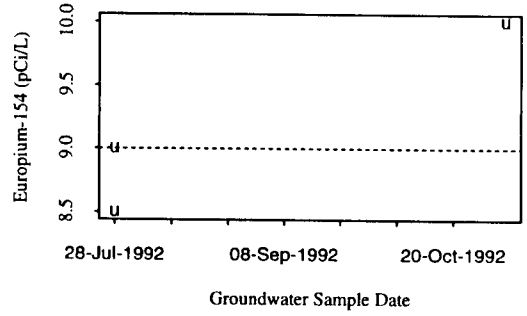
Segment 7-Cyanide
Well 199-D5-20



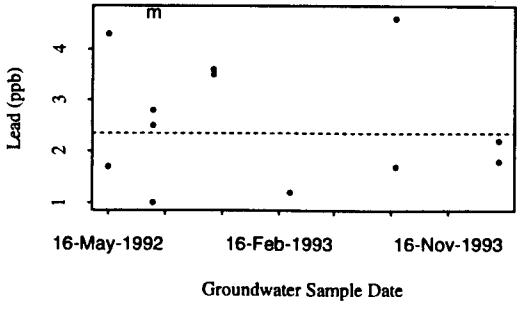
Segment 7-Europium-152
Well 199-D5-20



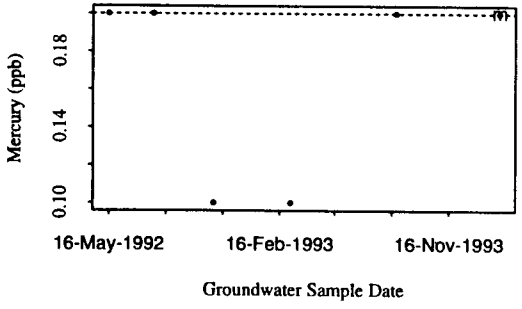
Segment 7-Europium-154
Well 199-D5-20



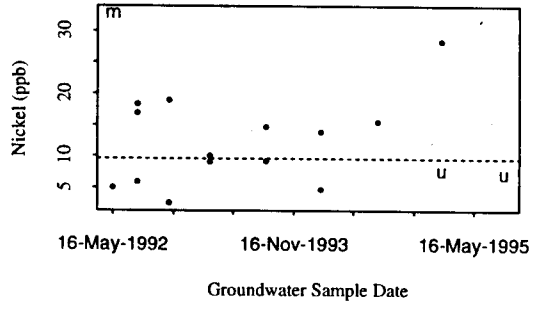
Segment 7-Lead
Well 199-D5-20



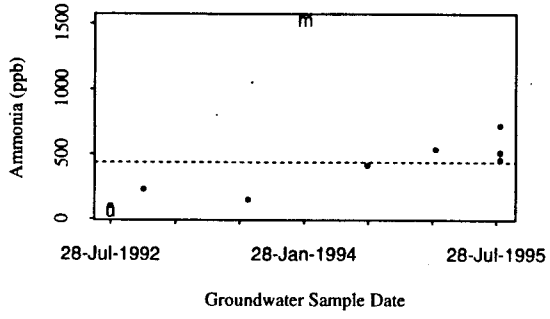
Segment 7-Mercury
Well 199-D5-20



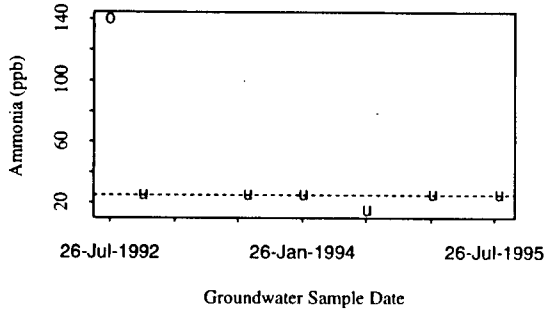
Segment 7-Nickel
Well 199-D5-20



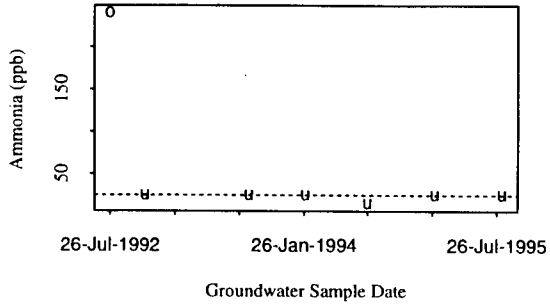
Segment 8-Ammonia
Well 199-D8-3



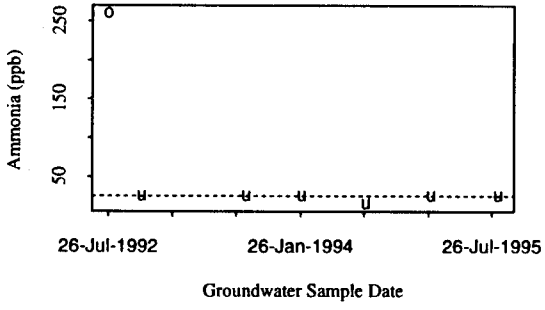
Segment 8-Ammonia
Well 199-D8-53



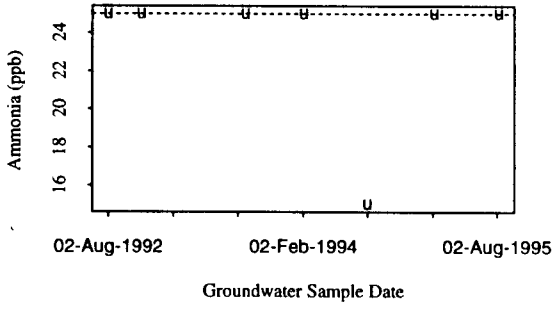
Segment 8-Ammonia
Well 199-D8-54A



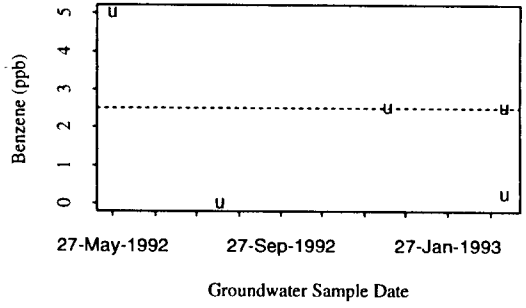
Segment 8-Ammonia
Well 199-D8-55



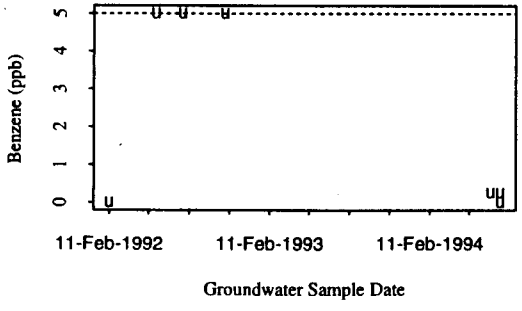
Segment 8-Ammonia
Well 699-97-51A



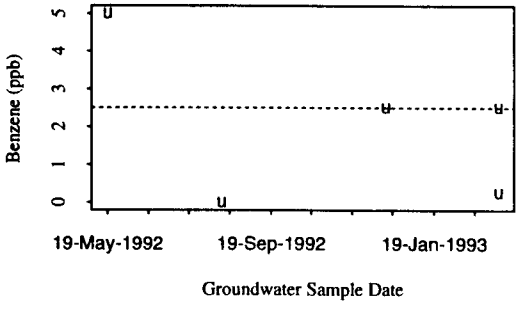
Segment 8-Benzene
Well 199-D5-13



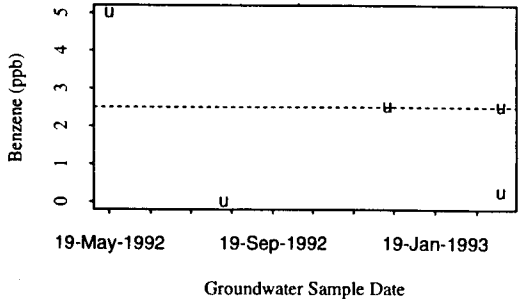
Segment 8-Benzene
Well 199-D8-3



Segment 8-Benzene
Well 199-D8-4

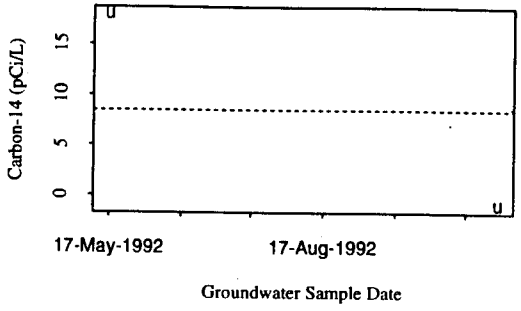


Segment 8-Benzene
Well 199-D8-5

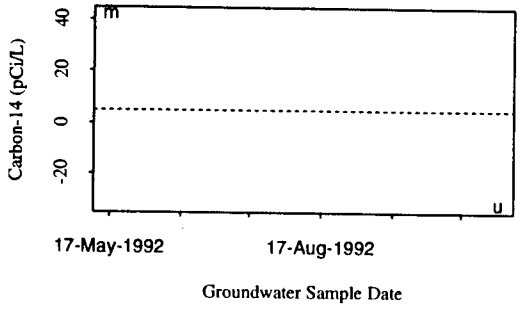


9513181.1616

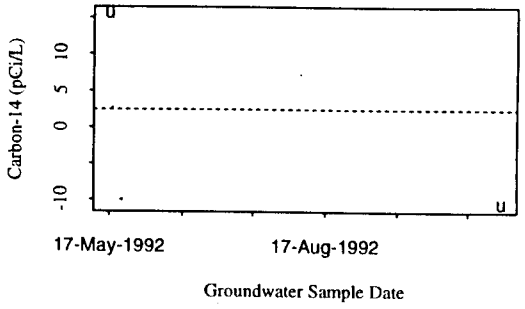
Segment 8-Carbon-14
Well 199-D8-53



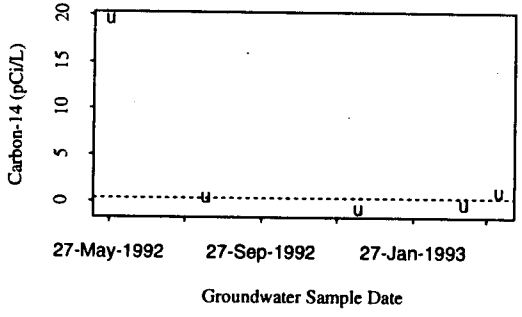
Segment 8-Carbon-14
Well 199-D8-54A



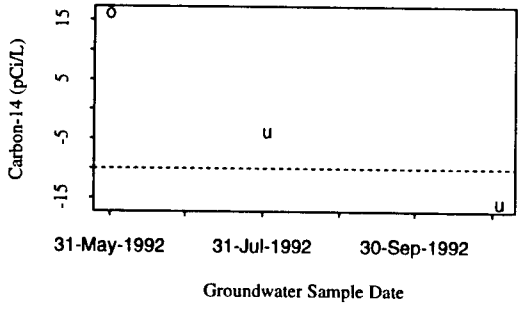
Segment 8-Carbon-14
Well 199-D8-55



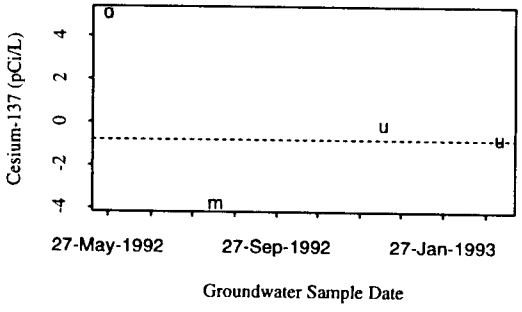
Segment 8-Carbon-14
Well 199-D8-6



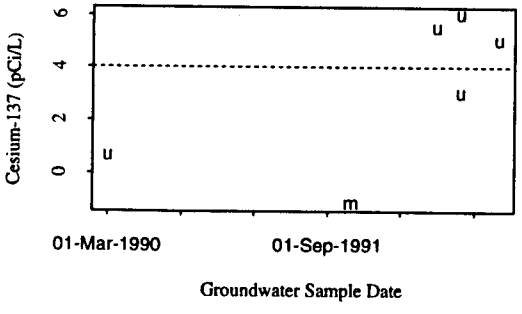
Segment 8-Carbon-14
Well 699-97-51A



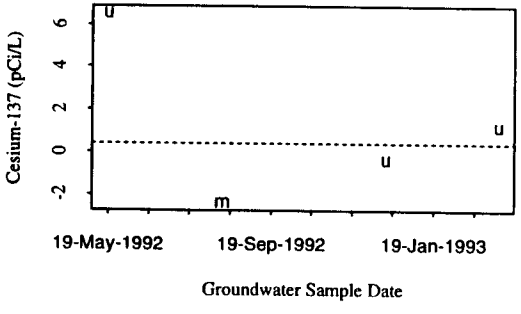
Segment 8-Cesium-137
Well 199-D5-13



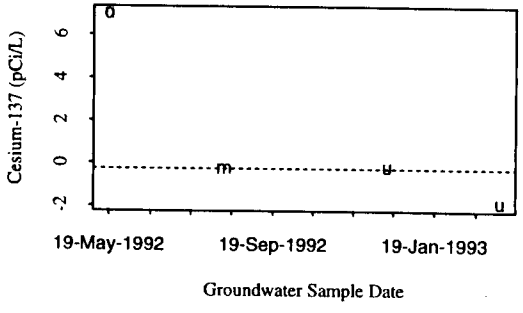
Segment 8-Cesium-137
Well 199-D8-3



Segment 8-Cesium-137
Well 199-D8-4

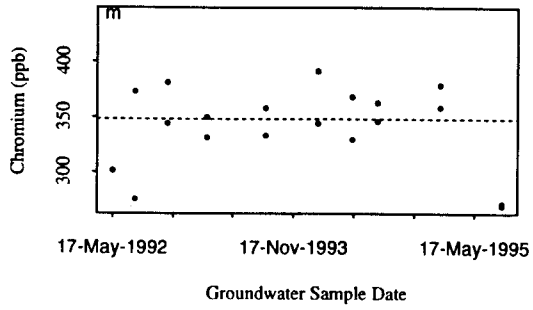


Segment 8-Cesium-137
Well 199-D8-5

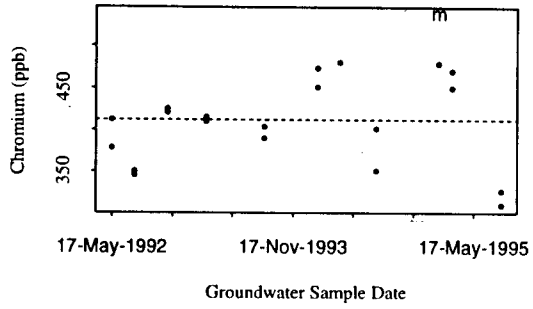


9616148.1647

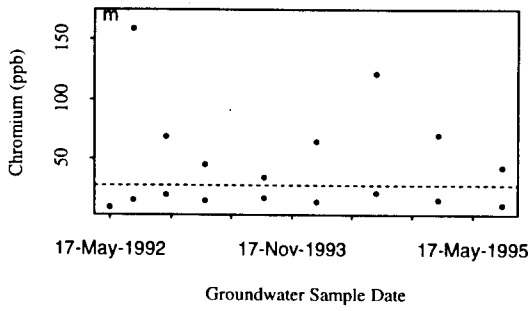
Segment 8-Chromium
Well 199-D8-53



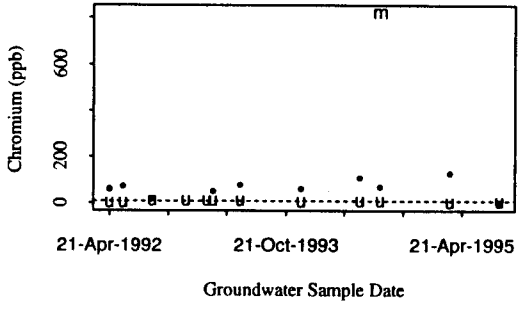
Segment 8-Chromium
Well 199-D8-54A



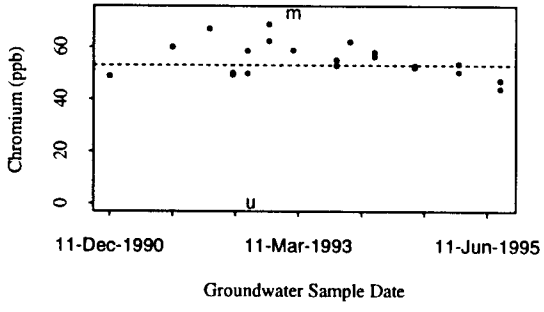
Segment 8-Chromium
Well 199-D8-55



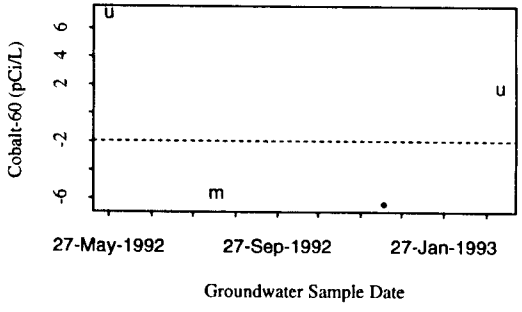
Segment 8-Chromium
Well 199-D8-6



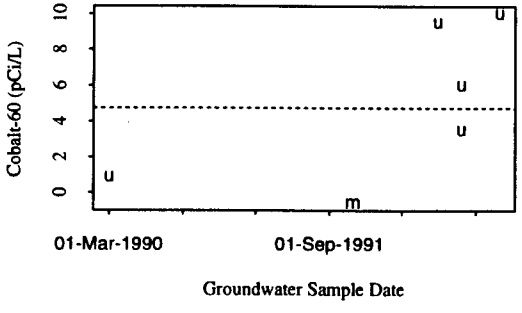
Segment 8-Chromium
Well 699-97-51A



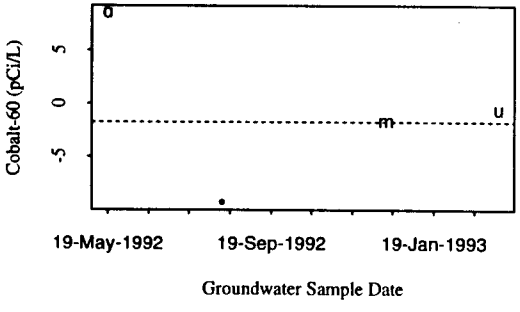
Segment 8-Cobalt-60
Well 199-D5-13



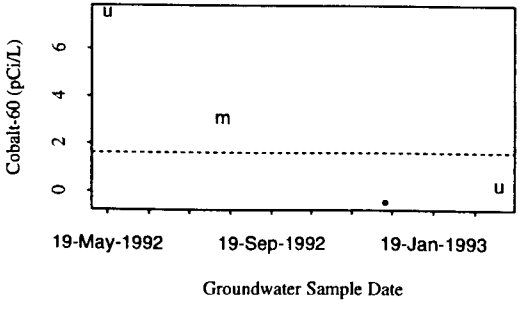
Segment 8-Cobalt-60
Well 199-D8-3



Segment 8-Cobalt-60
Well 199-D8-4

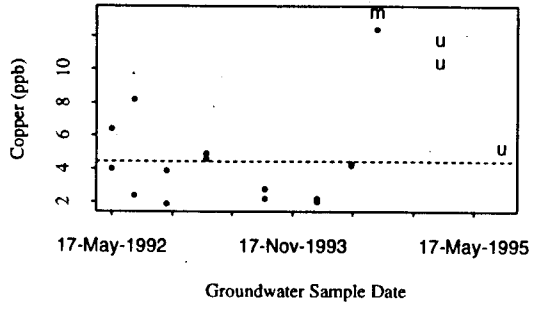


Segment 8-Cobalt-60
Well 199-D8-5

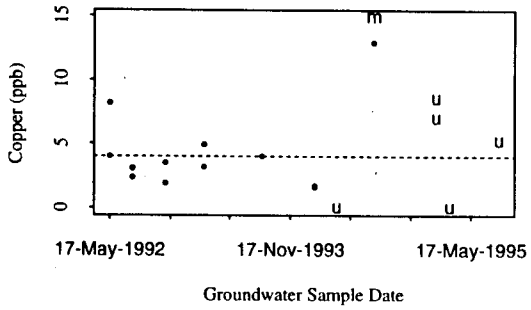


9615148.1618

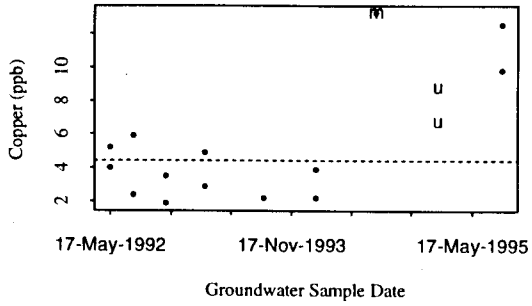
Segment 8-Copper
Well 199-D8-53



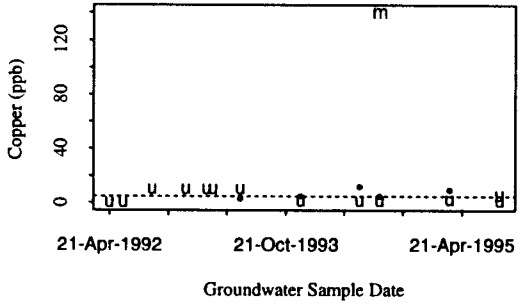
Segment 8-Copper
Well 199-D8-54A



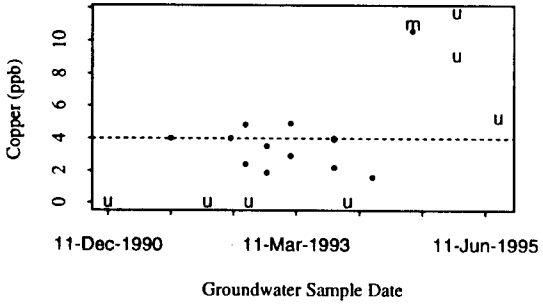
Segment 8-Copper
Well 199-D8-55



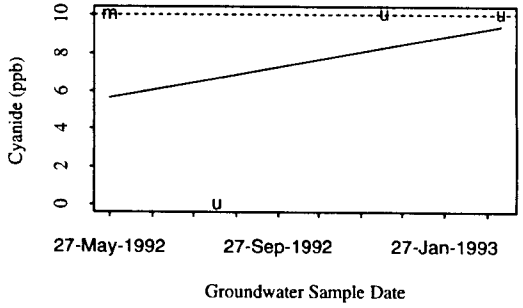
Segment 8-Copper
Well 199-D8-6



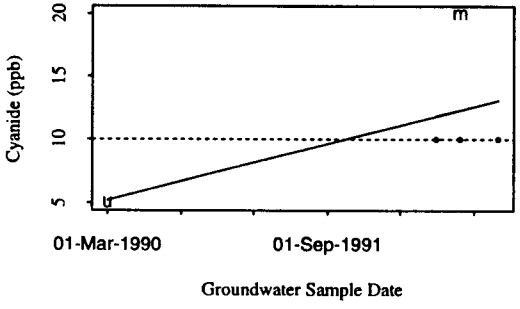
Segment 8-Copper
Well 699-97-51A



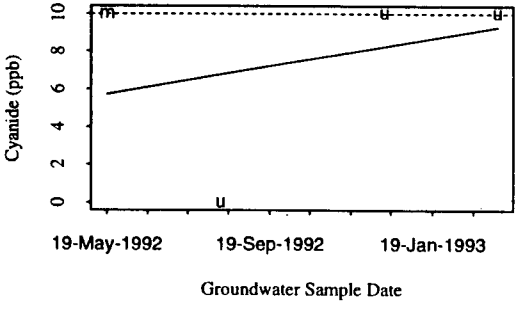
Segment 8-Cyanide
Well 199-D5-13



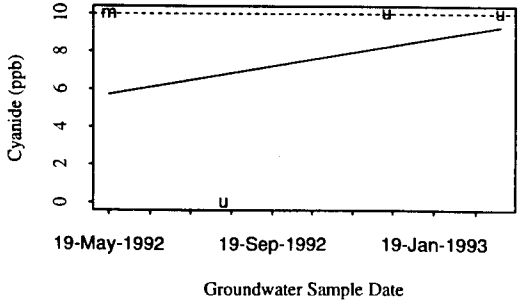
Segment 8-Cyanide
Well 199-D8-3



Segment 8-Cyanide
Well 199-D8-4

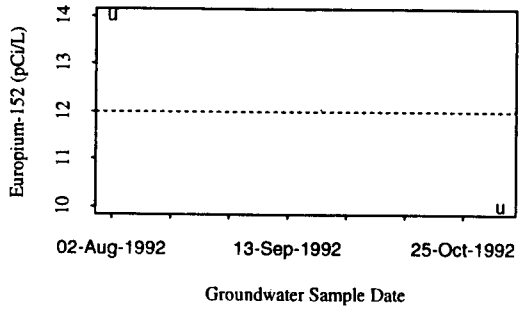


Segment 8-Cyanide
Well 199-D8-5

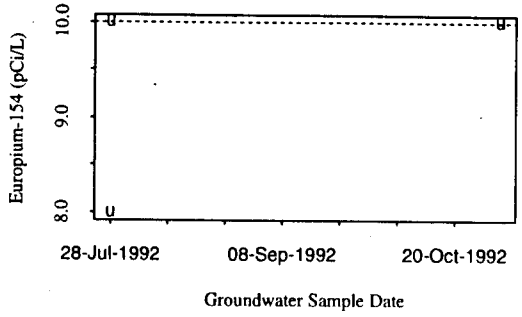


9413148.1619

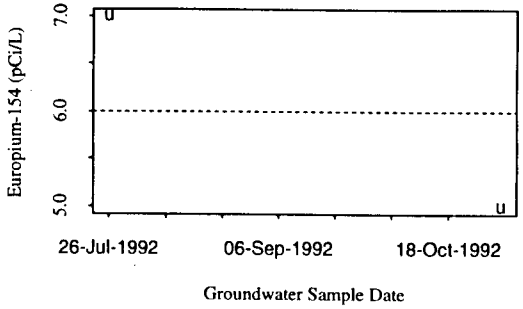
Segment 8-Europium-152
Well 699-97-51A



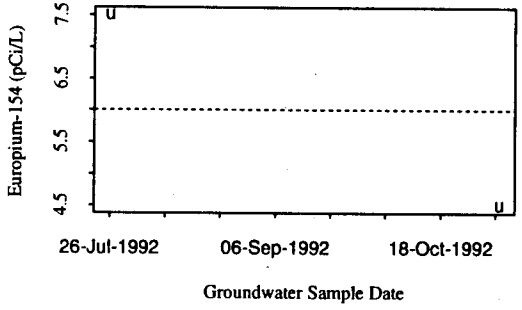
Segment 8-Europium-154
Well 199-D8-3



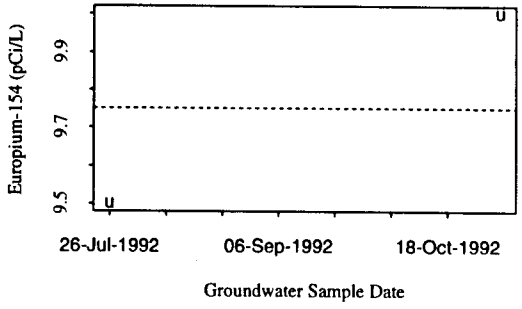
Segment 8-Europium-154
Well 199-D8-53



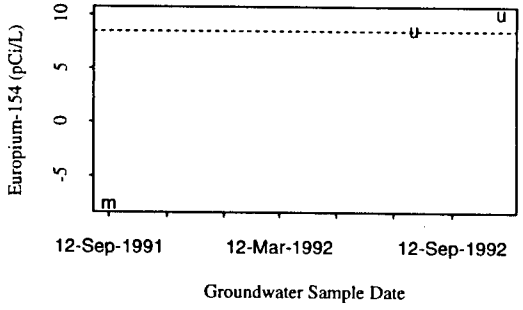
Segment 8-Europium-154
Well 199-D8-54A



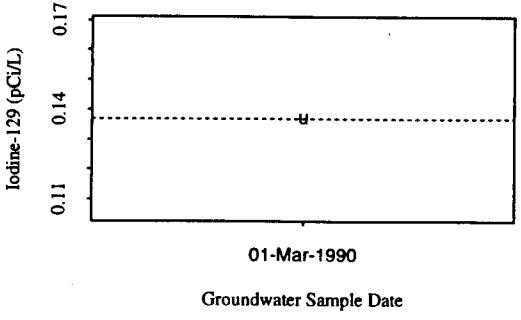
Segment 8-Europium-154
Well 199-D8-55



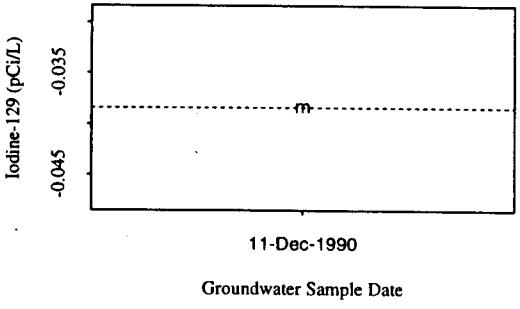
Segment 8-Europium-154
Well 699-97-51A



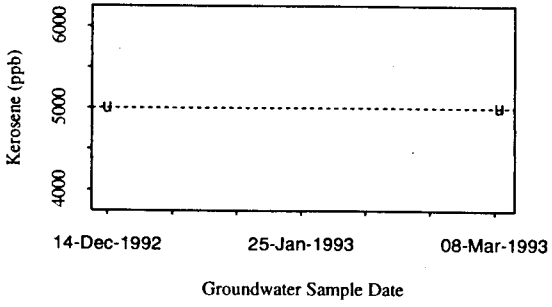
Segment 8-Iodine-129
Well 199-D8-3



Segment 8-Iodine-129
Well 699-97-51A

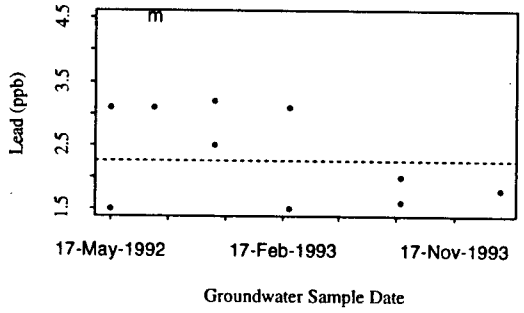


Segment 8-Kerosene
Well 199-D5-13

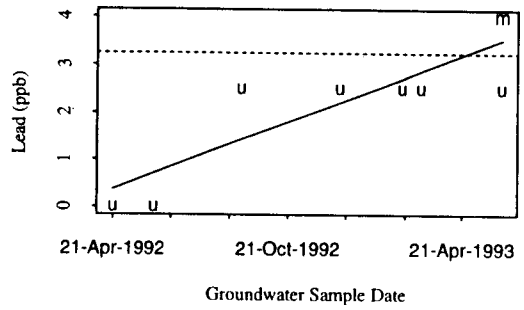


9614148.1660

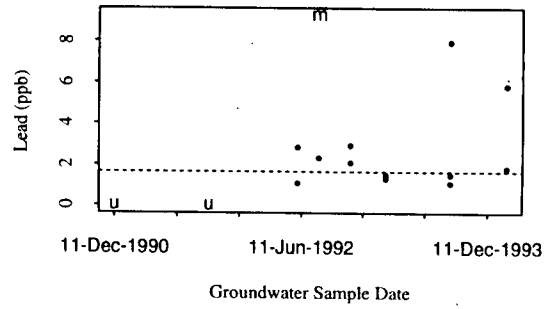
Segment 8-Lead
Well 199-D8-55



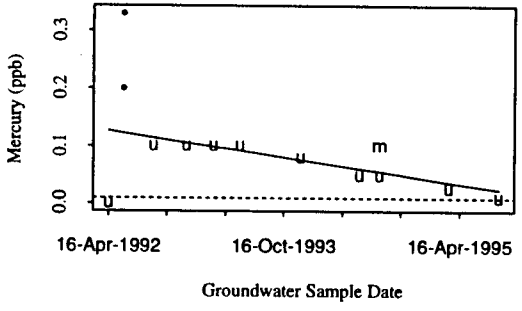
Segment 8-Lead
Well 199-D8-6



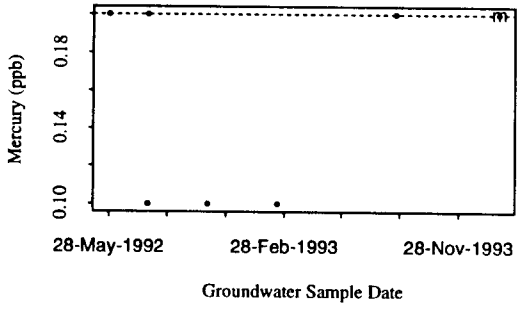
Segment 8-Lead
Well 699-97-51A



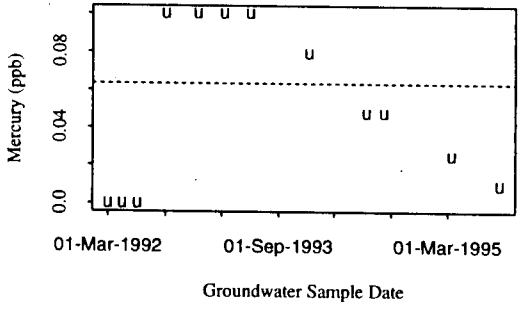
Segment 8-Mercury
Well 199-D5-13



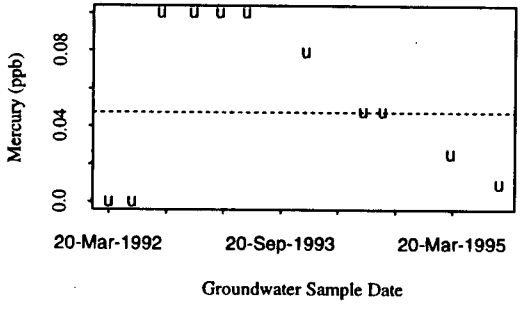
Segment 8-Mercury
Well 199-D8-3_



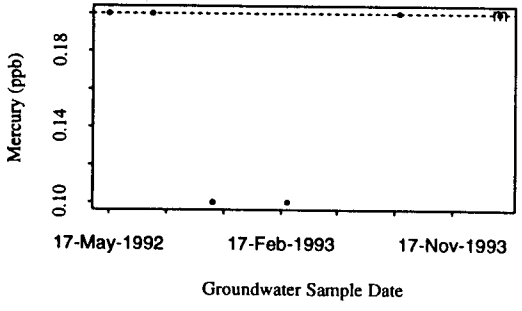
Segment 8-Mercury
Well 199-D8-4



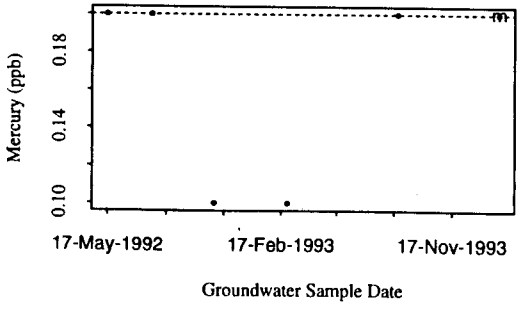
Segment 8-Mercury
Well 199-D8-5



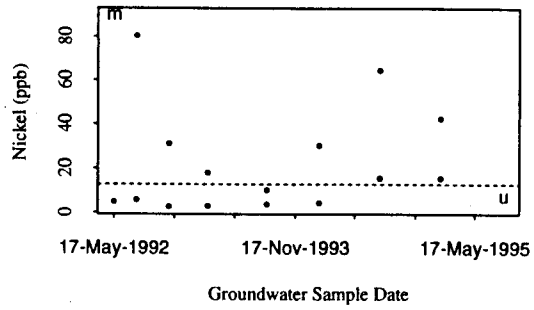
Segment 8-Mercury
Well 199-D8-53



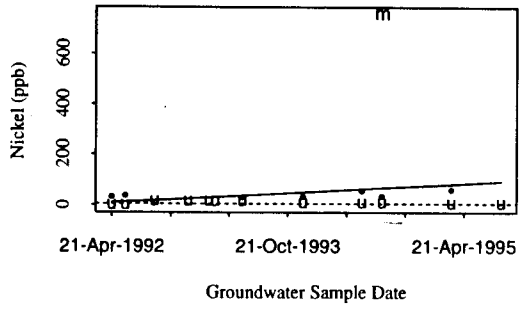
Segment 8-Mercury
Well 199-D8-54A



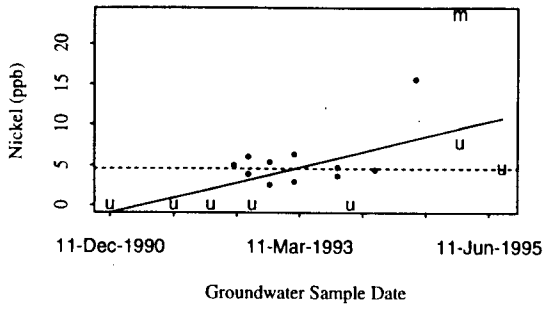
Segment 8-Nickel
Well 199-D8-55



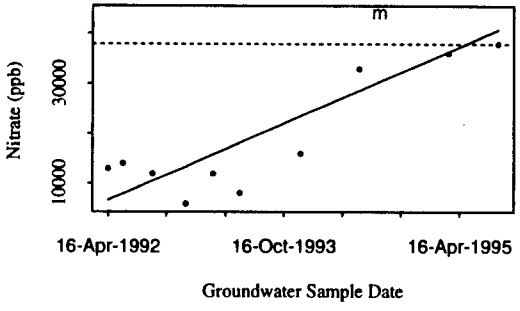
Segment 8-Nickel
Well 199-D8-6



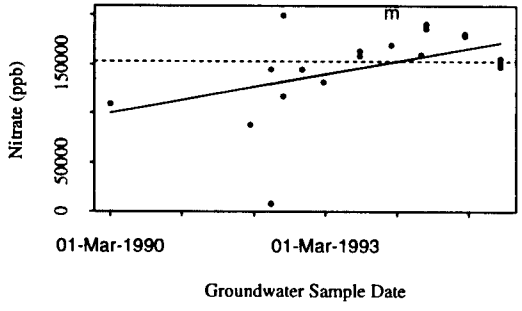
Segment 8-Nickel
Well 699-97-51A



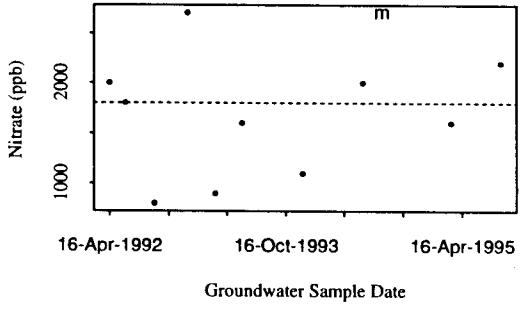
Segment 8-Nitrate
Well 199-D5-13



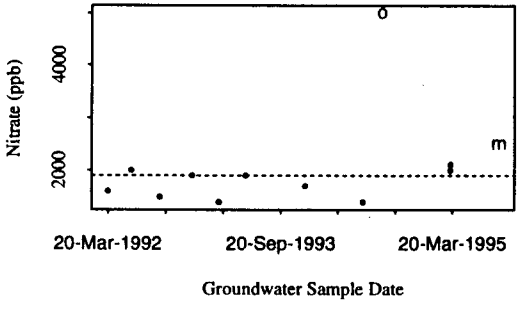
Segment 8-Nitrate
Well 199-D8-3



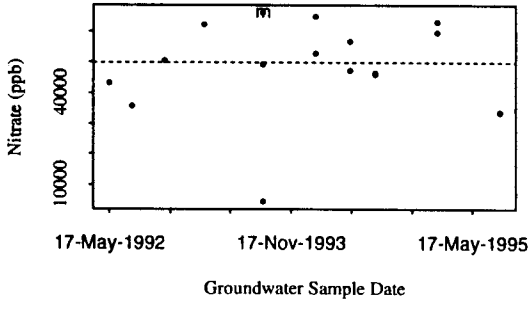
Segment 8-Nitrate
Well 199-D8-4



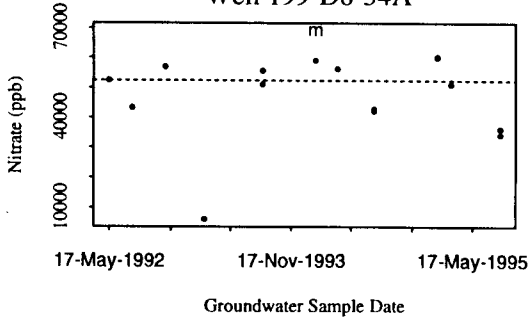
Segment 8-Nitrate
Well 199-D8-5



Segment 8-Nitrate
Well 199-D8-53

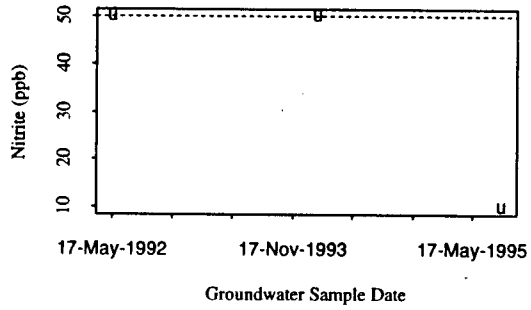


Segment 8-Nitrate
Well 199-D8-54A

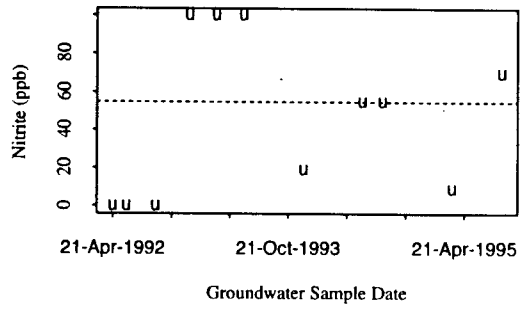


9513148.1652

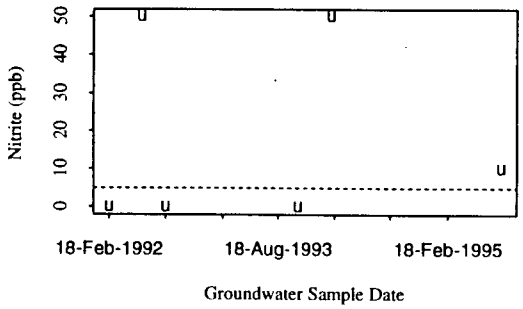
Segment 8-Nitrite
Well 199-D8-55



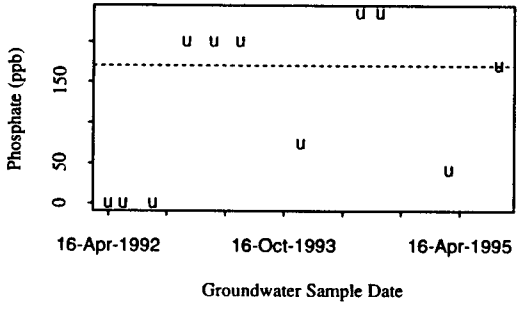
Segment 8-Nitrite
Well 199-D8-6



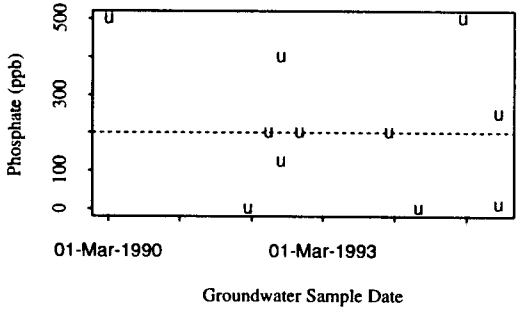
Segment 8-Nitrite
Well 699-97-51A



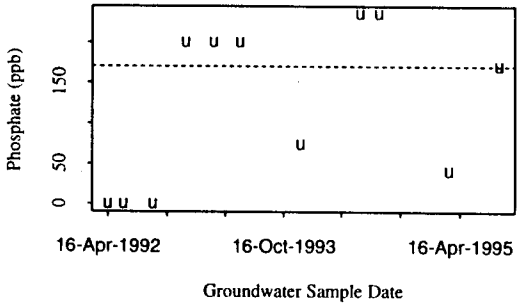
Segment 8-Phosphate
Well 199-D5-13



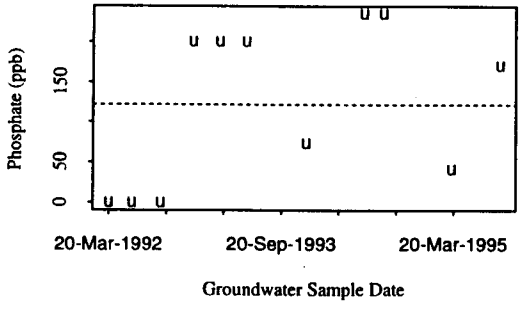
Segment 8-Phosphate
Well 199-D8-3



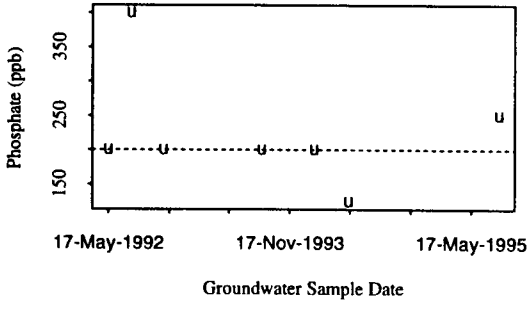
Segment 8-Phosphate
Well 199-D8-4



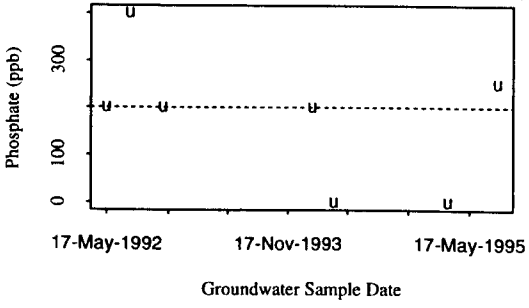
Segment 8-Phosphate
Well 199-D8-5



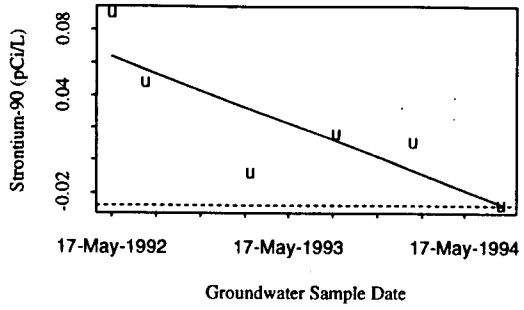
Segment 8-Phosphate
Well 199-D8-53



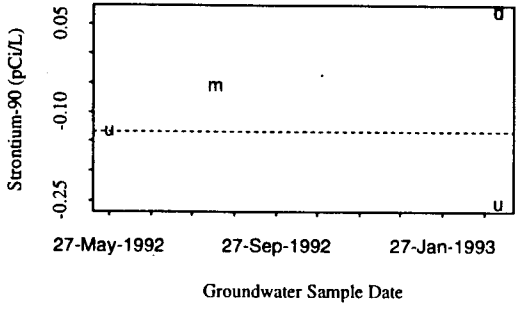
Segment 8-Phosphate
Well 199-D8-54A



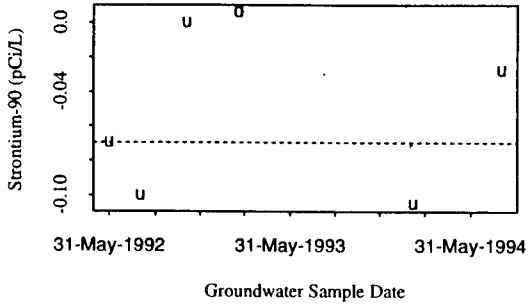
Segment 8-Strontium-90
Well 199-D8-55



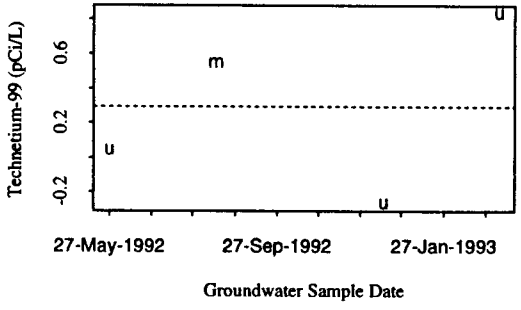
Segment 8-Strontium-90
Well 199-D8-6



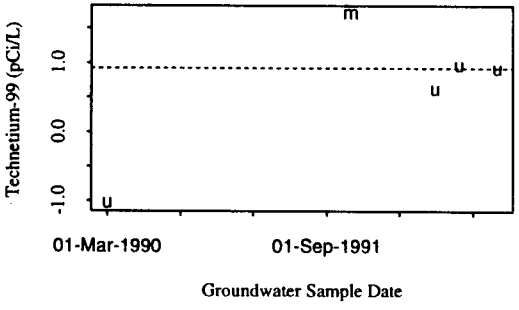
Segment 8-Strontium-90
Well 699-97-51A



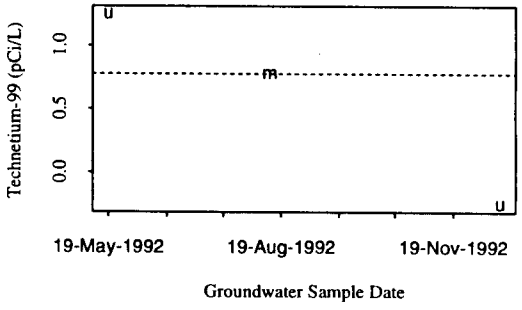
Segment 8-Technetium-99
Well 199-D5-13



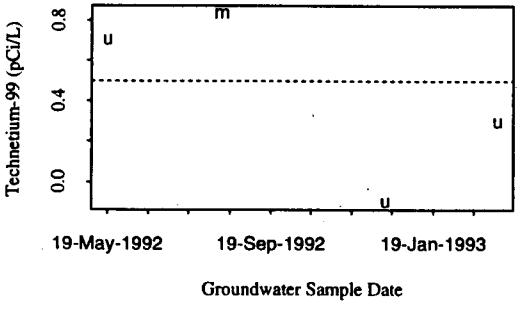
Segment 8-Technetium-99
Well 199-D8-3



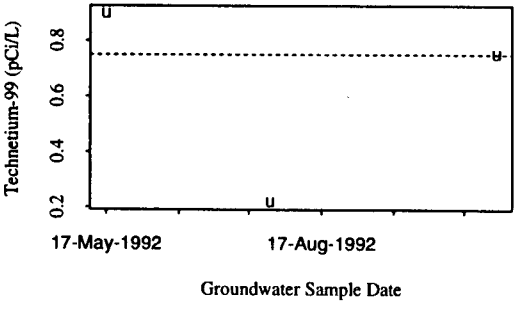
Segment 8-Technetium-99
Well 199-D8-4



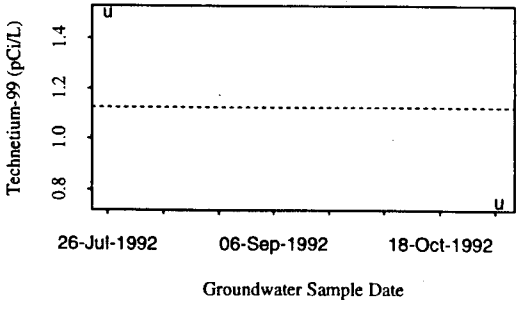
Segment 8-Technetium-99
Well 199-D8-5



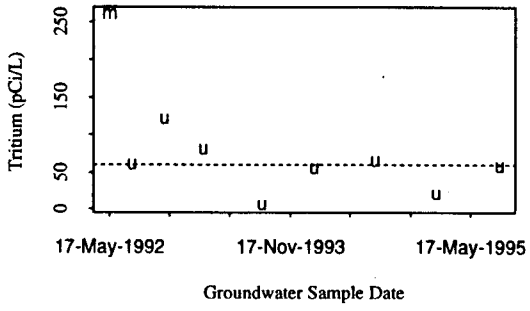
Segment 8-Technetium-99
Well 199-D8-53



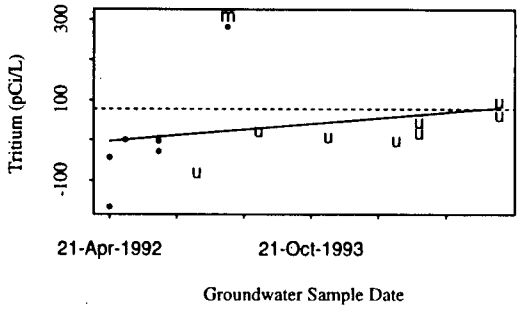
Segment 8-Technetium-99
Well 199-D8-54A



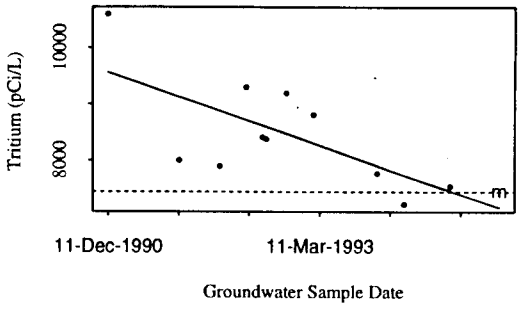
Segment 8-Tritium
Well 199-D8-55



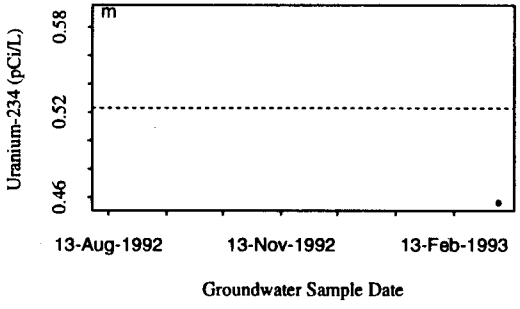
Segment 8-Tritium
Well 199-D8-6



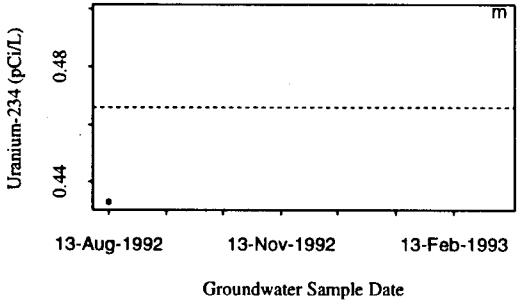
Segment 8-Tritium
Well 699-97-51A



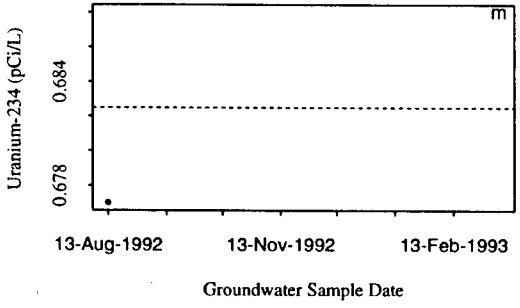
Segment 8-Uranium-234
Well 199-D5-13



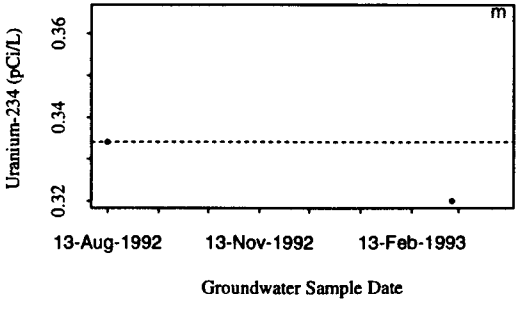
Segment 8-Uranium-234
Well 199-D8-4



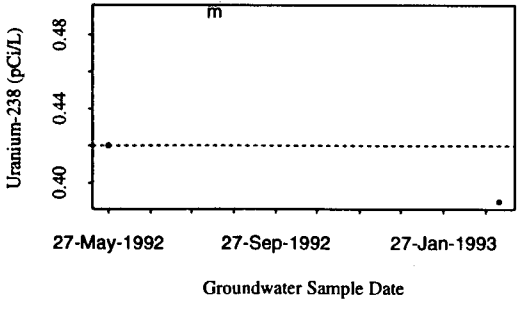
Segment 8-Uranium-234
Well 199-D8-5



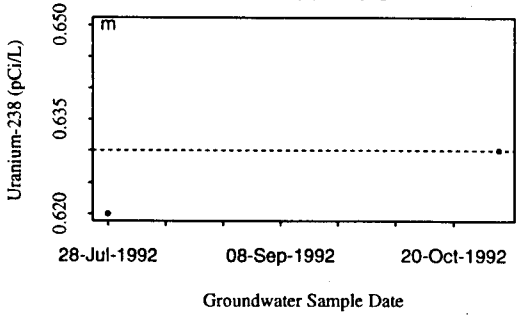
Segment 8-Uranium-234
Well 199-D8-6



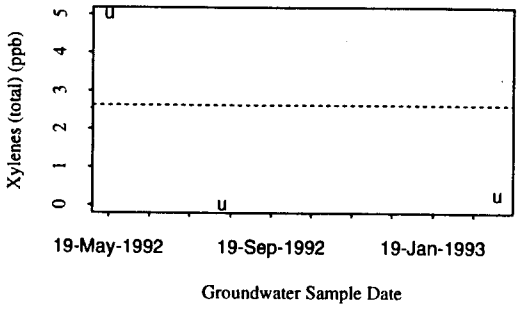
Segment 8-Uranium-238
Well 199-D5-13



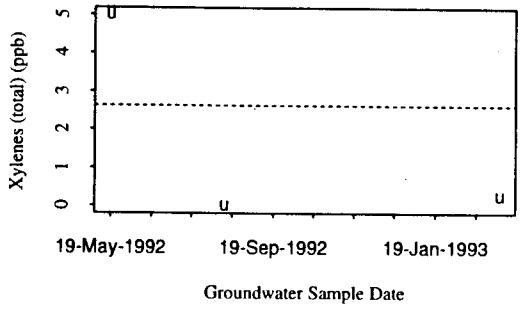
Segment 8-Uranium-238
Well 199-D8-3



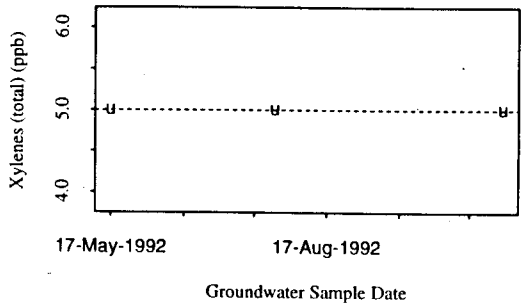
Segment 8-Xylenes (total)
Well 199-D8-4



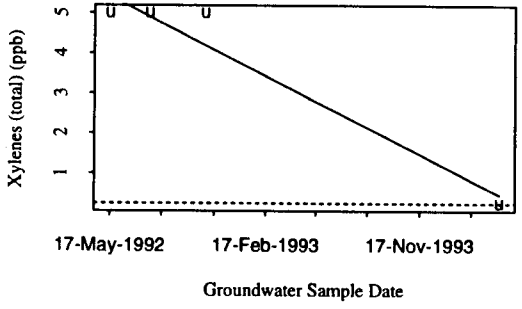
Segment 8-Xylenes (total)
Well 199-D8-5



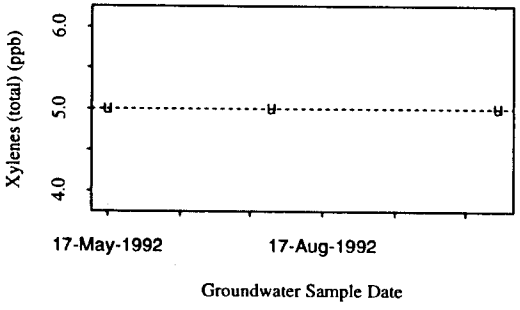
Segment 8-Xylenes (total)
Well 199-D8-53



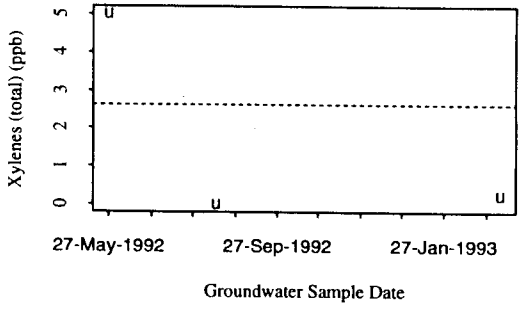
Segment 8-Xylenes (total)
Well 199-D8-54A



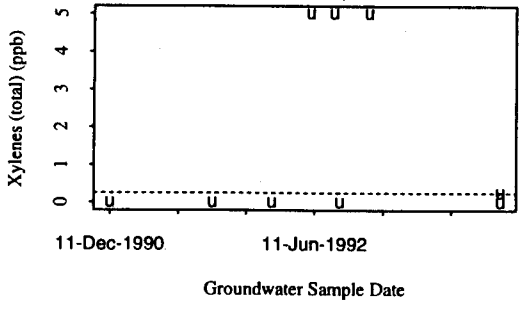
Segment 8-Xylenes (total)
Well 199-D8-55



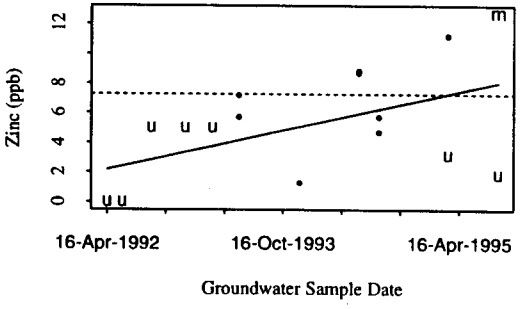
Segment 8-Xylenes (total)
Well 199-D8-6



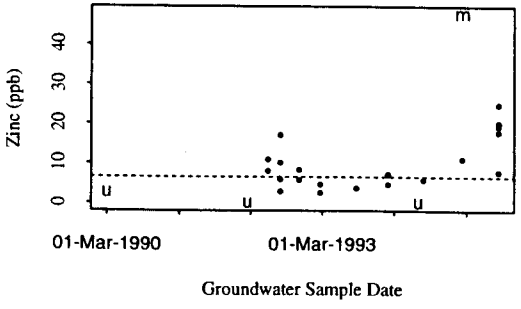
Segment 8-Xylenes (total)
Well 699-97-51A



Segment 8-Zinc
Well 199-D5-13

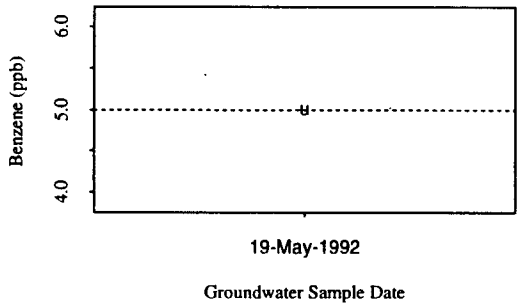


Segment 8-Zinc
Well 199-D8-3

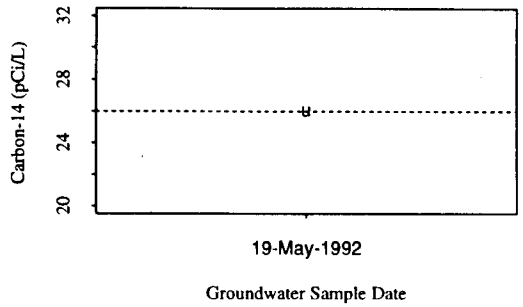


9615448.1656

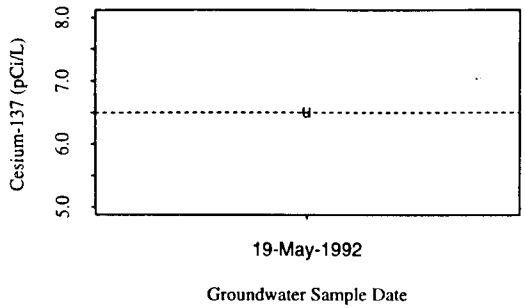
Segment 9-Benzene
Well 699-98-49A



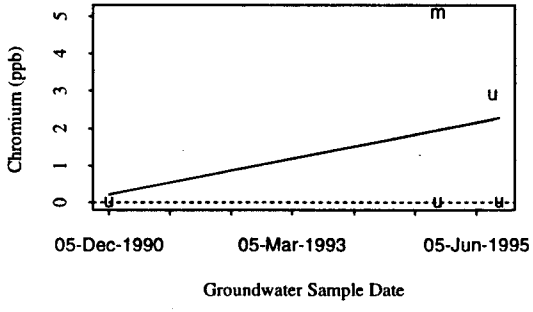
Segment 9-Carbon-14
Well 699-98-49A



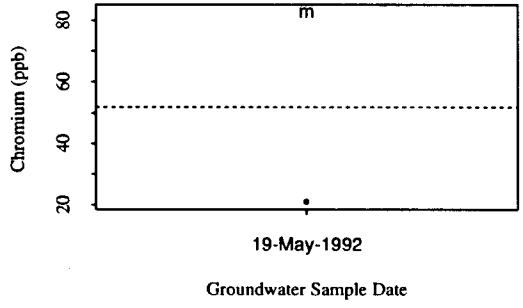
Segment 9-Cesium-137
Well 699-98-49A



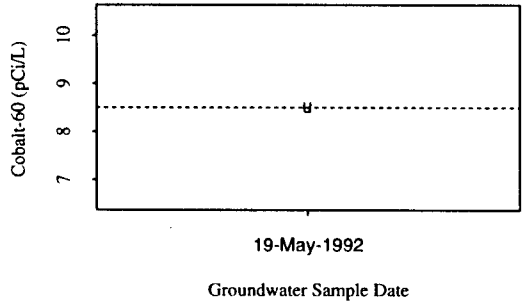
Segment 9-Chromium
Well 699-101-48B



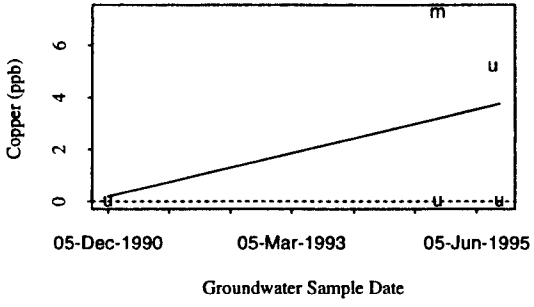
Segment 9-Chromium
Well 699-98-49A



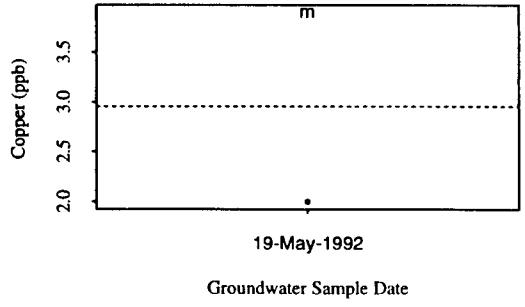
Segment 9-Cobalt-60
Well 699-98-49A



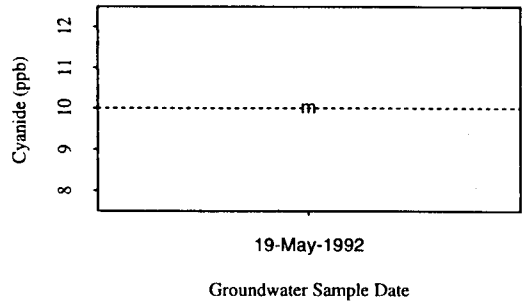
Segment 9-Copper
Well 699-101-48B



Segment 9-Copper
Well 699-98-49A

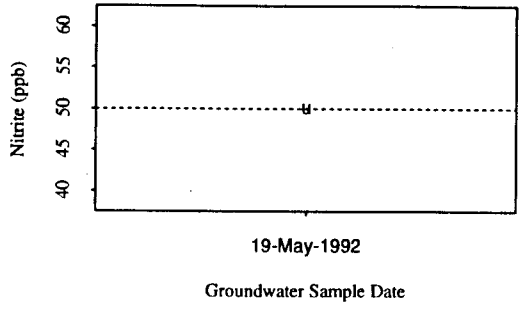


Segment 9-Cyanide
Well 699-98-49A

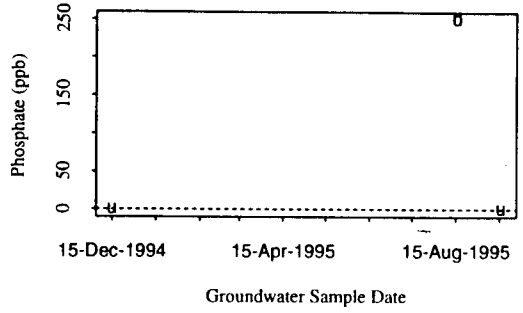


9613148.1657

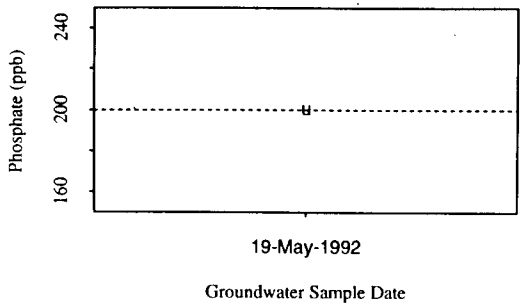
Segment 9-Nitrite
Well 699-98-49A



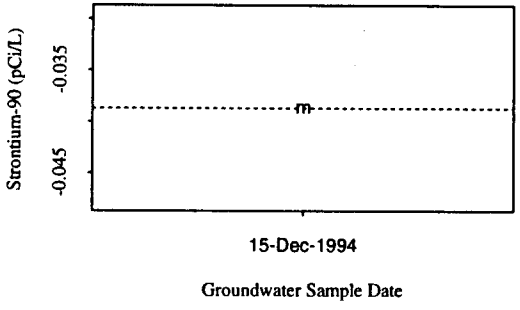
Segment 9-Phosphate
Well 699-101-48B



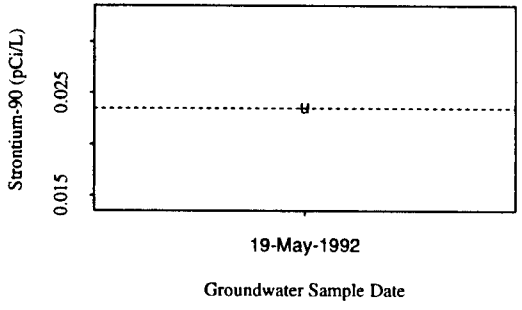
Segment 9-Phosphate
Well 699-98-49A



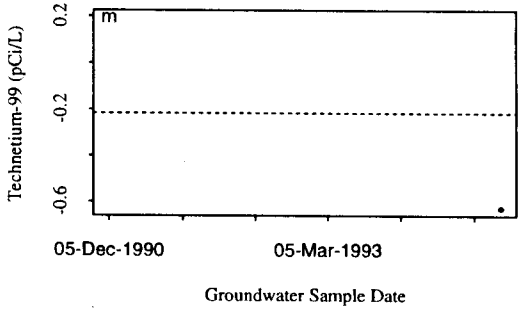
Segment 9-Strontium-90
Well 699-101-48B



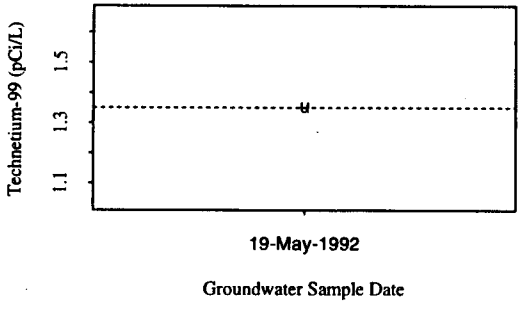
Segment 9-Strontium-90
Well 699-98-49A



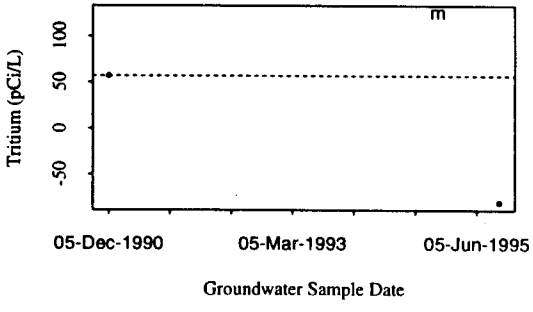
Segment 9-Technetium-99
Well 699-101-48B



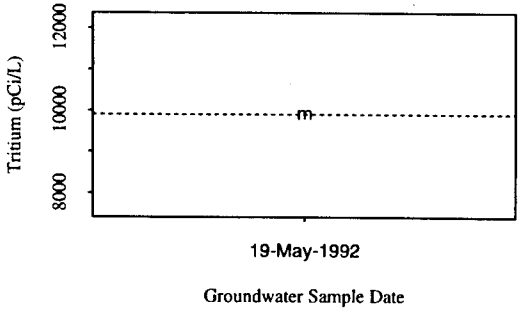
Segment 9-Technetium-99
Well 699-98-49A



Segment 9-Tritium
Well 699-101-48B

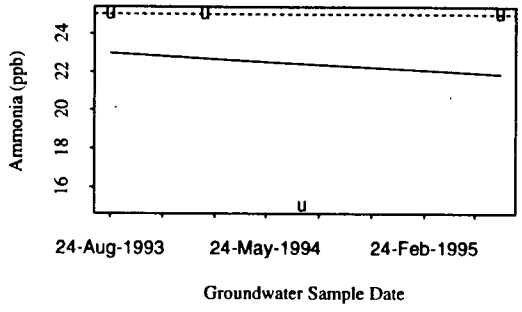


Segment 9-Tritium
Well 699-98-49A

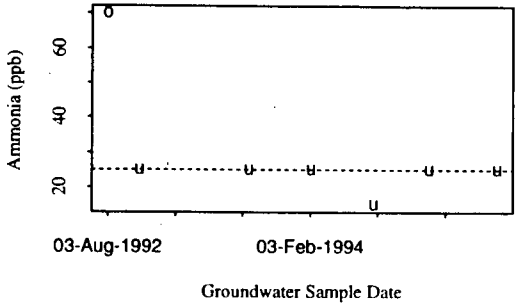


9613148.1658

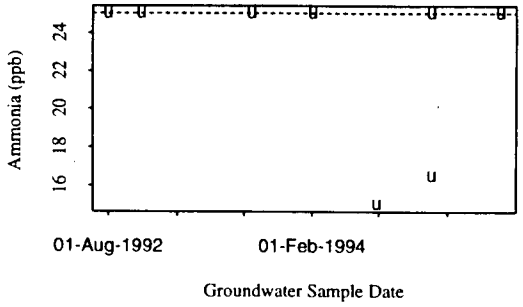
Segment 10-Ammonia
Well 199-H4-17



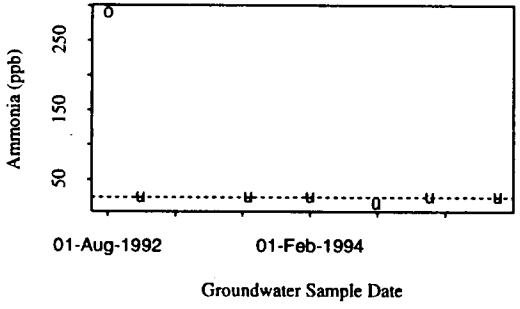
Segment 10-Ammonia
Well 199-H4-45



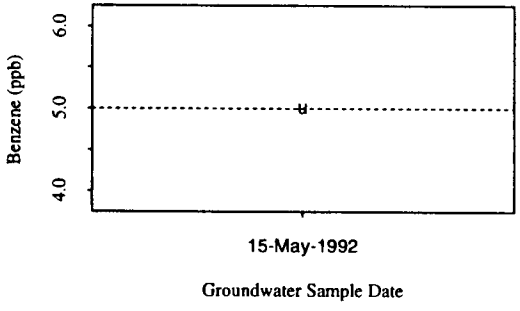
Segment 10-Ammonia
Well 199-H4-47



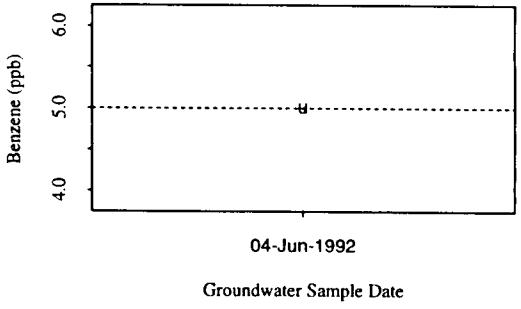
Segment 10-Ammonia
Well 199-H6-1



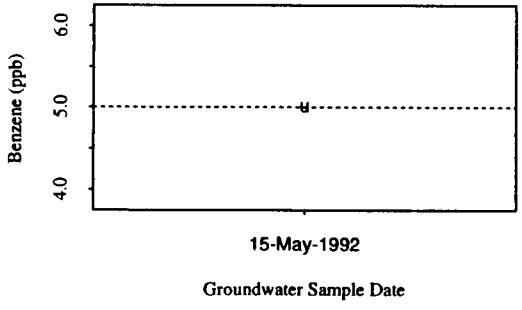
Segment 10-Benzene
Well 199-H4-10



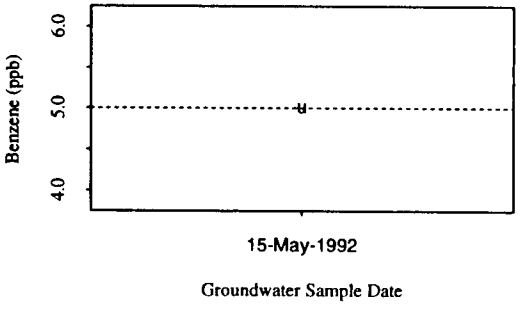
Segment 10-Benzene
Well 199-H4-11



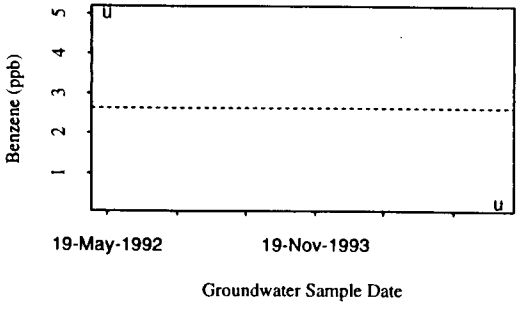
Segment 10-Benzene
Well 199-H4-12A



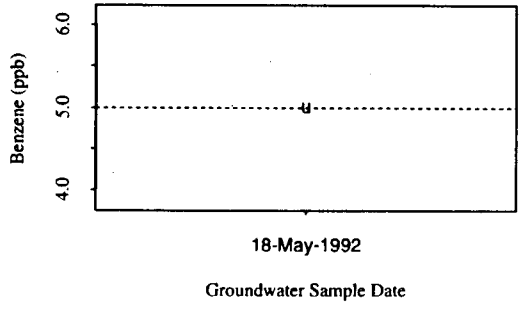
Segment 10-Benzene
Well 199-H4-12B



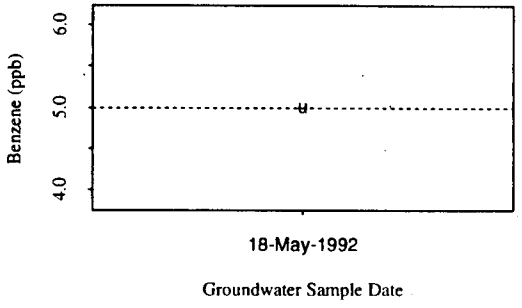
Segment 10-Benzene
Well 199-H4-13



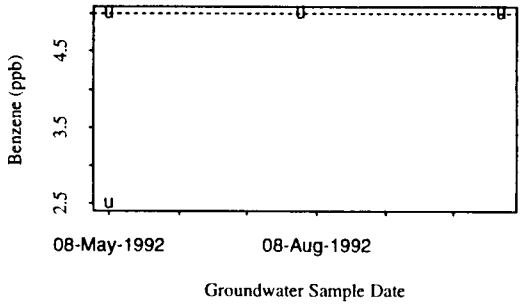
Segment 10-Benzene
Well 199-H4-7



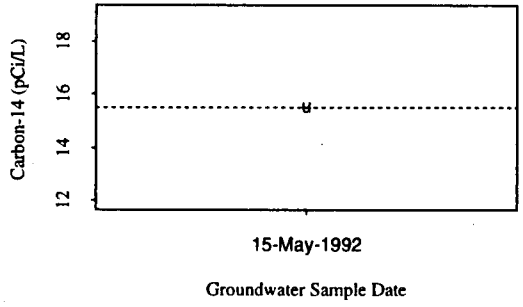
Segment 10-Benzene
Well 199-H4-9



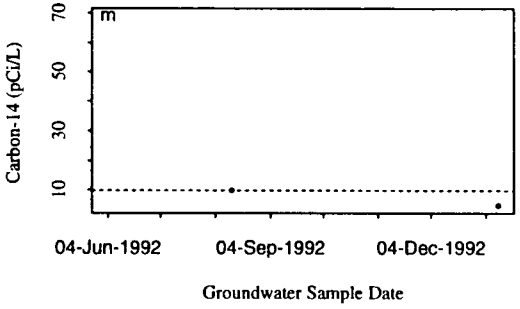
Segment 10-Benzene
Well 199-H6-1



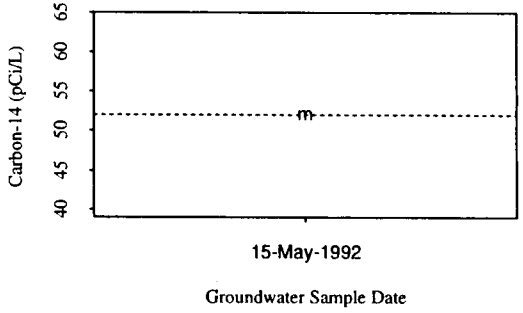
Segment 10-Carbon-14
Well 199-H4-10



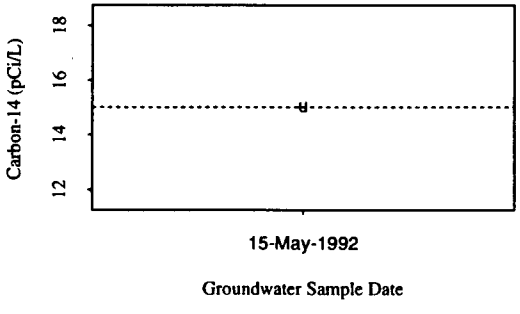
Segment 10-Carbon-14
Well 199-H4-11



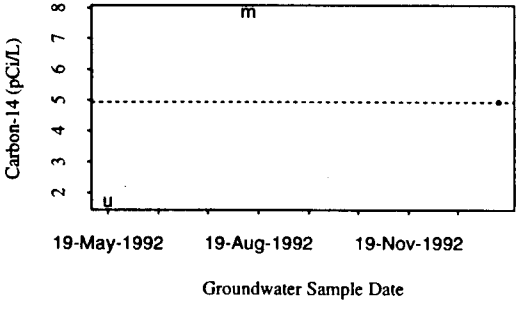
Segment 10-Carbon-14
Well 199-H4-12A



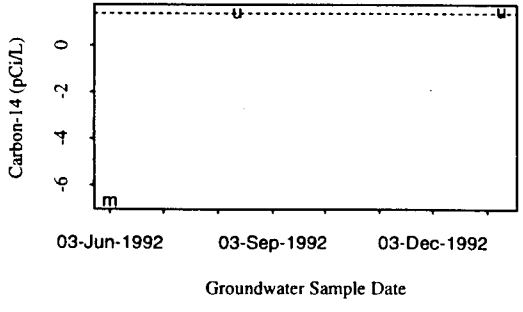
Segment 10-Carbon-14
Well 199-H4-12B



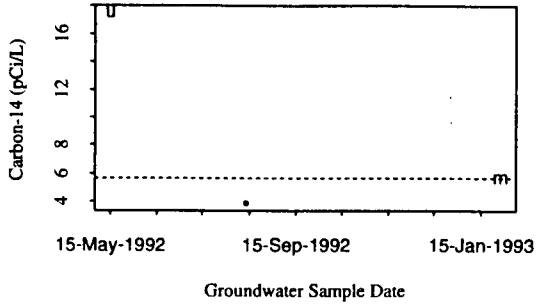
Segment 10-Carbon-14
Well 199-H4-13



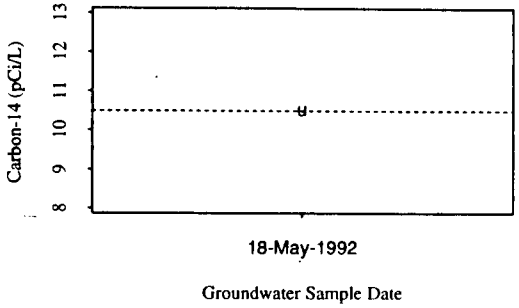
Segment 10-Carbon-14
Well 199-H4-14



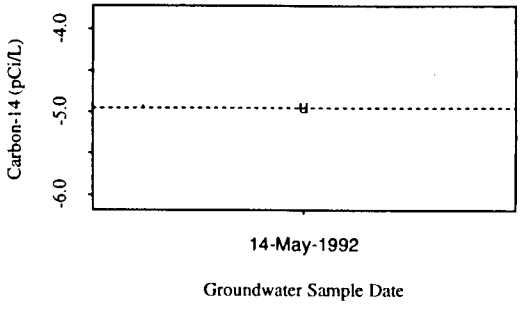
Segment 10-Carbon-14
Well 199-H4-5



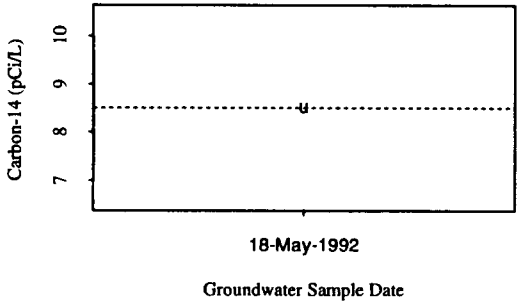
Segment 10-Carbon-14
Well 199-H4-7



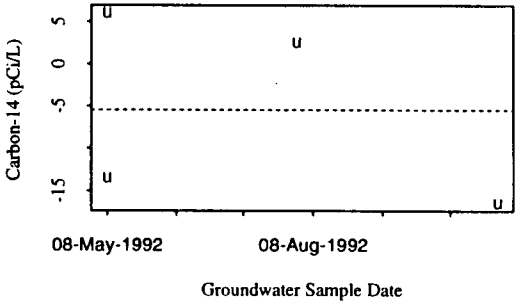
Segment 10-Carbon-14
Well 199-H4-8



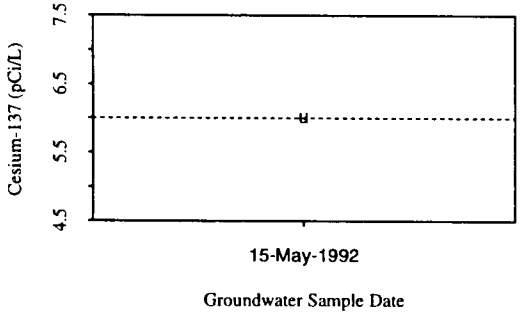
Segment 10-Carbon-14
Well 199-H4-9



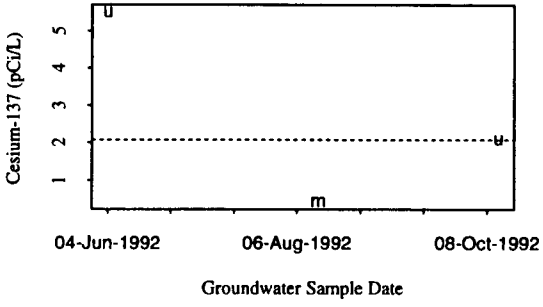
Segment 10-Carbon-14
Well 199-H6-1



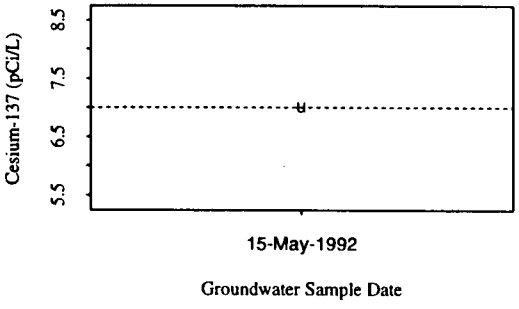
Segment 10-Cesium-137
Well 199-H4-10



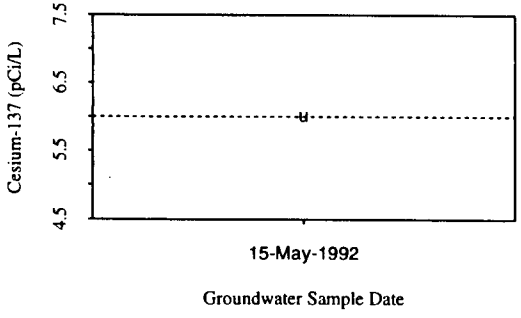
Segment 10-Cesium-137
Well 199-H4-11



Segment 10-Cesium-137
Well 199-H4-12A

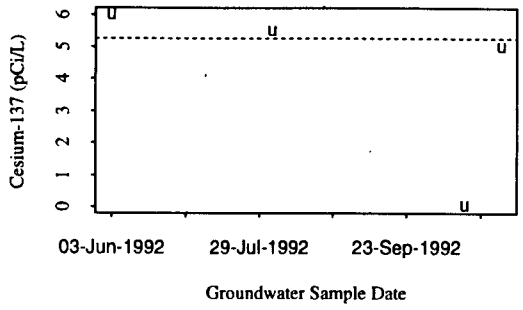


Segment 10-Cesium-137
Well 199-H4-12B

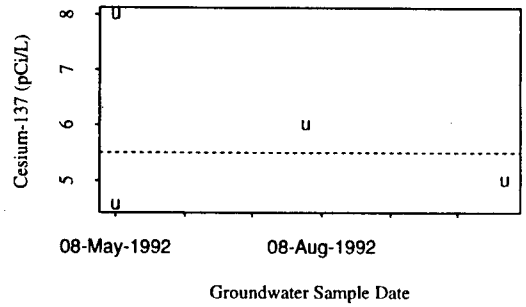


9313148.1601

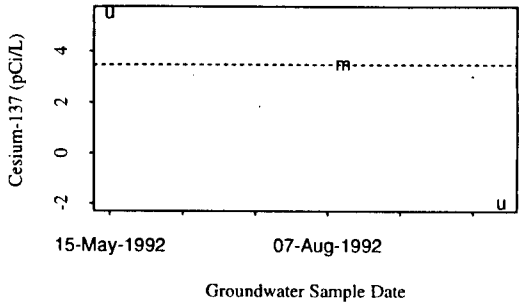
Segment 10-Cesium-137
Well 199-H4-45



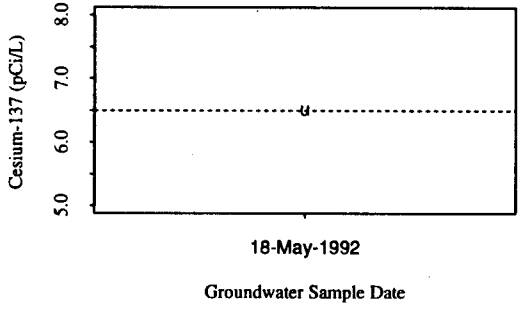
Segment 10-Cesium-137
Well 199-H4-47



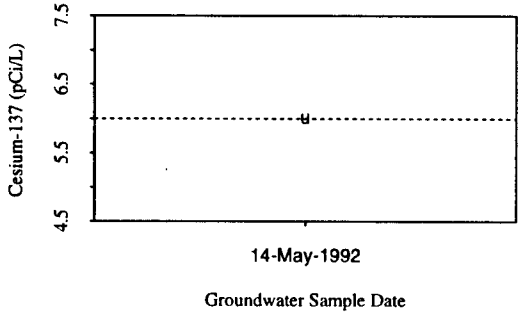
Segment 10-Cesium-137
Well 199-H4-5



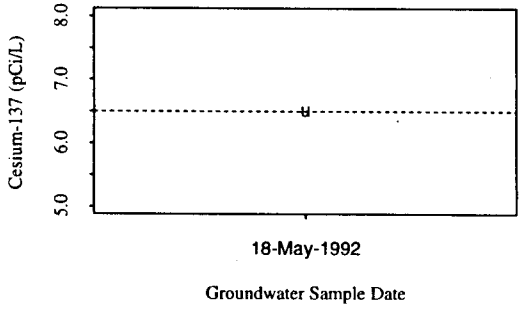
Segment 10-Cesium-137
Well 199-H4-7



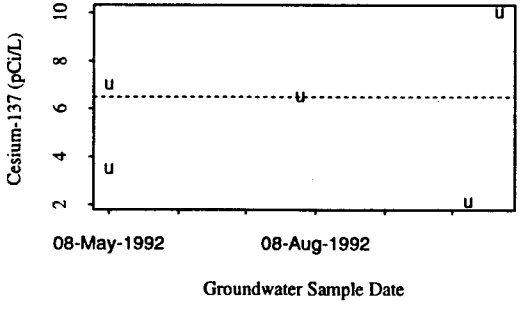
Segment 10-Cesium-137
Well 199-H4-8



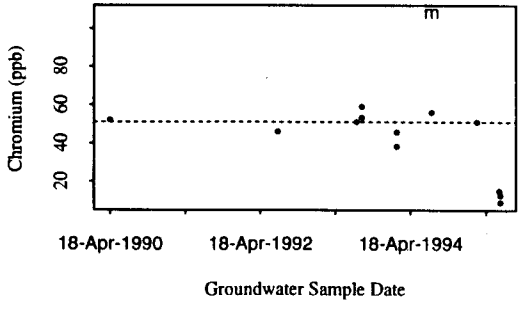
Segment 10-Cesium-137
Well 199-H4-9



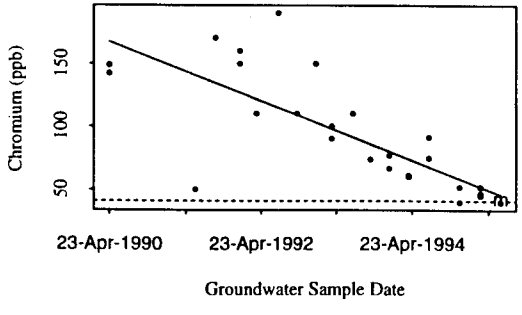
Segment 10-Cesium-137
Well 199-H6-1



Segment 10-Chromium
Well 199-H4-10

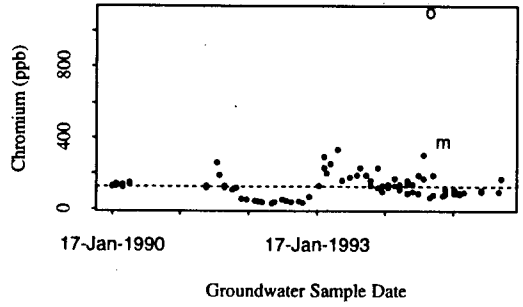


Segment 10-Chromium
Well 199-H4-11

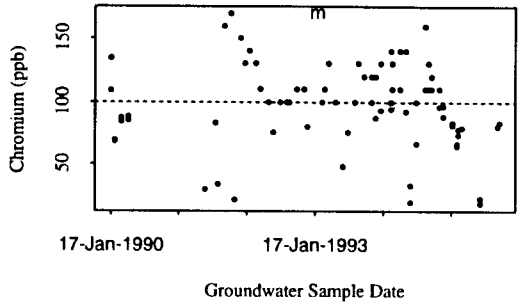


9413148.1692

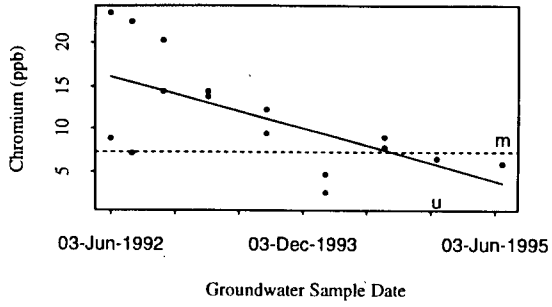
Segment 10-Chromium
Well 199-H4-3



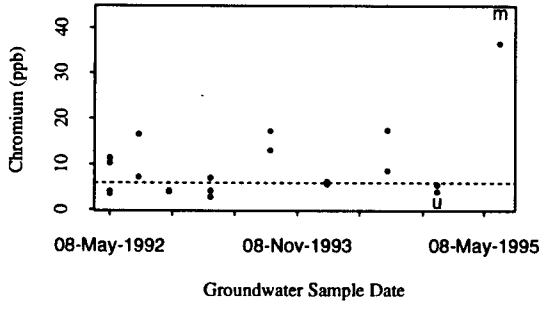
Segment 10-Chromium
Well 199-H4-4



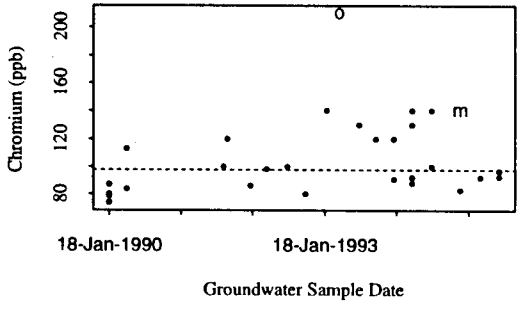
Segment 10-Chromium
Well 199-H4-45



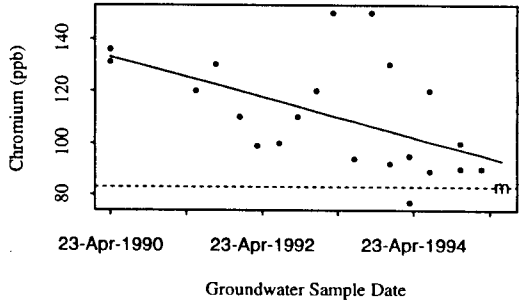
Segment 10-Chromium
Well 199-H4-47



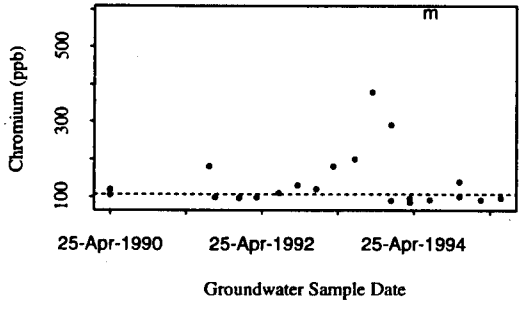
Segment 10-Chromium
Well 199-H4-5



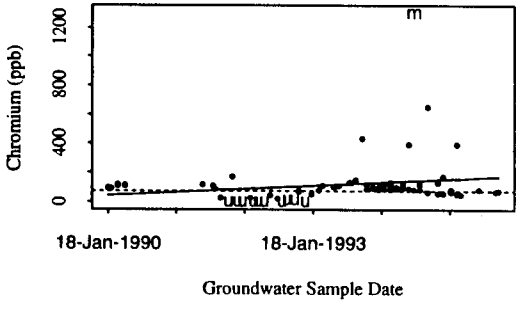
Segment 10-Chromium
Well 199-H4-7



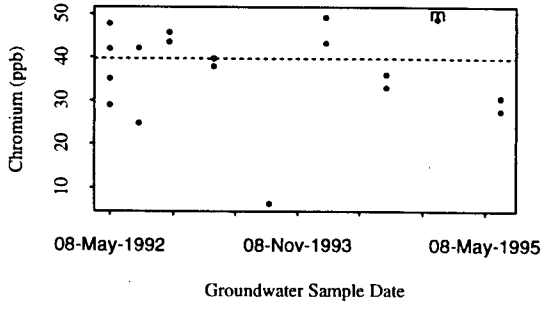
Segment 10-Chromium
Well 199-H4-8



Segment 10-Chromium
Well 199-H4-9

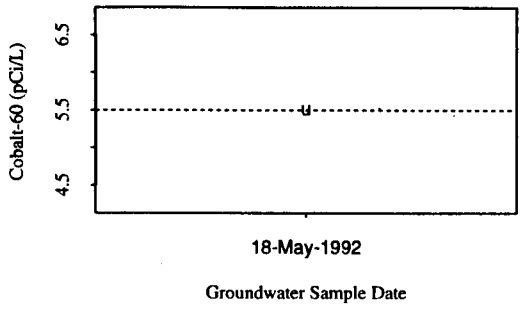


Segment 10-Chromium
Well 199-H6-1

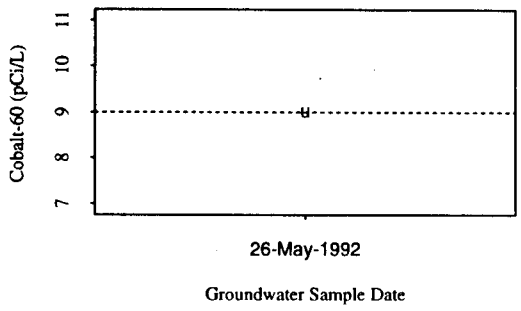


9613948.1653

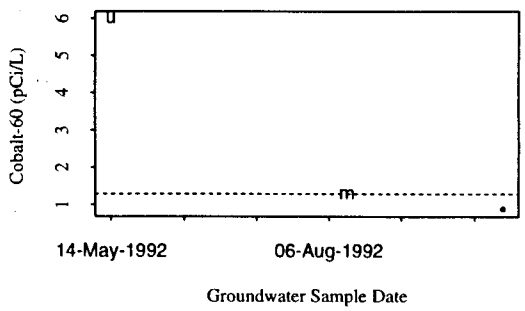
Segment 10-Cobalt-60
Well 199-H4-17



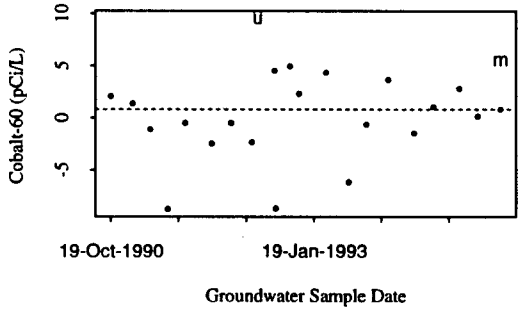
Segment 10-Cobalt-60
Well 199-H4-18



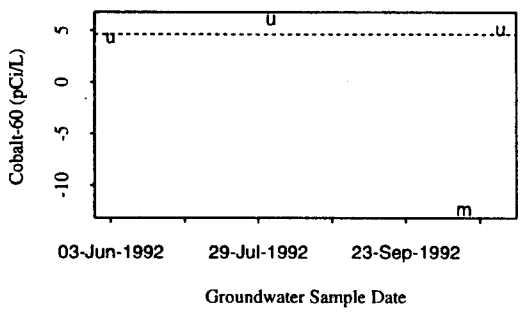
Segment 10-Cobalt-60
Well 199-H4-3



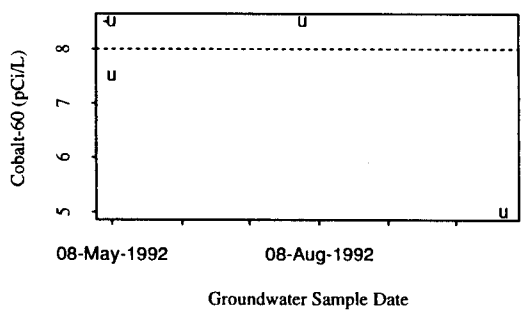
Segment 10-Cobalt-60
Well 199-H4-4



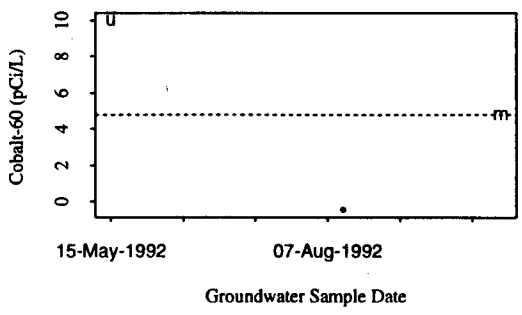
Segment 10-Cobalt-60
Well 199-H4-45



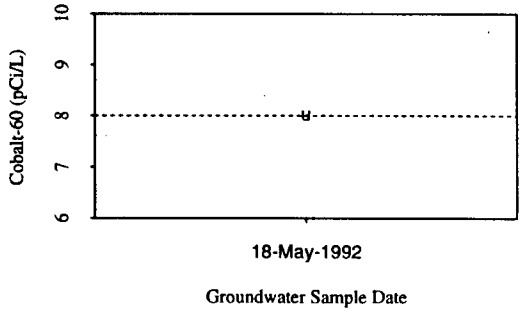
Segment 10-Cobalt-60
Well 199-H4-47



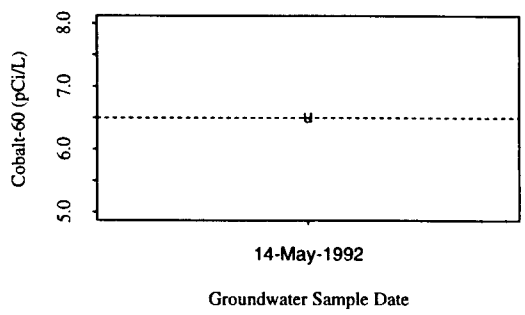
Segment 10-Cobalt-60
Well 199-H4-5



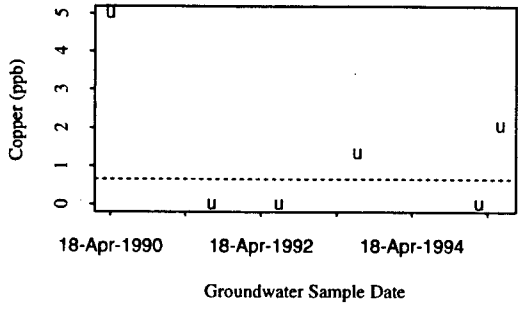
Segment 10-Cobalt-60
Well 199-H4-7



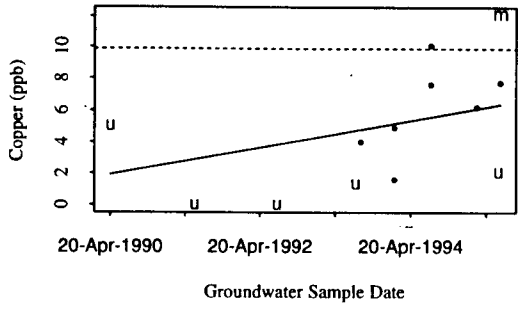
Segment 10-Cobalt-60
Well 199-H4-8



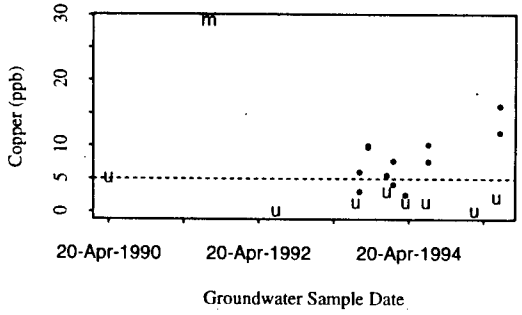
Segment 10-Copper
Well 199-H4-15B



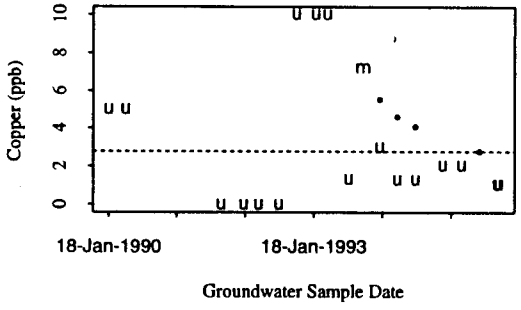
Segment 10-Copper
Well 199-H4-16



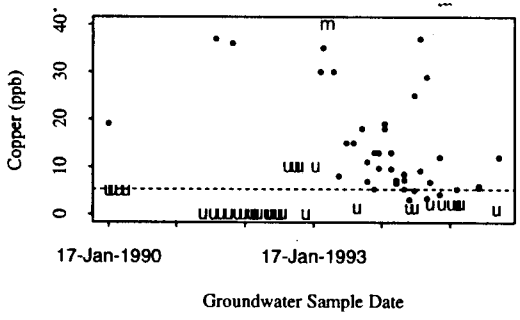
Segment 10-Copper
Well 199-H4-17



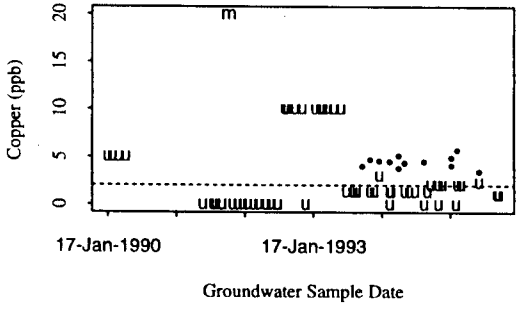
Segment 10-Copper
Well 199-H4-18



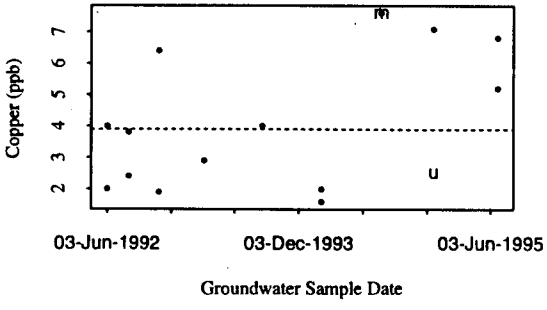
Segment 10-Copper
Well 199-H4-3



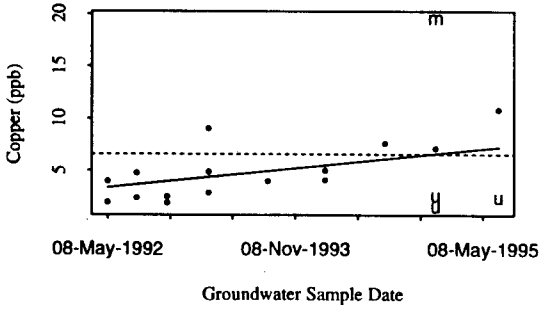
Segment 10-Copper
Well 199-H4-4



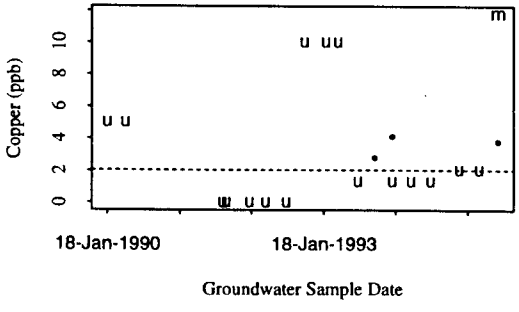
Segment 10-Copper
Well 199-H4-45



Segment 10-Copper
Well 199-H4-47

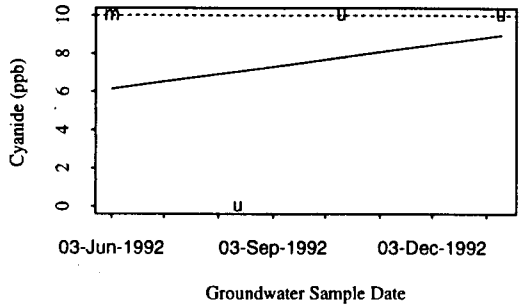


Segment 10-Copper
Well 199-H4-5

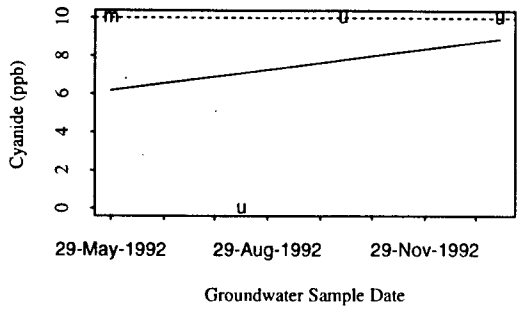


9413148.1065

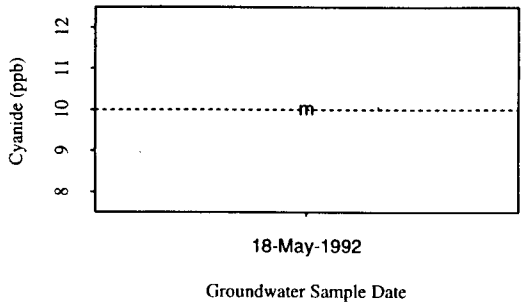
Segment 10-Cyanide
Well 199-H4-14



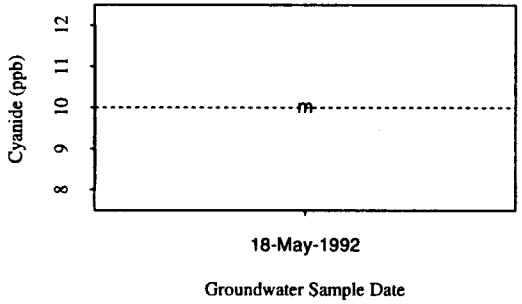
Segment 10-Cyanide
Well 199-H4-15A



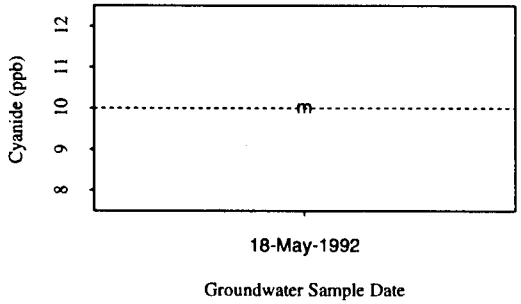
Segment 10-Cyanide
Well 199-H4-15B



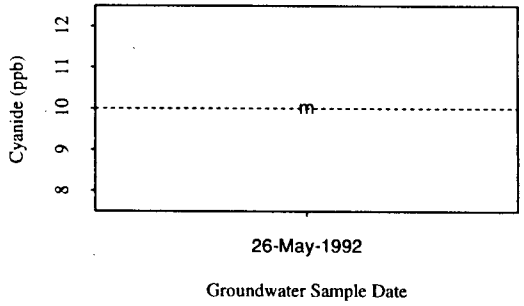
Segment 10-Cyanide
Well 199-H4-16



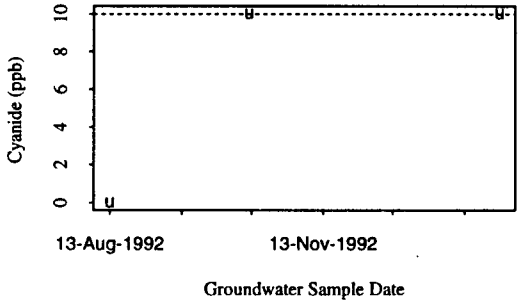
Segment 10-Cyanide
Well 199-H4-17



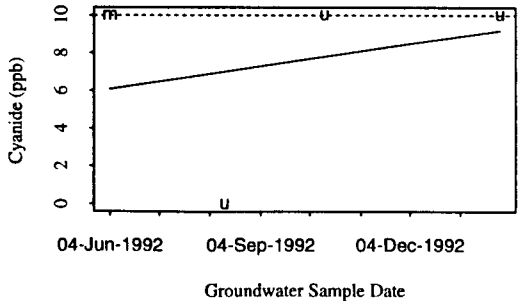
Segment 10-Cyanide
Well 199-H4-18



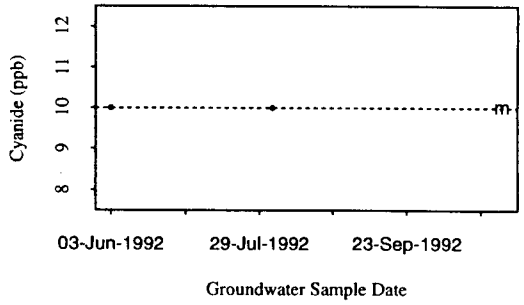
Segment 10-Cyanide
Well 199-H4-3



Segment 10-Cyanide
Well 199-H4-4

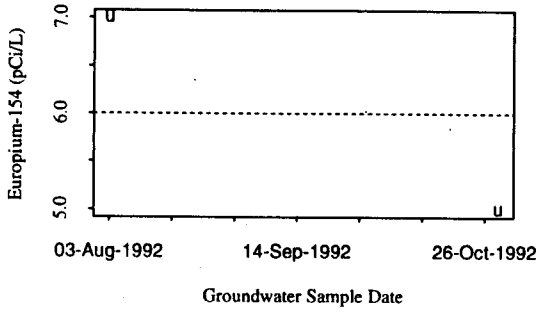


Segment 10-Cyanide
Well 199-H4-45

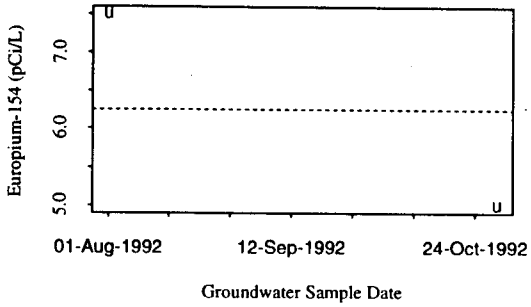


9612148.1066

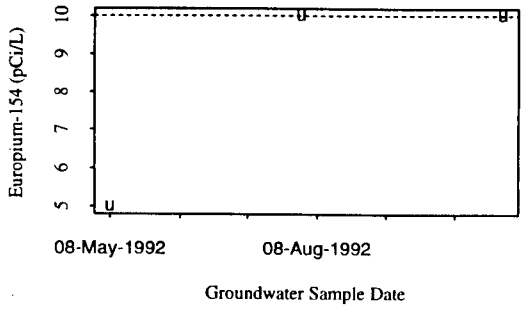
Segment 10-Europium-154
Well 199-H4-45



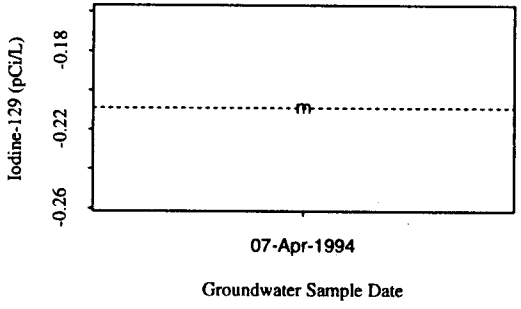
Segment 10-Europium-154
Well 199-H4-47



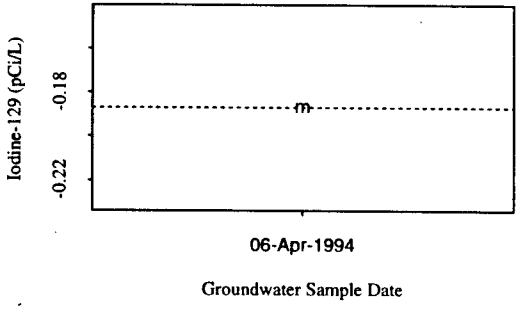
Segment 10-Europium-154
Well 199-H6-1



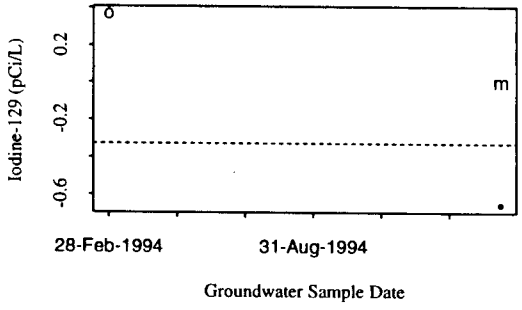
Segment 10-Iodine-129
Well 199-H4-12A



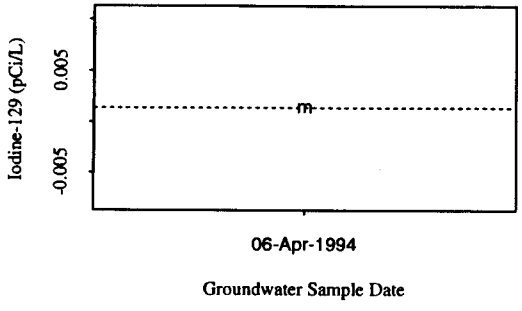
Segment 10-Iodine-129
Well 199-H4-12B



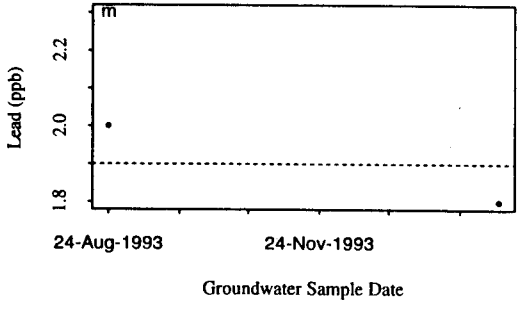
Segment 10-Iodine-129
Well 199-H4-4



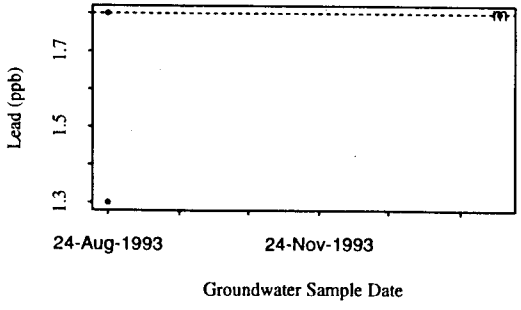
Segment 10-Iodine-129
Well 199-H6-1



Segment 10-Lead
Well 199-H4-10

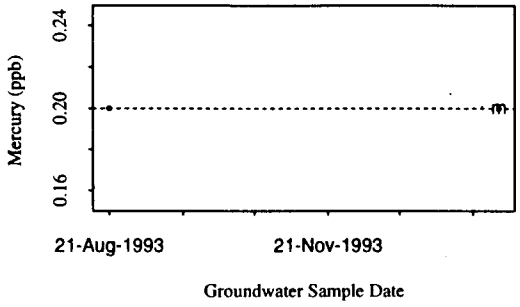


Segment 10-Lead
Well 199-H4-13

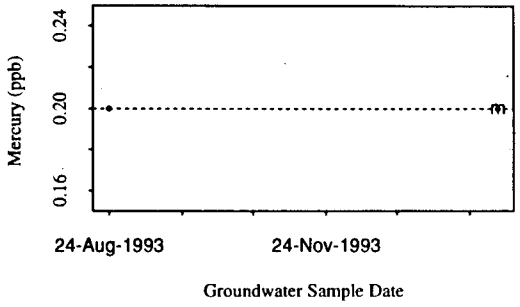


9413146.1667

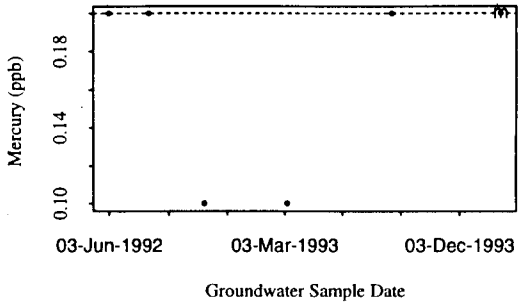
Segment 10-Mercury
Well 199-H4-16



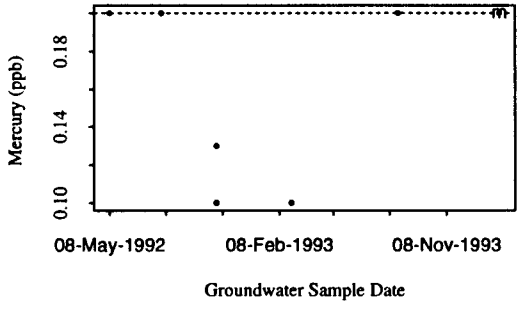
Segment 10-Mercury
Well 199-H4-17



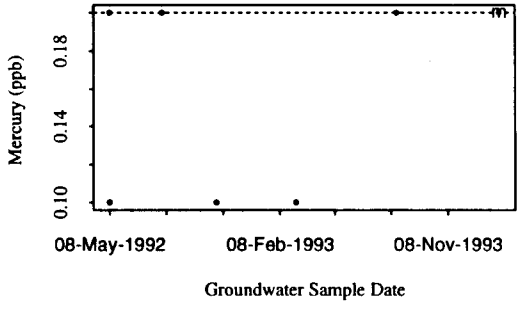
Segment 10-Mercury
Well 199-H4-45



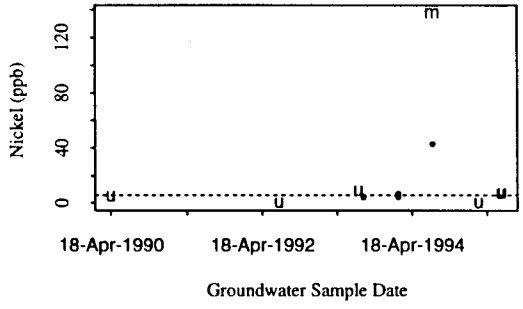
Segment 10-Mercury
Well 199-H4-47



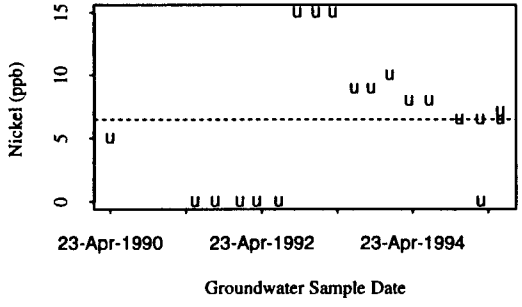
Segment 10-Mercury
Well 199-H6-1



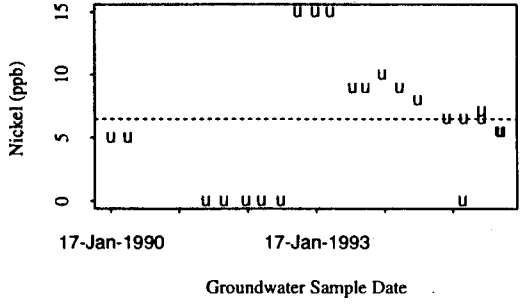
Segment 10-Nickel
Well 199-H4-10



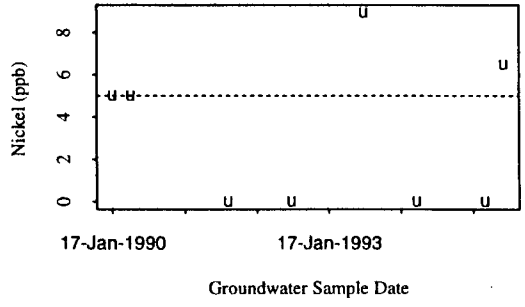
Segment 10-Nickel
Well 199-H4-11



Segment 10-Nickel
Well 199-H4-12A

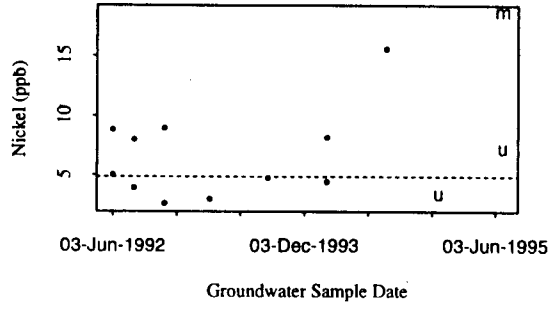


Segment 10-Nickel
Well 199-H4-12B

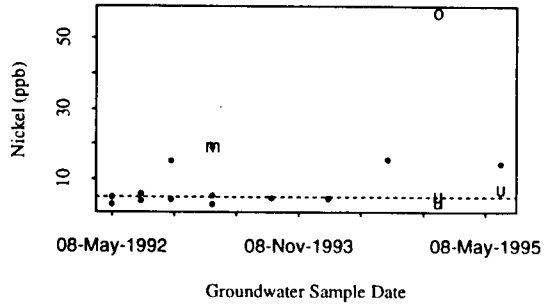


9613948.1038

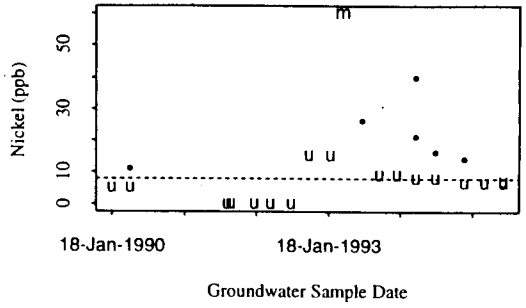
Segment 10-Nickel
Well 199-H4-45



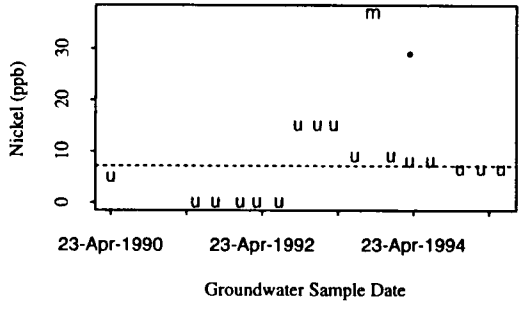
Segment 10-Nickel
Well 199-H4-47



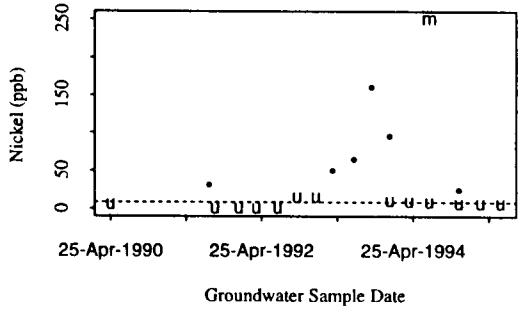
Segment 10-Nickel
Well 199-H4-5



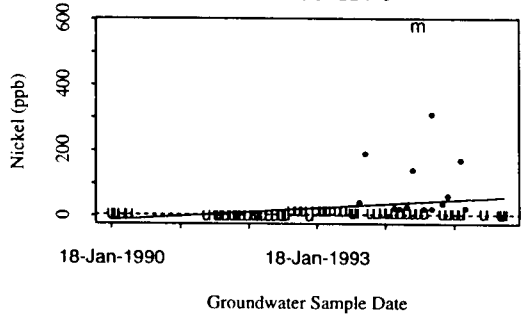
Segment 10-Nickel
Well 199-H4-7



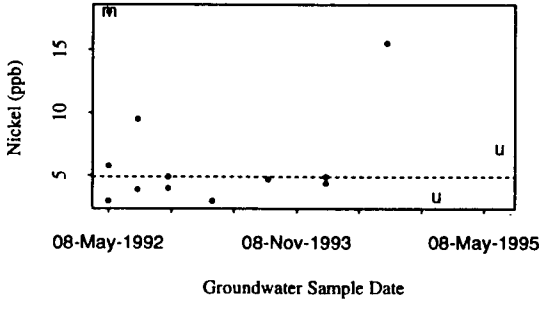
Segment 10-Nickel
Well 199-H4-8



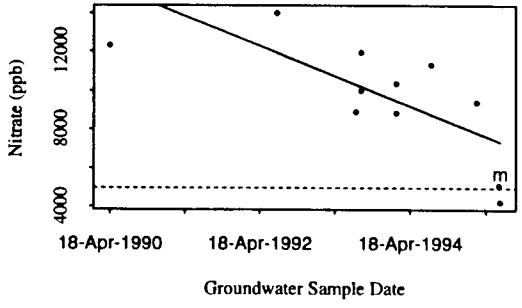
Segment 10-Nickel
Well 199-H4-9



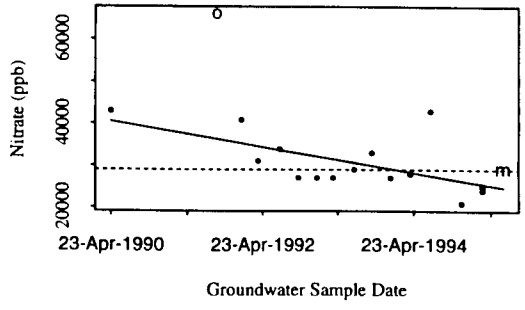
Segment 10-Nickel
Well 199-H6-1



Segment 10-Nitrate
Well 199-H4-10

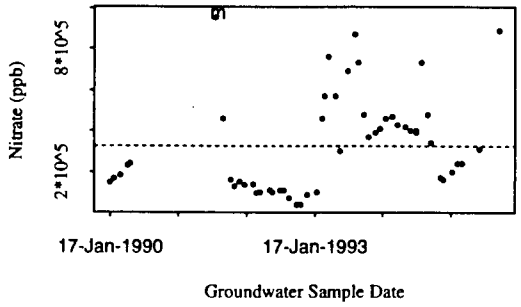


Segment 10-Nitrate
Well 199-H4-11

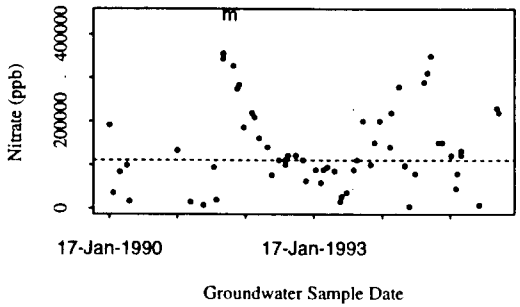


9639148.1069

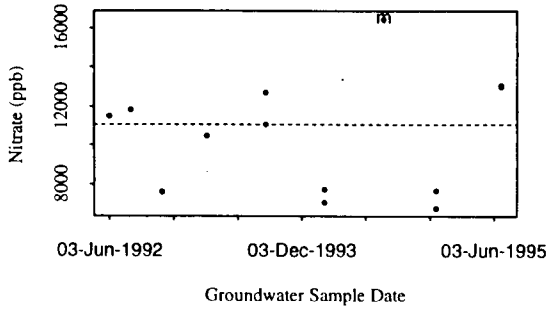
Segment 10-Nitrate
Well 199-H4-3



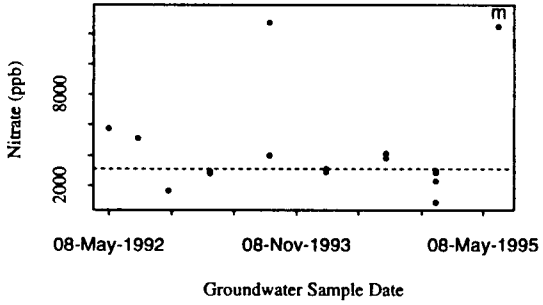
Segment 10-Nitrate
Well 199-H4-4



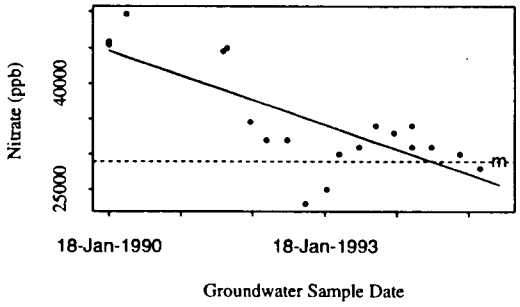
Segment 10-Nitrate
Well 199-H4-45



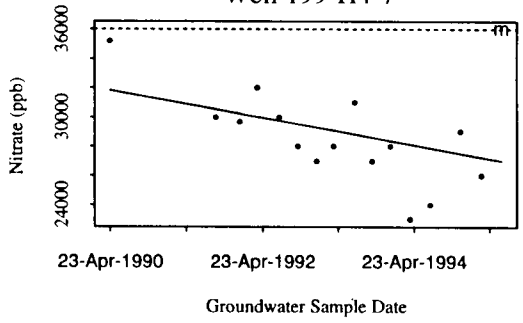
Segment 10-Nitrate
Well 199-H4-47



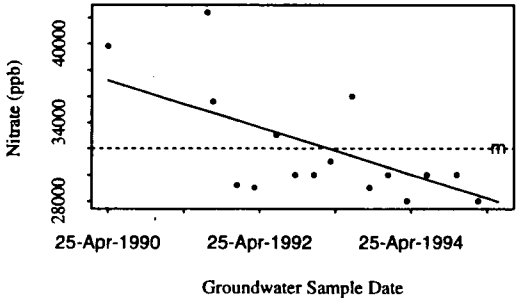
Segment 10-Nitrate
Well 199-H4-5



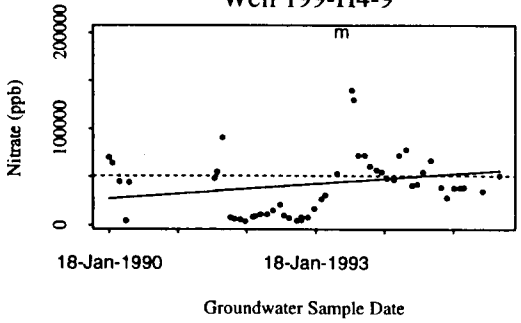
Segment 10-Nitrate
Well 199-H4-7



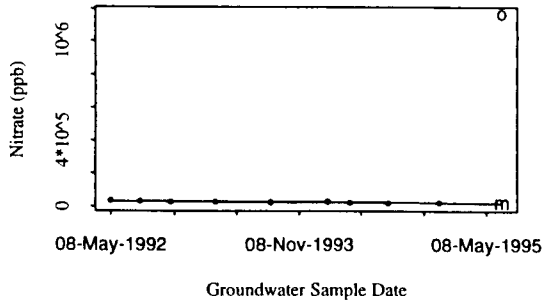
Segment 10-Nitrate
Well 199-H4-8



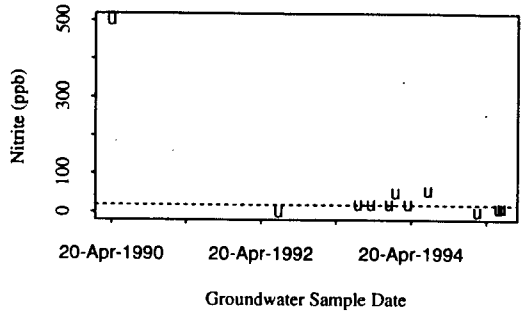
Segment 10-Nitrate
Well 199-H4-9



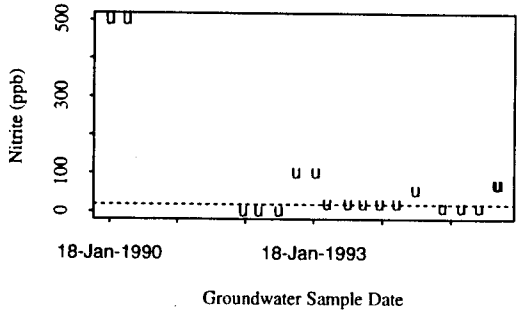
Segment 10-Nitrate
Well 199-H6-1



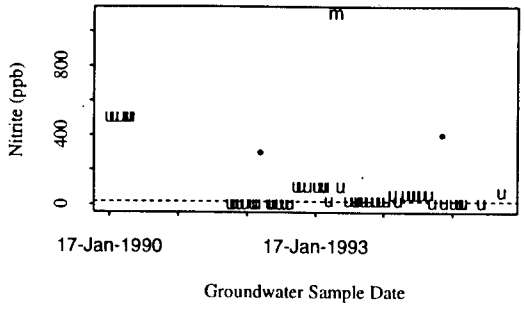
Segment 10-Nitrite
Well 199-H4-17



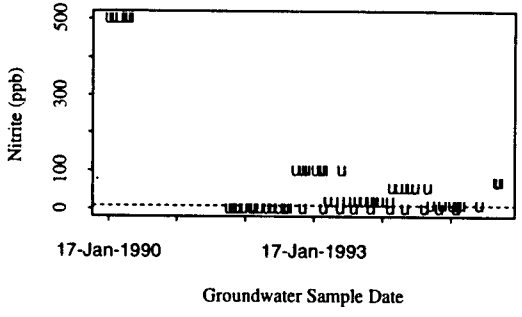
Segment 10-Nitrite
Well 199-H4-18



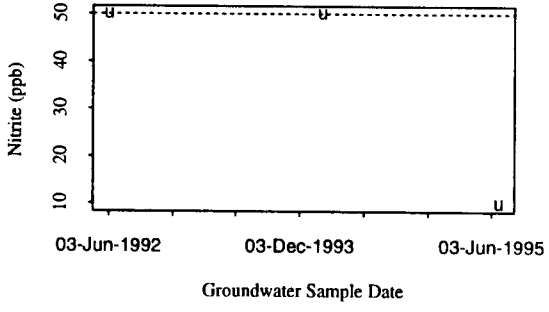
Segment 10-Nitrite
Well 199-H4-3



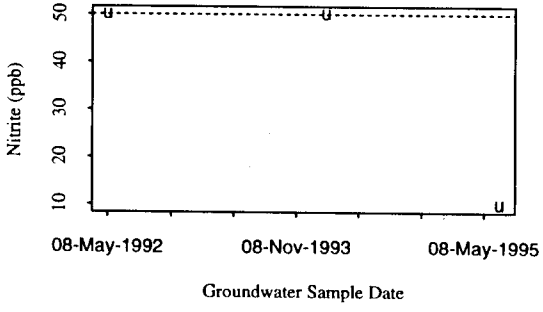
Segment 10-Nitrite
Well 199-H4-4



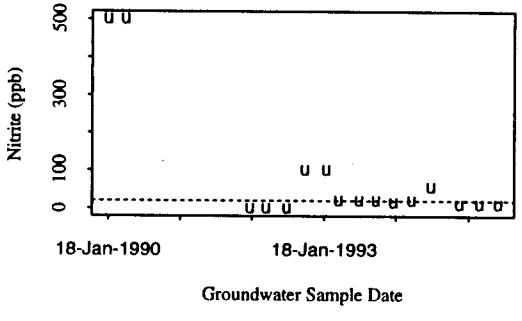
Segment 10-Nitrite
Well 199-H4-45



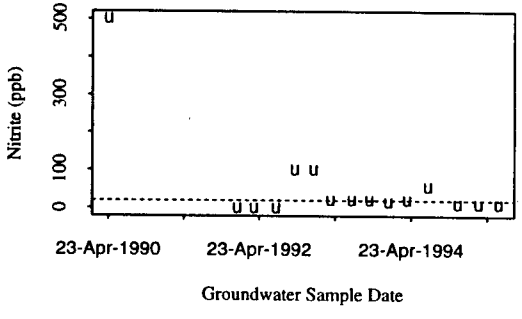
Segment 10-Nitrite
Well 199-H4-47



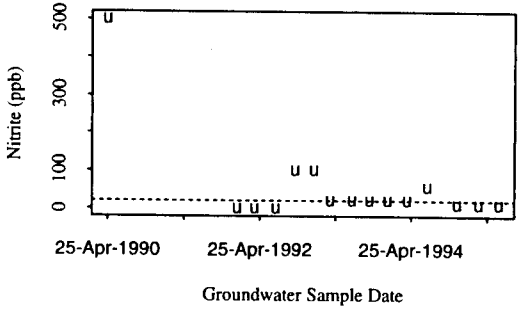
Segment 10-Nitrite
Well 199-H4-5



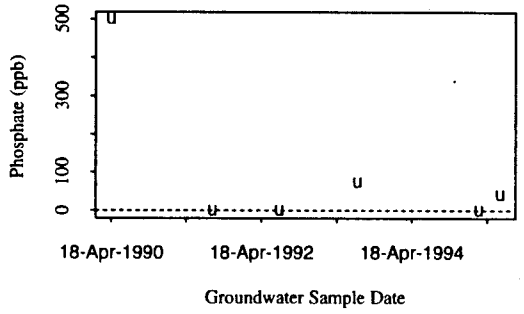
Segment 10-Nitrite
Well 199-H4-7



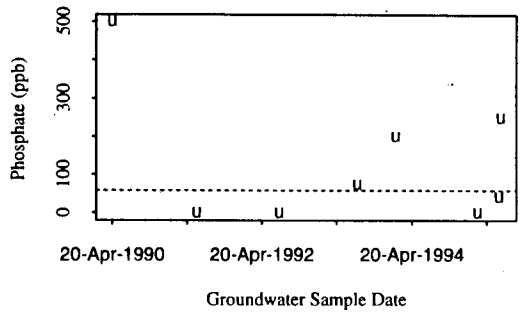
Segment 10-Nitrite
Well 199-H4-8



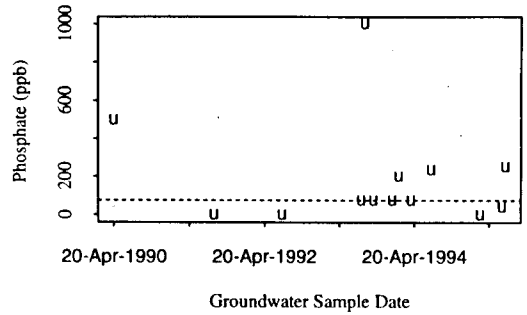
Segment 10-Phosphate
Well 199-H4-15B



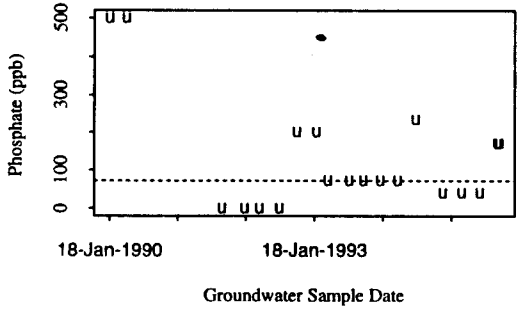
Segment 10-Phosphate
Well 199-H4-16



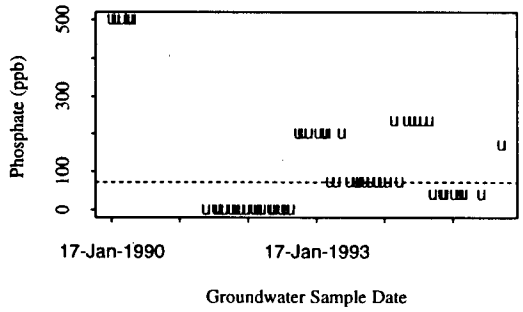
Segment 10-Phosphate
Well 199-H4-17



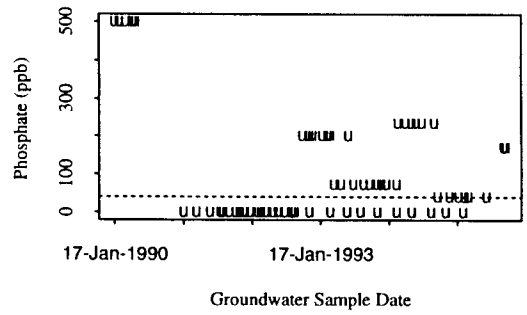
Segment 10-Phosphate
Well 199-H4-18



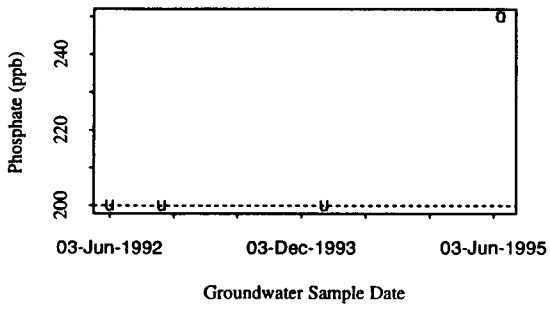
Segment 10-Phosphate
Well 199-H4-3



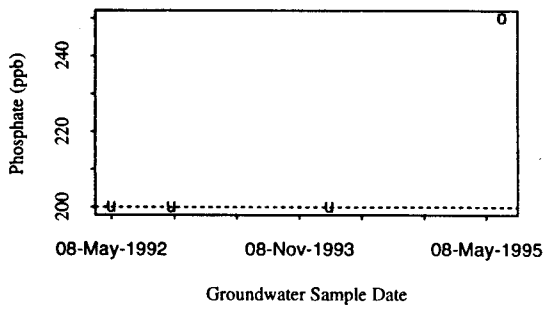
Segment 10-Phosphate
Well 199-H4-4



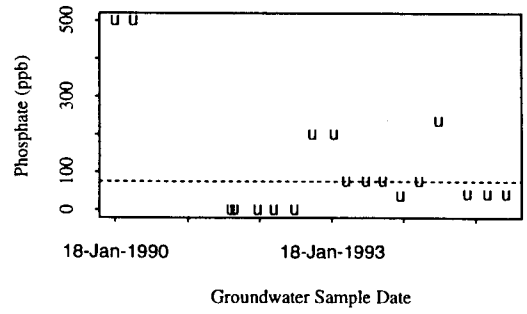
Segment 10-Phosphate
Well 199-H4-45



Segment 10-Phosphate
Well 199-H4-47

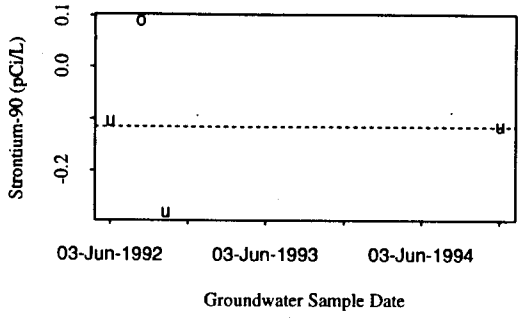


Segment 10-Phosphate
Well 199-H4-5

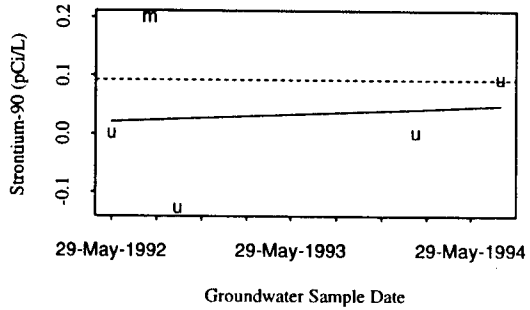


9413148.1072

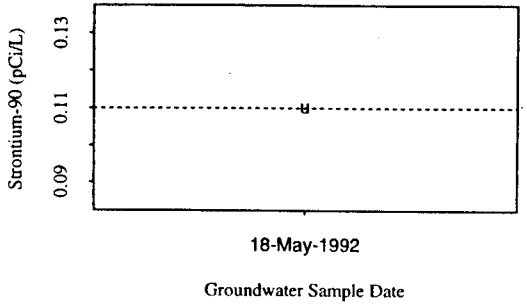
Segment 10-Strontium-90
Well 199-H4-14



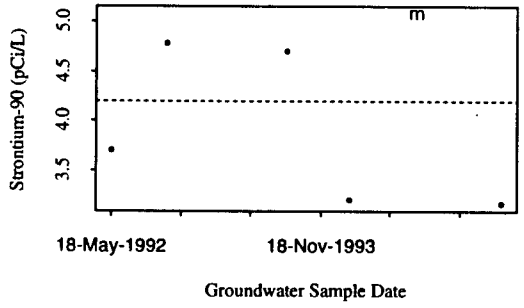
Segment 10-Strontium-90
Well 199-H4-15A



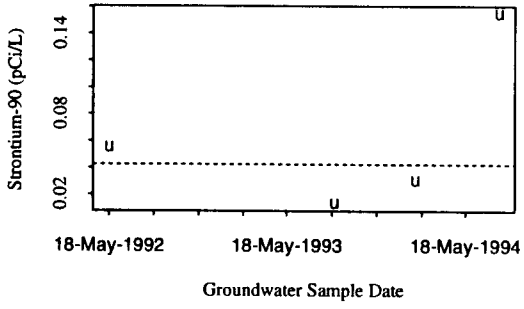
Segment 10-Strontium-90
Well 199-H4-15B



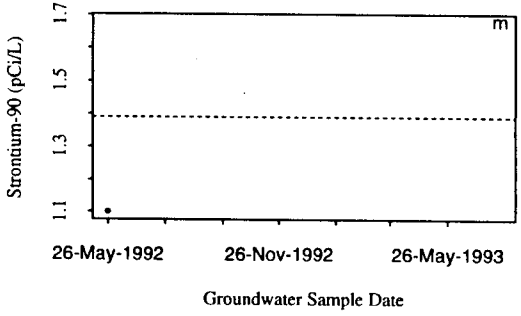
Segment 10-Strontium-90
Well 199-H4-16



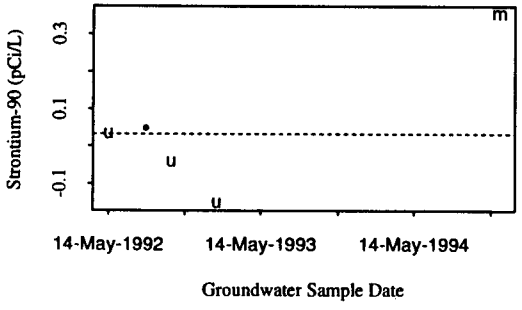
Segment 10-Strontium-90
Well 199-H4-17



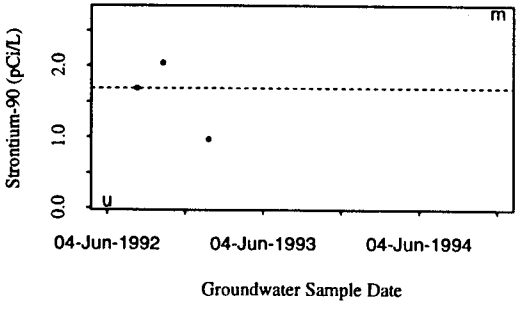
Segment 10-Strontium-90
Well 199-H4-18



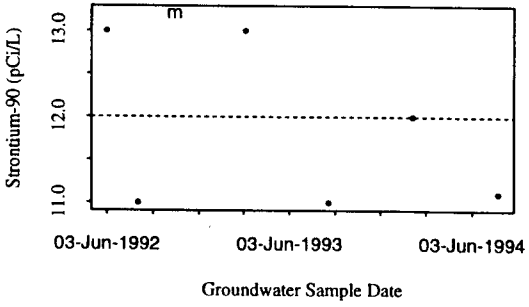
Segment 10-Strontium-90
Well 199-H4-3



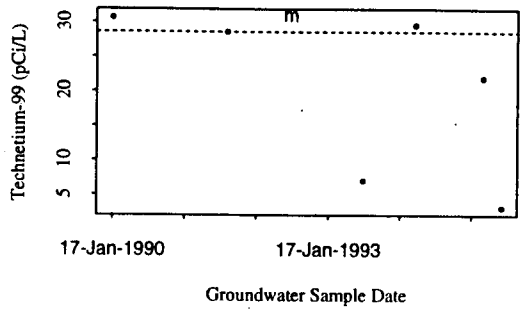
Segment 10-Strontium-90
Well 199-H4-4



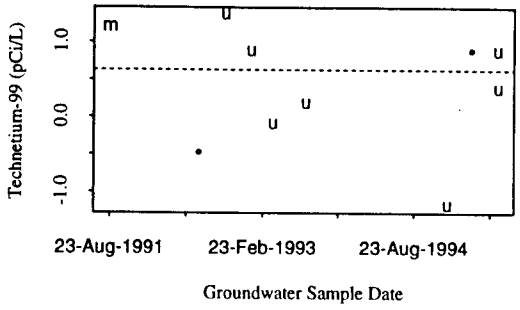
Segment 10-Strontium-90
Well 199-H4-45



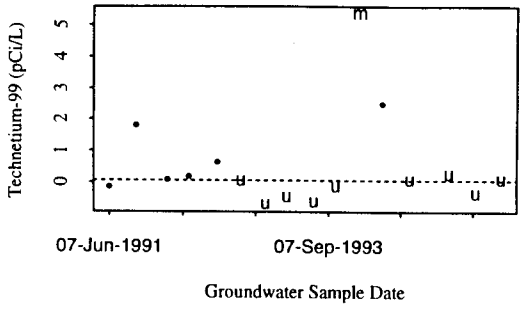
Segment 10-Technetium-99
Well 199-H4-12B



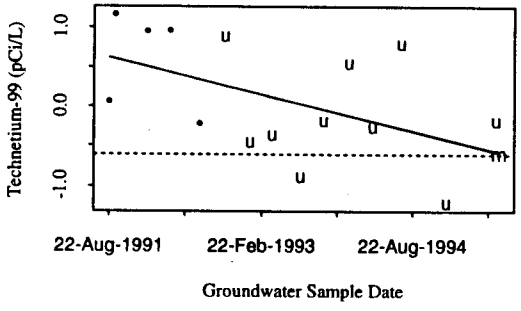
Segment 10-Technetium-99
Well 199-H4-13



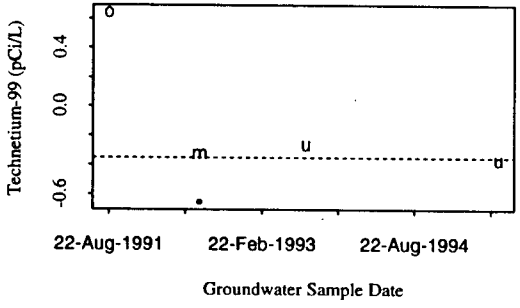
Segment 10-Technetium-99
Well 199-H4-14



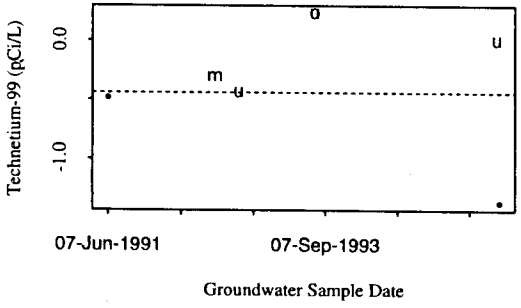
Segment 10-Technetium-99
Well 199-H4-15A



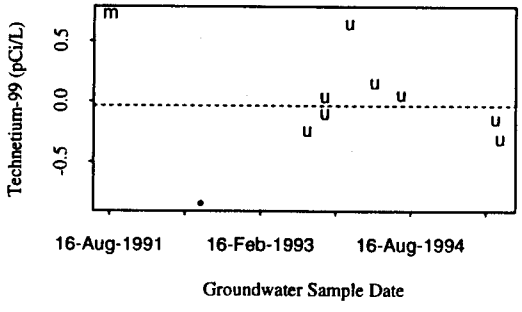
Segment 10-Technetium-99
Well 199-H4-15B



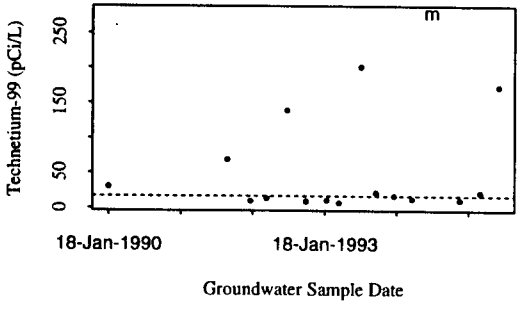
Segment 10-Technetium-99
Well 199-H4-16



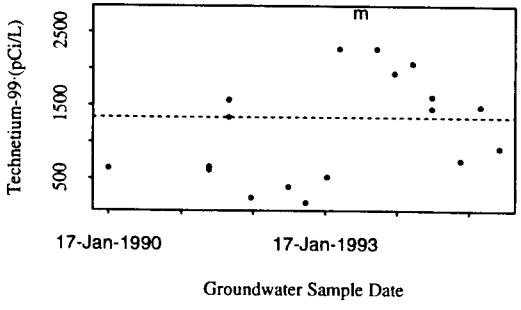
Segment 10-Technetium-99
Well 199-H4-17



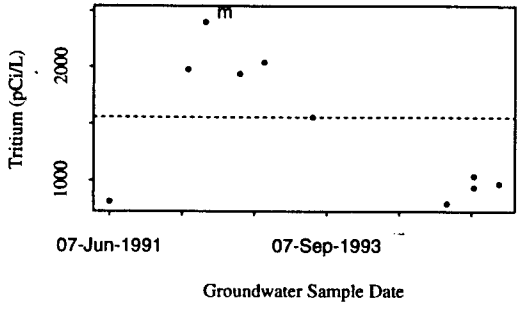
Segment 10-Technetium-99
Well 199-H4-18



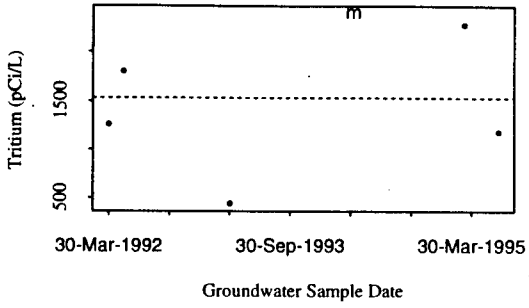
Segment 10-Technetium-99
Well 199-H4-3



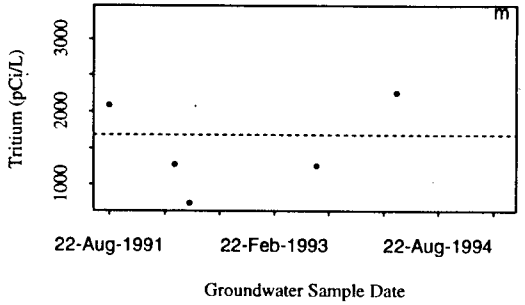
Segment 10-Tritium
Well 199-H4-11



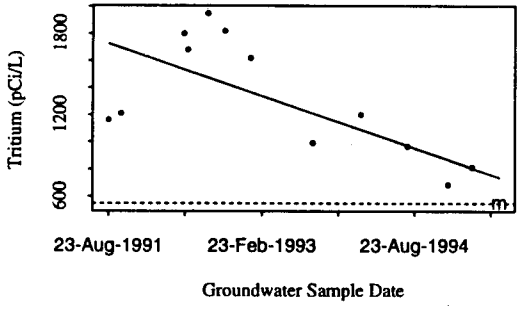
Segment 10-Tritium
Well 199-H4-12A



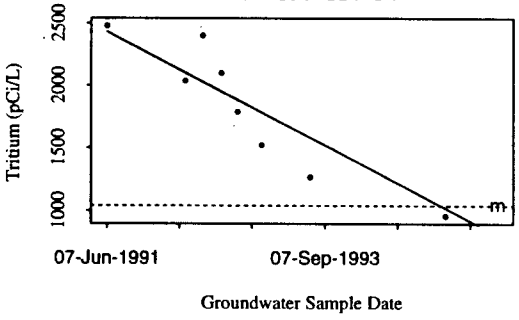
Segment 10-Tritium
Well 199-H4-12B



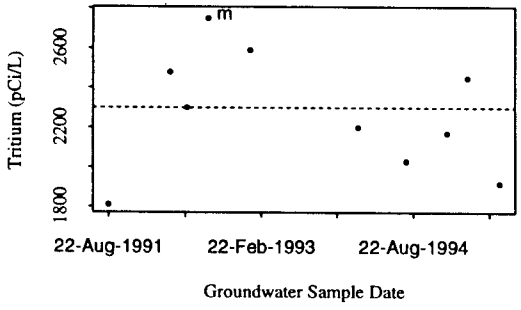
Segment 10-Tritium
Well 199-H4-13



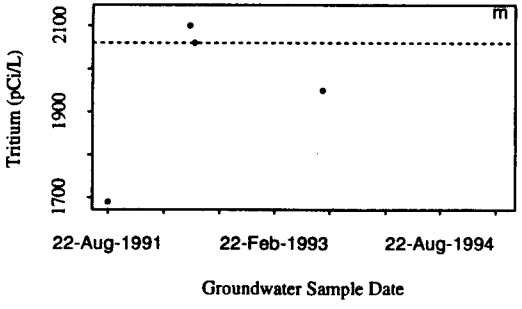
Segment 10-Tritium
Well 199-H4-14



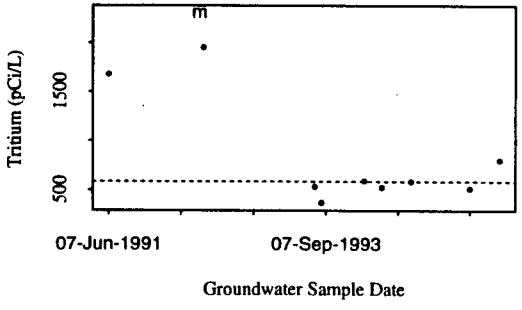
Segment 10-Tritium
Well 199-H4-15A



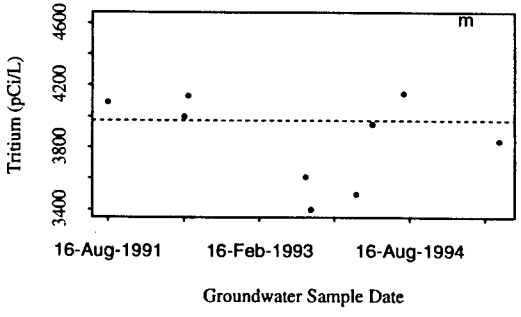
Segment 10-Tritium
Well 199-H4-15B



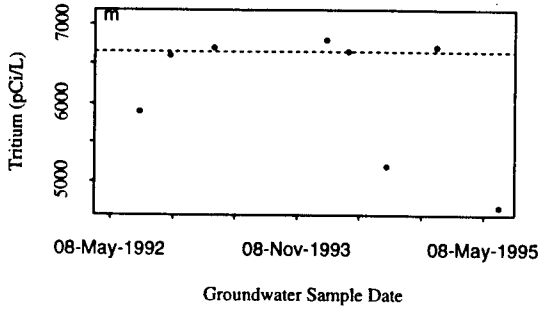
Segment 10-Tritium
Well 199-H4-16



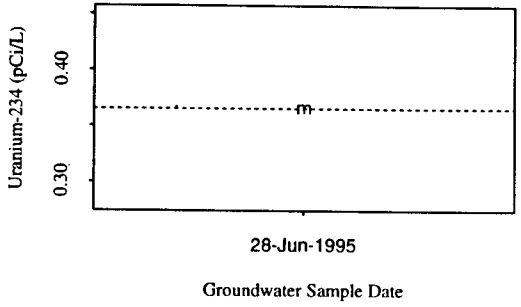
Segment 10-Tritium
Well 199-H4-17



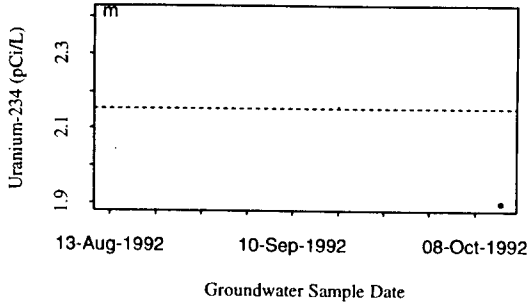
Segment 10-Tritium
Well 199-H6-1



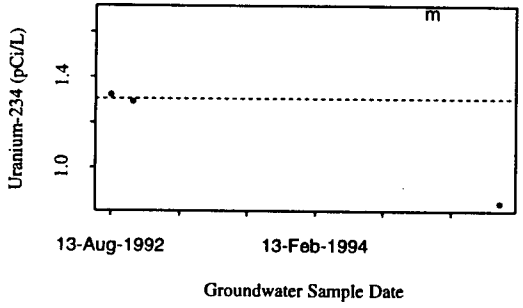
Segment 10-Uranium-234
Well 199-H4-10



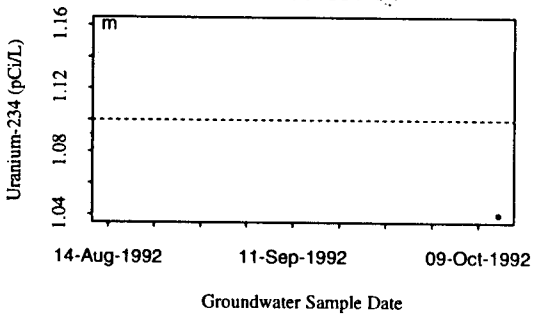
Segment 10-Uranium-234
Well 199-H4-11



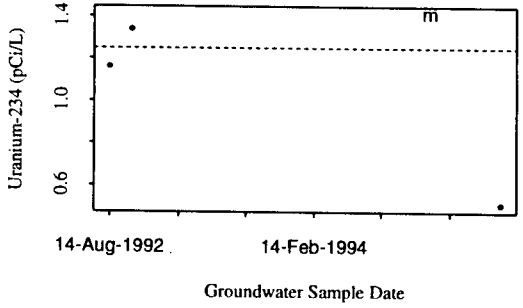
Segment 10-Uranium-234
Well 199-H4-13



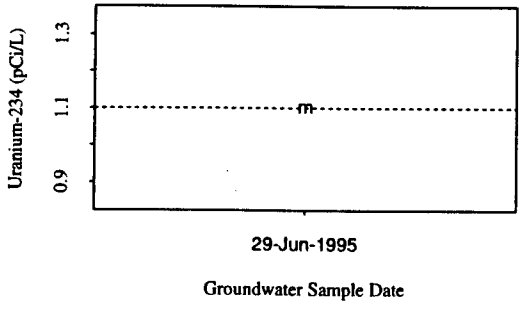
Segment 10-Uranium-234
Well 199-H4-14



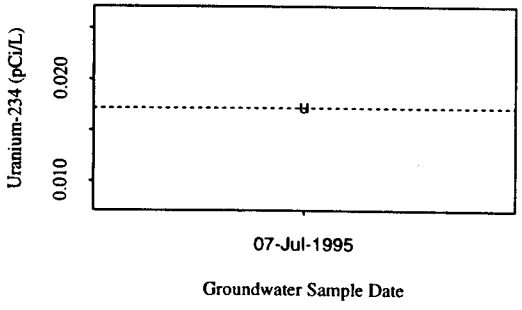
Segment 10-Uranium-234
Well 199-H4-15A



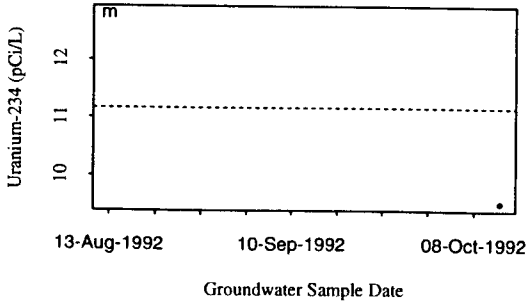
Segment 10-Uranium-234
Well 199-H4-16



Segment 10-Uranium-234
Well 199-H4-17

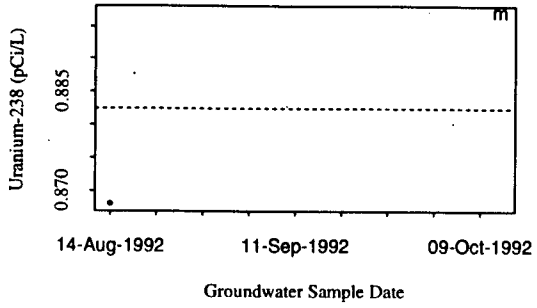


Segment 10-Uranium-234
Well 199-H4-3

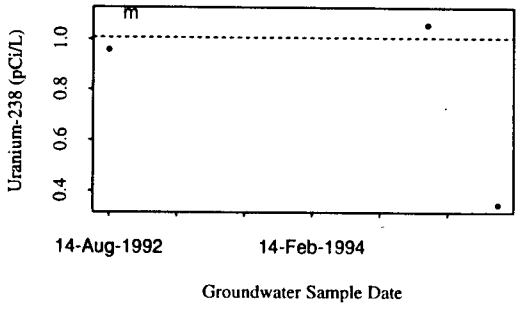


9613148.1676

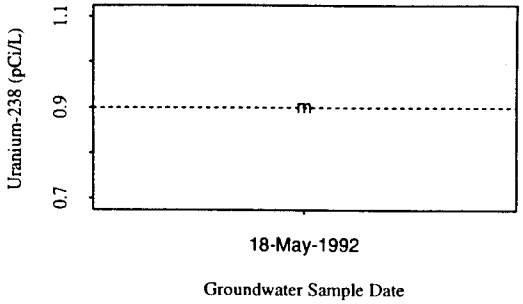
Segment 10-Uranium-238
Well 199-H4-14



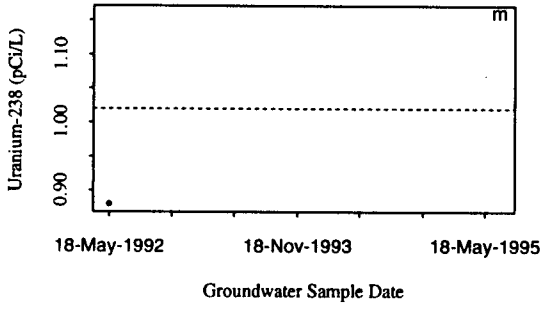
Segment 10-Uranium-238
Well 199-H4-15A



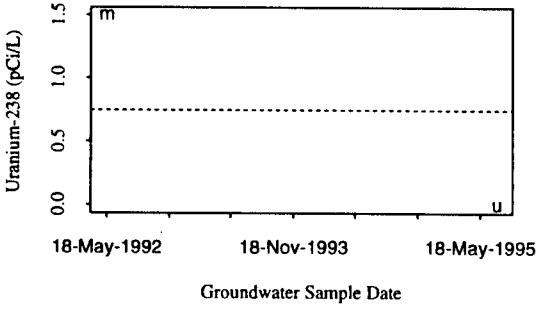
Segment 10-Uranium-238
Well 199-H4-15B



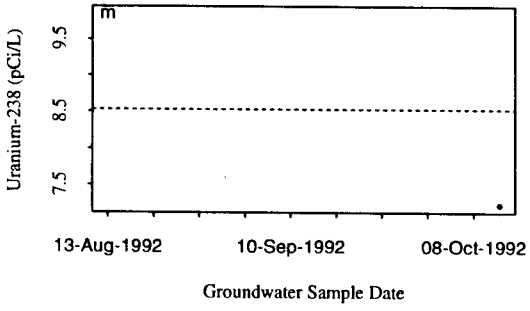
Segment 10-Uranium-238
Well 199-H4-16



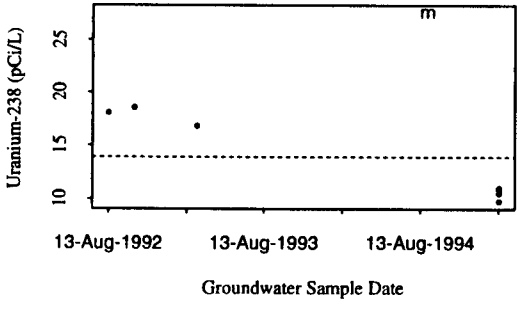
Segment 10-Uranium-238
Well 199-H4-17



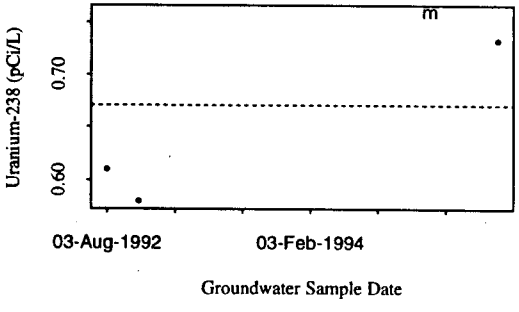
Segment 10-Uranium-238
Well 199-H4-3



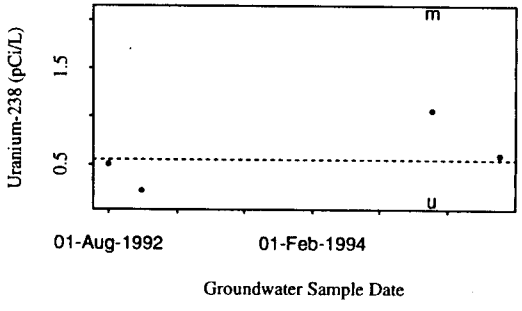
Segment 10-Uranium-238
Well 199-H4-4



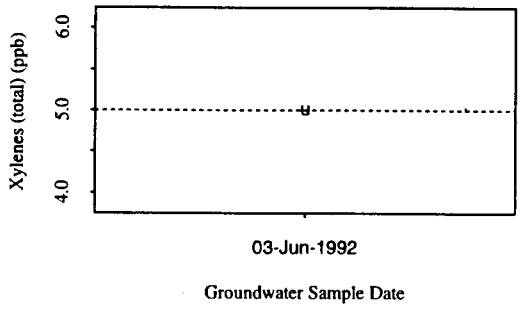
Segment 10-Uranium-238
Well 199-H4-45



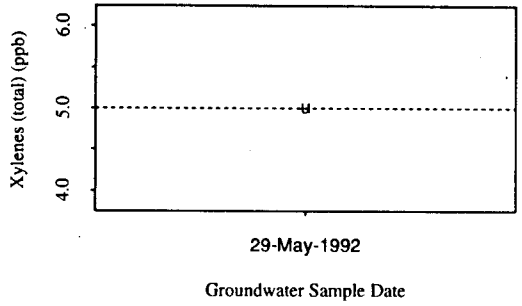
Segment 10-Uranium-238
Well 199-H4-47



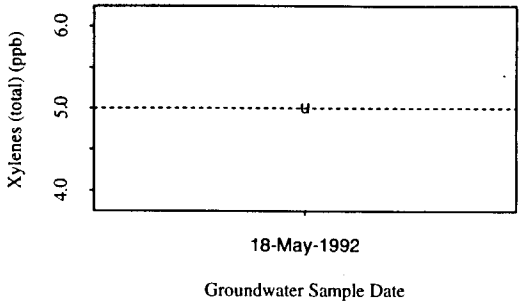
Segment 10-Xylenes (total)
Well 199-H4-14



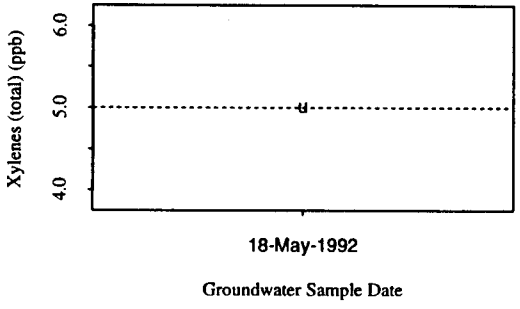
Segment 10-Xylenes (total)
Well 199-H4-15A



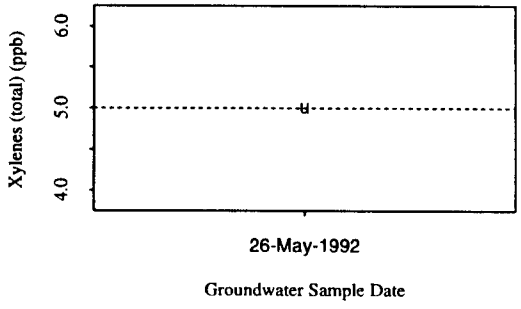
Segment 10-Xylenes (total)
Well 199-H4-16



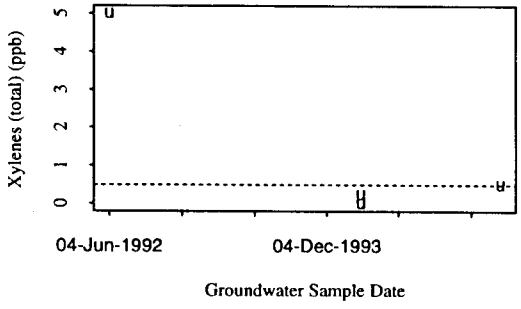
Segment 10-Xylenes (total)
Well 199-H4-17



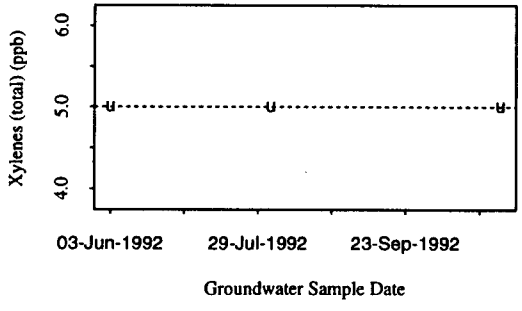
Segment 10-Xylenes (total)
Well 199-H4-18



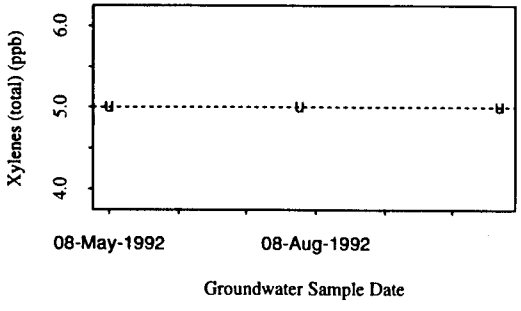
Segment 10-Xylenes (total)
Well 199-H4-4



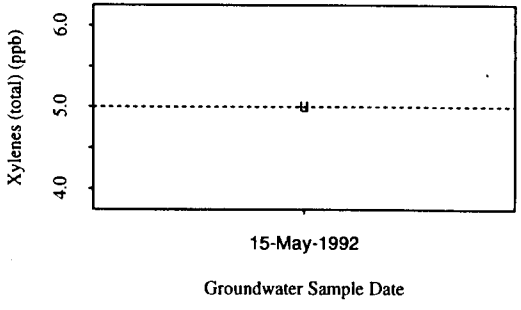
Segment 10-Xylenes (total)
Well 199-H4-45



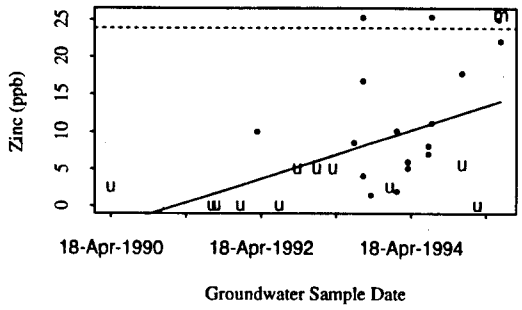
Segment 10-Xylenes (total)
Well 199-H4-47



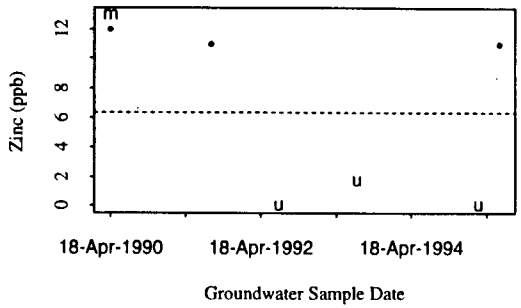
Segment 10-Xylenes (total)
Well 199-H4-5



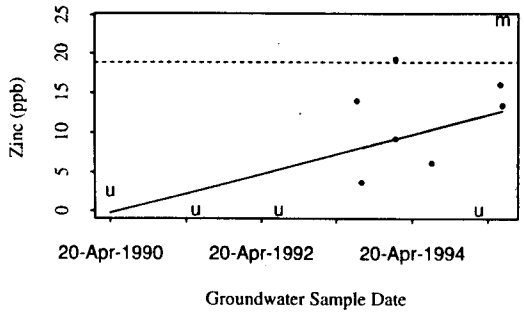
Segment 10-Zinc
Well 199-H4-15A



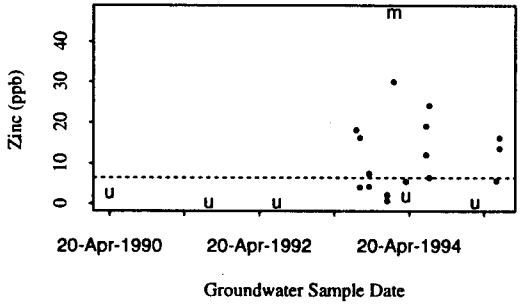
Segment 10-Zinc
Well 199-H4-15B



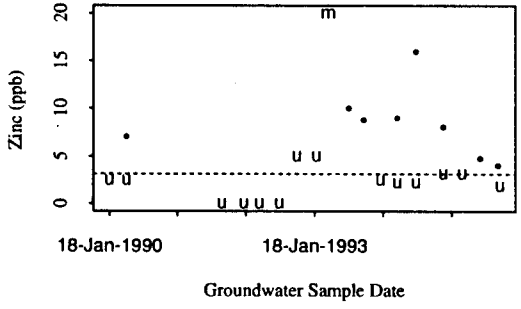
Segment 10-Zinc
Well 199-H4-16



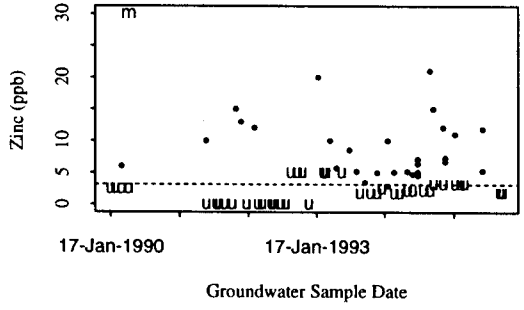
Segment 10-Zinc
Well 199-H4-17



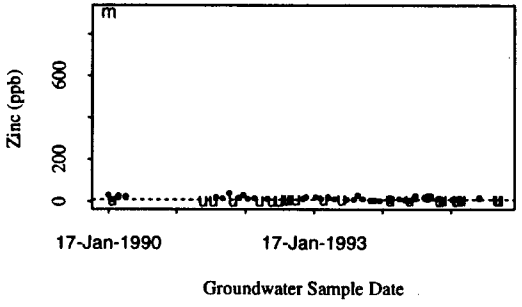
Segment 10-Zinc
Well 199-H4-18



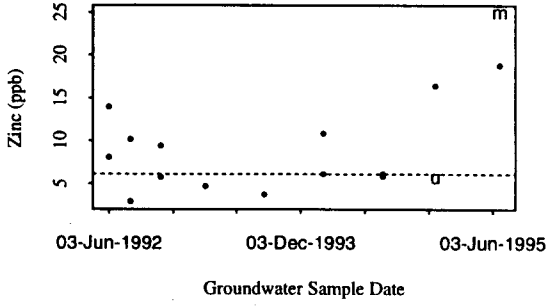
Segment 10-Zinc
Well 199-H4-3



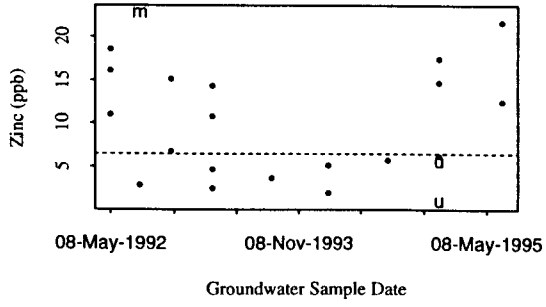
Segment 10-Zinc
Well 199-H4-4



Segment 10-Zinc
Well 199-H4-45

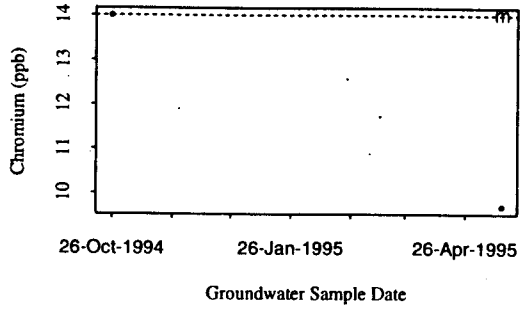


Segment 10-Zinc
Well 199-H4-47

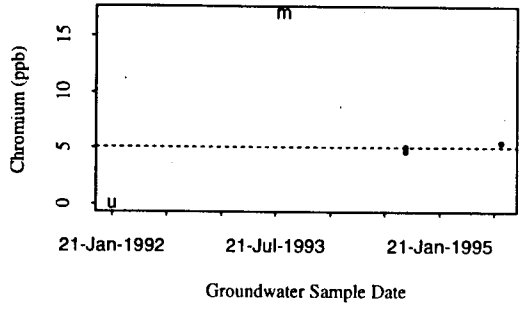


9613448.1679

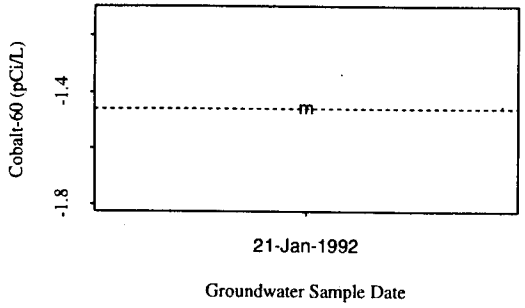
Segment 12-Chromium
Well 699-84-35A



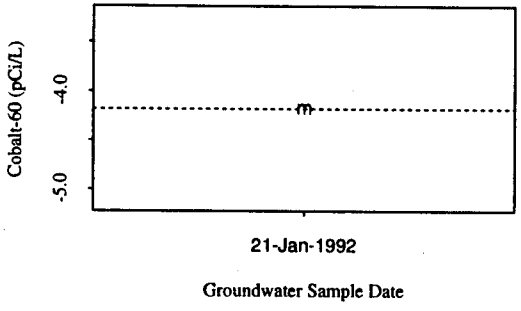
Segment 12-Chromium
Well 699-89-35



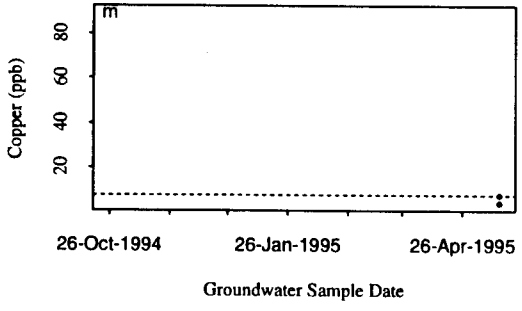
Segment 12-Cobalt-60
Well 699-84-35A



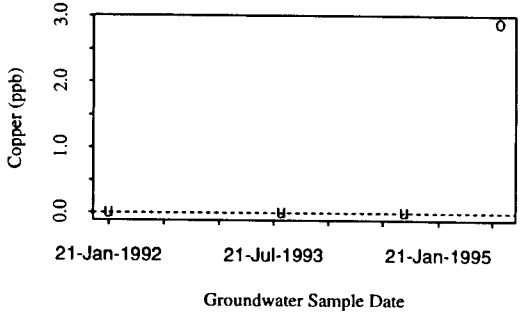
Segment 12-Cobalt-60
Well 699-89-35



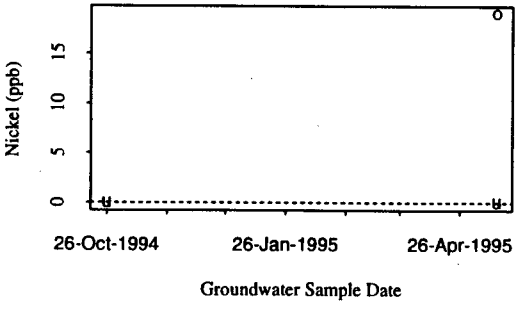
Segment 12-Copper
Well 699-84-35A



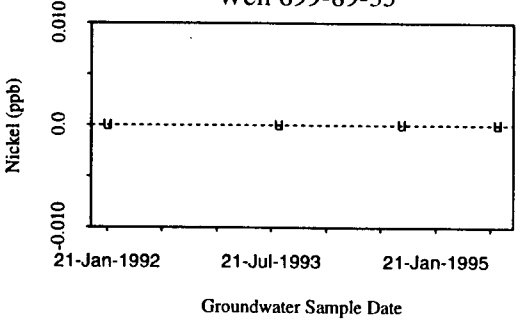
Segment 12-Copper
Well 699-89-35



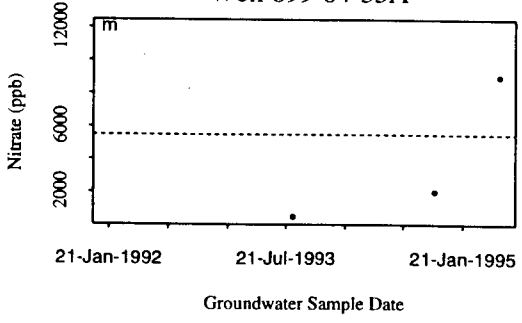
Segment 12-Nickel
Well 699-84-35A



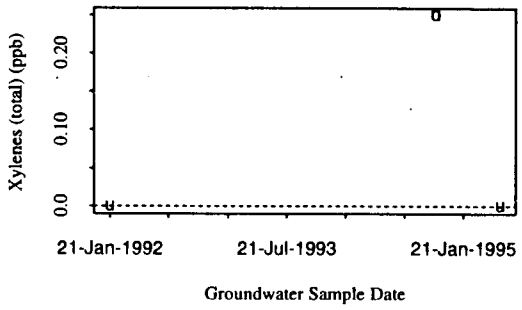
Segment 12-Nickel
Well 699-89-35



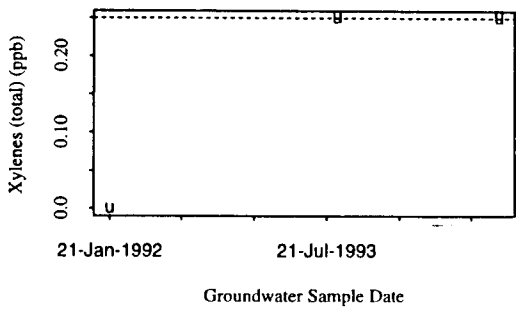
Segment 12-Nitrate
Well 699-84-35A



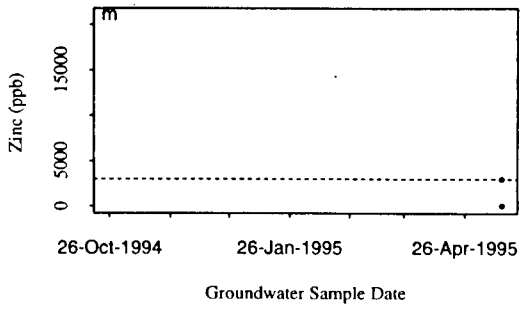
Segment 12-Xylenes (total)
Well 699-84-35A



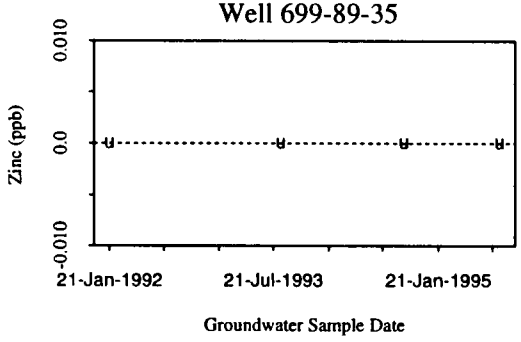
Segment 12-Xylenes (total)
Well 699-89-35



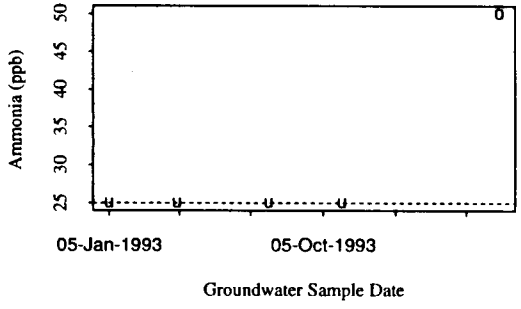
Segment 12-Zinc
Well 699-84-35A



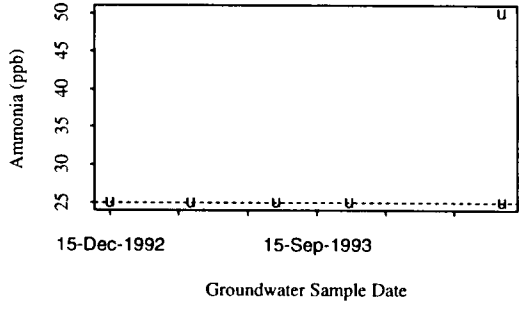
Segment 12-Zinc
Well 699-89-35



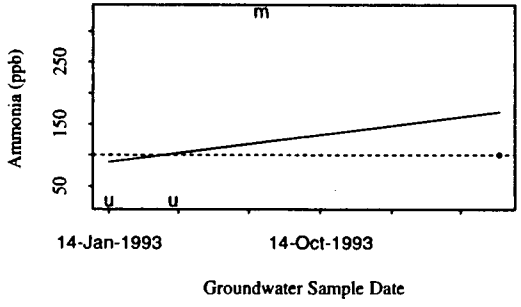
Segment 13-Ammonia
Well 199-F1-2



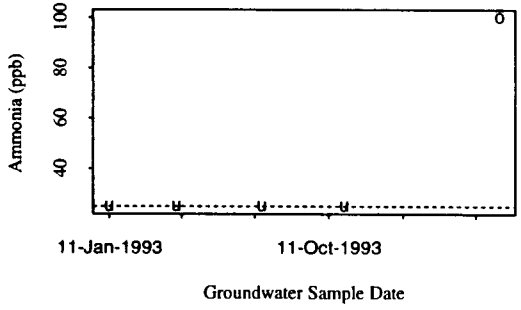
Segment 13-Ammonia
Well 199-F5-1



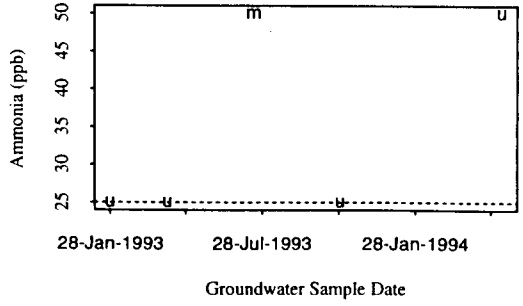
Segment 13-Ammonia
Well 199-F5-3



Segment 13-Ammonia
Well 199-F5-42

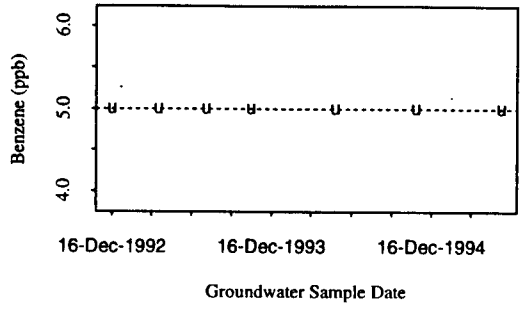


Segment 13-Ammonia
Well 199-F5-43A

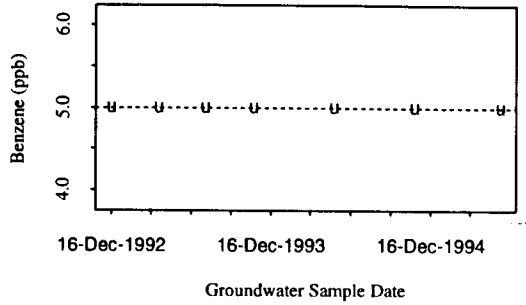


9413148.1031

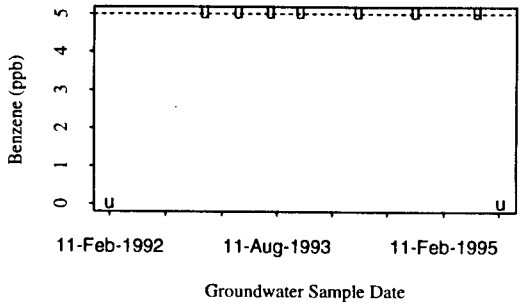
Segment 13-Benzene
Well 199-F5-44



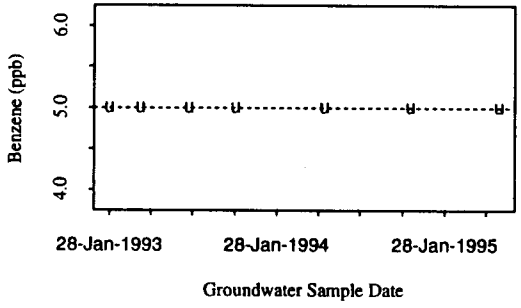
Segment 13-Benzene
Well 199-F5-46



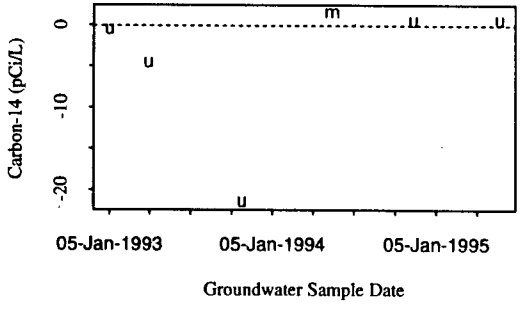
Segment 13-Benzene
Well 199-F5-6



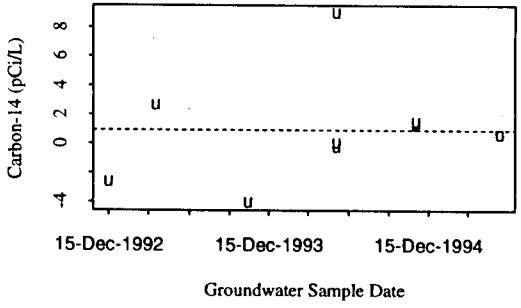
Segment 13-Benzene
Well 199-F6-1



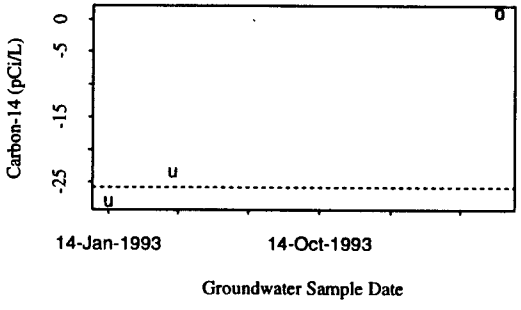
Segment 13-Carbon-14
Well 199-F1-2



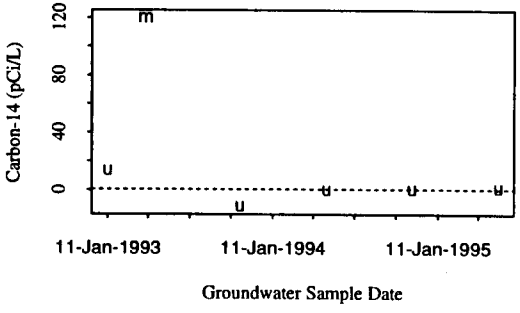
Segment 13-Carbon-14
Well 199-F5-1



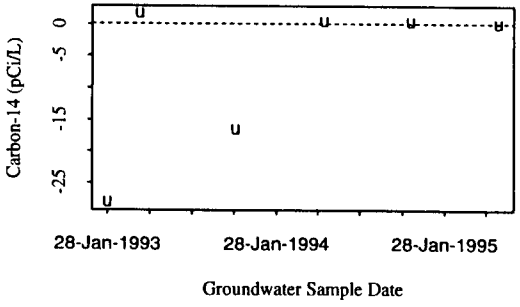
Segment 13-Carbon-14
Well 199-F5-3



Segment 13-Carbon-14
Well 199-F5-42

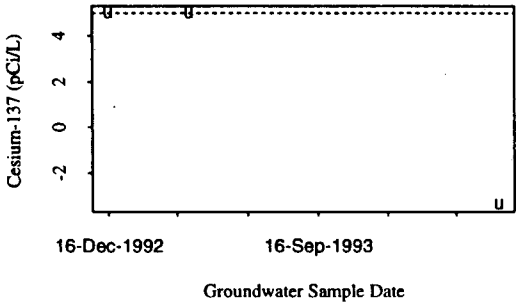


Segment 13-Carbon-14
Well 199-F5-43A

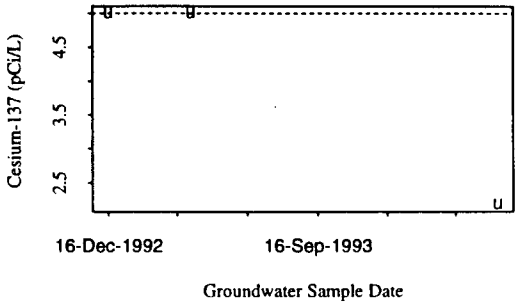


9613448.1662

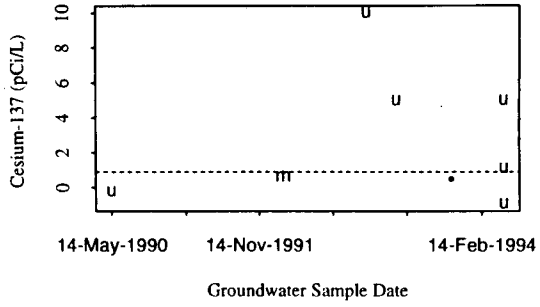
Segment 13-Cesium-137
Well 199-F5-44



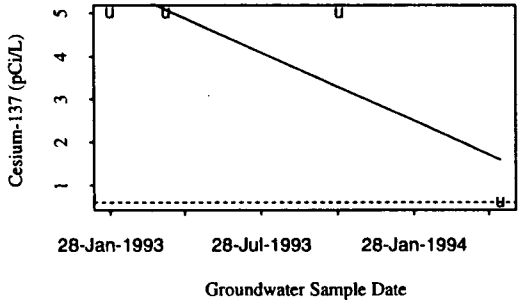
Segment 13-Cesium-137
Well 199-F5-46



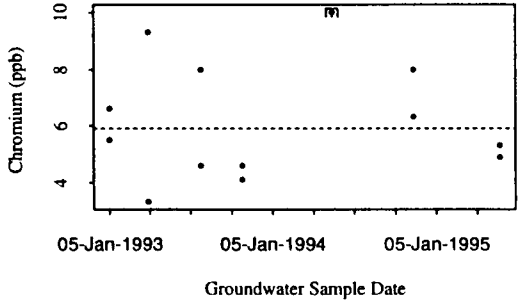
Segment 13-Cesium-137
Well 199-F5-6



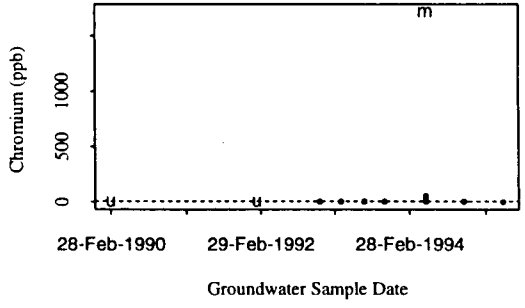
Segment 13-Cesium-137
Well 199-F6-1



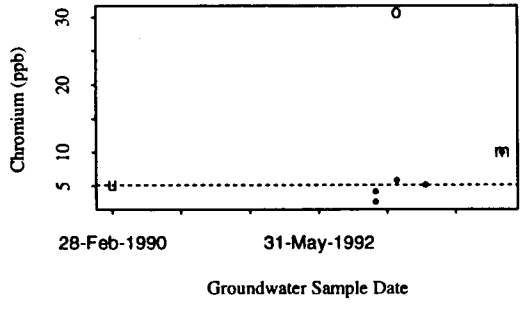
Segment 13-Chromium
Well 199-F1-2



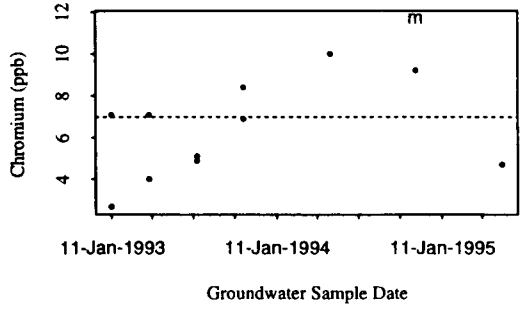
Segment 13-Chromium
Well 199-F5-1



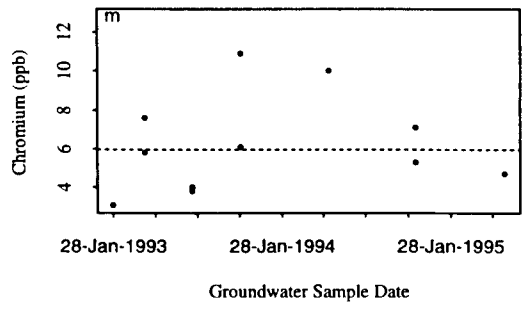
Segment 13-Chromium
Well 199-F5-3



Segment 13-Chromium
Well 199-F5-42

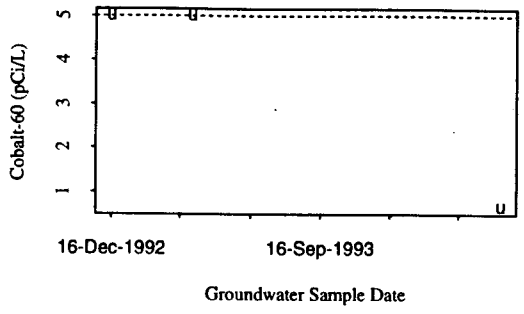


Segment 13-Chromium
Well 199-F5-43A

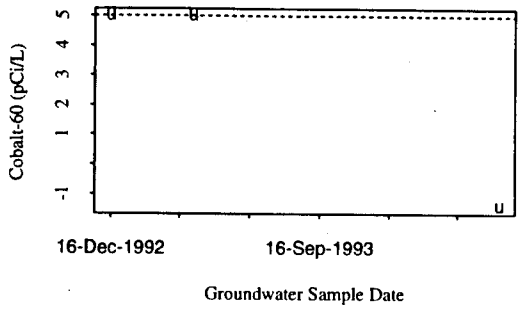


9623948.1063

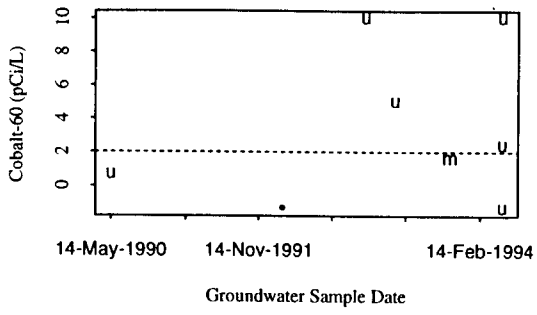
Segment 13-Cobalt-60
Well 199-F5-44



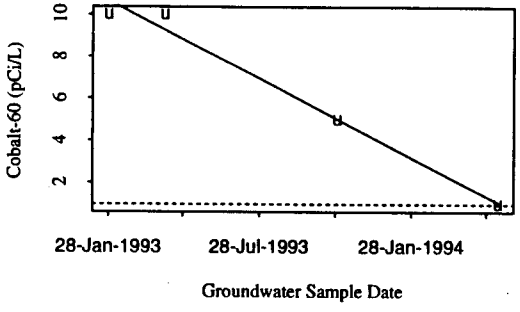
Segment 13-Cobalt-60
Well 199-F5-46



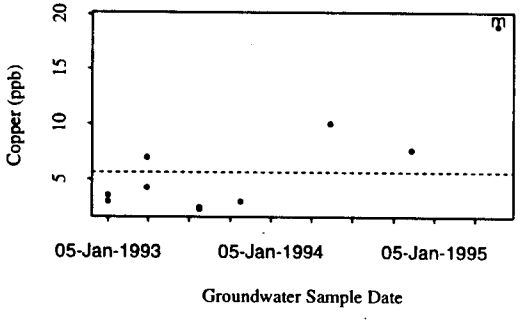
Segment 13-Cobalt-60
Well 199-F5-6



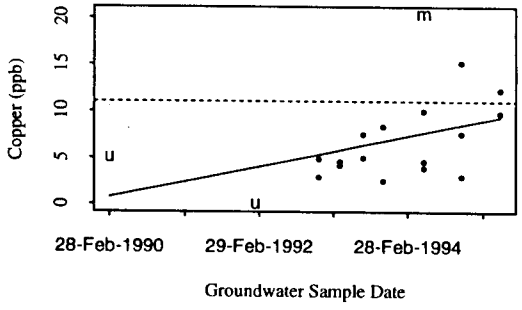
Segment 13-Cobalt-60
Well 199-F6-1



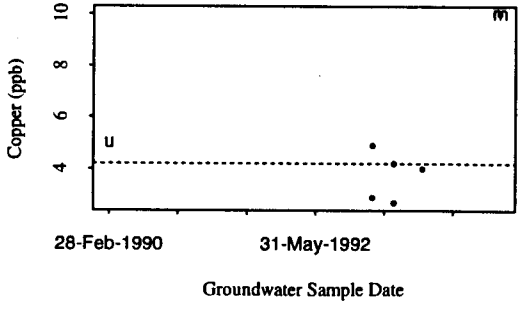
Segment 13-Copper
Well 199-F1-2



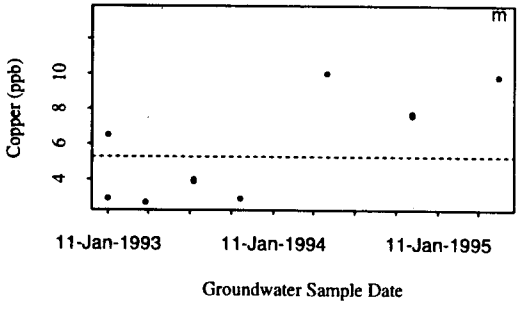
Segment 13-Copper
Well 199-F5-1



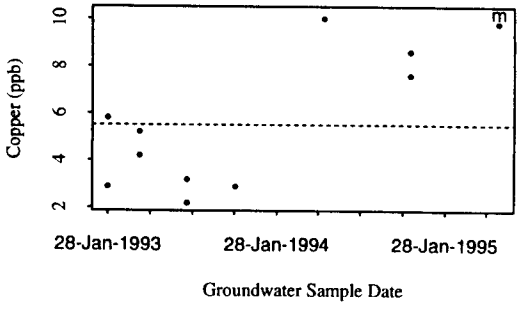
Segment 13-Copper
Well 199-F5-3



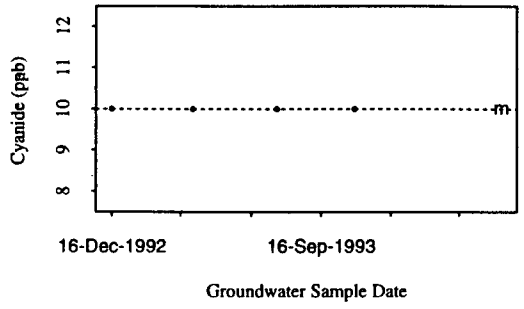
Segment 13-Copper
Well 199-F5-42



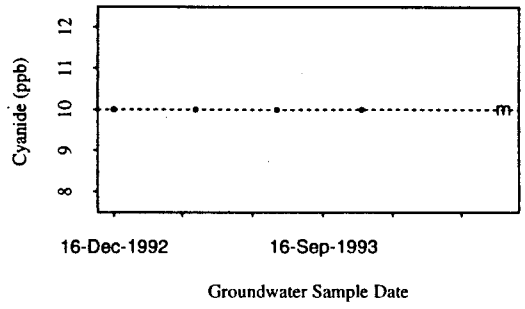
Segment 13-Copper
Well 199-F5-43A



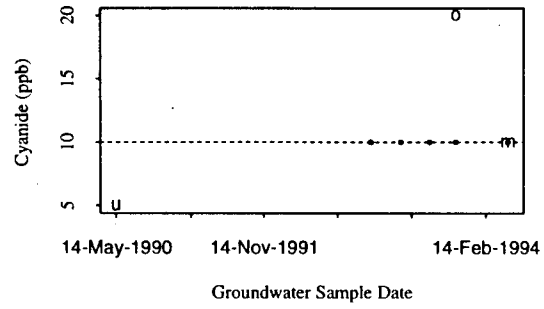
Segment 13-Cyanide
Well 199-F5-44



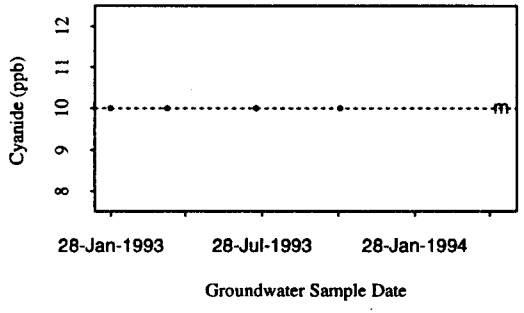
Segment 13-Cyanide
Well 199-F5-46



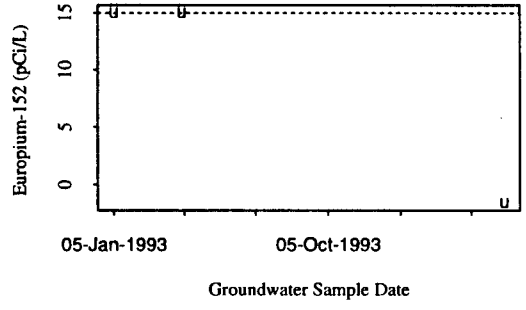
Segment 13-Cyanide
Well 199-F5-6



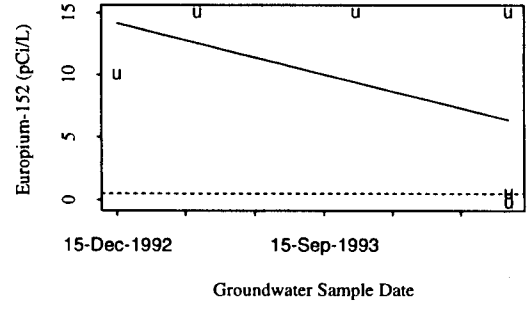
Segment 13-Cyanide
Well 199-F6-1



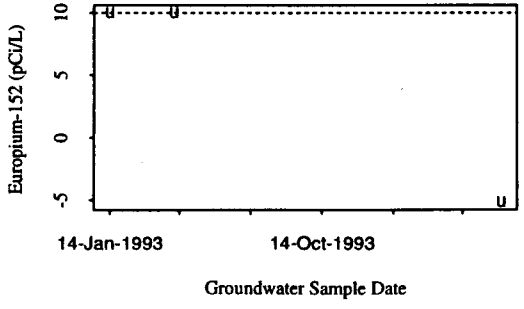
Segment 13-Europium-152
Well 199-F1-2



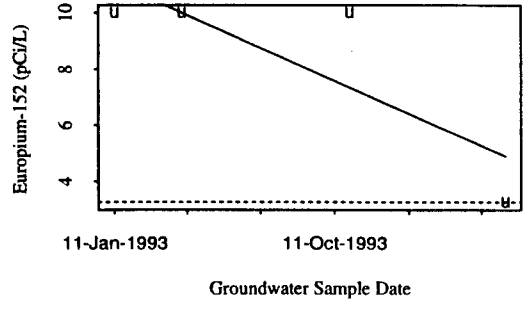
Segment 13-Europium-152
Well 199-F5-1



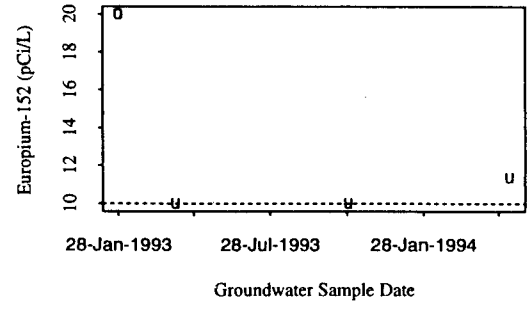
Segment 13-Europium-152
Well 199-F5-3



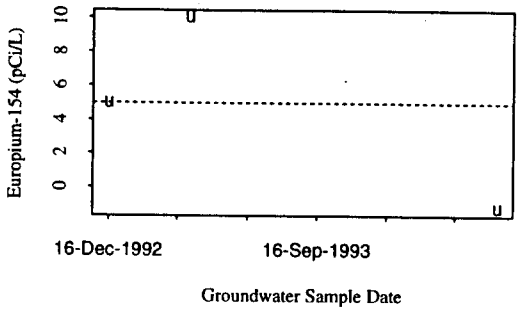
Segment 13-Europium-152
Well 199-F5-42



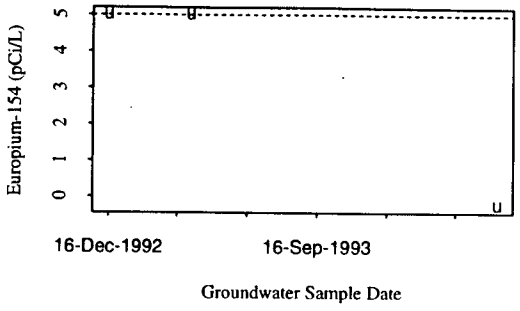
Segment 13-Europium-152
Well 199-F5-43A



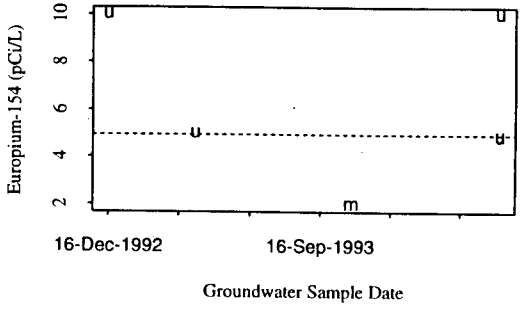
Segment 13-Europium-154
Well 199-F5-44



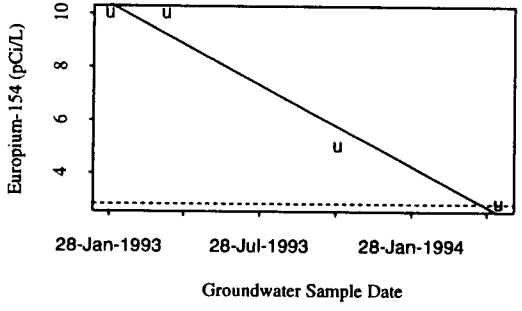
Segment 13-Europium-154
Well 199-F5-46



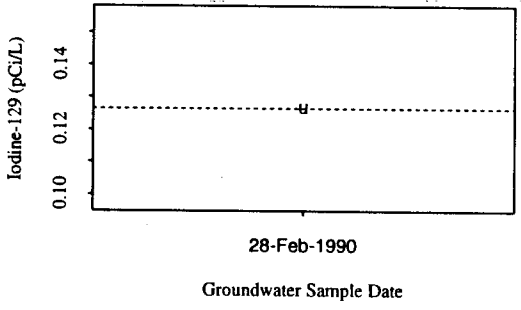
Segment 13-Europium-154
Well 199-F5-6



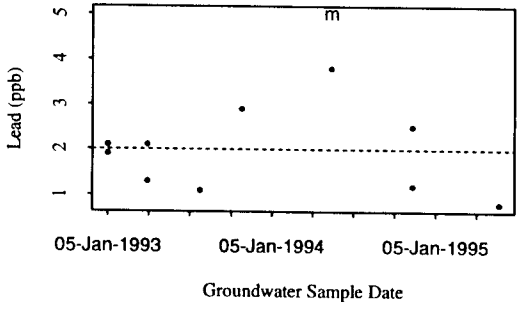
Segment 13-Europium-154
Well 199-F6-1



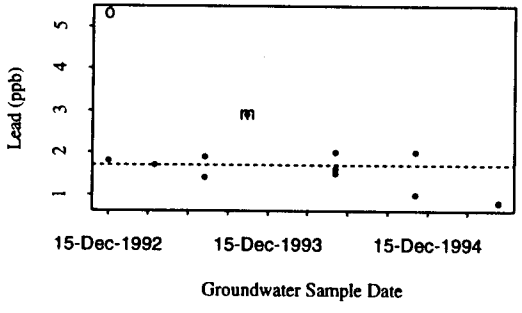
Segment 13-Iodine-129
Well 199-F5-1



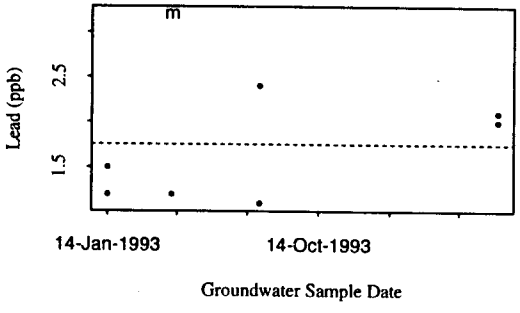
Segment 13-Lead
Well 199-F1-2



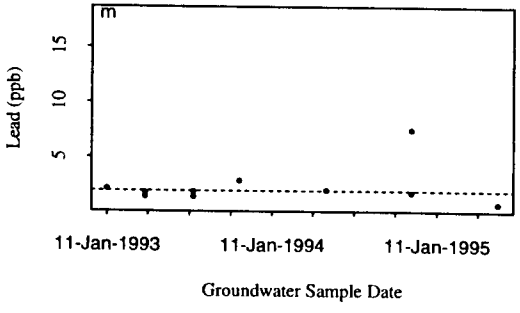
Segment 13-Lead
Well 199-F5-1



Segment 13-Lead
Well 199-F5-3

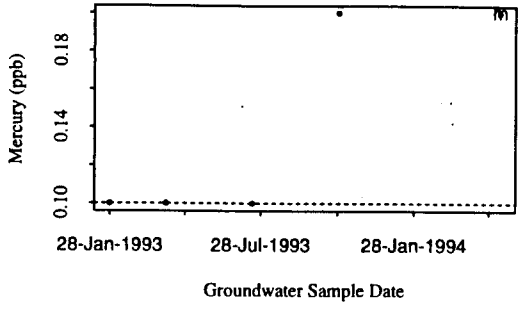


Segment 13-Lead
Well 199-F5-42

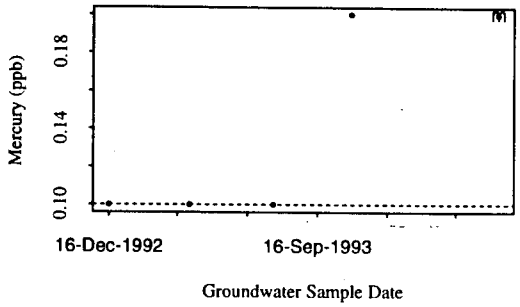


9513148.1696

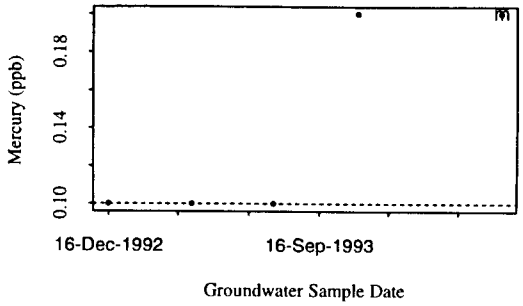
Segment 13-Mercury
Well 199-F5-43A



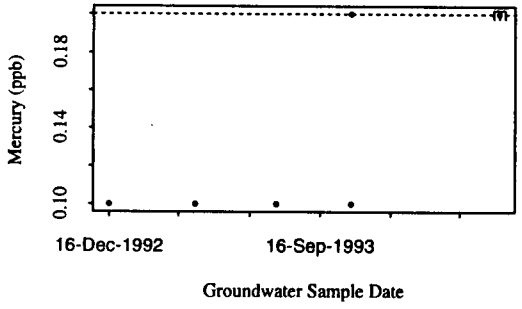
Segment 13-Mercury
Well 199-F5-44



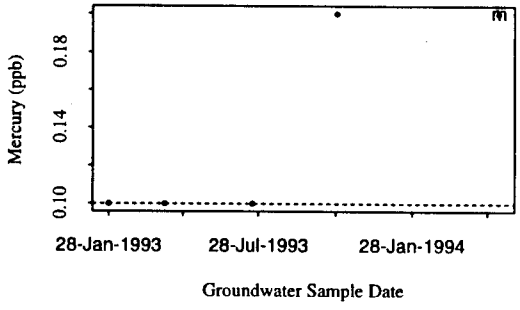
Segment 13-Mercury
Well 199-F5-46



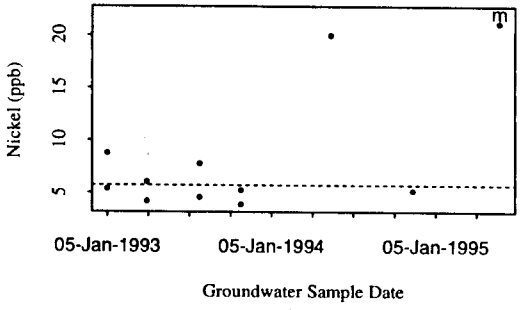
Segment 13-Mercury
Well 199-F5-6



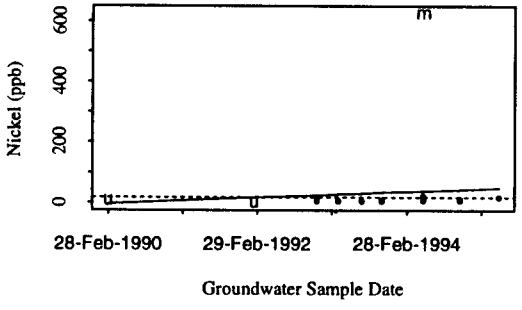
Segment 13-Mercury
Well 199-F6-1



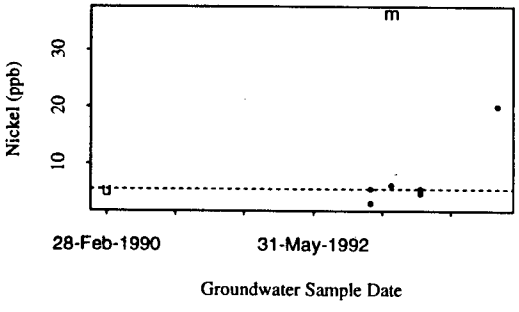
Segment 13-Nickel
Well 199-F1-2



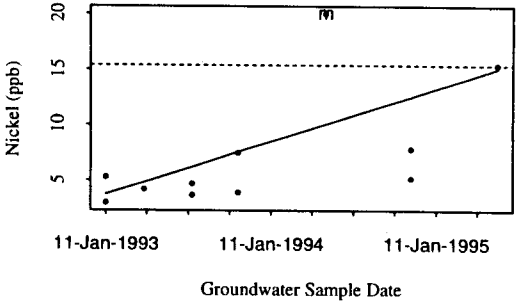
Segment 13-Nickel
Well 199-F5-1



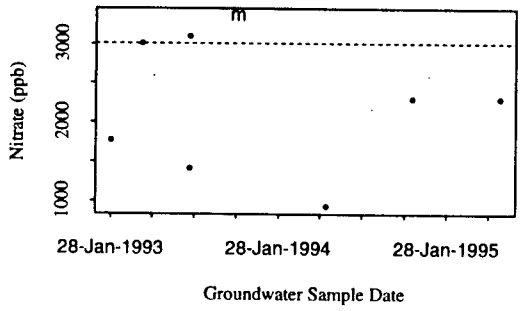
Segment 13-Nickel
Well 199-F5-3



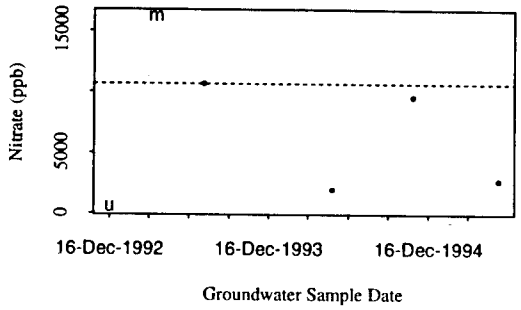
Segment 13-Nickel
Well 199-F5-42



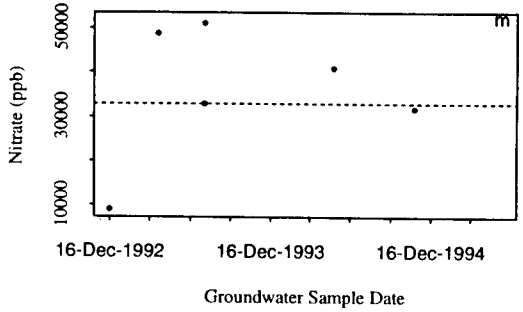
Segment 13-Nitrate
Well 199-F5-43A



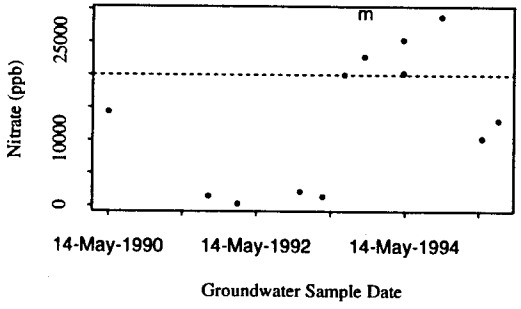
Segment 13-Nitrate
Well 199-F5-44



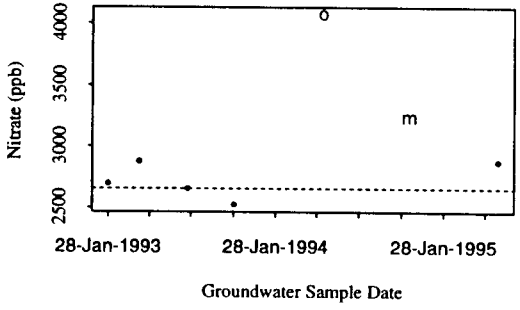
Segment 13-Nitrate
Well 199-F5-46



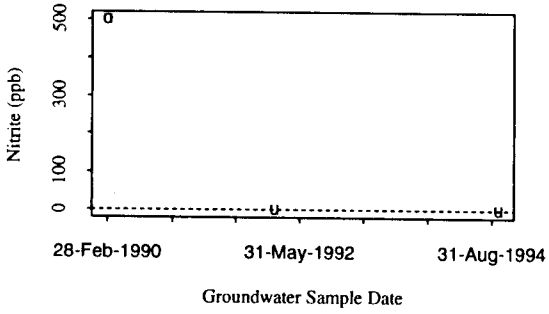
Segment 13-Nitrate
Well 199-F5-6



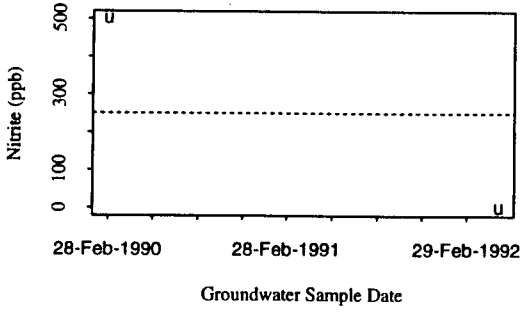
Segment 13-Nitrate
Well 199-F6-1



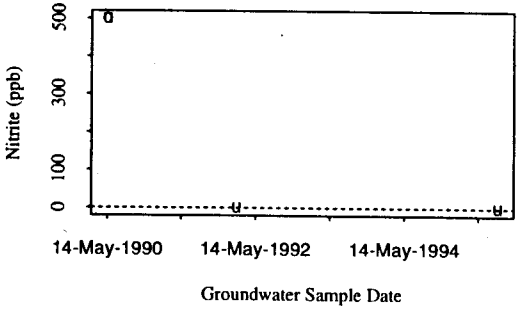
Segment 13-Nitrite
Well 199-F5-1



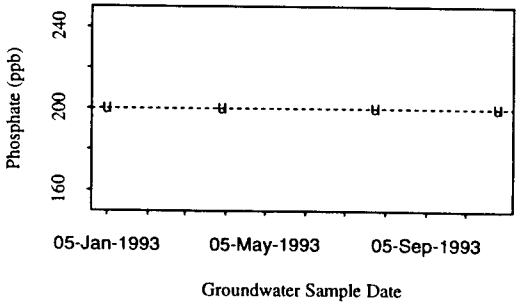
Segment 13-Nitrite
Well 199-F5-3



Segment 13-Nitrite
Well 199-F5-6

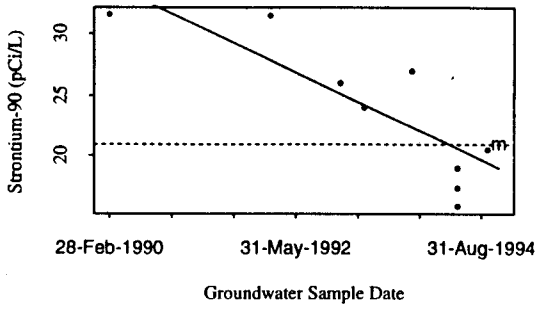


Segment 13-Phosphate
Well 199-F1-2

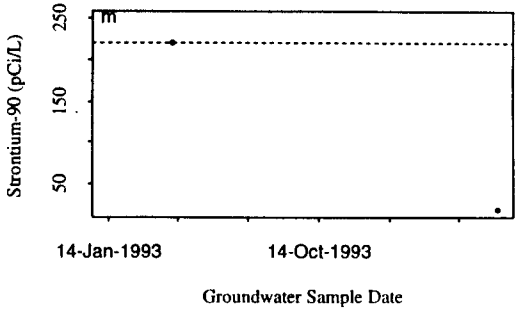


9612348.1608

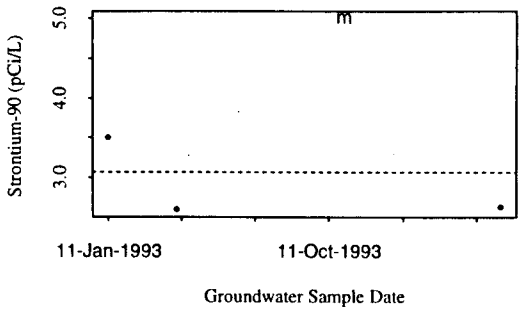
Segment 13-Strontium-90
Well 199-F5-1



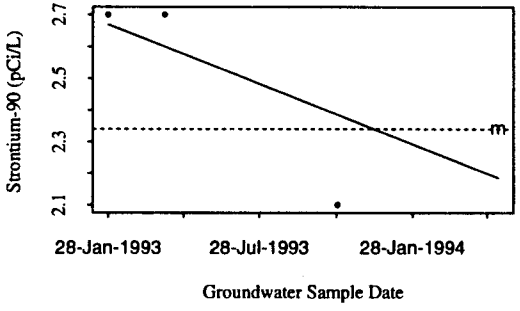
Segment 13-Strontium-90
Well 199-F5-3



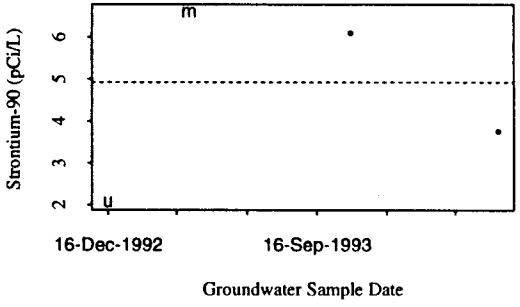
Segment 13-Strontium-90
Well 199-F5-42



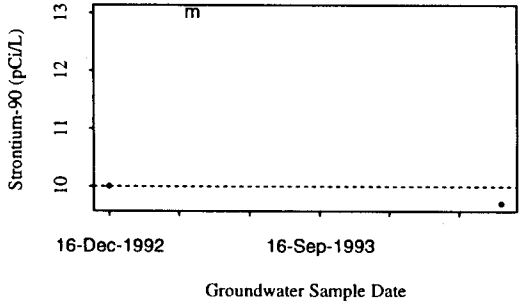
Segment 13-Strontium-90
Well 199-F5-43A



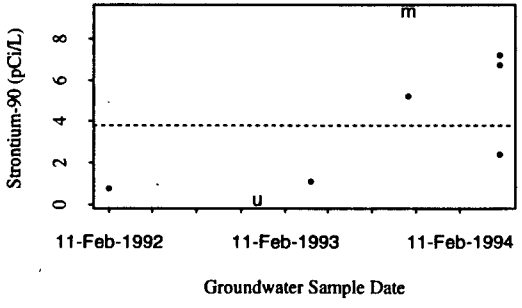
Segment 13-Strontium-90
Well 199-F5-44



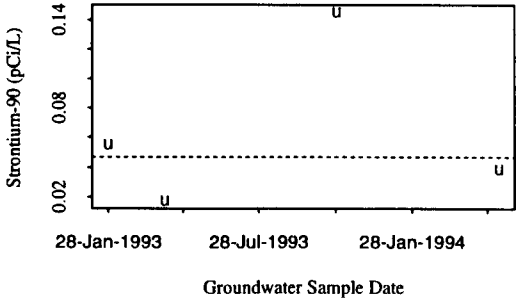
Segment 13-Strontium-90
Well 199-F5-46



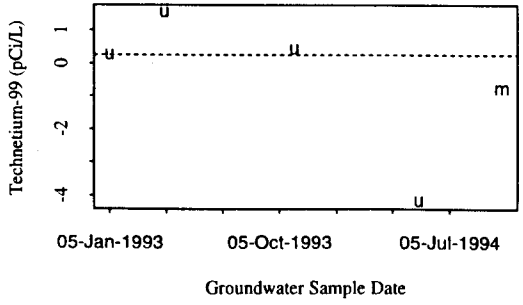
Segment 13-Strontium-90
Well 199-F5-6



Segment 13-Strontium-90
Well 199-F6-1

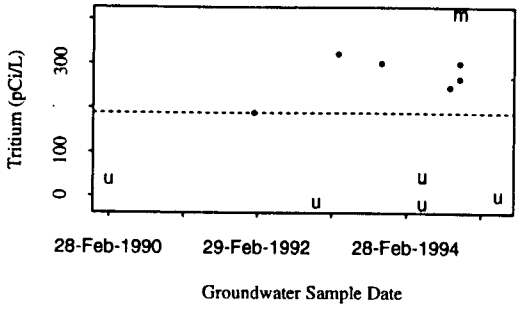


Segment 13-Technetium-99
Well 199-F1-2

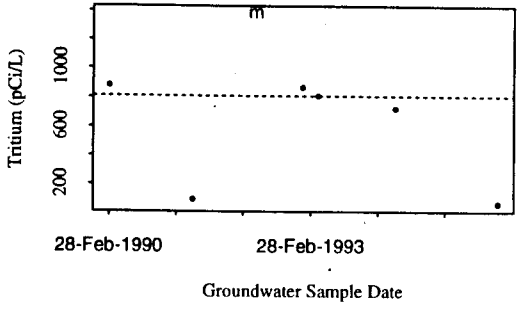


9613148.1639

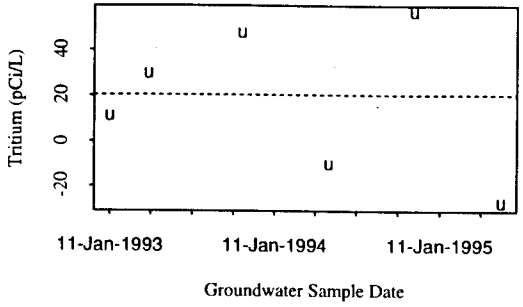
Segment 13-Tritium
Well 199-F5-1



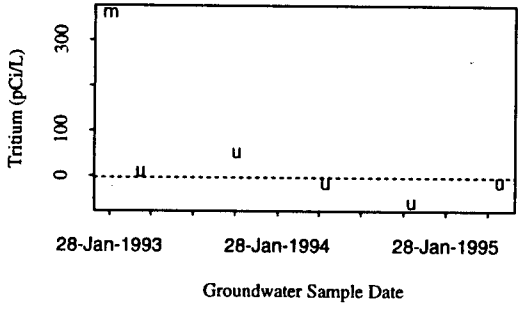
Segment 13-Tritium
Well 199-F5-3



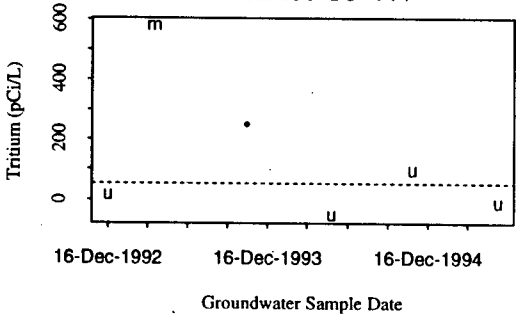
Segment 13-Tritium
Well 199-F5-42



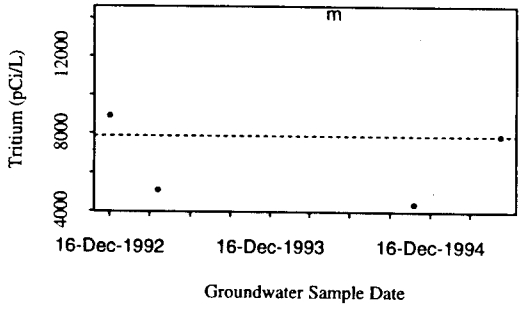
Segment 13-Tritium
Well 199-F5-43A



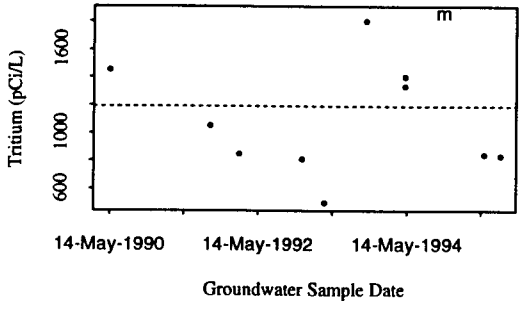
Segment 13-Tritium
Well 199-F5-44



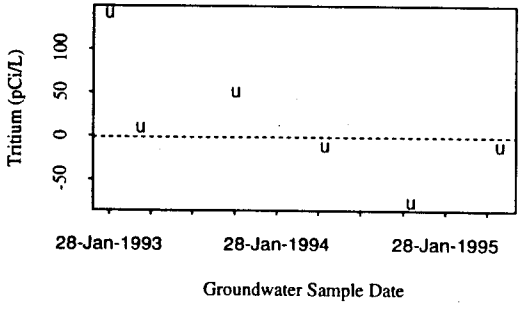
Segment 13-Tritium
Well 199-F5-46



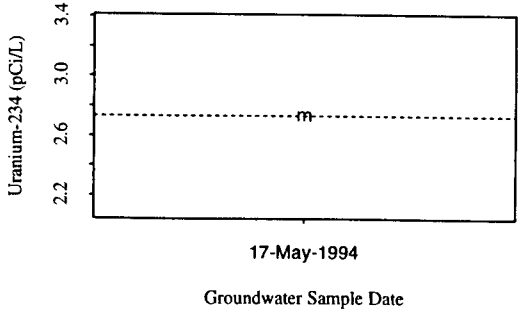
Segment 13-Tritium
Well 199-F5-6



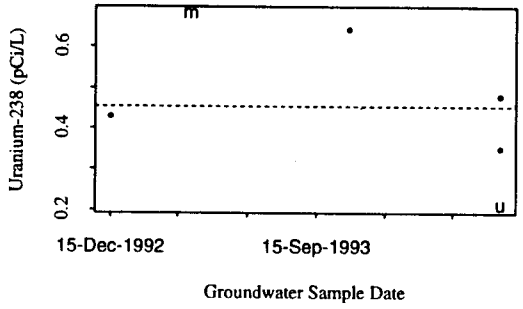
Segment 13-Tritium
Well 199-F6-1



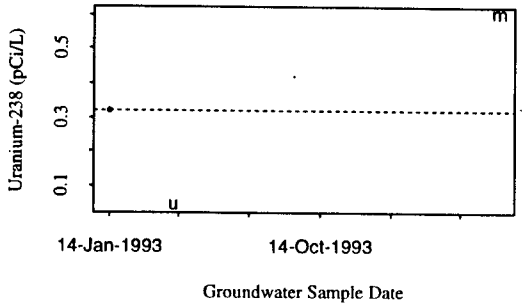
Segment 13-Uranium-234
Well 199-F1-2



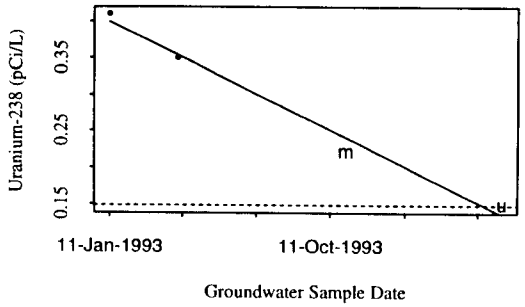
Segment 13-Uranium-238
Well 199-F5-1



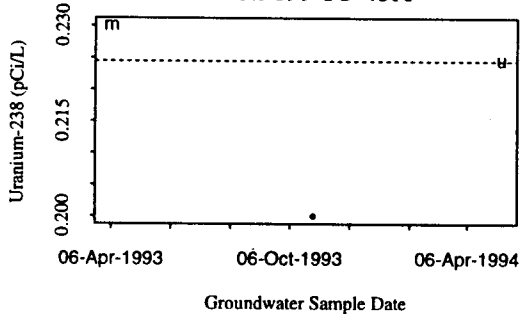
Segment 13-Uranium-238
Well 199-F5-3



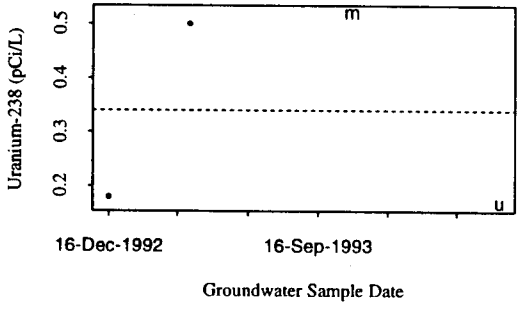
Segment 13-Uranium-238
Well 199-F5-42



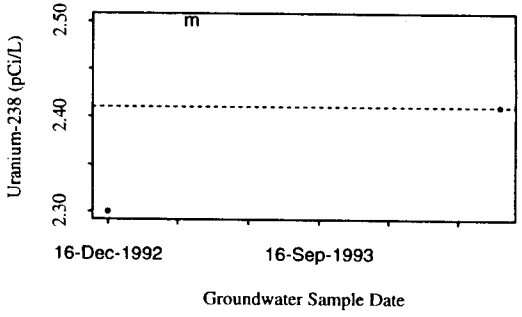
Segment 13-Uranium-238
Well 199-F5-43A



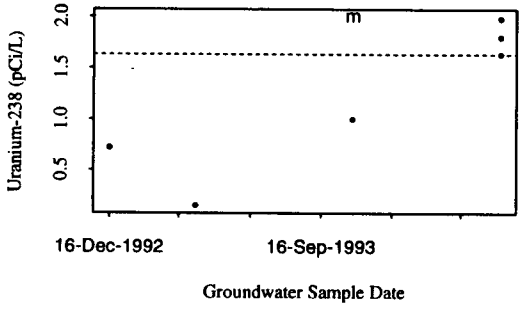
Segment 13-Uranium-238
Well 199-F5-44



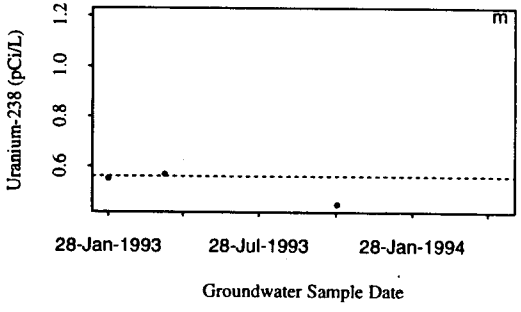
Segment 13-Uranium-238
Well 199-F5-46



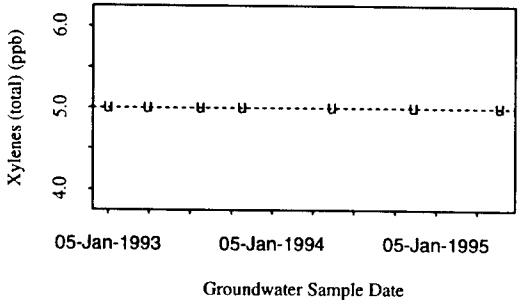
Segment 13-Uranium-238
Well 199-F5-6



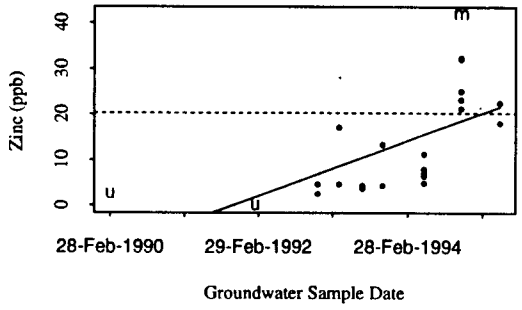
Segment 13-Uranium-238
Well 199-F6-1



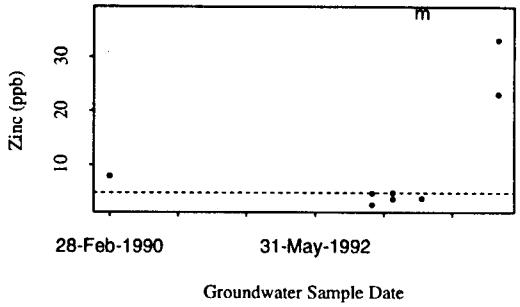
Segment 13-Xylenes (total)
Well 199-F1-2



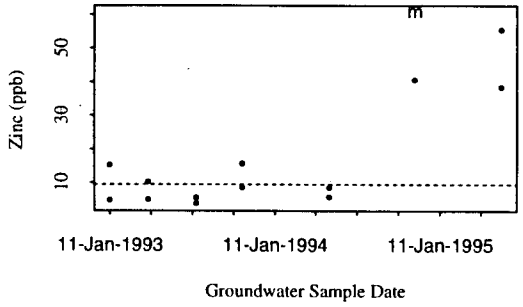
Segment 13-Zinc
Well 199-F5-1



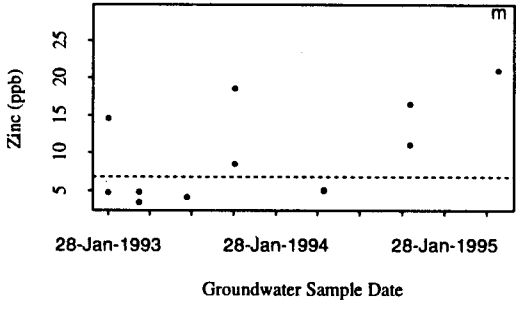
Segment 13-Zinc
Well 199-F5-3



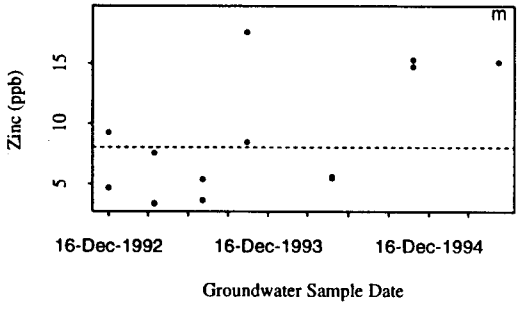
Segment 13-Zinc
Well 199-F5-42



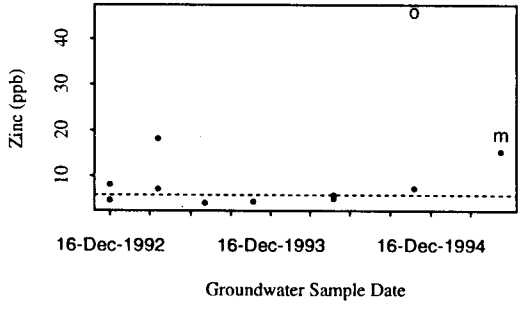
Segment 13-Zinc
Well 199-F5-43A



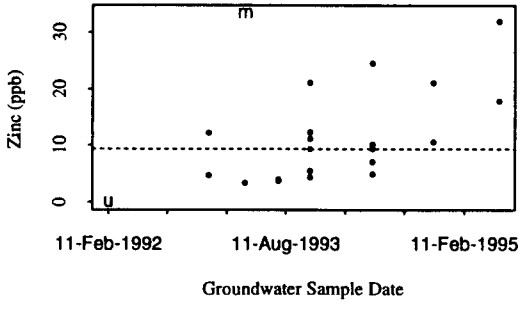
Segment 13-Zinc
Well 199-F5-44



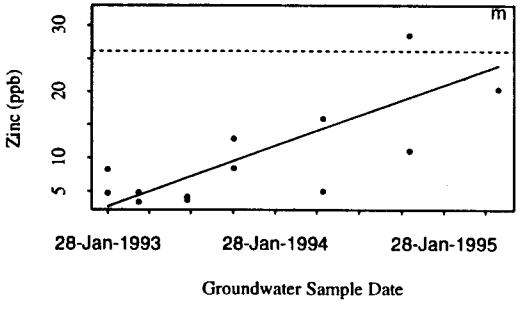
Segment 13-Zinc
Well 199-F5-46



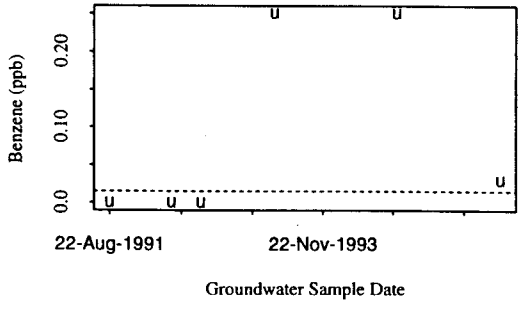
Segment 13-Zinc
Well 199-F5-6



Segment 13-Zinc
Well 199-F6-1

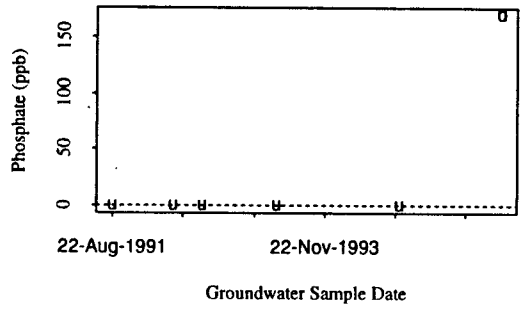


Segment 15-Benzene
Well 699-66-23

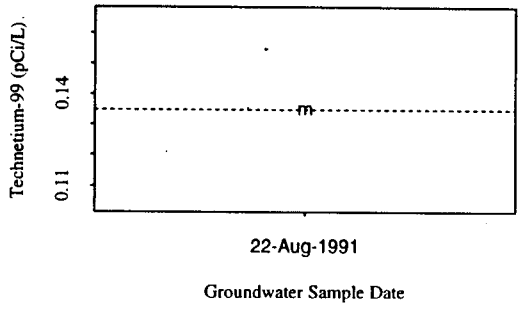


9413148.0672

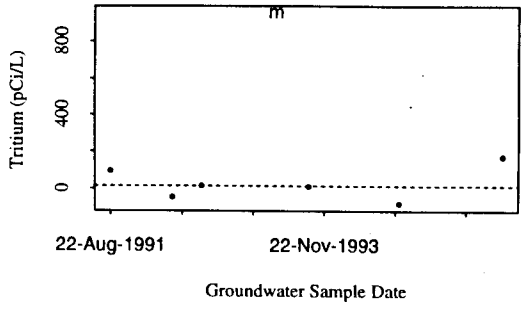
Segment 15-Phosphate
Well 699-66-23



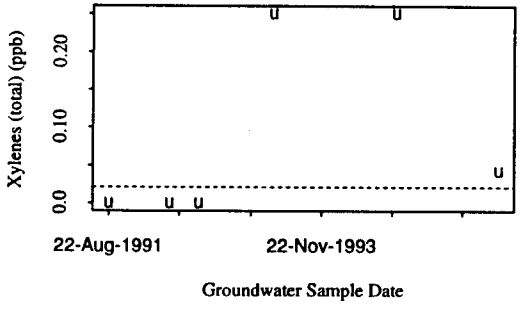
Segment 15-Technetium-99
Well 699-66-23



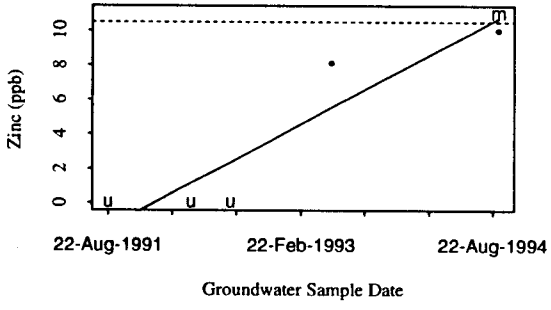
Segment 15-Tritium
Well 699-66-23



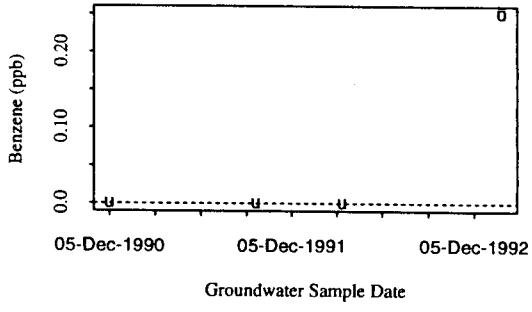
Segment 15-Xylenes (total)
Well 699-66-23



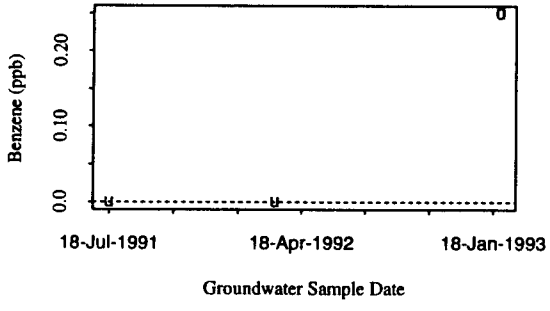
Segment 15-Zinc
Well 699-66-23



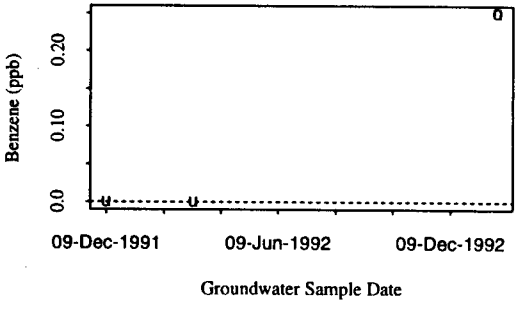
Segment 17-Benzene
Well 699-37-E4



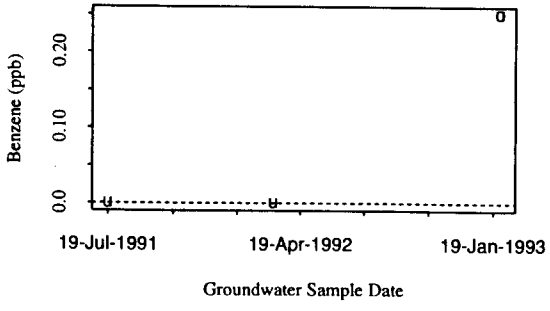
Segment 17-Benzene
Well 699-43-3



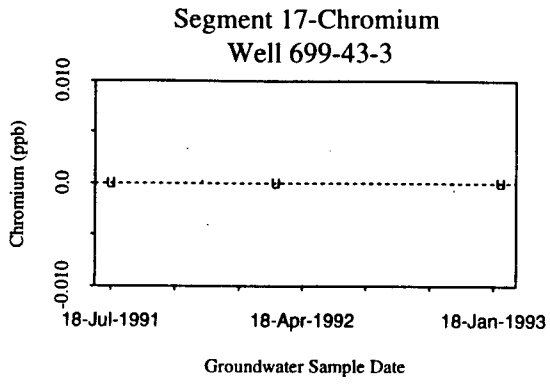
Segment 17-Benzene
Well 699-45-2

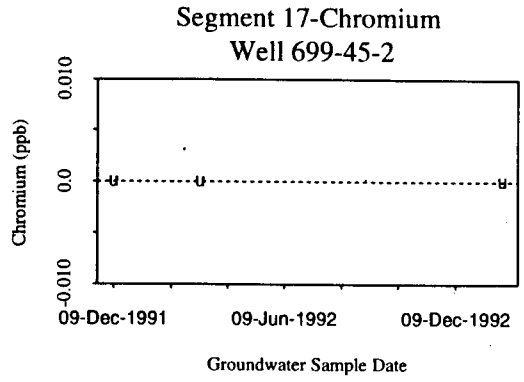


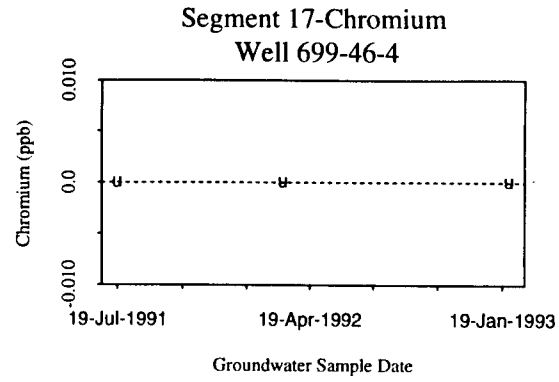
Segment 17-Benzene
Well 699-46-4

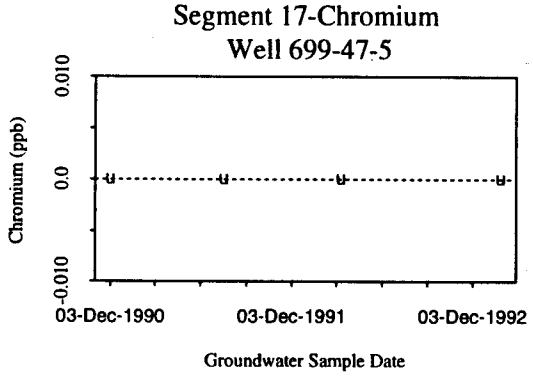


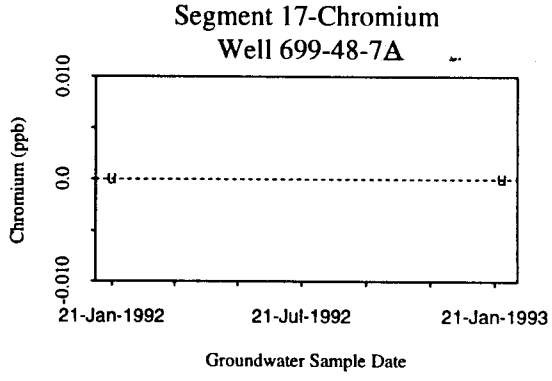
9413148.1073

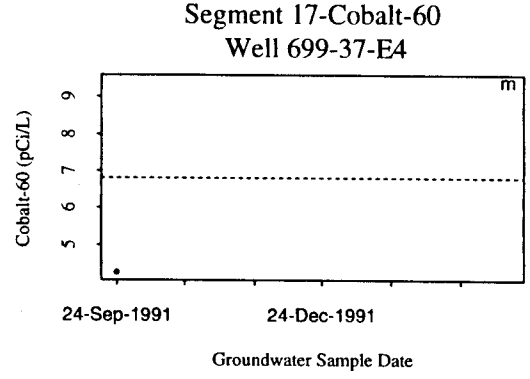

Segment 17-Chromium
Well 699-43-3
Chromium (ppb)
0.010
0.0
-0.010
18-Jul-1991
18-Apr-1992
18-Jan-1993
Groundwater Sample Date

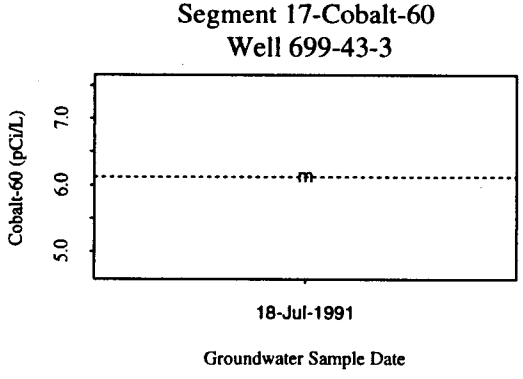

Segment 17-Chromium
Well 699-45-2
Chromium (ppb)
0.010
0.0
-0.010
09-Dec-1991
09-Jun-1992
09-Dec-1992
Groundwater Sample Date

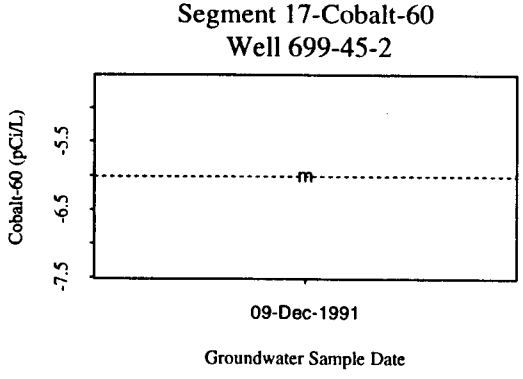

Segment 17-Chromium
Well 699-46-4
Chromium (ppb)
0.010
0.0
-0.010
19-Jul-1991
19-Apr-1992
19-Jan-1993
Groundwater Sample Date

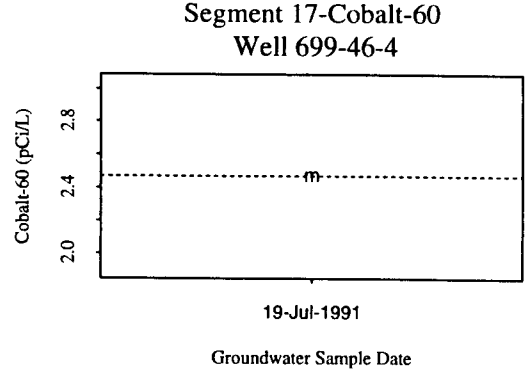

Segment 17-Chromium
Well 699-47-5
Chromium (ppb)
0.010
0.0
-0.010
03-Dec-1990
03-Dec-1991
03-Dec-1992
Groundwater Sample Date


Segment 17-Chromium
Well 699-48-7A
Chromium (ppb)
0.010
0.0
-0.010
21-Jan-1992
21-Jul-1992
21-Jan-1993
Groundwater Sample Date

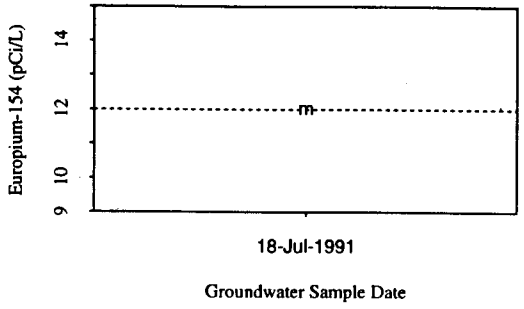

Segment 17-Cobalt-60
Well 699-37-E4
Cobalt-60 (pCi/L)
9
8
7
6
5
24-Sep-1991
24-Dec-1991
Groundwater Sample Date


Segment 17-Cobalt-60
Well 699-43-3
Cobalt-60 (pCi/L)
7.0
6.0
5.0
18-Jul-1991
Groundwater Sample Date

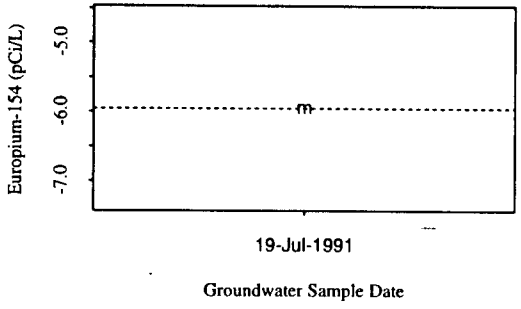

Segment 17-Cobalt-60
Well 699-45-2
Cobalt-60 (pCi/L)
-5.5
-6.5
-7.5
09-Dec-1991
Groundwater Sample Date


Segment 17-Cobalt-60
Well 699-46-4
Cobalt-60 (pCi/L)
2.8
2.4
2.0
19-Jul-1991
Groundwater Sample Date

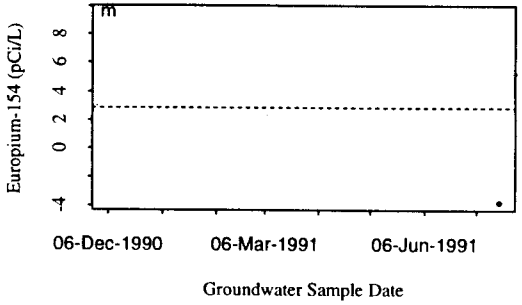
Segment 17-Europium-154
Well 699-43-3



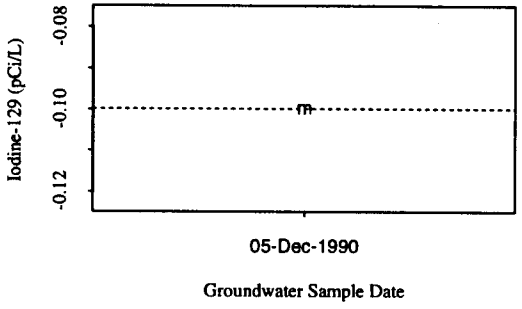
Segment 17-Europium-154
Well 699-46-4



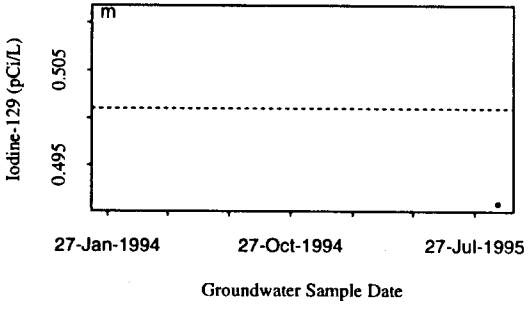
Segment 17-Europium-154
Well 699-47-5



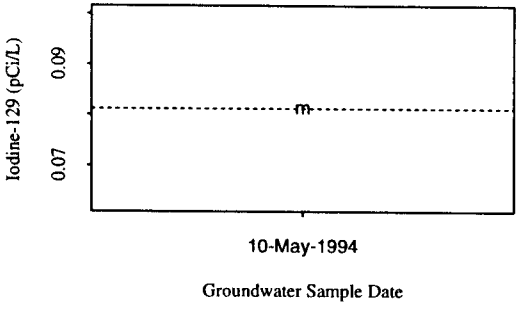
Segment 17-Iodine-129
Well 699-37-E4



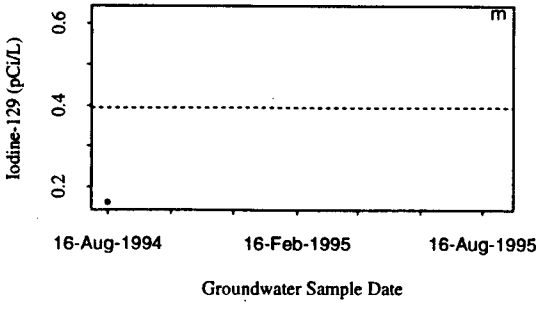
Segment 17-Iodine-129
Well 699-43-3



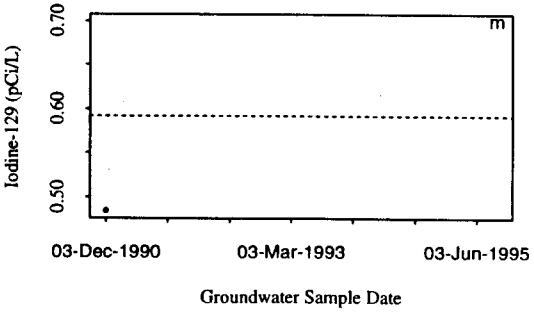
Segment 17-Iodine-129
Well 699-45-2



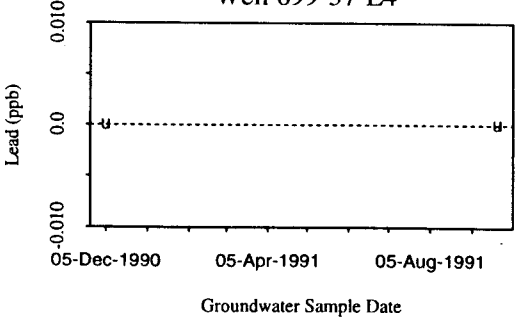
Segment 17-Iodine-129
Well 699-46-4



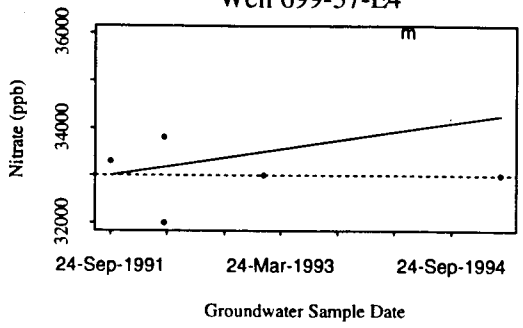
Segment 17-Iodine-129
Well 699-47-5



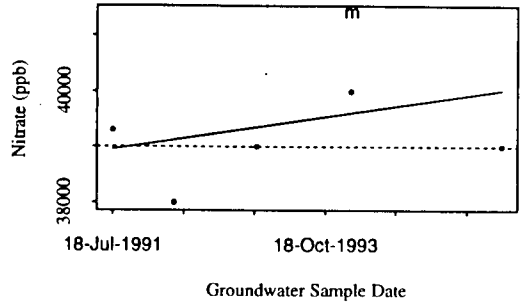
Segment 17-Lead
Well 699-37-E4



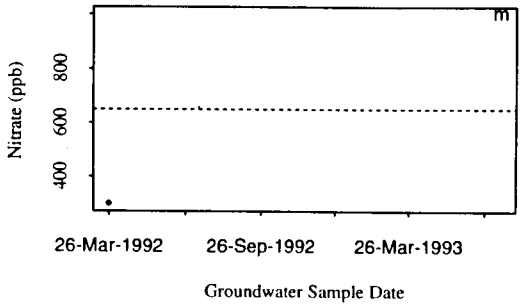
Segment 17-Nitrate
Well 699-37-E4



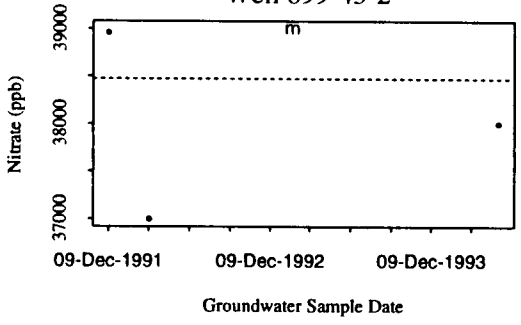
Segment 17-Nitrate
Well 699-43-3



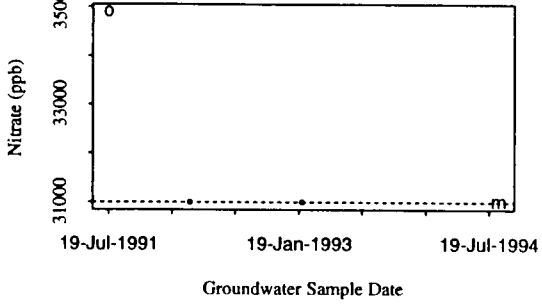
Segment 17-Nitrate
Well 699-44-4



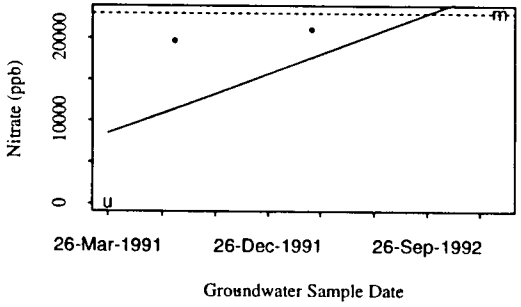
Segment 17-Nitrate
Well 699-45-2



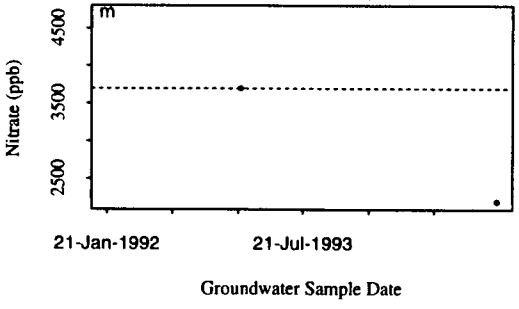
Segment 17-Nitrate
Well 699-46-4



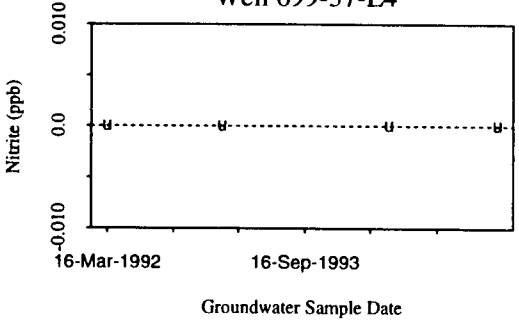
Segment 17-Nitrate
Well 699-47-5



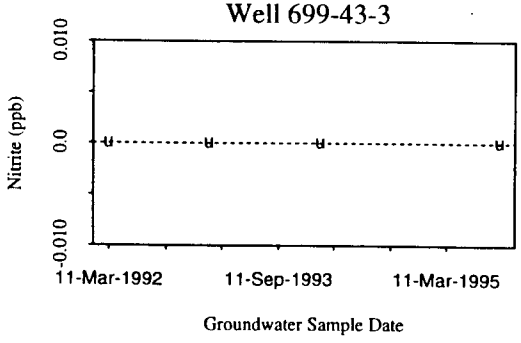
Segment 17-Nitrate
Well 699-48-7A



Segment 17-Nitrite
Well 699-37-E4

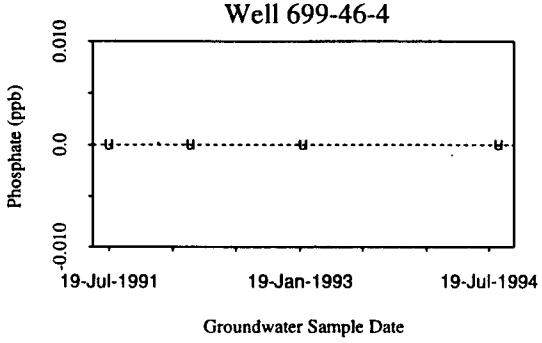


Segment 17-Nitrite
Well 699-43-3

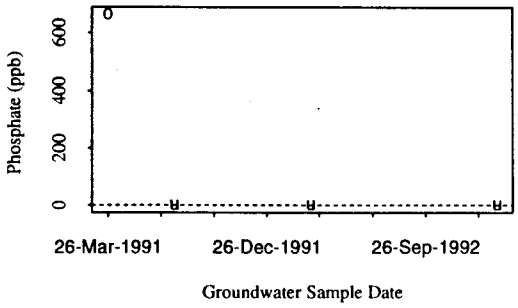


9516146.1076

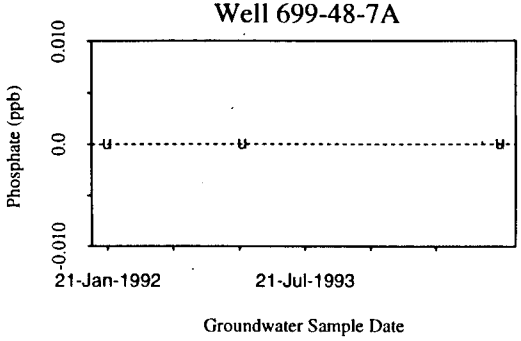
Segment 17-Phosphate
Well 699-46-4



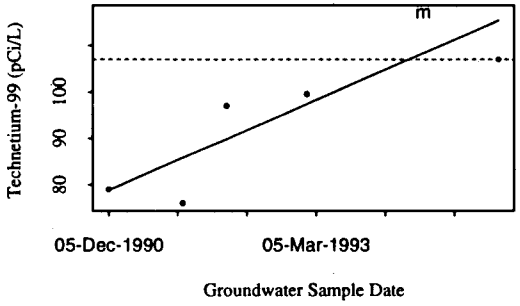
Segment 17-Phosphate
Well 699-47-5



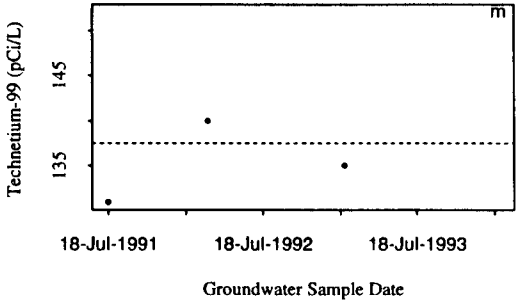
Segment 17-Phosphate
Well 699-48-7A



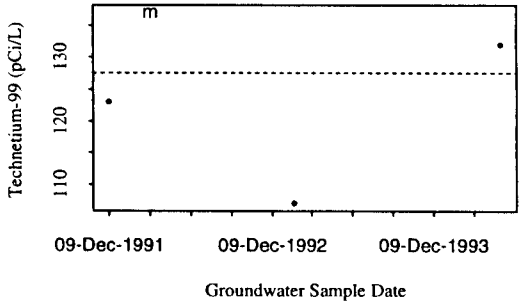
Segment 17-Technetium-99
Well 699-37-E4



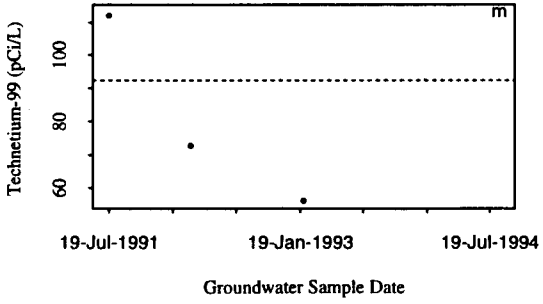
Segment 17-Technetium-99
Well 699-43-3



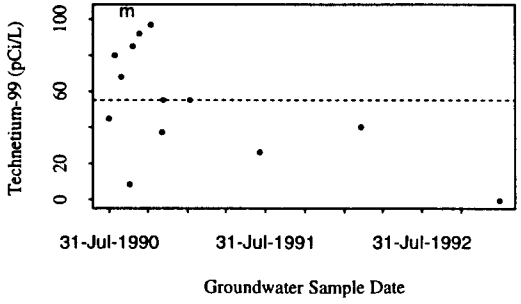
Segment 17-Technetium-99
Well 699-45-2



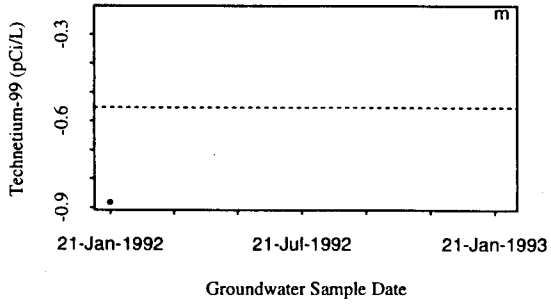
Segment 17-Technetium-99
Well 699-46-4



Segment 17-Technetium-99
Well 699-47-5

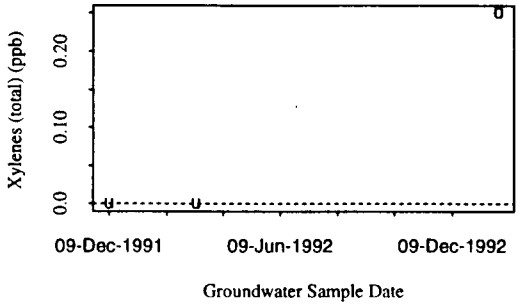


Segment 17-Technetium-99
Well 699-48-7A

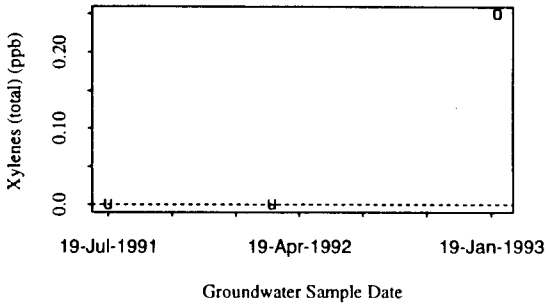


9513148.1197

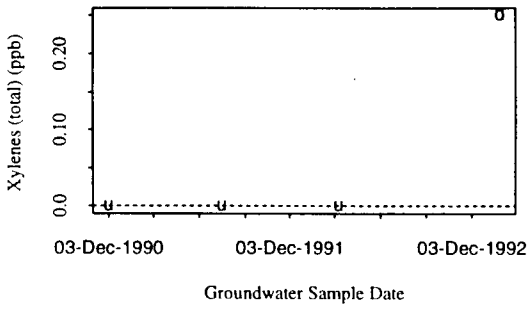
Segment 17-Xylenes (total)
Well 699-45-2



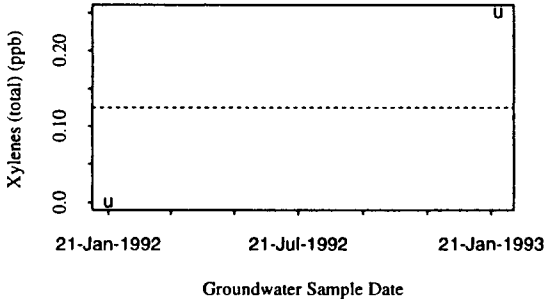
Segment 17-Xylenes (total)
Well 699-46-4



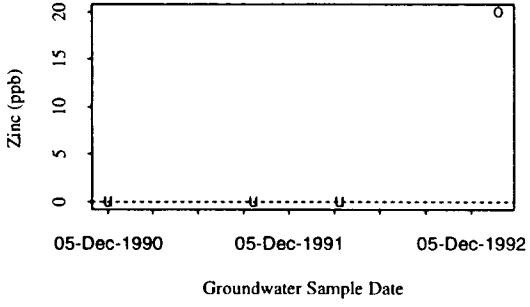
Segment 17-Xylenes (total)
Well 699-47-5



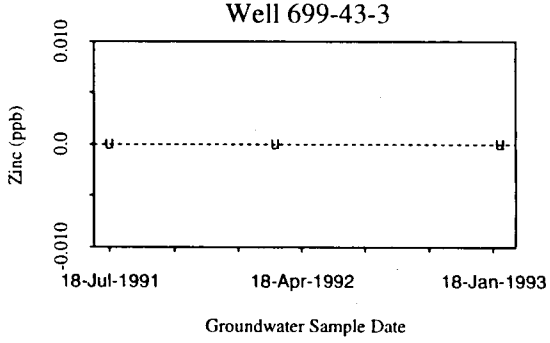
Segment 17-Xylenes (total)
Well 699-48-7A



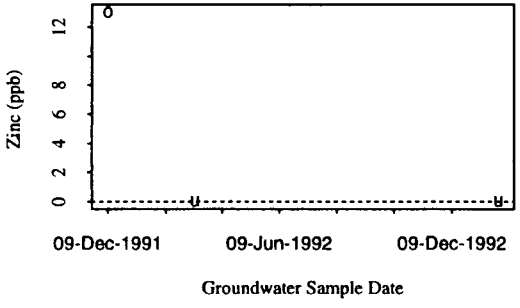
Segment 17-Zinc
Well 699-37-E4



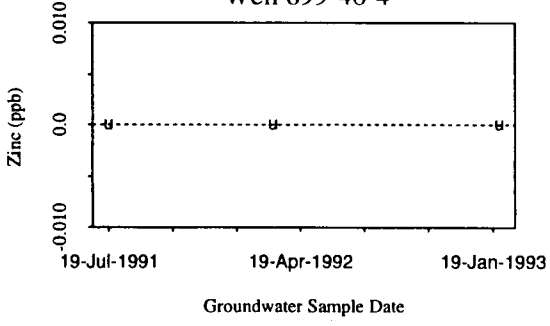
Segment 17-Zinc
Well 699-43-3



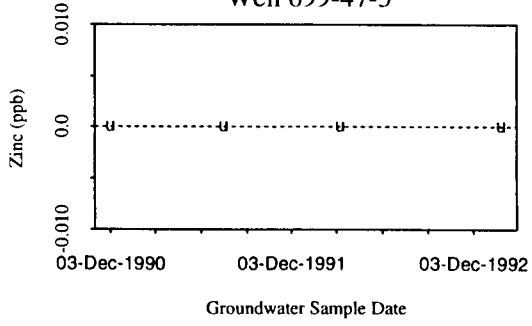
Segment 17-Zinc
Well 699-45-2



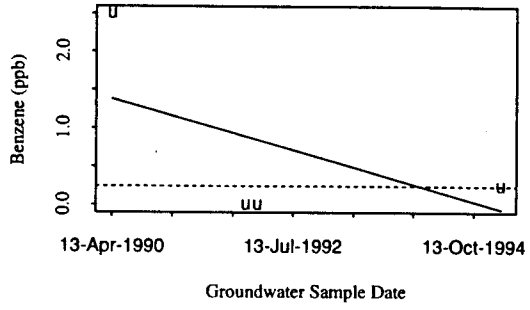
Segment 17-Zinc
Well 699-46-4



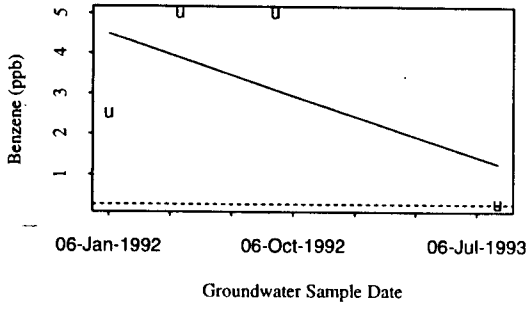
Segment 17-Zinc
Well 699-47-5



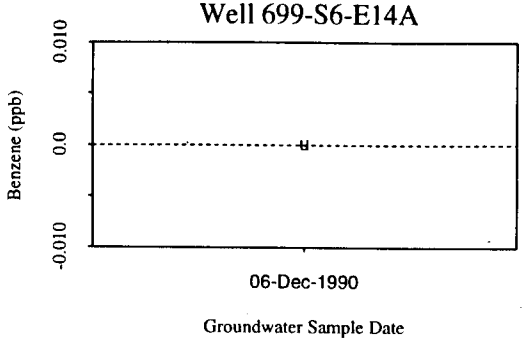
Segment 19-Benzene
Well 699-S19-E13



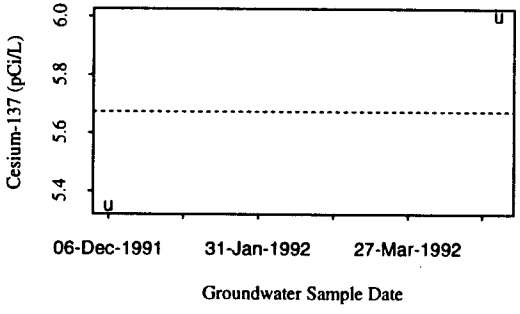
Segment 19-Benzene
Well 699-S19-E14



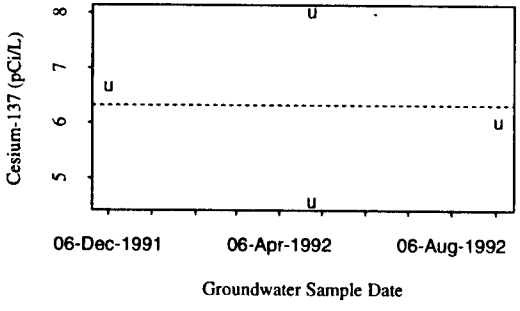
Segment 19-Benzene
Well 699-S6-E14A



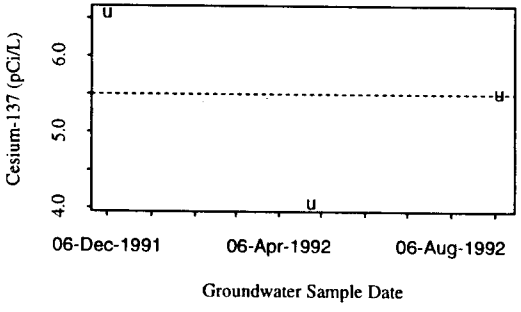
Segment 19-Cesium-137
Well 399-1-18A



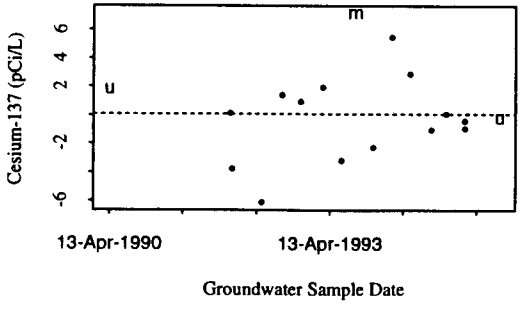
Segment 19-Cesium-137
Well 399-1-18B



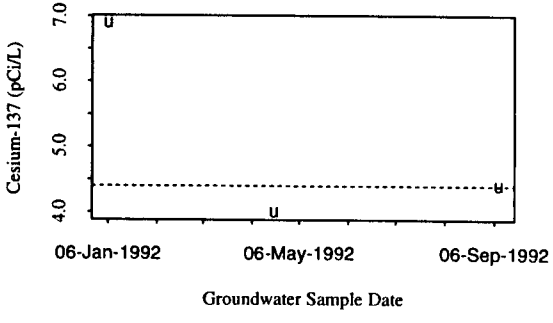
Segment 19-Cesium-137
Well 399-1-18C



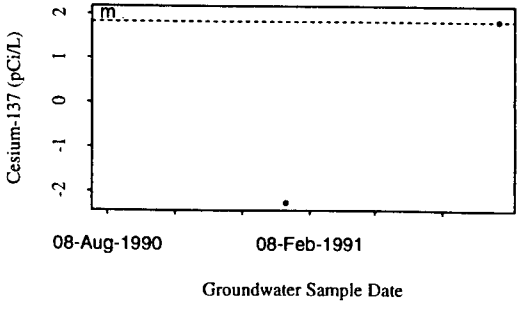
Segment 19-Cesium-137
Well 699-S19-E13



Segment 19-Cesium-137
Well 699-S19-E14

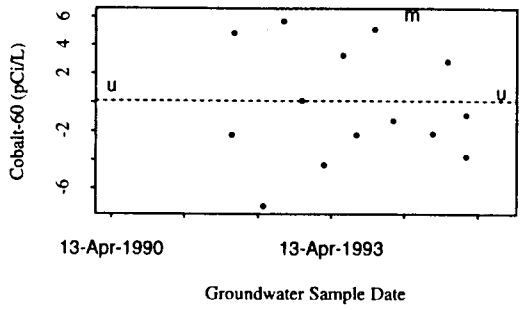


Segment 19-Cesium-137
Well 699-S6-E14A

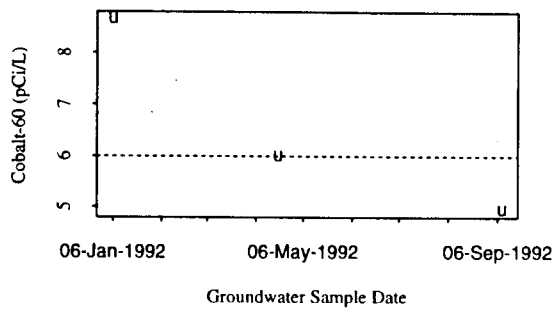


9613448.1696

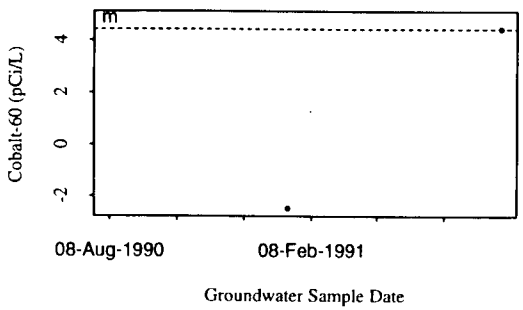
Segment 19-Cobalt-60
Well 699-S19-E13



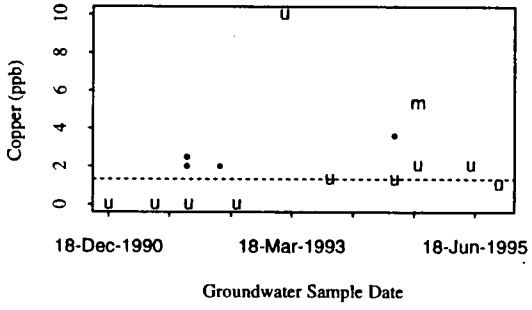
Segment 19-Cobalt-60
Well 699-S19-E14



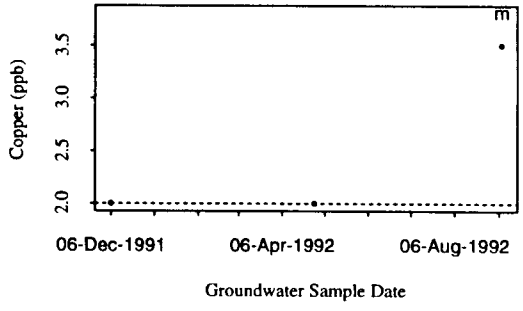
Segment 19-Cobalt-60
Well 699-S6-E14A



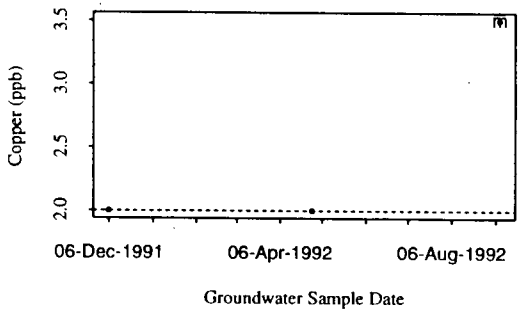
Segment 19-Copper
Well 399-1-18A



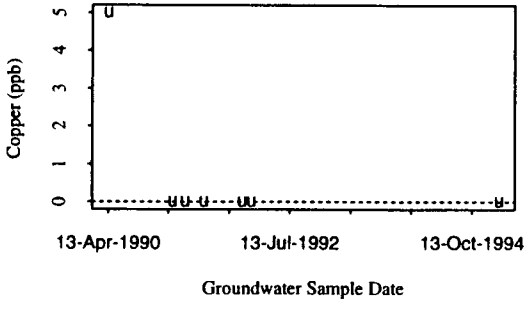
Segment 19-Copper
Well 399-1-18B



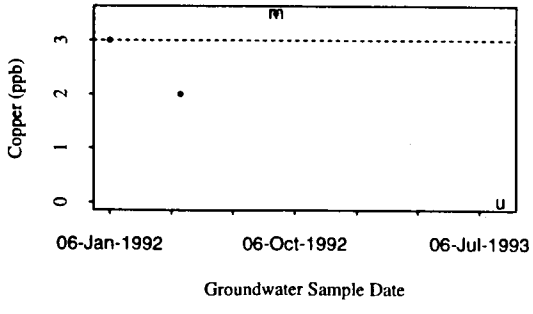
Segment 19-Copper
Well 399-1-18C



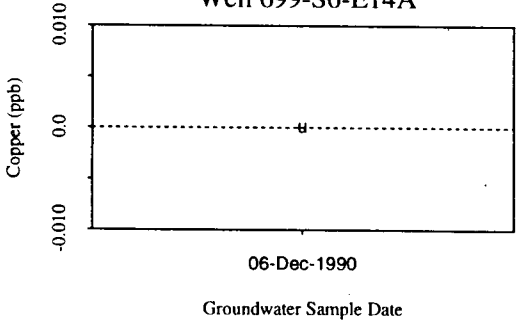
Segment 19-Copper
Well 699-S19-E13



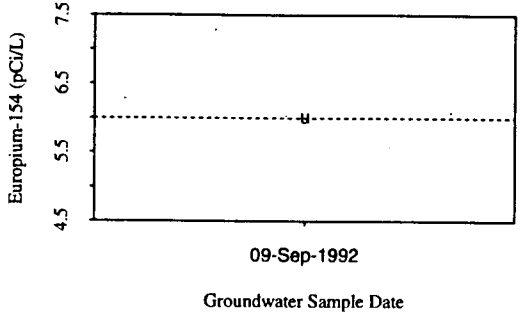
Segment 19-Copper
Well 699-S19-E14



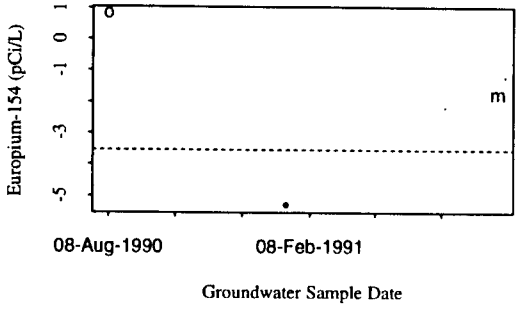
Segment 19-Copper
Well 699-S6-E14A



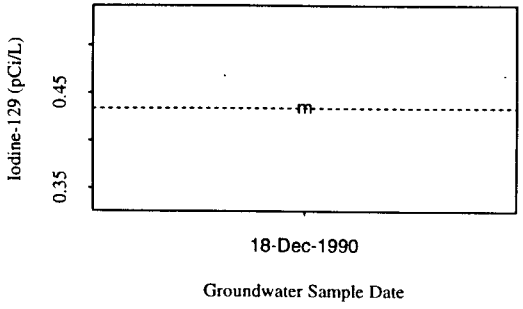
Segment 19-Europium-154
Well 699-S19-E14



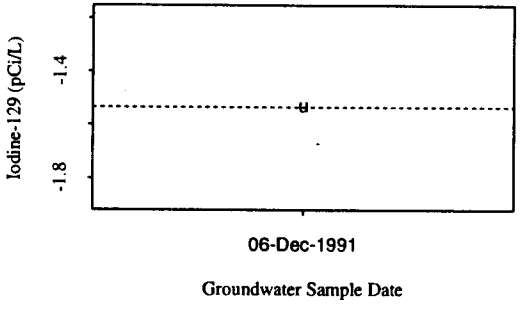
Segment 19-Europium-154
Well 699-S6-E14A



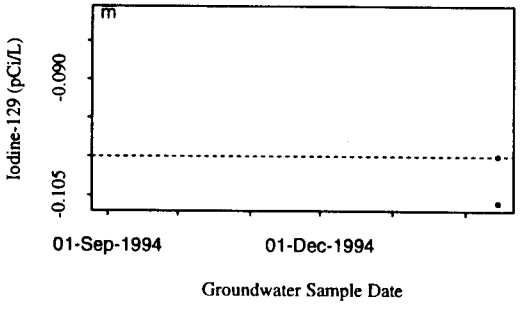
Segment 19-Iodine-129
Well 399-1-18A



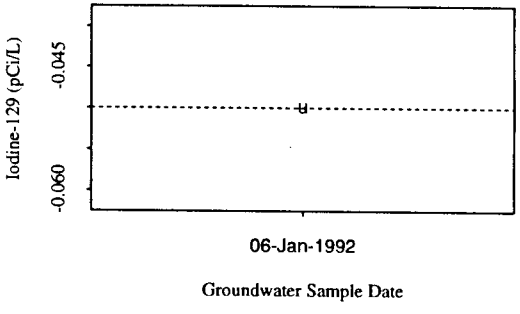
Segment 19-Iodine-129
Well 399-1-18C



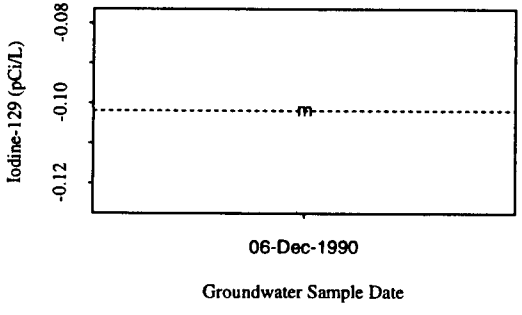
Segment 19-Iodine-129
Well 699-S19-E13



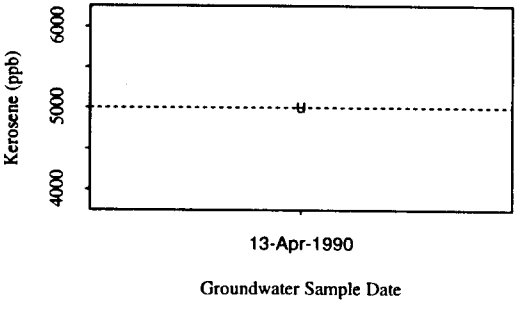
Segment 19-Iodine-129
Well 699-S19-E14



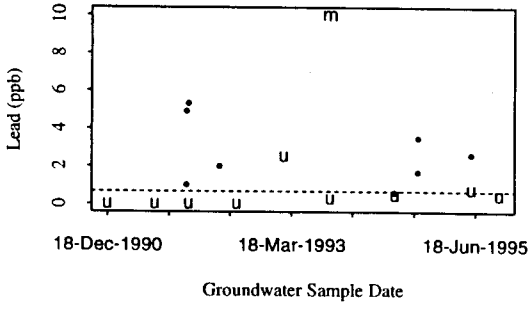
Segment 19-Iodine-129
Well 699-S6-E14A



Segment 19-Kerosene
Well 699-S19-E13

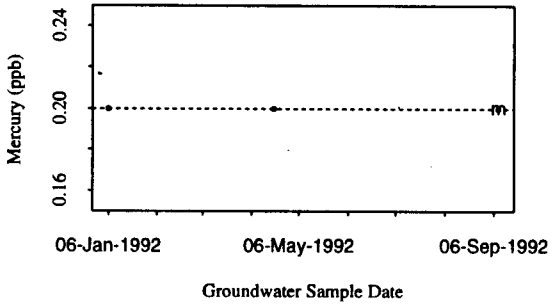


Segment 19-Lead
Well 399-1-18A

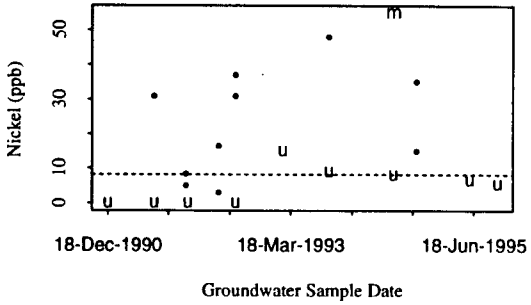


9513148.1701

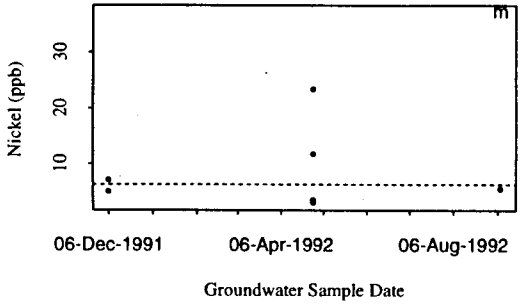
Segment 19-Mercury
Well 699-S19-E14



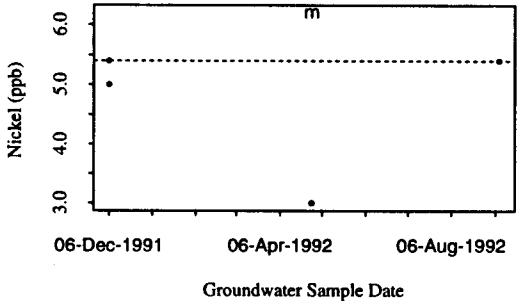
Segment 19-Nickel
Well 399-1-18A



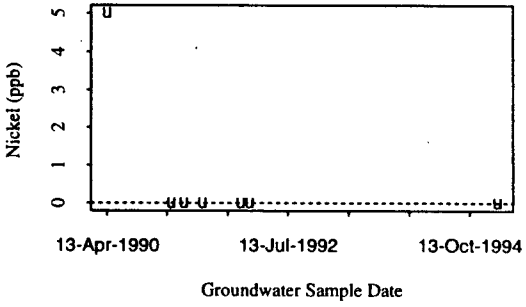
Segment 19-Nickel
Well 399-1-18B



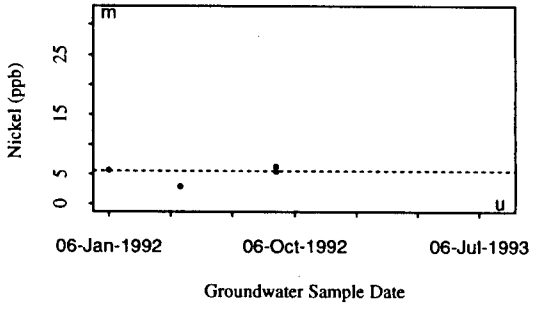
Segment 19-Nickel
Well 399-1-18C



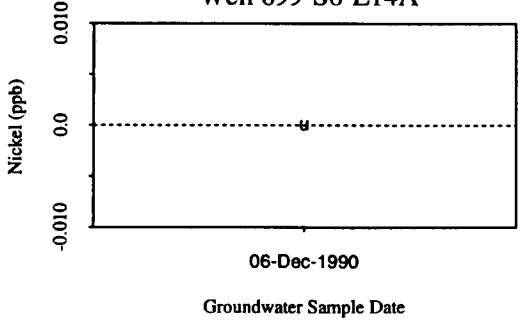
Segment 19-Nickel
Well 699-S19-E13



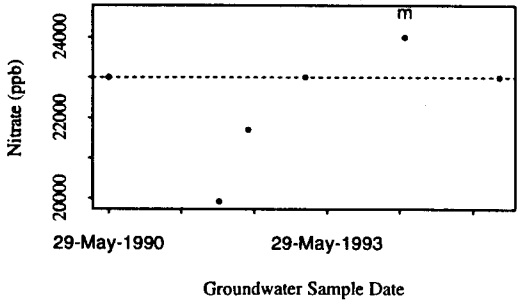
Segment 19-Nickel
Well 699-S19-E14



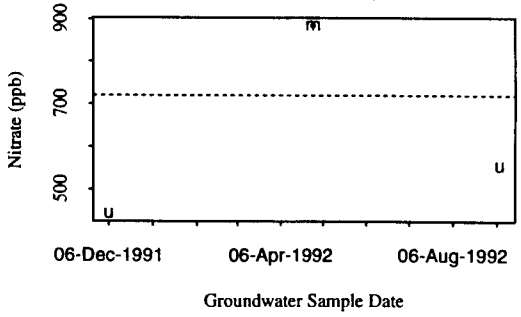
Segment 19-Nickel
Well 699-S6-E14A



Segment 19-Nitrate
Well 399-1-18A

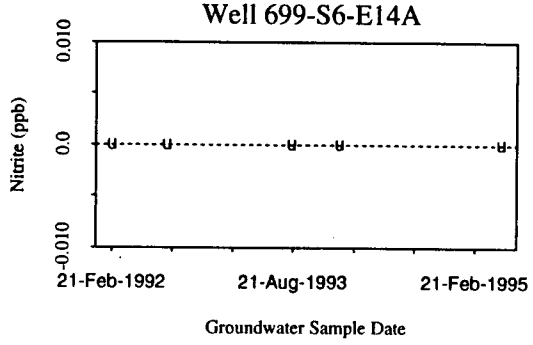


Segment 19-Nitrate
Well 399-1-18B

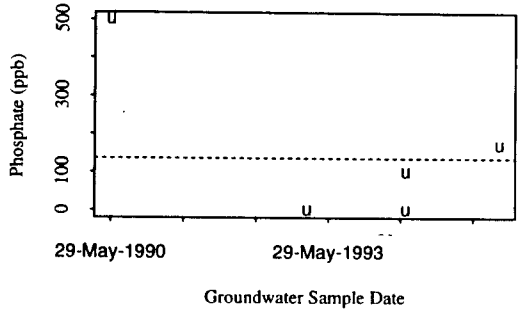


9613948.1702

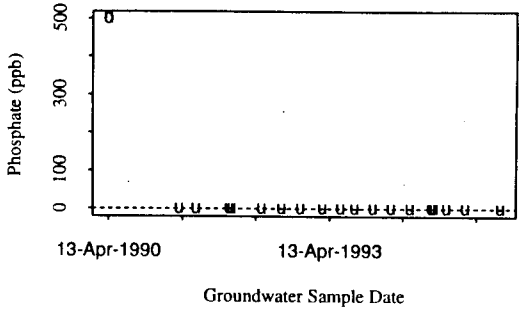
Segment 19-Nitrite
Well 699-S6-E14A



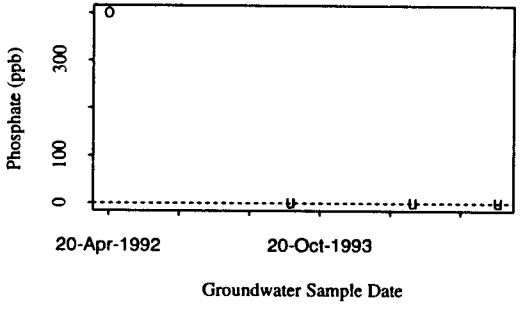
Segment 19-Phosphate
Well 399-1-18A



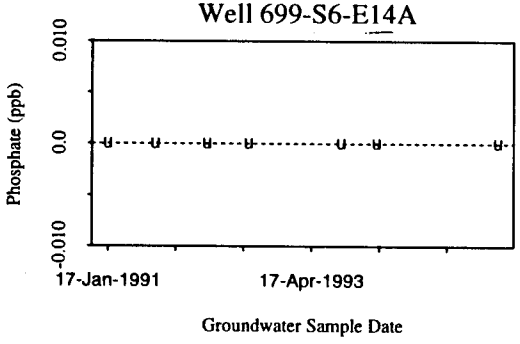
Segment 19-Phosphate
Well 699-S19-E13



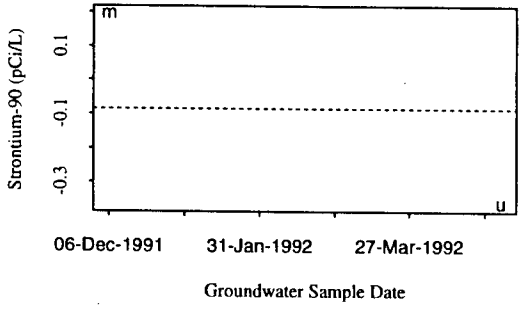
Segment 19-Phosphate
Well 699-S19-E14



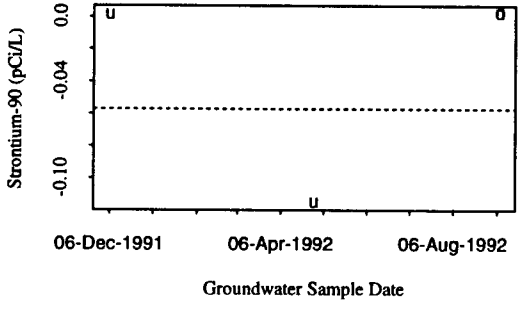
Segment 19-Phosphate
Well 699-S6-E14A



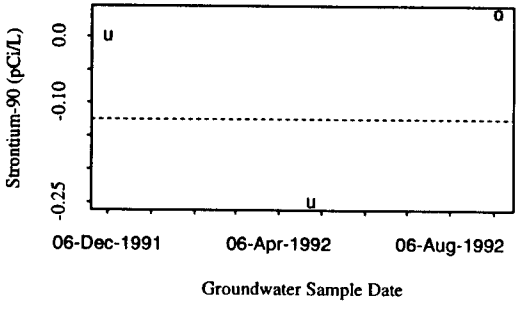
Segment 19-Strontium-90
Well 399-1-18A



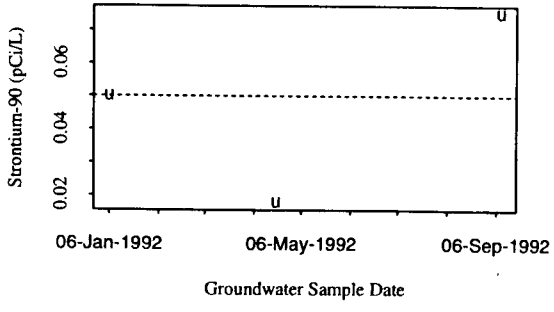
Segment 19-Strontium-90
Well 399-1-18B



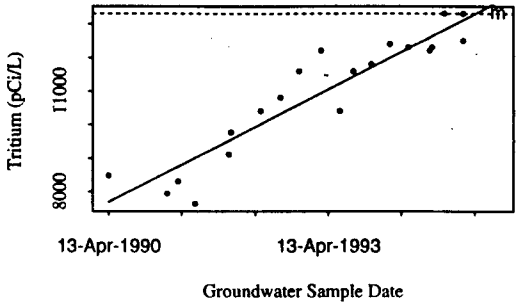
Segment 19-Strontium-90
Well 399-1-18C



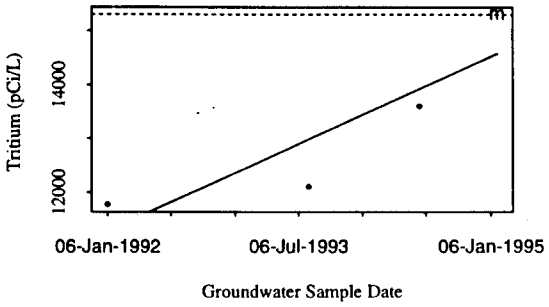
Segment 19-Strontium-90
Well 699-S19-E14



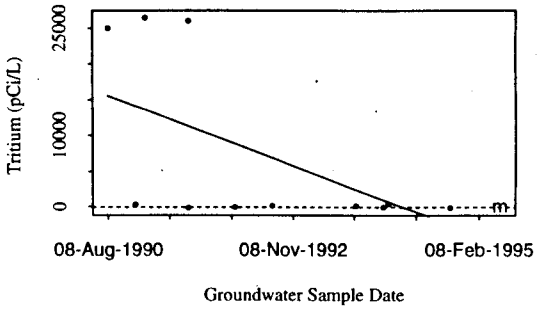
Segment 19-Tritium
Well 699-S19-E13



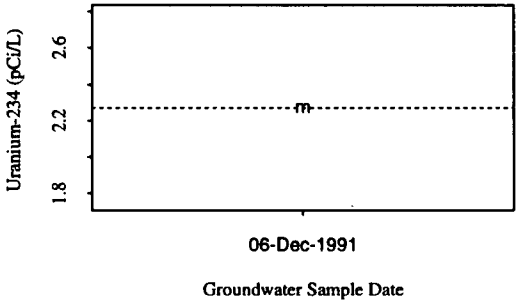
Segment 19-Tritium
Well 699-S19-E14



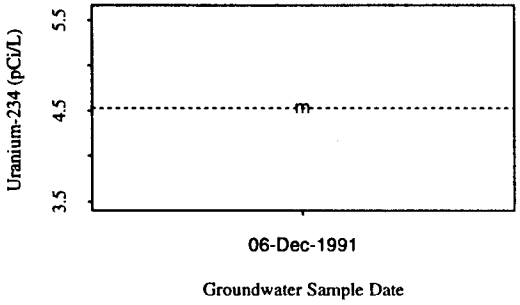
Segment 19-Tritium
Well 699-S6-E14A



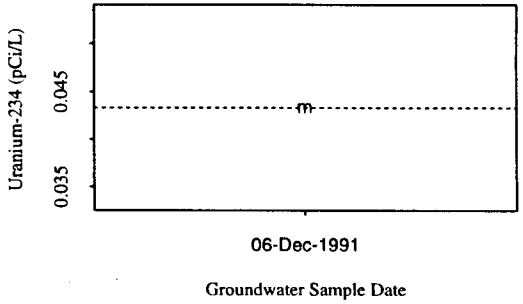
Segment 19-Uranium-234
Well 399-1-18A



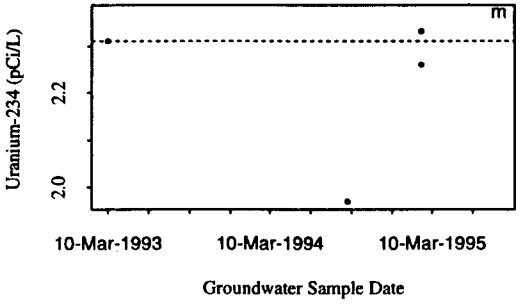
Segment 19-Uranium-234
Well 399-1-18B



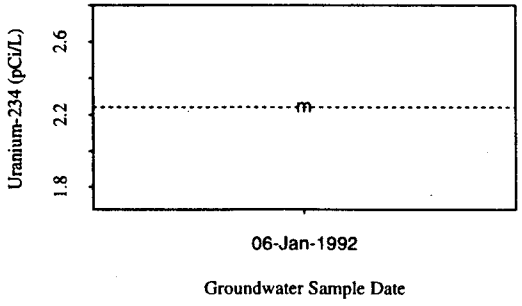
Segment 19-Uranium-234
Well 399-1-18C



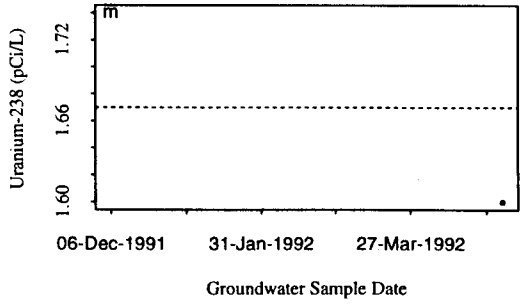
Segment 19-Uranium-234
Well 699-S19-E13



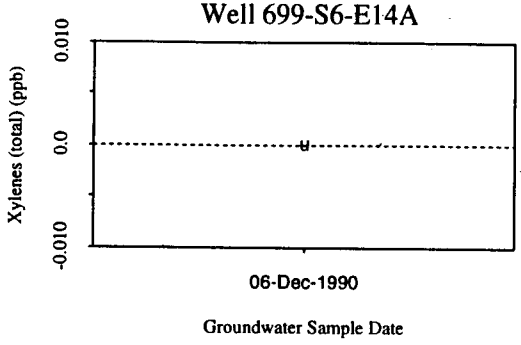
Segment 19-Uranium-234
Well 699-S19-E14



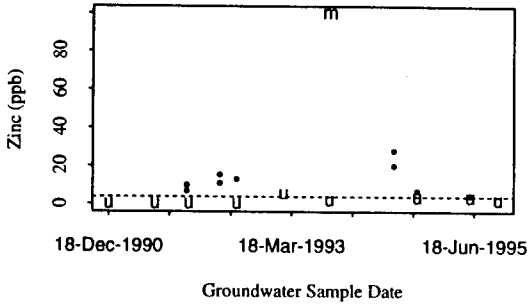
Segment 19-Uranium-238
Well 399-1-18A



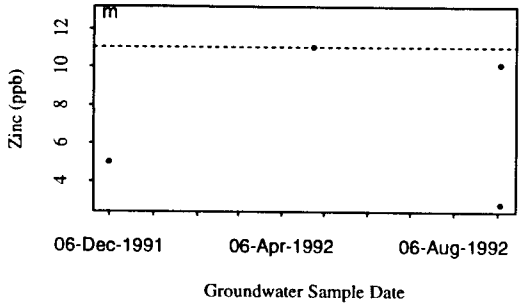
Segment 19-Xylenes (total)
Well 699-S6-E14A



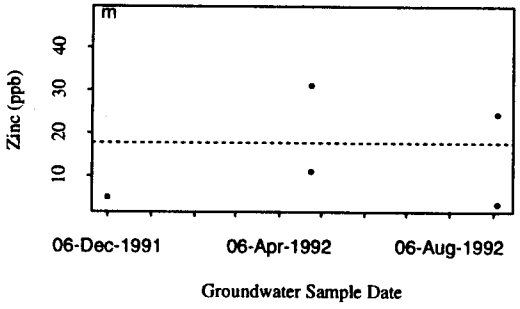
Segment 19-Zinc
Well 399-1-18A



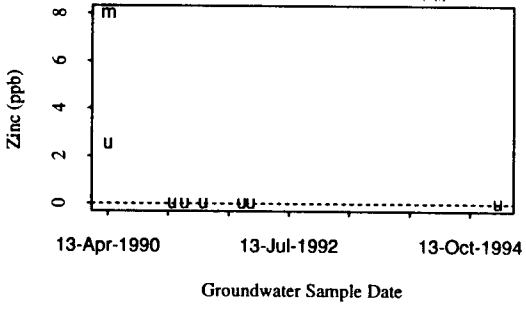
Segment 19-Zinc
Well 399-1-18B



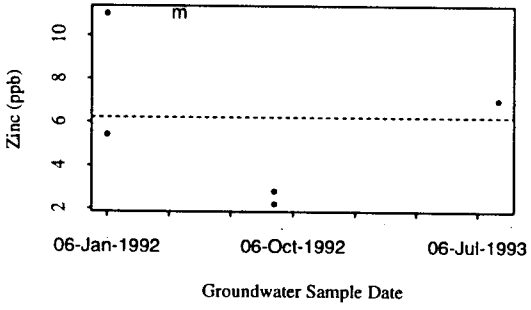
Segment 19-Zinc
Well 399-1-18C



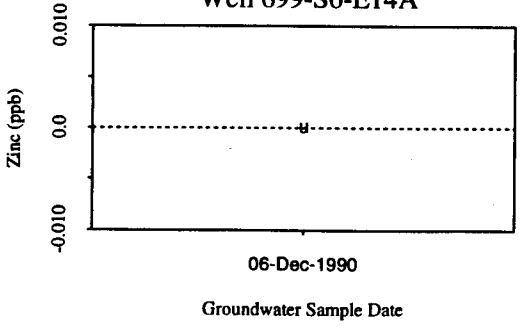
Segment 19-Zinc
Well 699-S19-E13



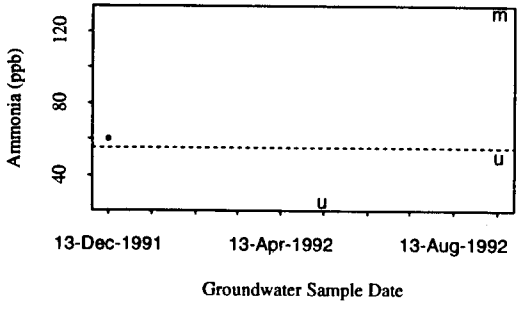
Segment 19-Zinc
Well 699-S19-E14



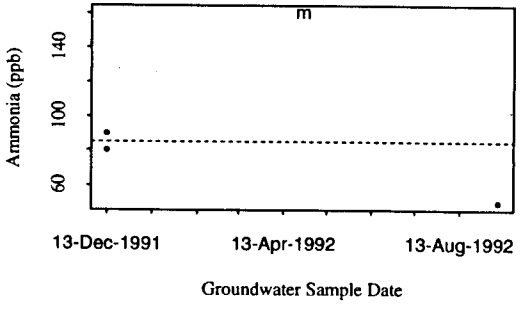
Segment 19-Zinc
Well 699-S6-E14A



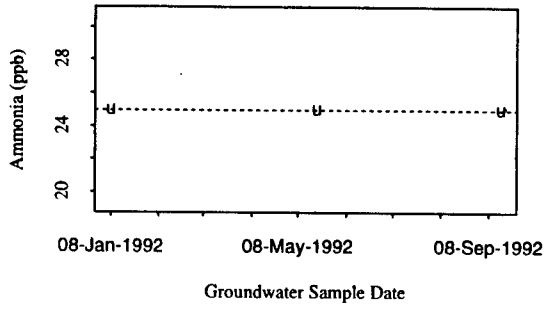
Segment 20-Ammonia
Well 399-1-10A



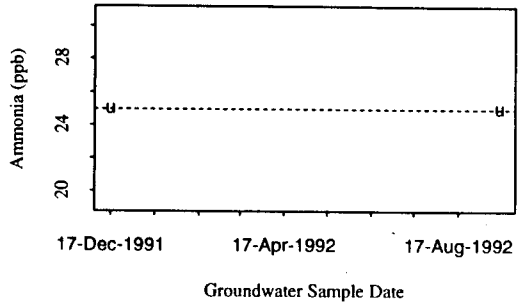
Segment 20-Ammonia
Well 399-1-10B



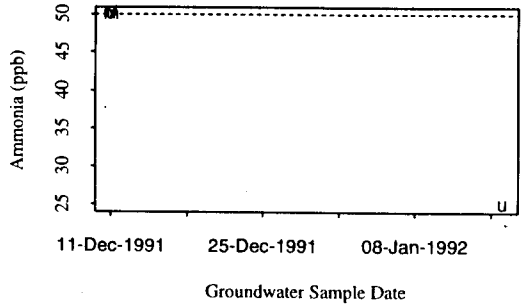
Segment 20-Ammonia
Well 399-1-5



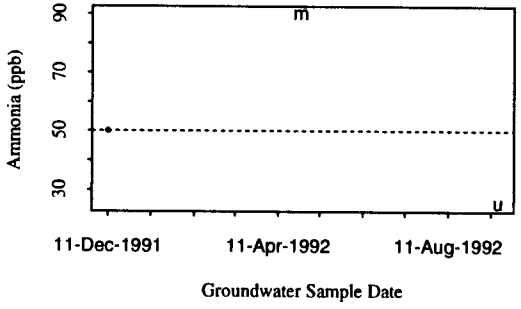
Segment 20-Ammonia
Well 399-1-6



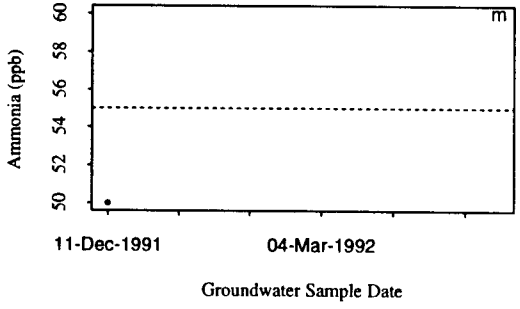
Segment 20-Ammonia
Well 399-1-7



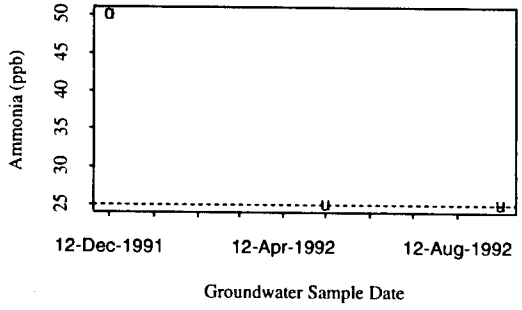
Segment 20-Ammonia
Well 399-1-8



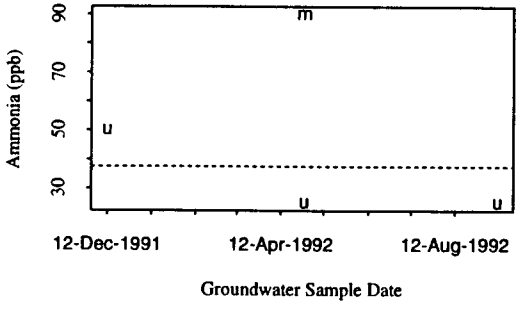
Segment 20-Ammonia
Well 399-2-1



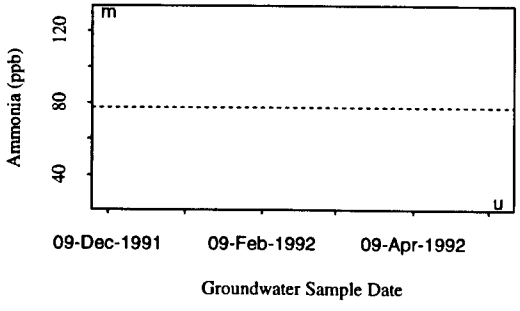
Segment 20-Ammonia
Well 399-2-2



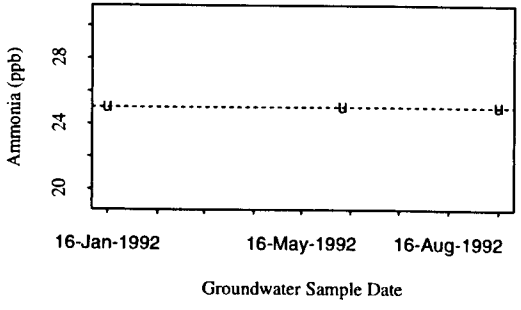
Segment 20-Ammonia
Well 399-2-3



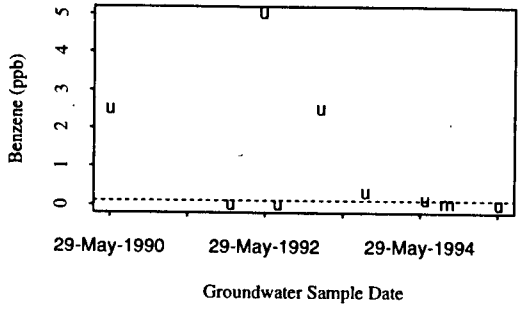
Segment 20-Ammonia
Well 399-3-10



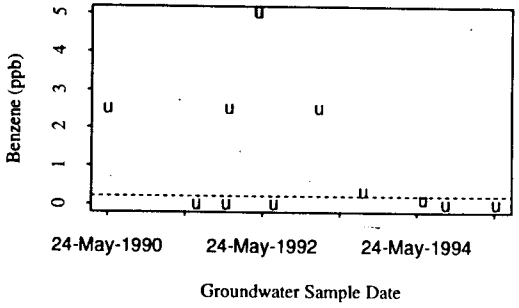
Segment 20-Ammonia
Well 399-3-11



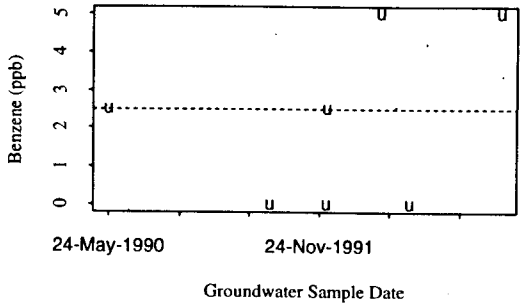
Segment 20-Benzene
Well 399-1-11



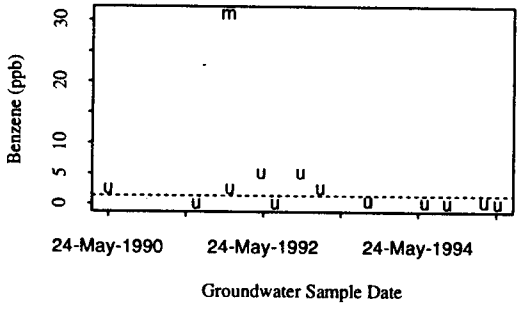
Segment 20-Benzene
Well 399-1-12



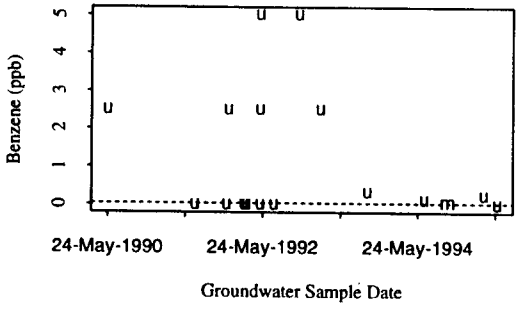
Segment 20-Benzene
Well 399-1-15



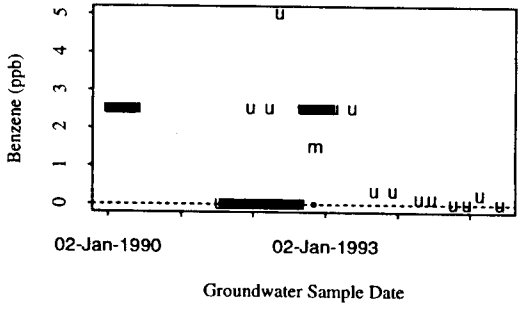
Segment 20-Benzene
Well 399-1-16A



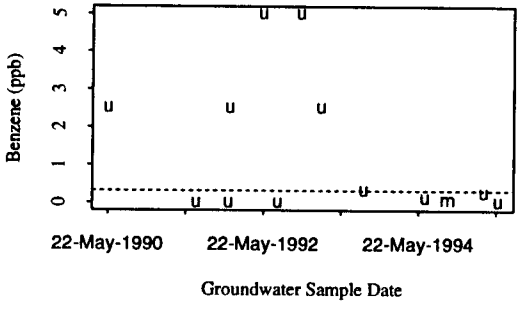
Segment 20-Benzene
Well 399-1-16B



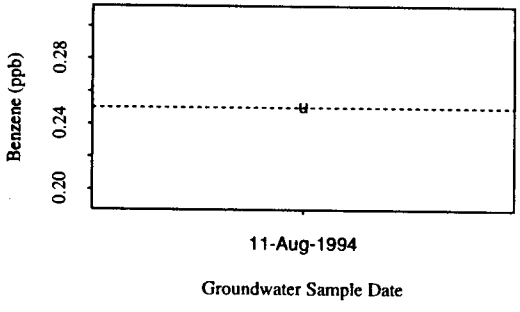
Segment 20-Benzene
Well 399-1-17A



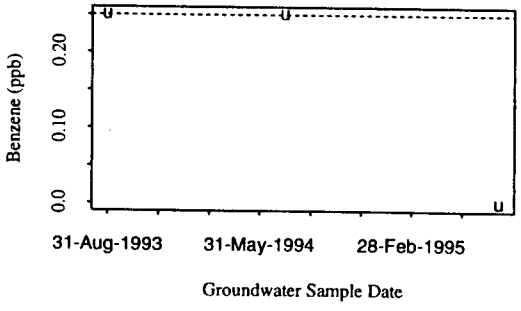
Segment 20-Benzene
Well 399-1-17B



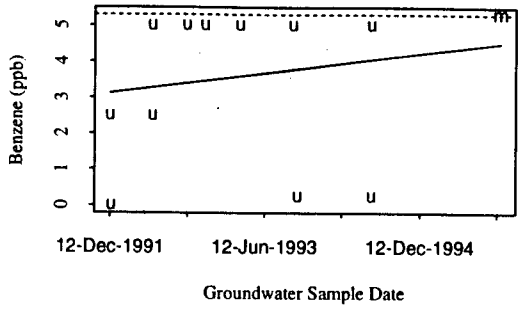
Segment 20-Benzene
Well 399-1-19



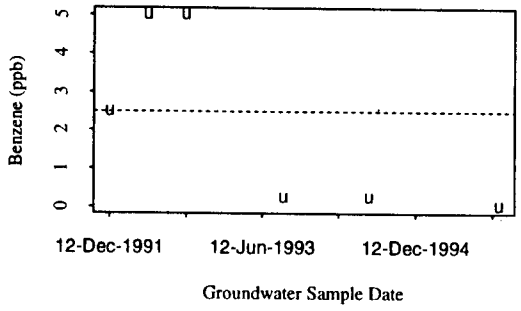
Segment 20-Benzene
Well 399-1-2



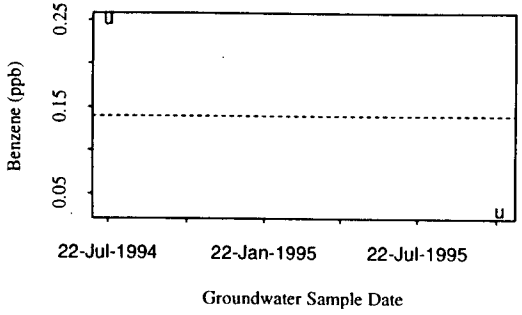
Segment 20-Benzene
Well 399-2-2



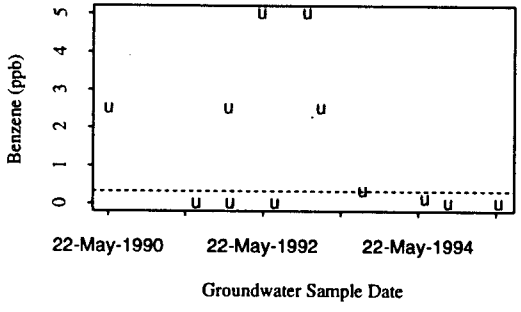
Segment 20-Benzene
Well 399-2-3



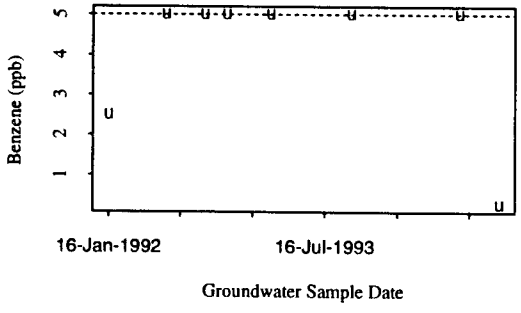
Segment 20-Benzene
Well 399-3-1



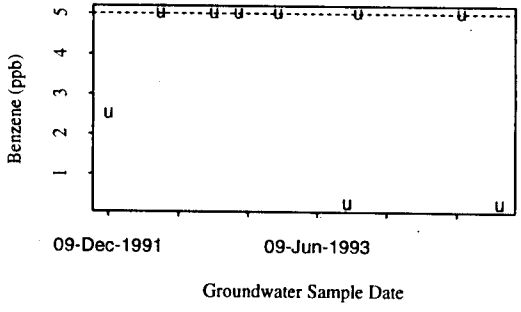
Segment 20-Benzene
Well 399-3-10



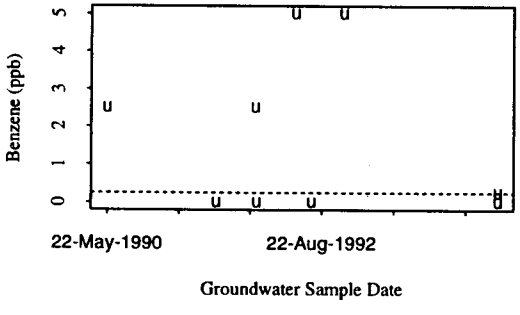
Segment 20-Benzene
Well 399-3-11



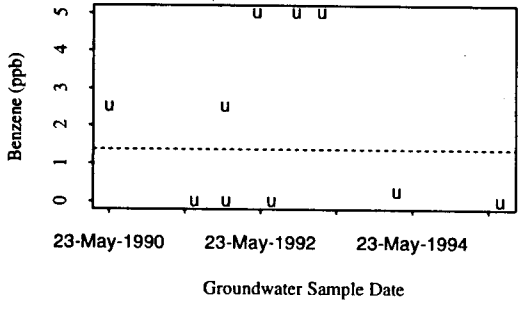
Segment 20-Benzene
Well 399-3-12



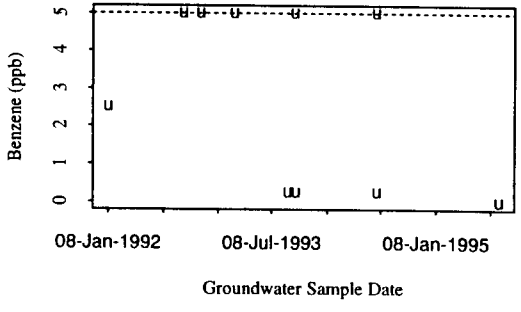
Segment 20-Benzene
Well 399-3-9



Segment 20-Benzene
Well 399-4-1

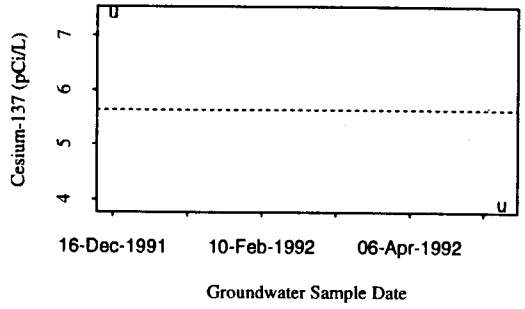


Segment 20-Benzene
Well 399-4-10

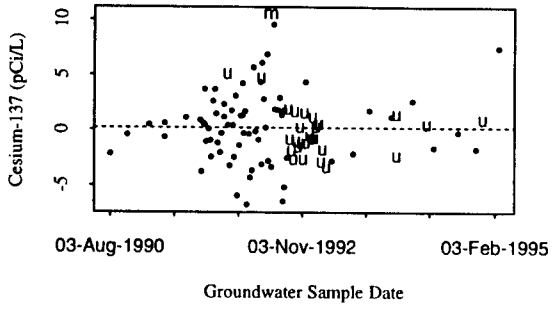


9016448.1708

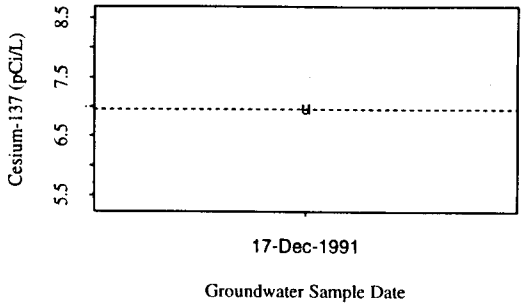
Segment 20-Cesium-137
Well 399-1-16B



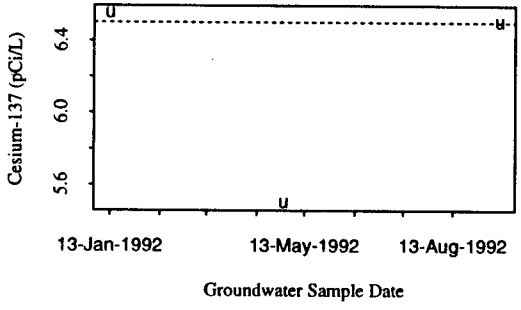
Segment 20-Cesium-137
Well 399-1-17A



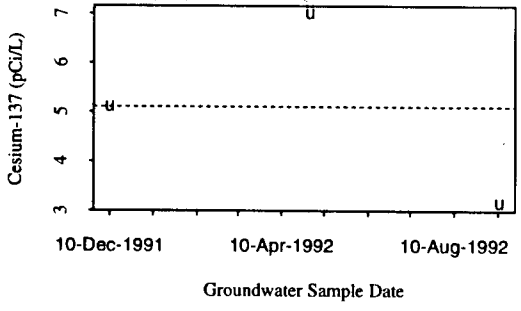
Segment 20-Cesium-137
Well 399-1-17B



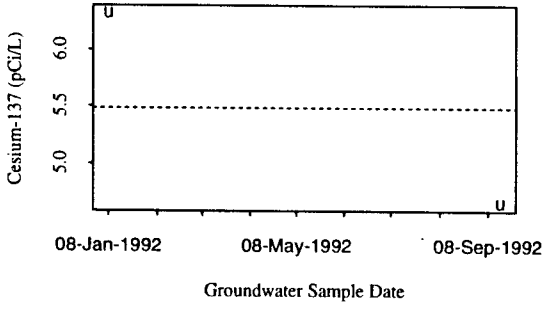
Segment 20-Cesium-137
Well 399-1-21A



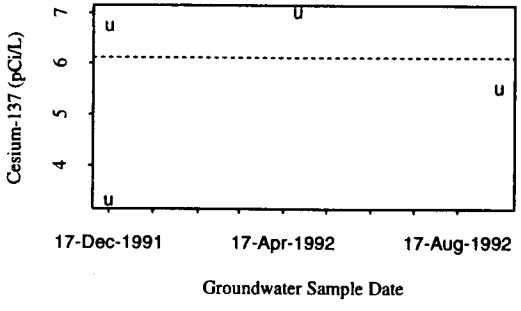
Segment 20-Cesium-137
Well 399-1-21B



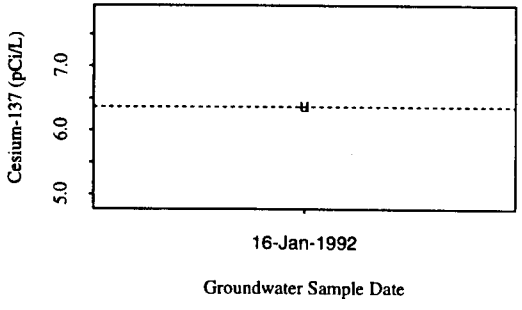
Segment 20-Cesium-137
Well 399-1-5



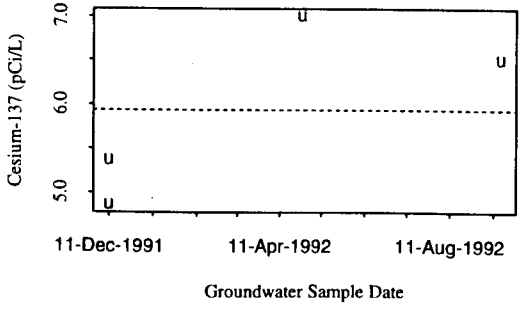
Segment 20-Cesium-137
Well 399-1-6



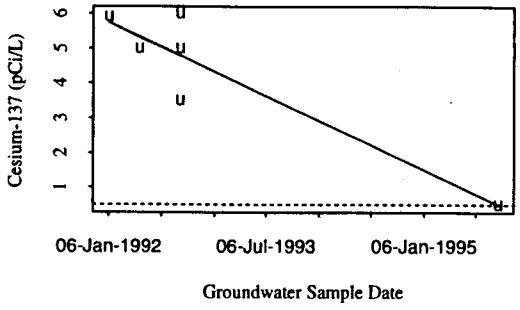
Segment 20-Cesium-137
Well 399-1-7



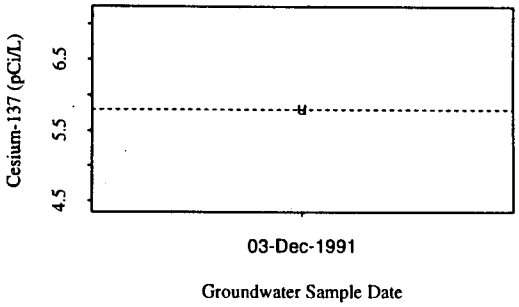
Segment 20-Cesium-137
Well 399-1-8



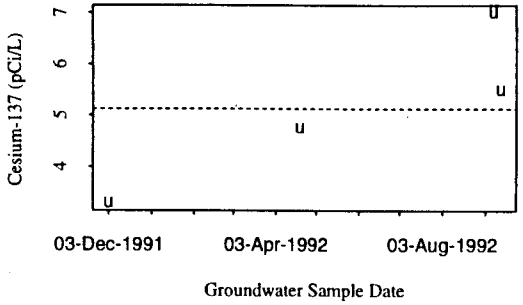
Segment 20-Cesium-137
Well 399-4-12



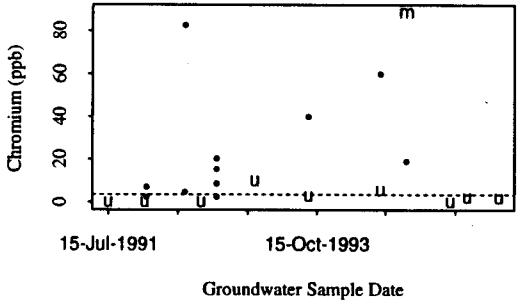
Segment 20-Cesium-137
Well 399-4-7



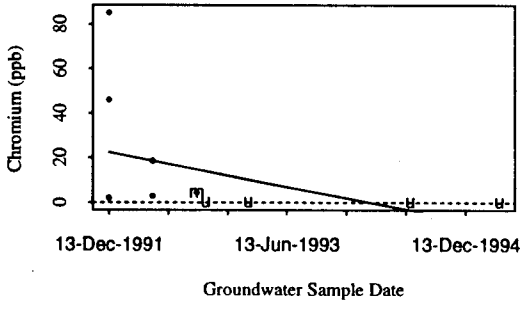
Segment 20-Cesium-137
Well 399-4-9



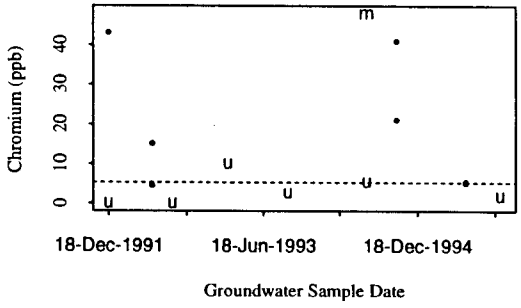
Segment 20-Chromium
Well 399-1-10A



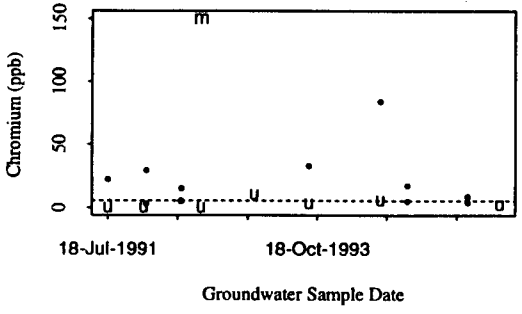
Segment 20-Chromium
Well 399-1-10B



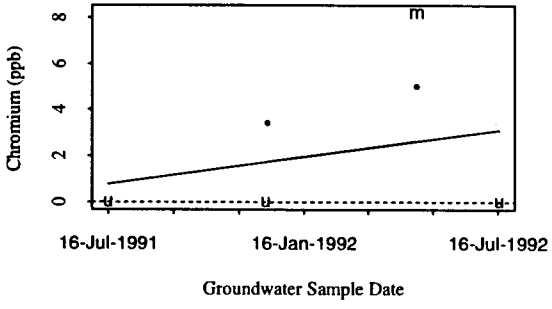
Segment 20-Chromium
Well 399-1-11



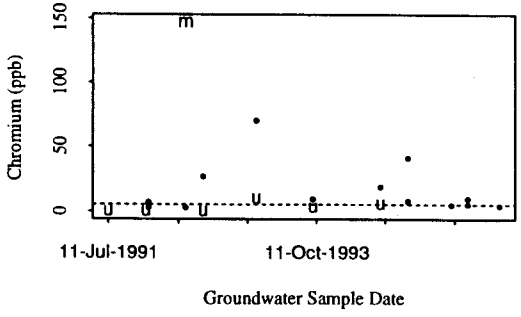
Segment 20-Chromium
Well 399-1-12



Segment 20-Chromium
Well 399-1-15

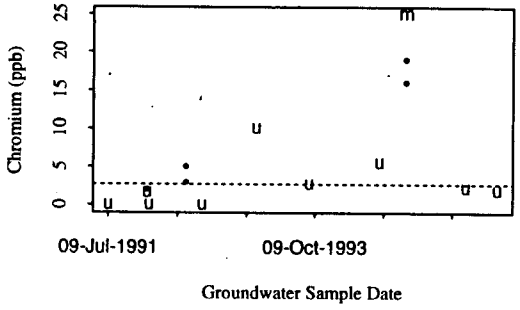


Segment 20-Chromium
Well 399-1-16A

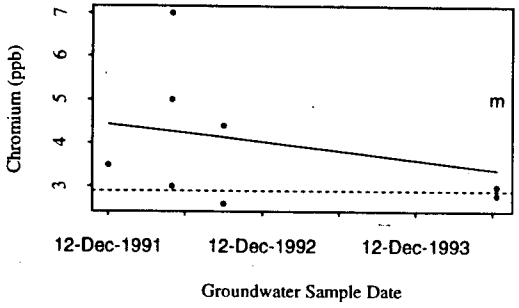


9513044.1706

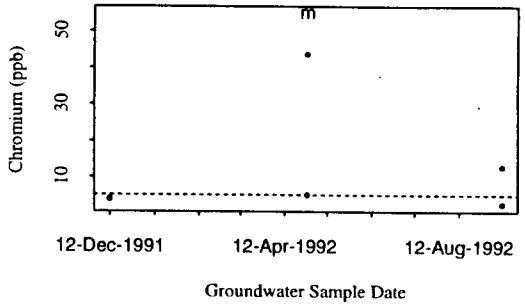
Segment 20-Chromium
Well 399-2-1



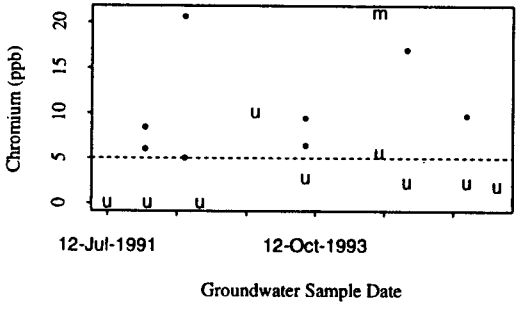
Segment 20-Chromium
Well 399-2-2



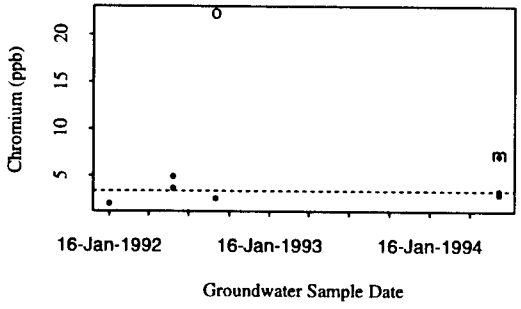
Segment 20-Chromium
Well 399-2-3



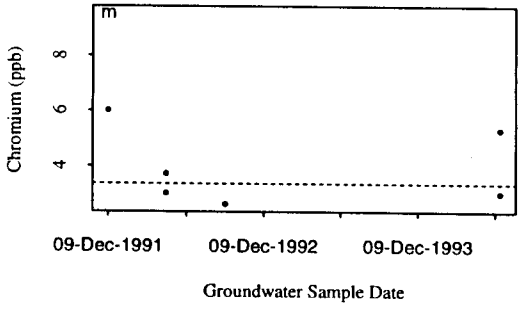
Segment 20-Chromium
Well 399-3-10



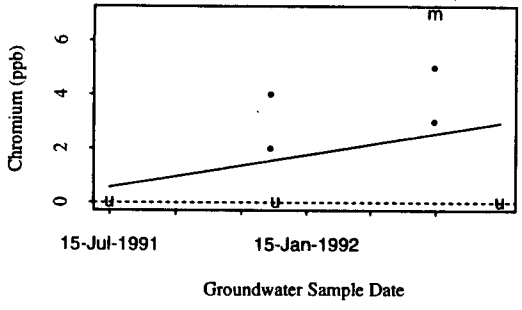
Segment 20-Chromium
Well 399-3-11



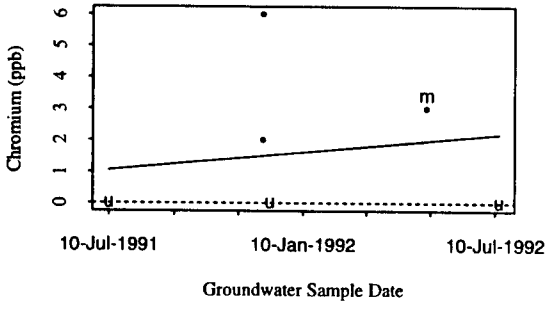
Segment 20-Chromium
Well 399-3-12



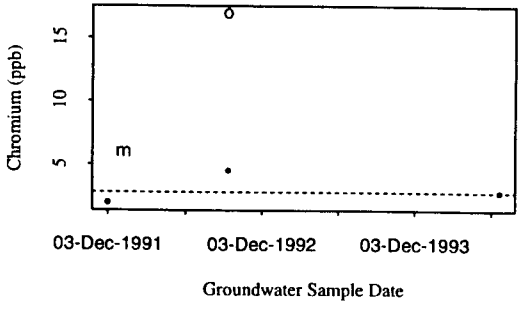
Segment 20-Chromium
Well 399-3-9



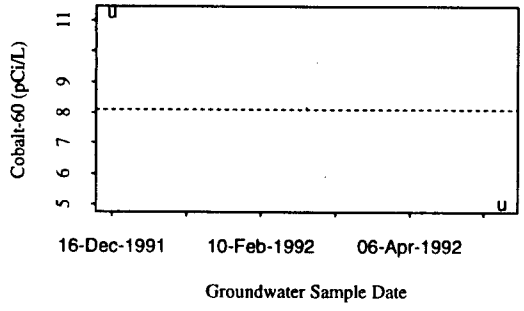
Segment 20-Chromium
Well 399-4-1



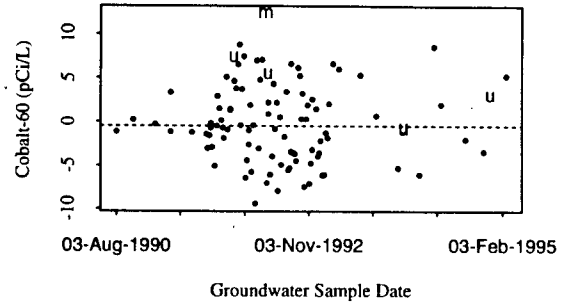
Segment 20-Chromium
Well 399-4-10



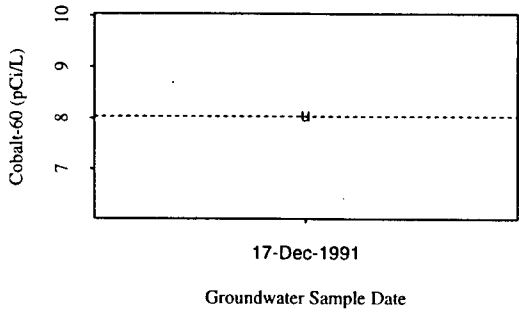
Segment 20-Cobalt-60
Well 399-1-16B



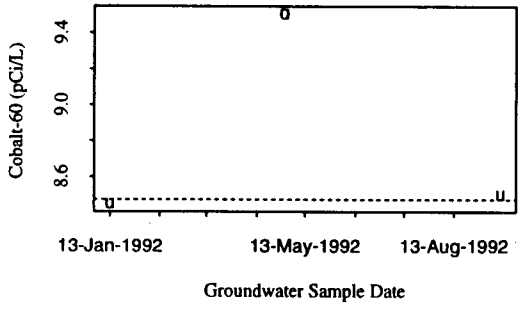
Segment 20-Cobalt-60
Well 399-1-17A



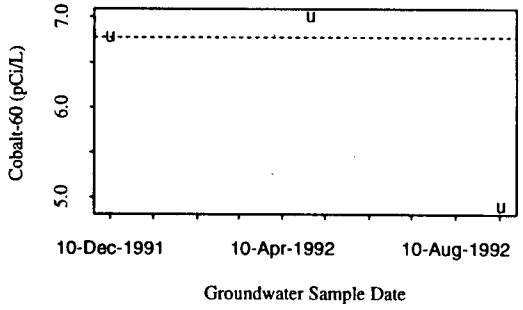
Segment 20-Cobalt-60
Well 399-1-17B



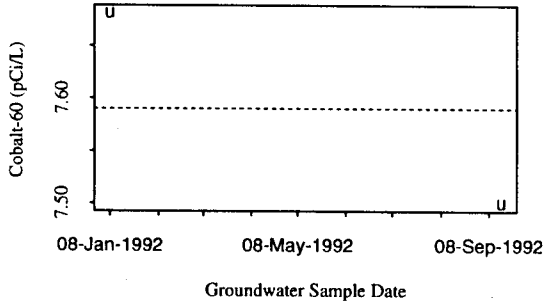
Segment 20-Cobalt-60
Well 399-1-21A



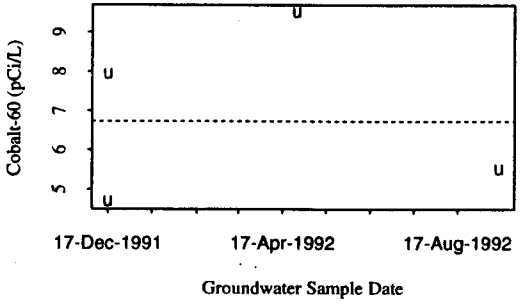
Segment 20-Cobalt-60
Well 399-1-21B



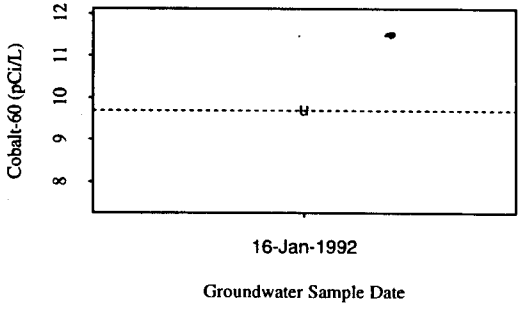
Segment 20-Cobalt-60
Well 399-1-5



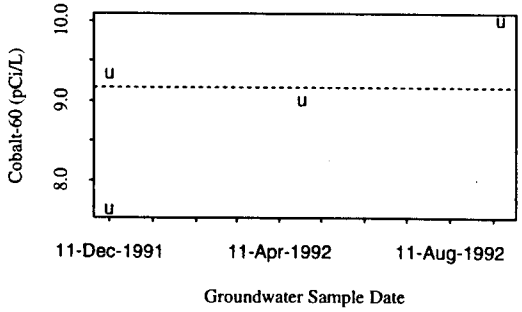
Segment 20-Cobalt-60
Well 399-1-6



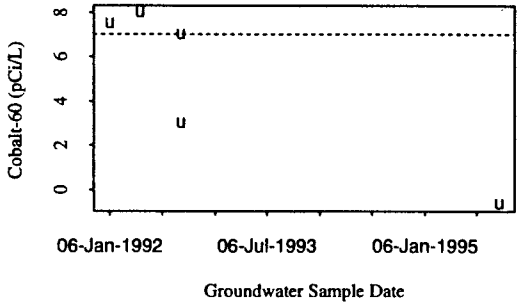
Segment 20-Cobalt-60
Well 399-1-7



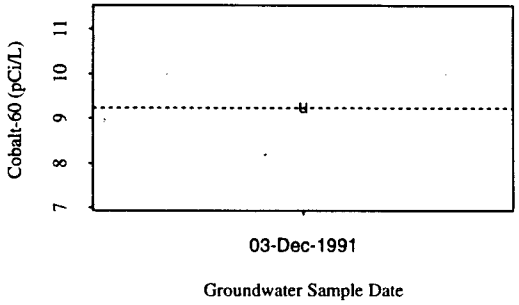
Segment 20-Cobalt-60
Well 399-1-8



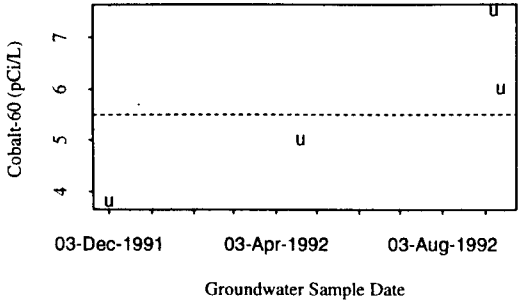
Segment 20-Cobalt-60
Well 399-4-12



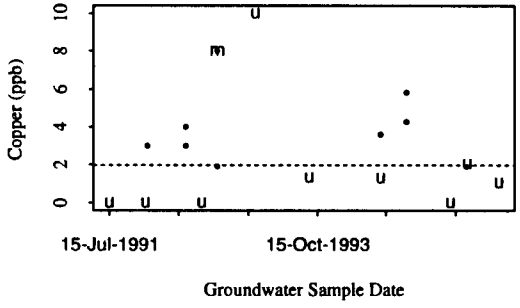
Segment 20-Cobalt-60
Well 399-4-7



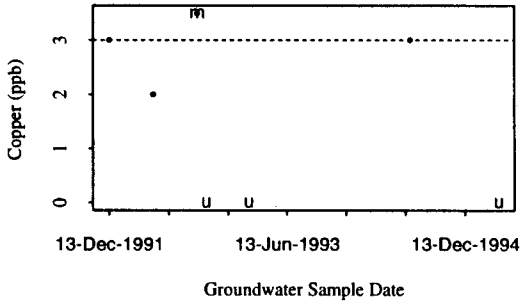
Segment 20-Cobalt-60
Well 399-4-9



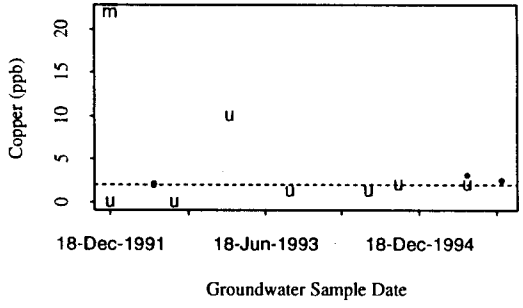
Segment 20-Copper
Well 399-1-10A



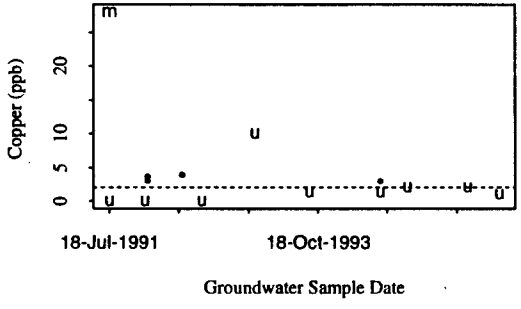
Segment 20-Copper
Well 399-1-10B



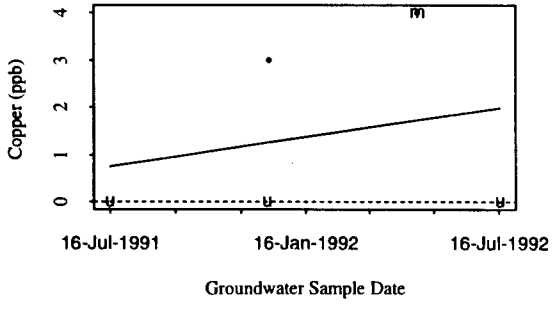
Segment 20-Copper
Well 399-1-11



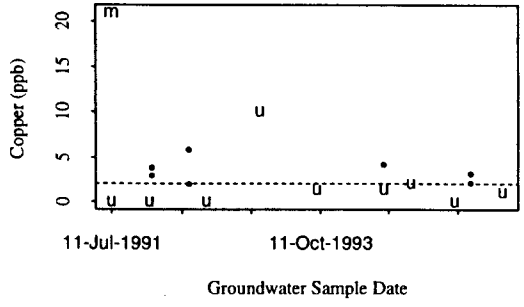
Segment 20-Copper
Well 399-1-12



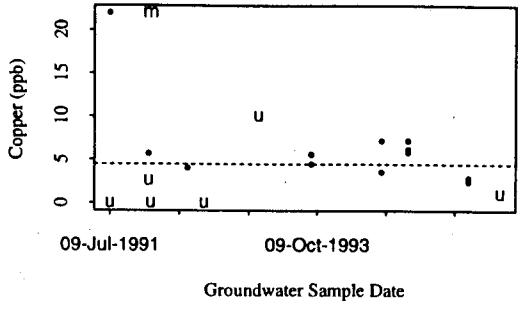
Segment 20-Copper
Well 399-1-15



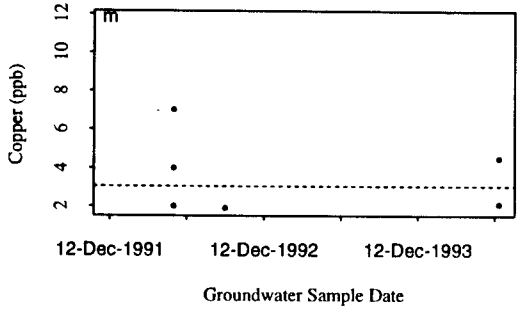
Segment 20-Copper
Well 399-1-16A



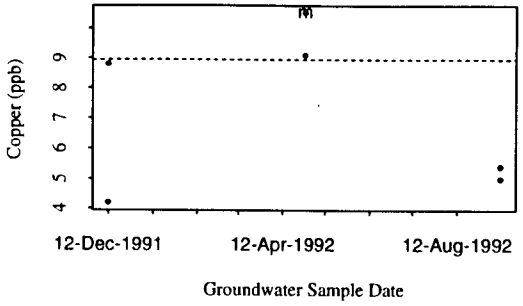
Segment 20-Copper
Well 399-2-1



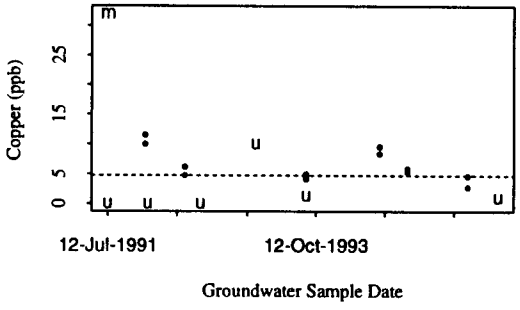
Segment 20-Copper
Well 399-2-2



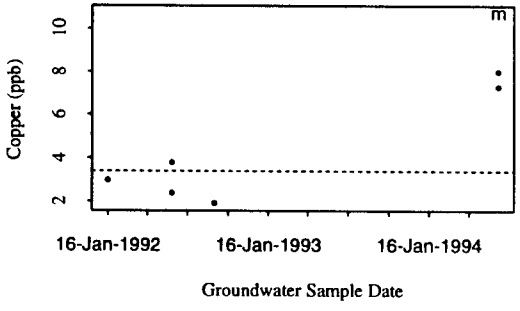
Segment 20-Copper
Well 399-2-3



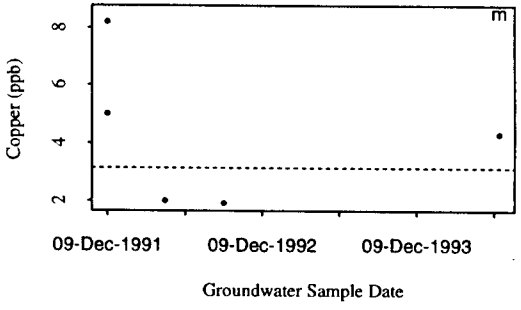
Segment 20-Copper
Well 399-3-10



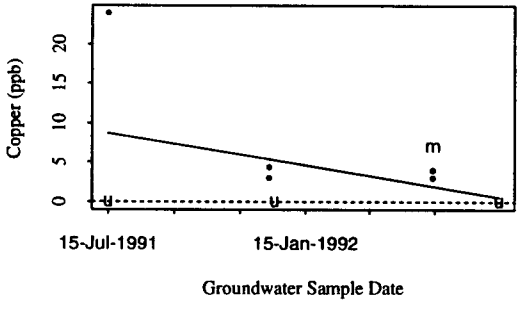
Segment 20-Copper
Well 399-3-11



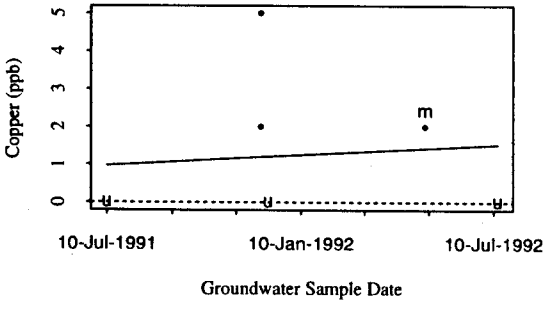
Segment 20-Copper
Well 399-3-12



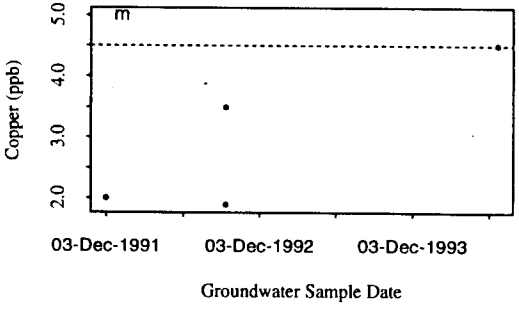
Segment 20-Copper
Well 399-3-9



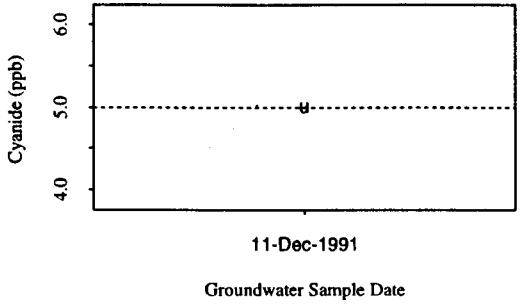
Segment 20-Copper
Well 399-4-1



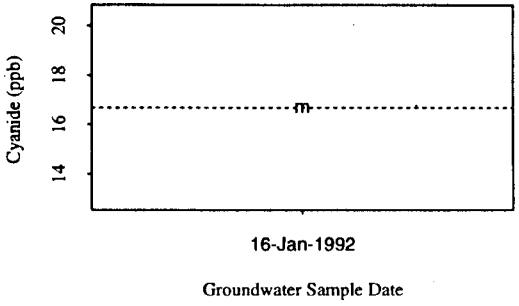
Segment 20-Copper
Well 399-4-10



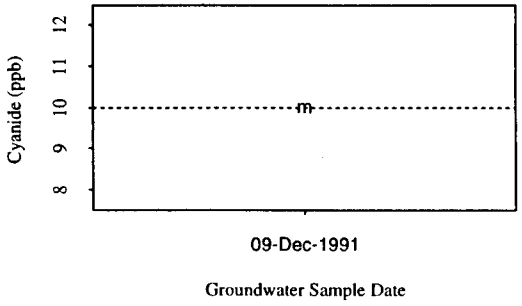
Segment 20-Cyanide
Well 399-1-8



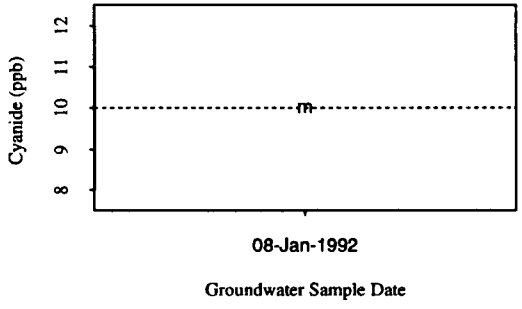
Segment 20-Cyanide
Well 399-3-11



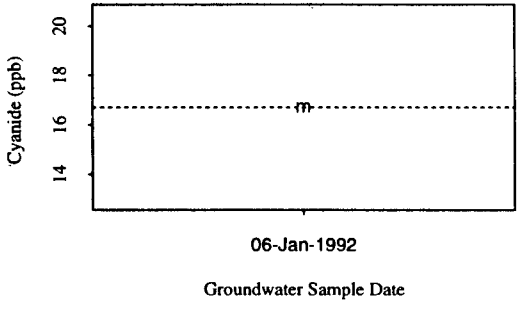
Segment 20-Cyanide
Well 399-3-12



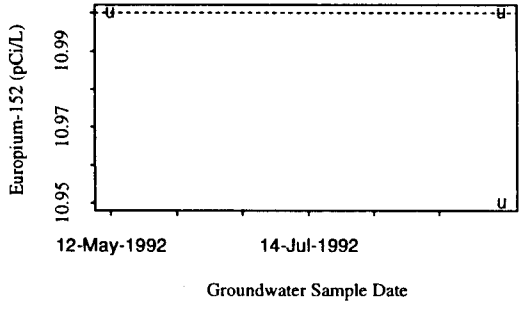
Segment 20-Cyanide
Well 399-4-10



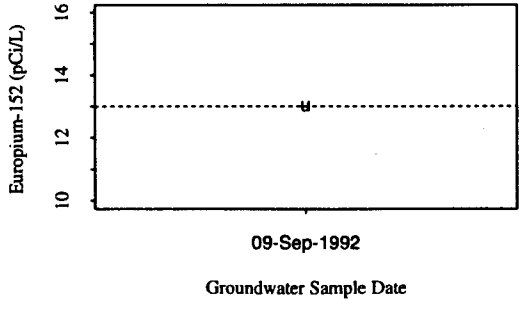
Segment 20-Cyanide
Well 399-4-12



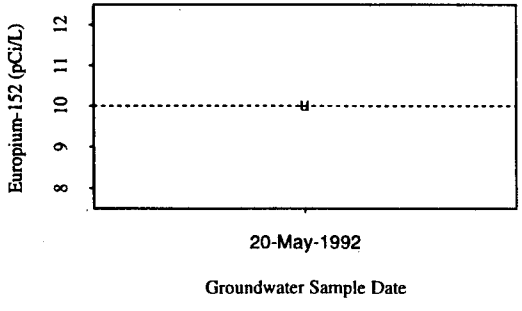
Segment 20-Europium-152
Well 399-1-10A



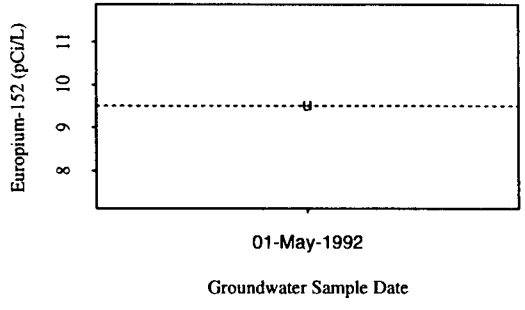
Segment 20-Europium-152
Well 399-1-10B



Segment 20-Europium-152
Well 399-1-11

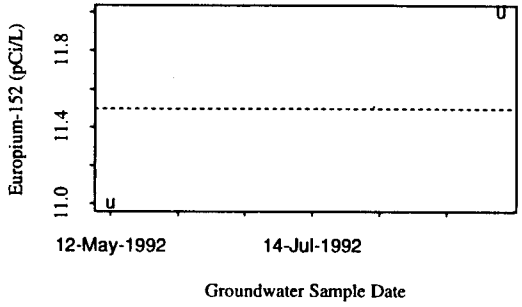


Segment 20-Europium-152
Well 399-1-15

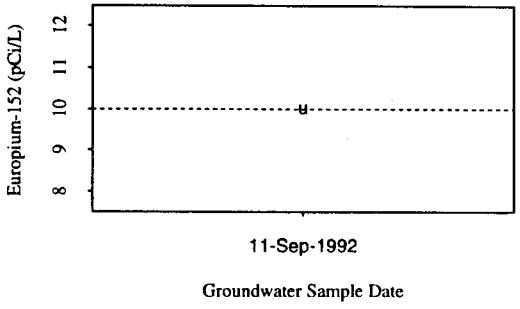


9613481.1715

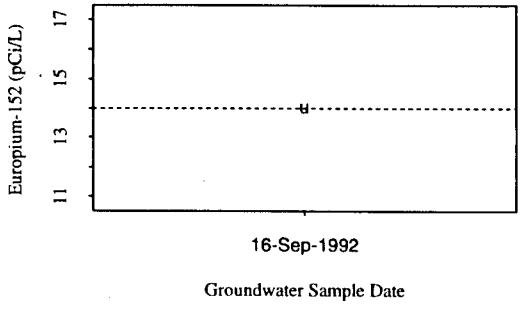
Segment 20-Europium-152
Well 399-2-2



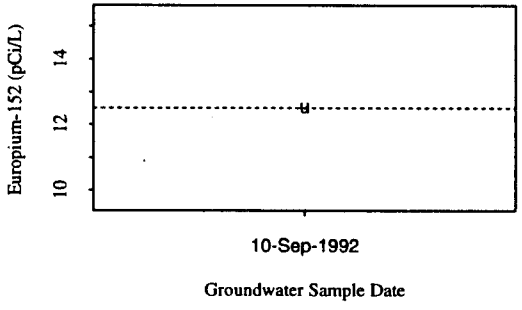
Segment 20-Europium-152
Well 399-2-3



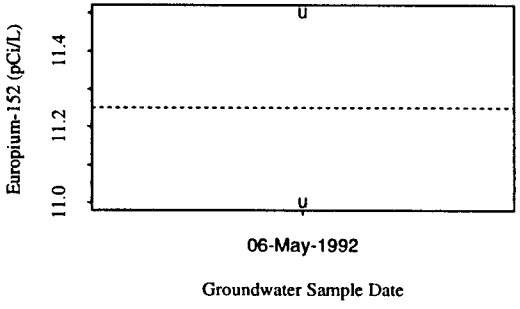
Segment 20-Europium-152
Well 399-3-11



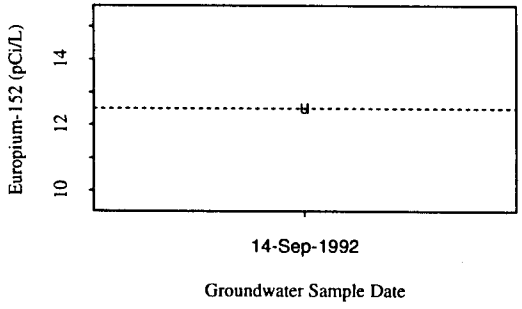
Segment 20-Europium-152
Well 399-3-12



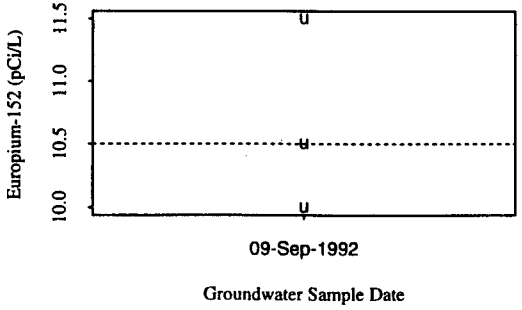
Segment 20-Europium-152
Well 399-4-1



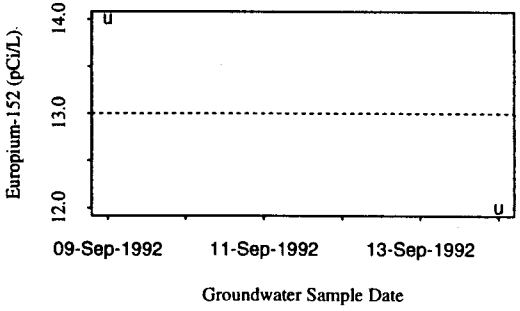
Segment 20-Europium-152
Well 399-4-10



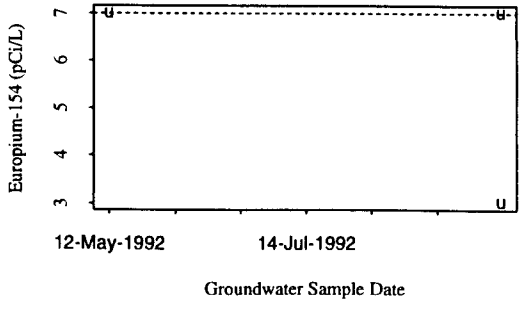
Segment 20-Europium-152
Well 399-4-12



Segment 20-Europium-152
Well 399-4-9

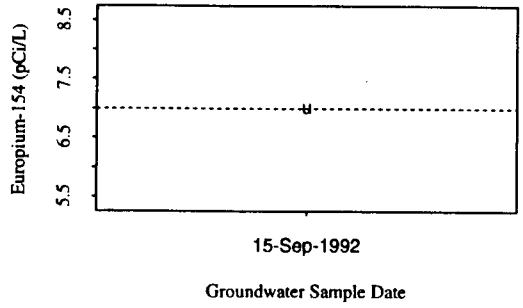


Segment 20-Europium-154
Well 399-1-10A

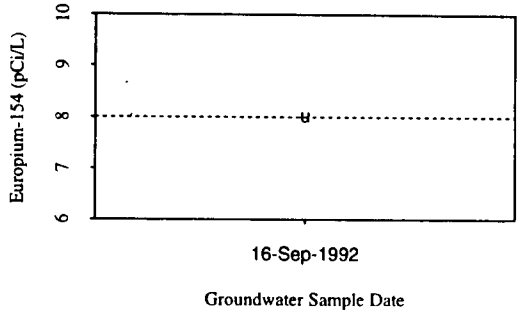


9615448.1716

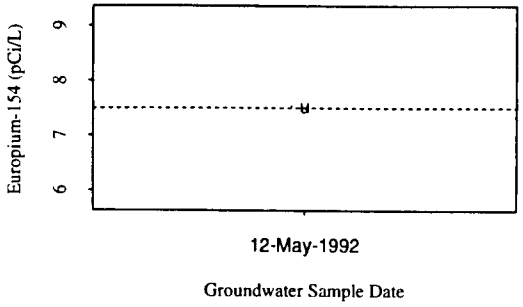
Segment 20-Europium-154
Well 399-1-6



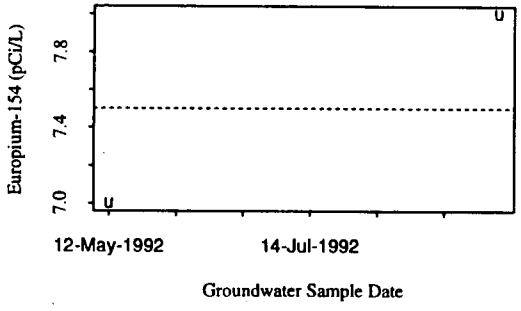
Segment 20-Europium-154
Well 399-1-8



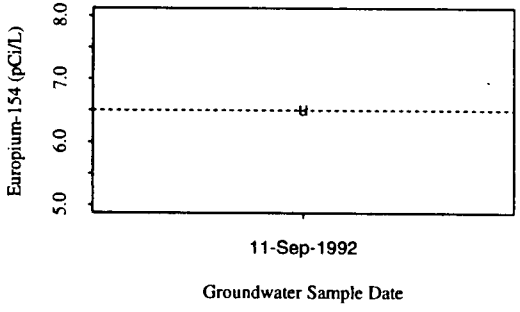
Segment 20-Europium-154
Well 399-2-1



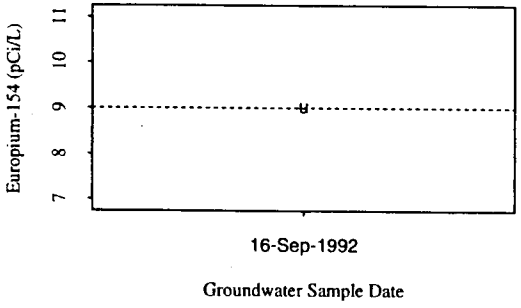
Segment 20-Europium-154
Well 399-2-2



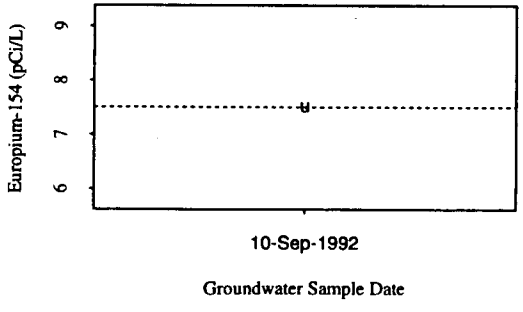
Segment 20-Europium-154
Well 399-2-3



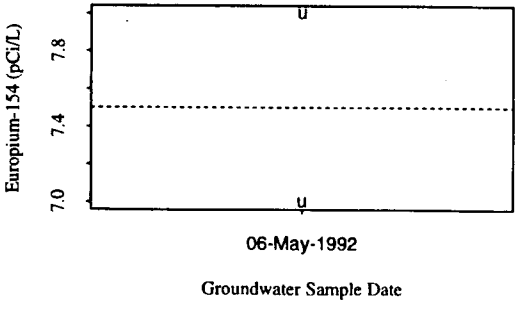
Segment 20-Europium-154
Well 399-3-11



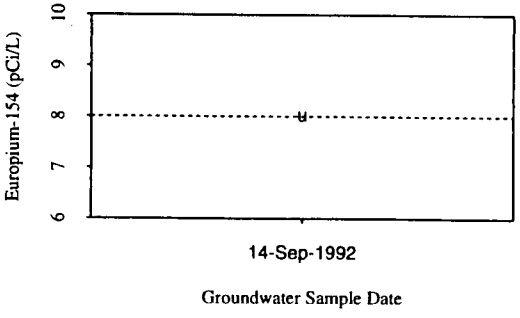
Segment 20-Europium-154
Well 399-3-12



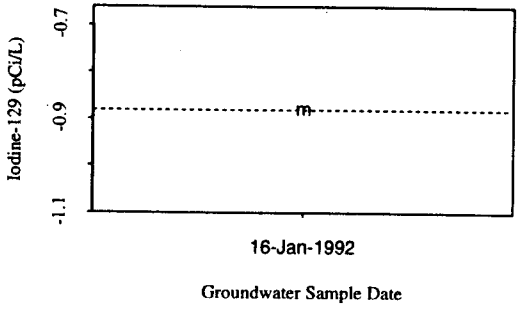
Segment 20-Europium-154
Well 399-4-1



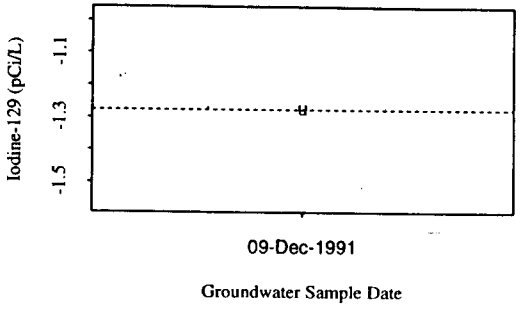
Segment 20-Europium-154
Well 399-4-10



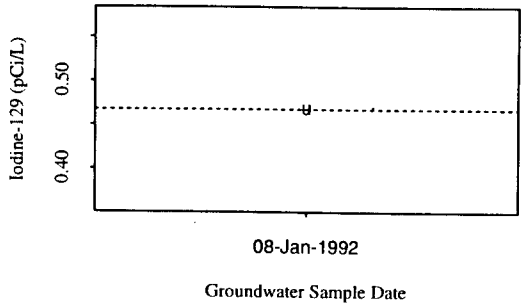
Segment 20-Iodine-129
Well 399-3-11



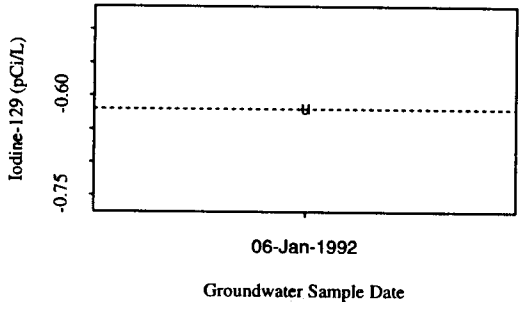
Segment 20-Iodine-129
Well 399-3-12



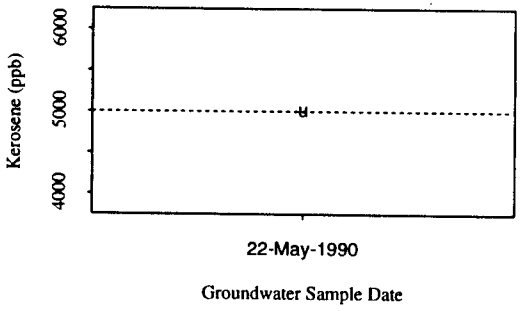
Segment 20-Iodine-129
Well 399-4-10



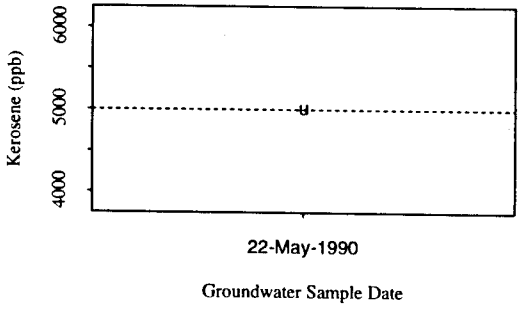
Segment 20-Iodine-129
Well 399-4-12



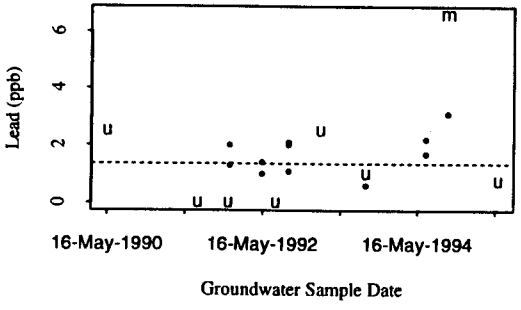
Segment 20-Kerosene
Well 399-1-17A



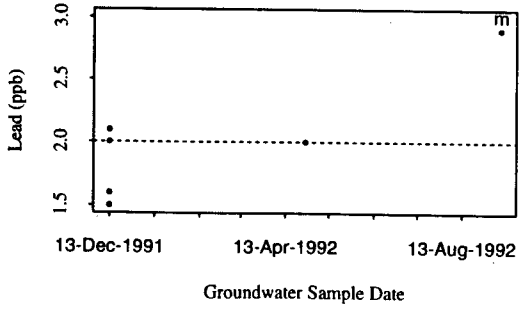
Segment 20-Kerosene
Well 399-1-17B



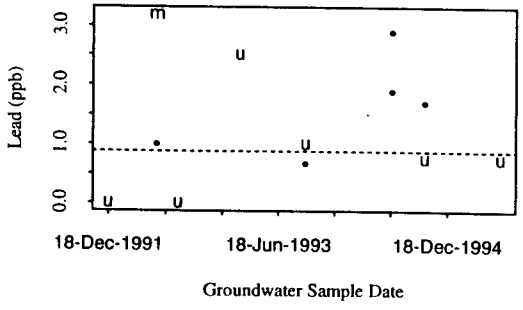
Segment 20-Lead
Well 399-1-10A



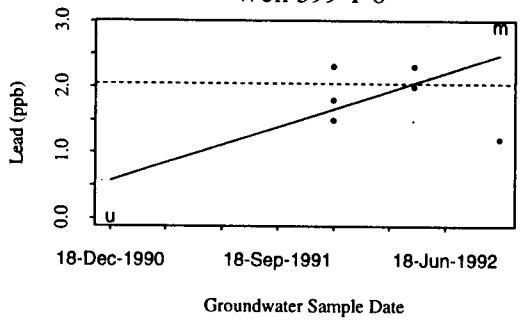
Segment 20-Lead
Well 399-1-10B



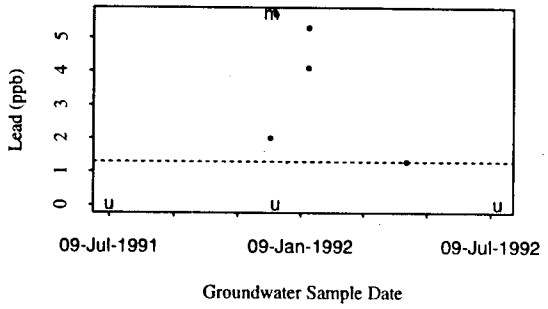
Segment 20-Lead
Well 399-1-11



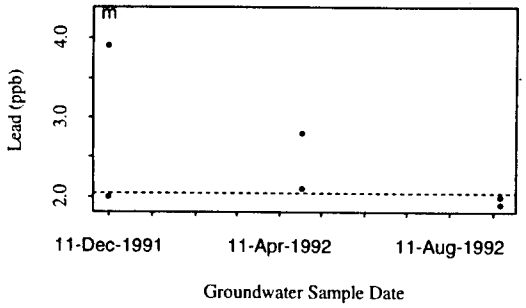
Segment 20-Lead
Well 399-1-6



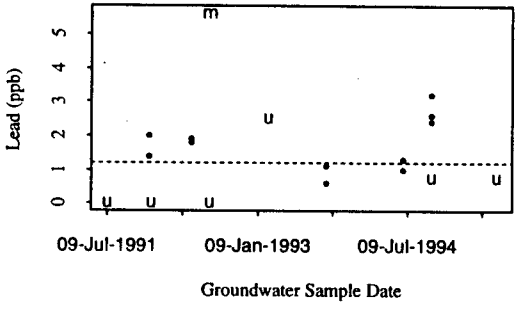
Segment 20-Lead
Well 399-1-7



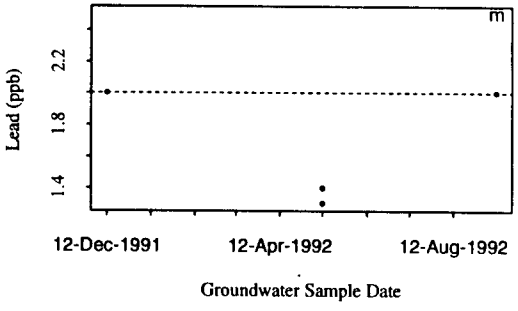
Segment 20-Lead
Well 399-1-8



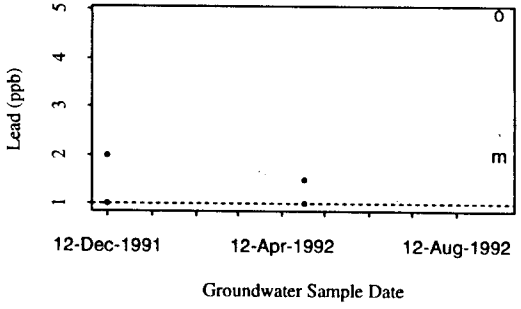
Segment 20-Lead
Well 399-2-1



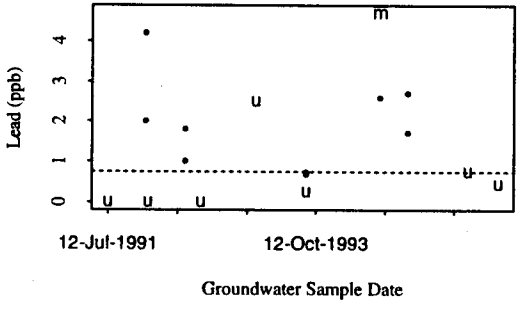
Segment 20-Lead
Well 399-2-2



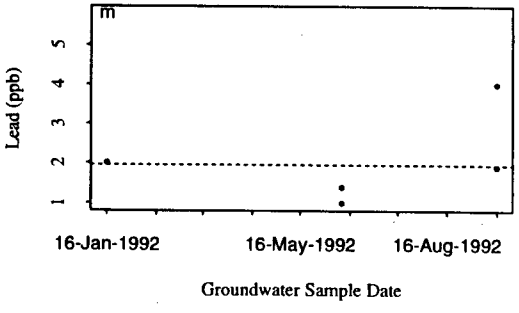
Segment 20-Lead
Well 399-2-3



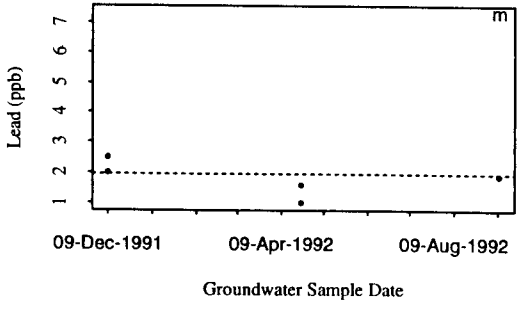
Segment 20-Lead
Well 399-3-10



Segment 20-Lead
Well 399-3-11

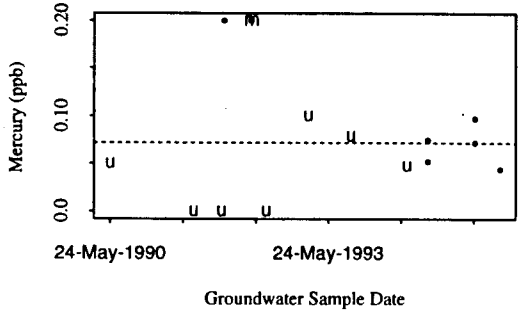


Segment 20-Lead
Well 399-3-12

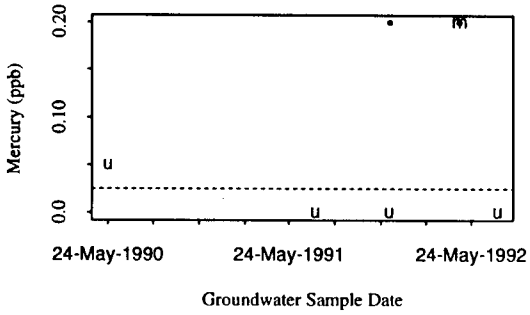


96-3148.1.9

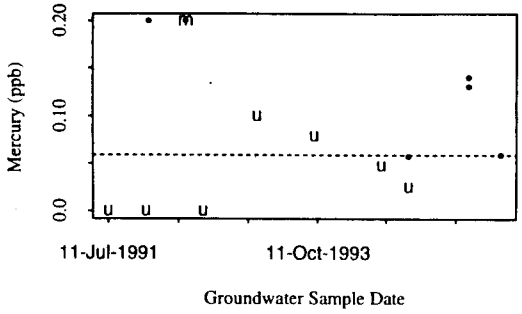
Segment 20-Mercury
Well 399-1-12



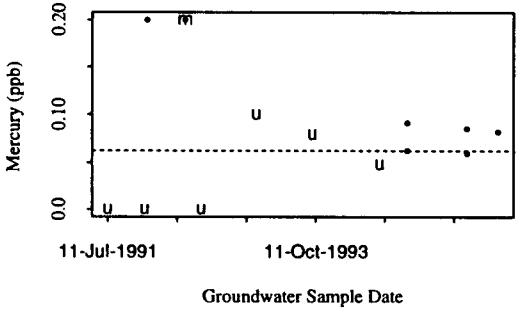
Segment 20-Mercury
Well 399-1-15



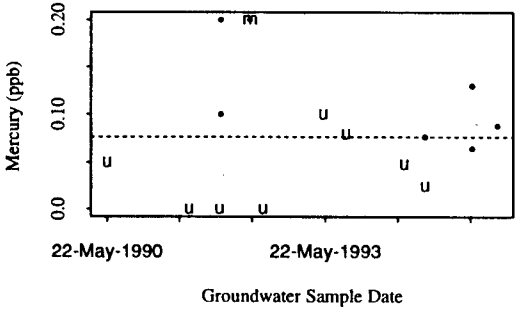
Segment 20-Mercury
Well 399-1-16A



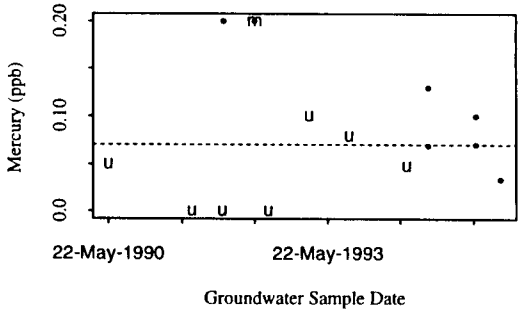
Segment 20-Mercury
Well 399-1-16B



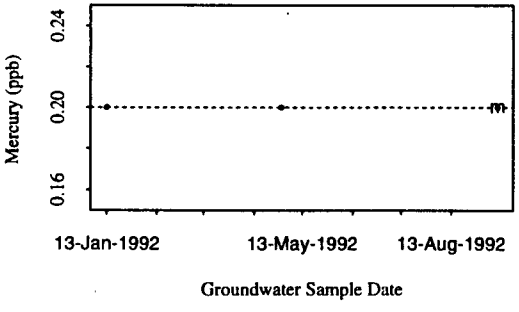
Segment 20-Mercury
Well 399-1-17A



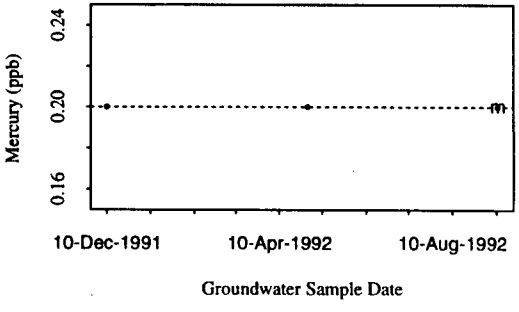
Segment 20-Mercury
Well 399-1-17B



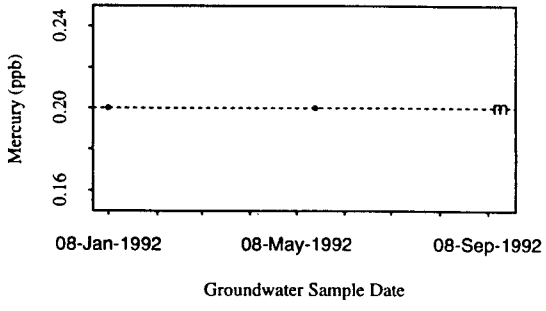
Segment 20-Mercury
Well 399-1-21A



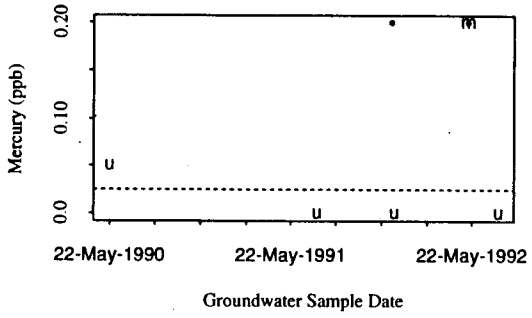
Segment 20-Mercury
Well 399-1-21B



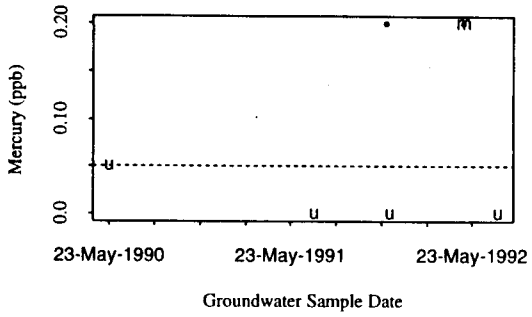
Segment 20-Mercury
Well 399-1-5



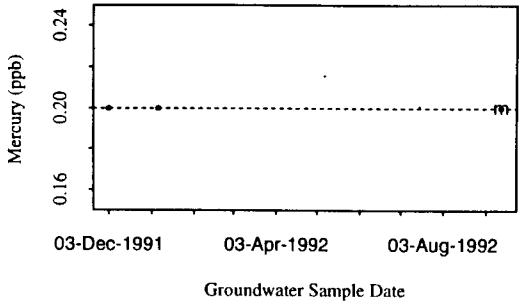
Segment 20-Mercury
Well 399-3-9



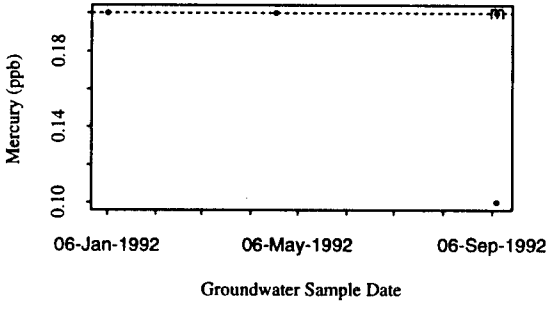
Segment 20-Mercury
Well 399-4-1



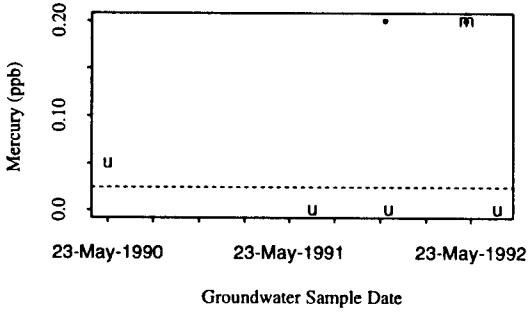
Segment 20-Mercury
Well 399-4-10



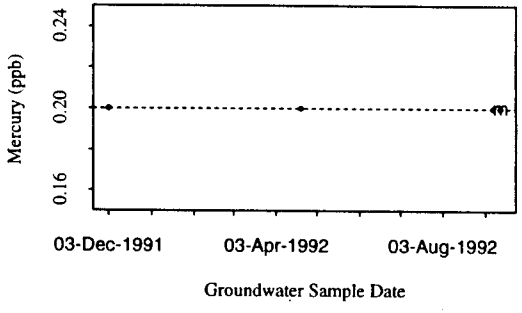
Segment 20-Mercury
Well 399-4-12



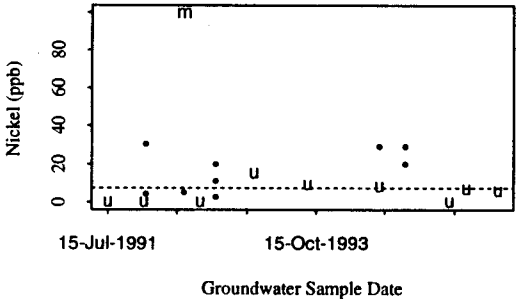
Segment 20-Mercury
Well 399-4-7



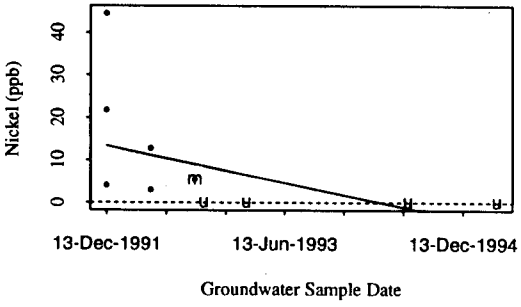
Segment 20-Mercury
Well 399-4-9



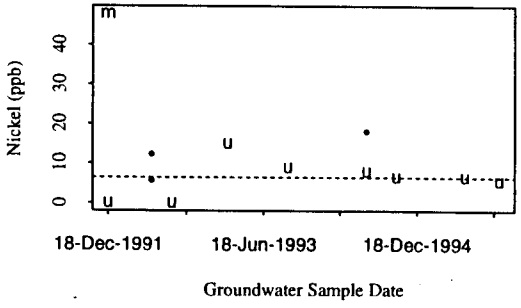
Segment 20-Nickel
Well 399-1-10A

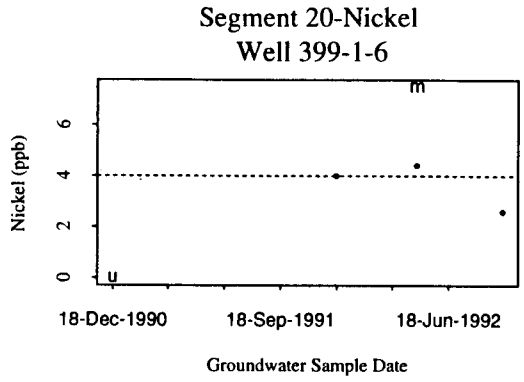


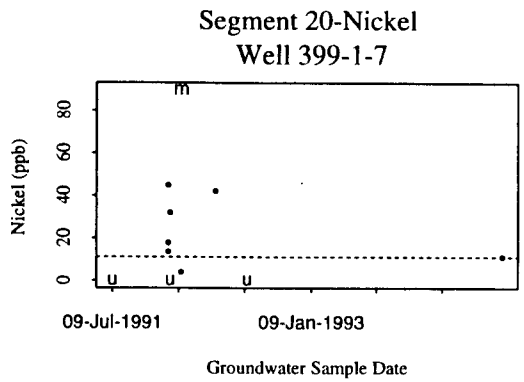
Segment 20-Nickel
Well 399-1-10B

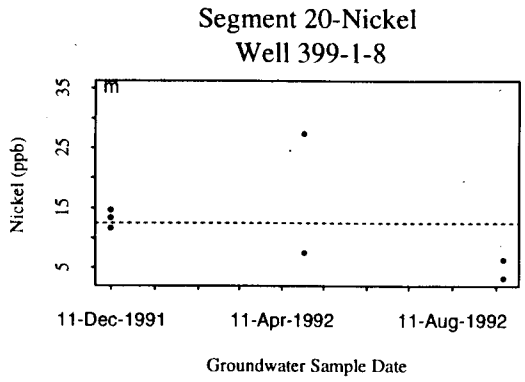


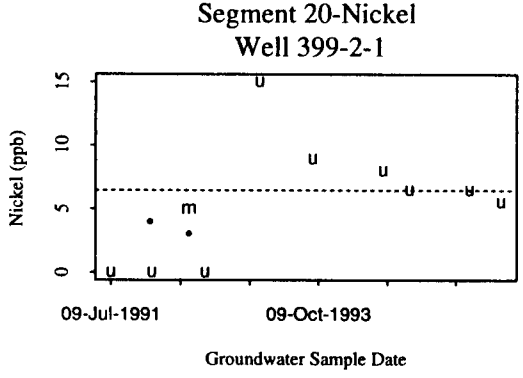
Segment 20-Nickel
Well 399-1-11

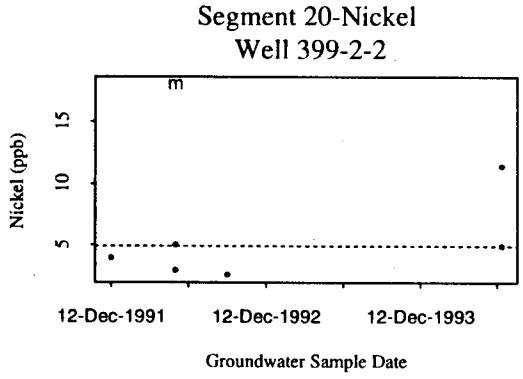


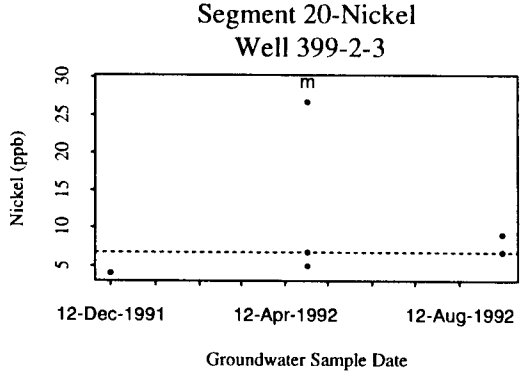

Segment 20-Nickel
Well 399-1-6
Nickel (ppb)
0
2
4
6
18-Dec-1990
18-Sep-1991
18-Jun-1992
Groundwater Sample Date

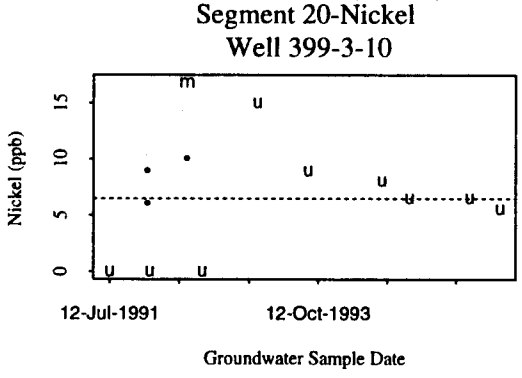

Segment 20-Nickel
Well 399-1-7
Nickel (ppb)
0
20
40
60
80
09-Jul-1991
09-Jan-1993
Groundwater Sample Date

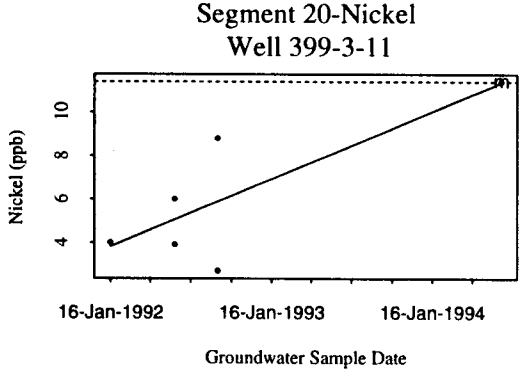

Segment 20-Nickel
Well 399-1-8
Nickel (ppb)
5
15
25
35
11-Dec-1991
11-Apr-1992
11-Aug-1992
Groundwater Sample Date

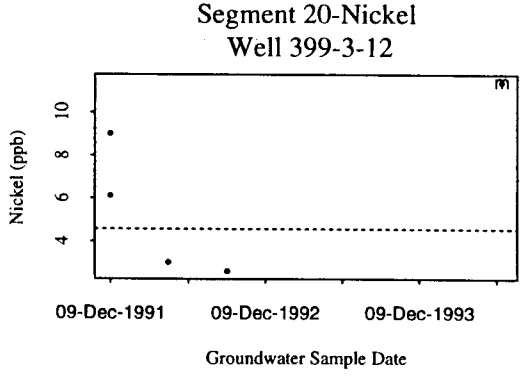

Segment 20-Nickel
Well 399-2-1
Nickel (ppb)
0
5
10
15
09-Jul-1991
09-Oct-1993
Groundwater Sample Date


Segment 20-Nickel
Well 399-2-2
Nickel (ppb)
5
10
15
12-Dec-1991
12-Dec-1992
12-Dec-1993
Groundwater Sample Date

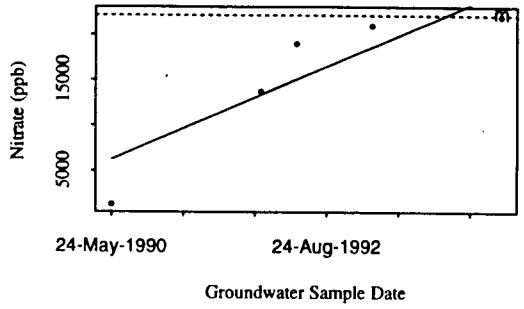

Segment 20-Nickel
Well 399-2-3
Nickel (ppb)
5
10
15
20
25
30
12-Dec-1991
12-Apr-1992
12-Aug-1992
Groundwater Sample Date


Segment 20-Nickel
Well 399-3-10
Nickel (ppb)
0
5
10
15
12-Jul-1991
12-Oct-1993
Groundwater Sample Date

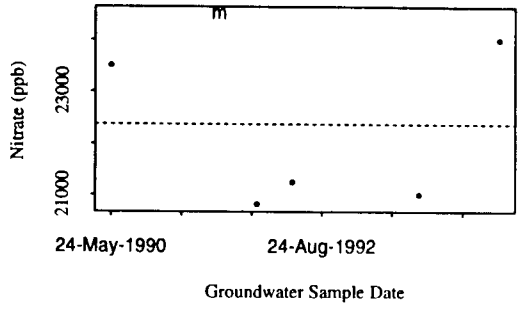

Segment 20-Nickel
Well 399-3-11
Nickel (ppb)
4
6
8
10
16-Jan-1992
16-Jan-1993
16-Jan-1994
Groundwater Sample Date


Segment 20-Nickel
Well 399-3-12
Nickel (ppb)
4
6
8
10
09-Dec-1991
09-Dec-1992
09-Dec-1993
Groundwater Sample Date

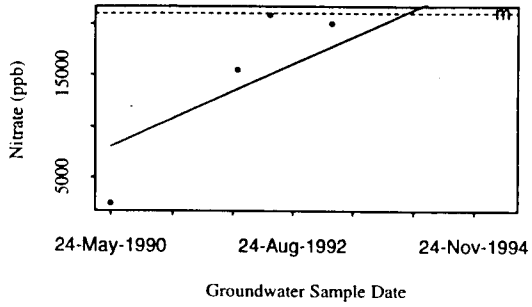
Segment 20-Nitrate
Well 399-1-12



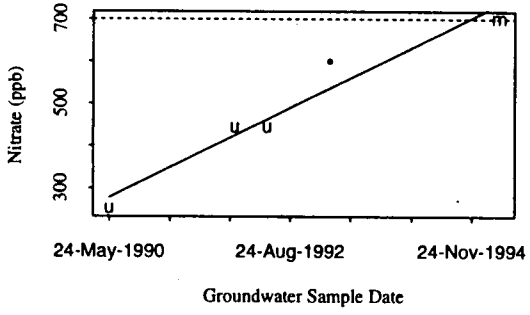
Segment 20-Nitrate
Well 399-1-15



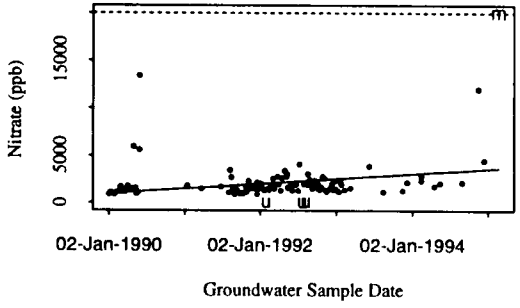
Segment 20-Nitrate
Well 399-1-16A



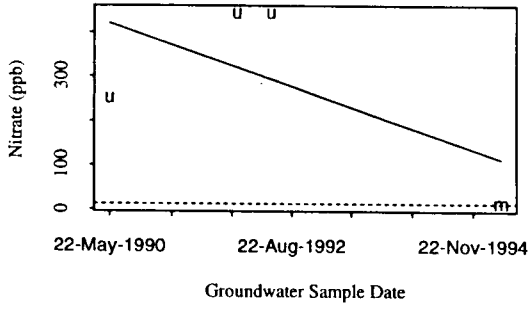
Segment 20-Nitrate
Well 399-1-16B



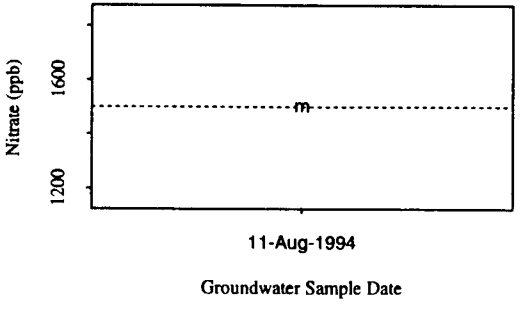
Segment 20-Nitrate
Well 399-1-17A



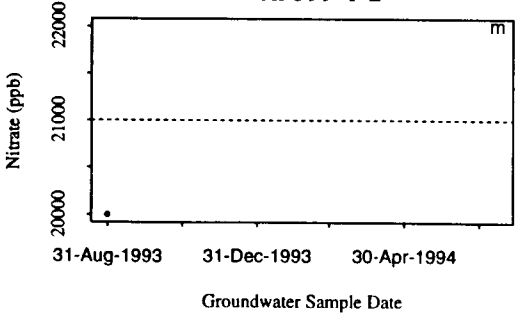
Segment 20-Nitrate
Well 399-1-17B



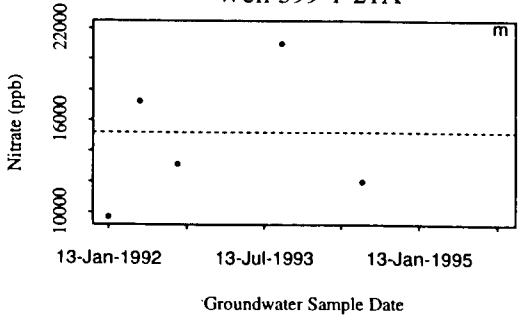
Segment 20-Nitrate
Well 399-1-19



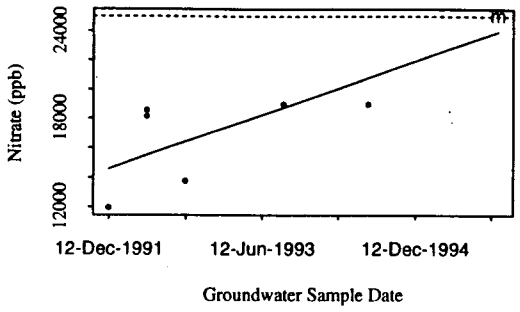
Segment 20-Nitrate
Well 399-1-2



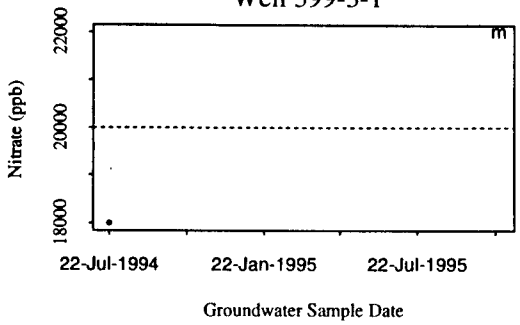
Segment 20-Nitrate
Well 399-1-21A



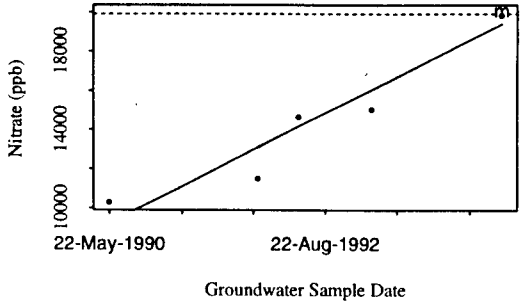
Segment 20-Nitrate
Well 399-2-3



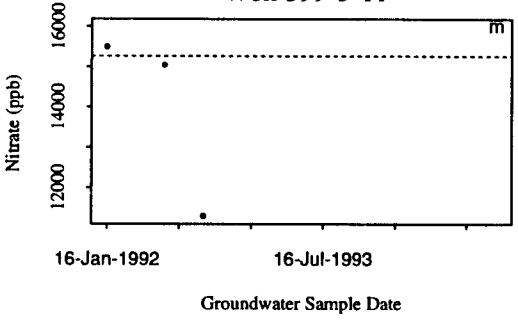
Segment 20-Nitrate
Well 399-3-1



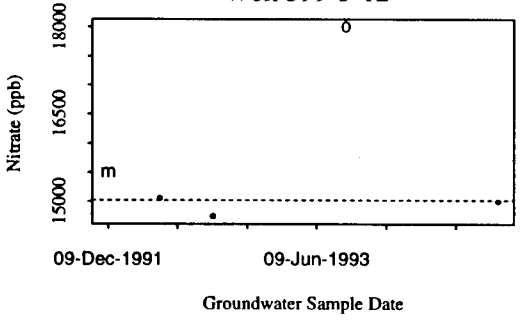
Segment 20-Nitrate
Well 399-3-10



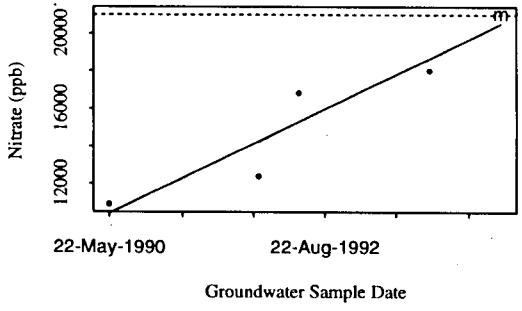
Segment 20-Nitrate
Well 399-3-11



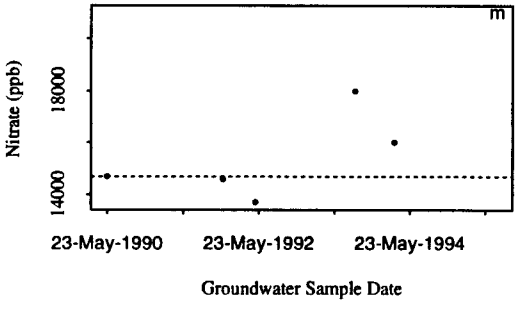
Segment 20-Nitrate
Well 399-3-12



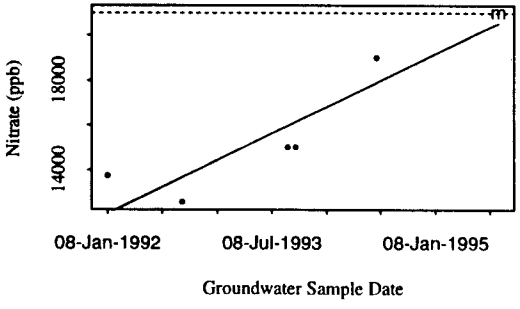
Segment 20-Nitrate
Well 399-3-9



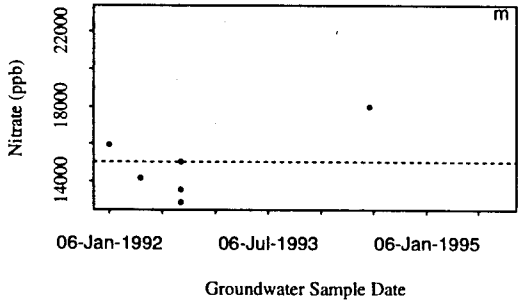
Segment 20-Nitrate
Well 399-4-1



Segment 20-Nitrate
Well 399-4-10

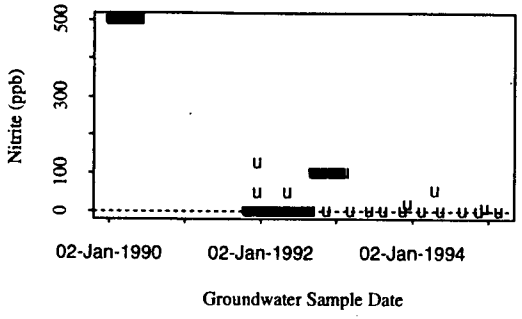


Segment 20-Nitrate
Well 399-4-12

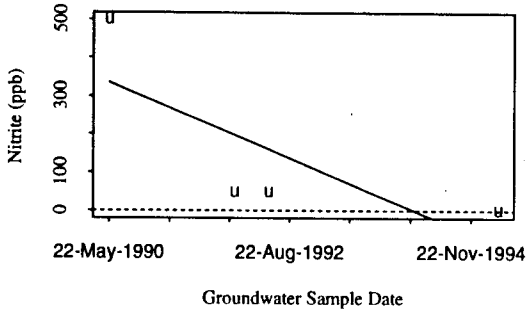


9613448.1724

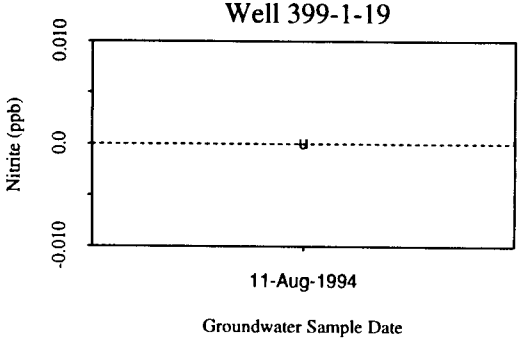
Segment 20-Nitrite
Well 399-1-17A



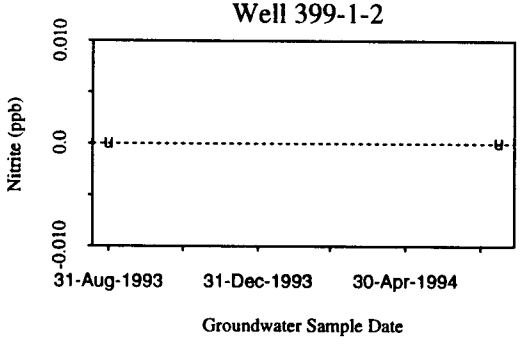
Segment 20-Nitrite
Well 399-1-17B



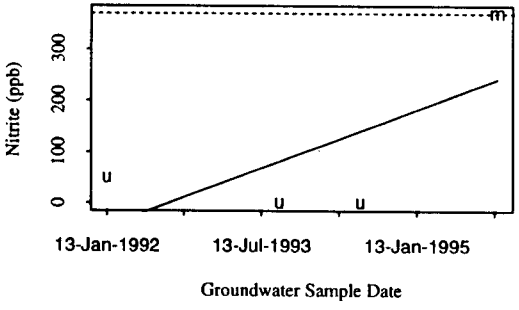
Segment 20-Nitrite
Well 399-1-19



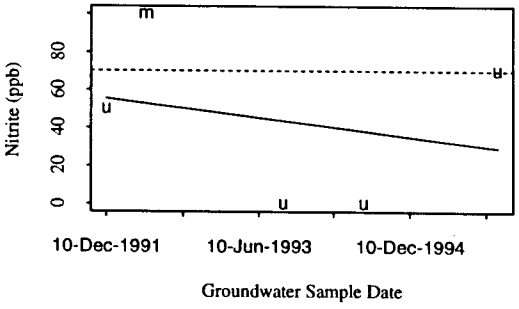
Segment 20-Nitrite
Well 399-1-2



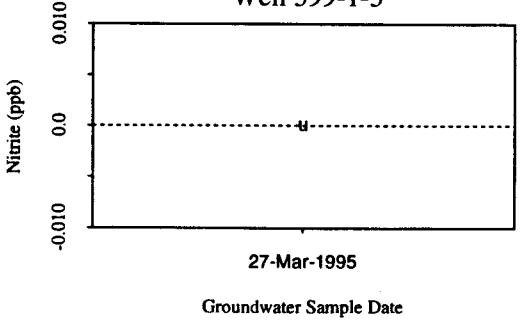
Segment 20-Nitrite
Well 399-1-21A



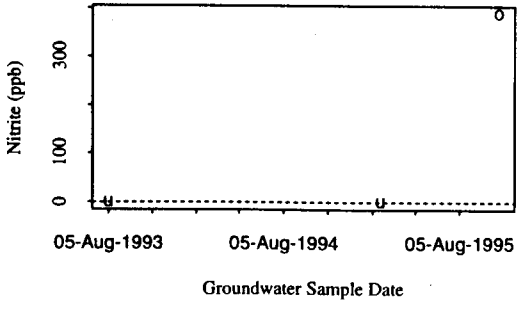
Segment 20-Nitrite
Well 399-1-21B



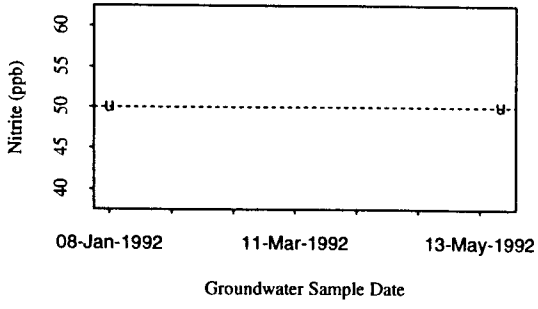
Segment 20-Nitrite
Well 399-1-3



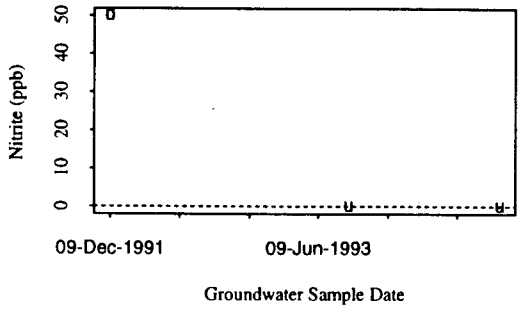
Segment 20-Nitrite
Well 399-1-4



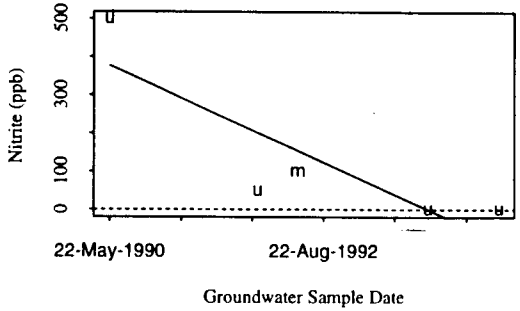
Segment 20-Nitrite
Well 399-1-5



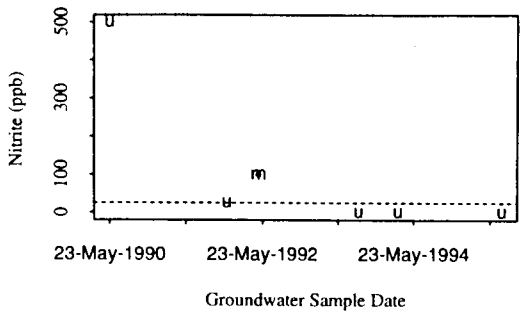
Segment 20-Nitrite
Well 399-3-12



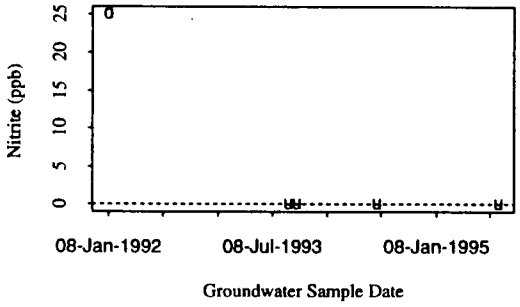
Segment 20-Nitrite
Well 399-3-9



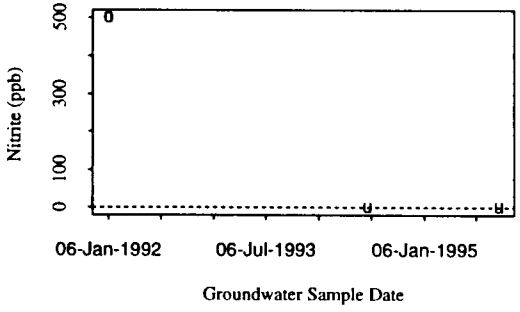
Segment 20-Nitrite
Well 399-4-1



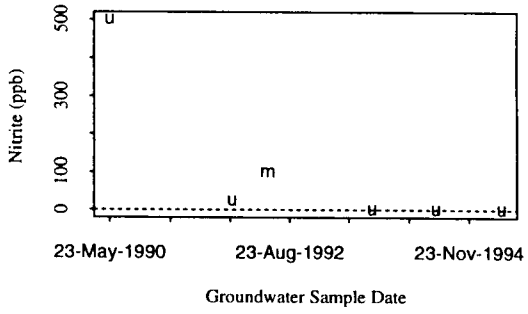
Segment 20-Nitrite
Well 399-4-10



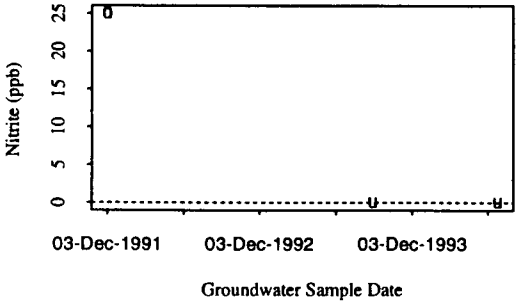
Segment 20-Nitrite
Well 399-4-12



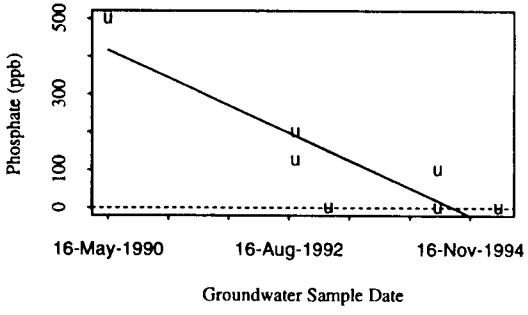
Segment 20-Nitrite
Well 399-4-7



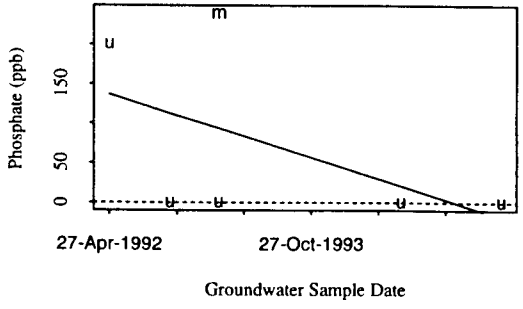
Segment 20-Nitrite
Well 399-4-9



Segment 20-Phosphate
Well 399-1-10A

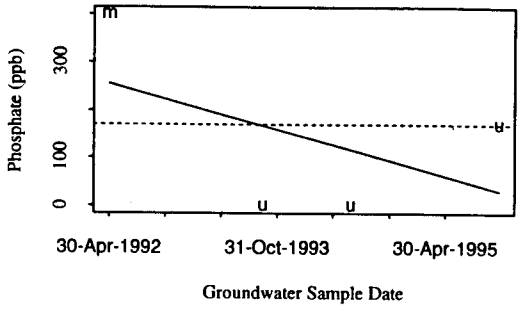


Segment 20-Phosphate
Well 399-1-10B

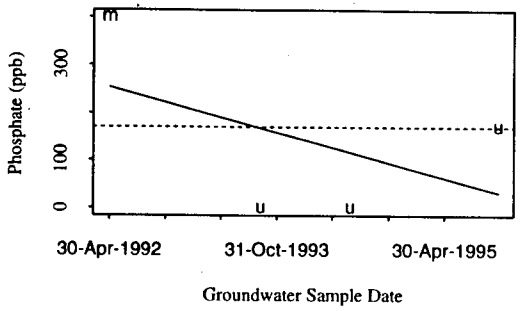


9513048.1726

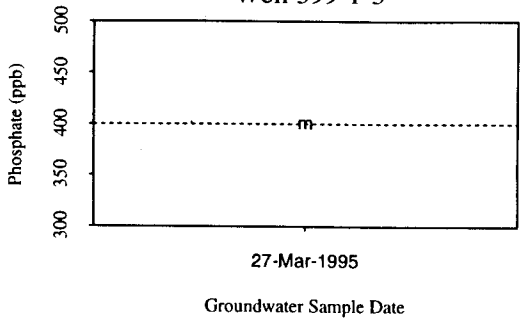
Segment 20-Phosphate
Well 399-1-21A



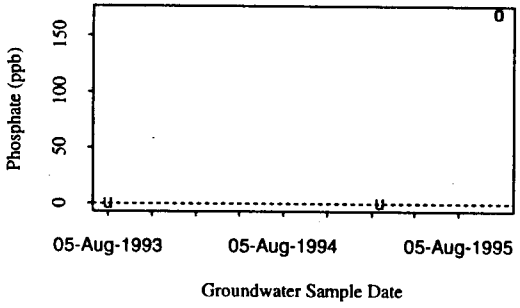
Segment 20-Phosphate
Well 399-1-21B



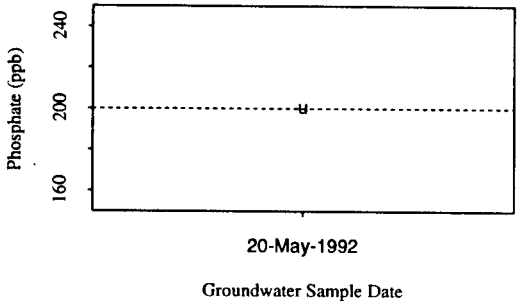
Segment 20-Phosphate
Well 399-1-3



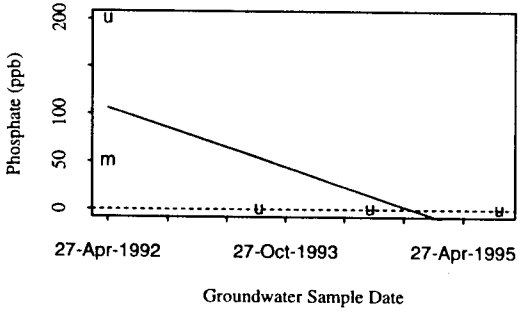
Segment 20-Phosphate
Well 399-1-4



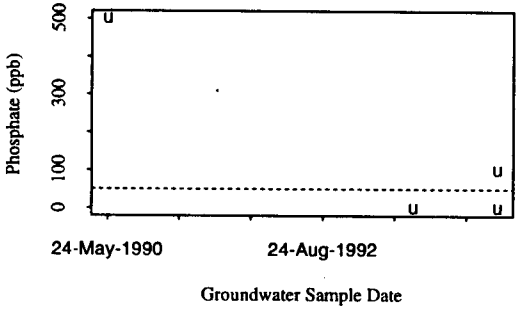
Segment 20-Phosphate
Well 399-1-5



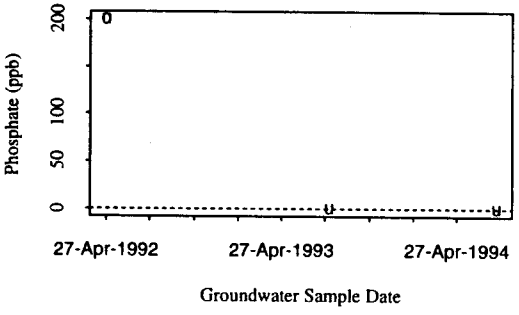
Segment 20-Phosphate
Well 399-1-6



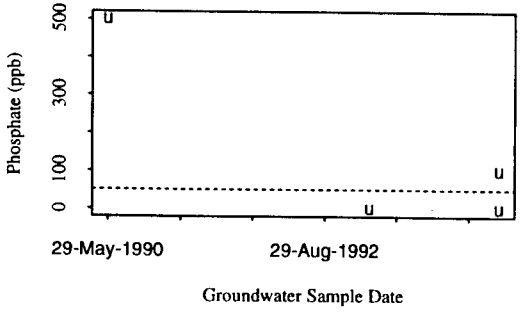
Segment 20-Phosphate
Well 399-1-7



Segment 20-Phosphate
Well 399-1-8

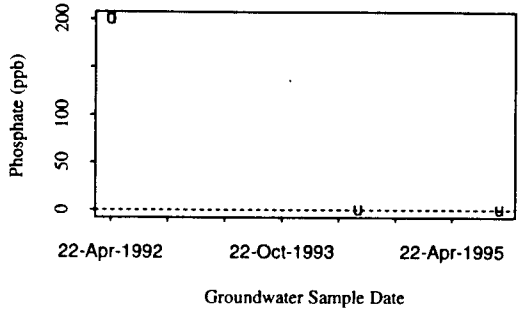


Segment 20-Phosphate
Well 399-2-1

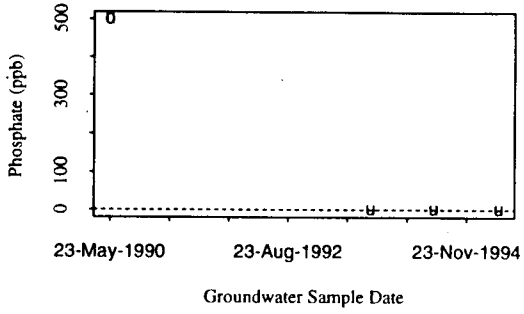


9413168.1727

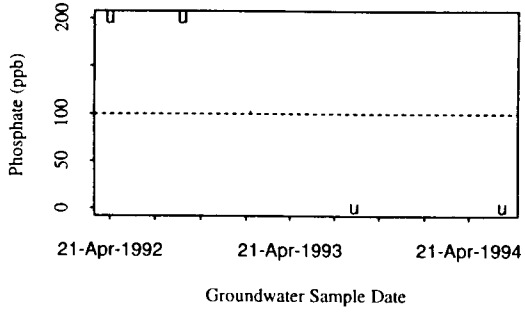
Segment 20-Phosphate
Well 399-4-12



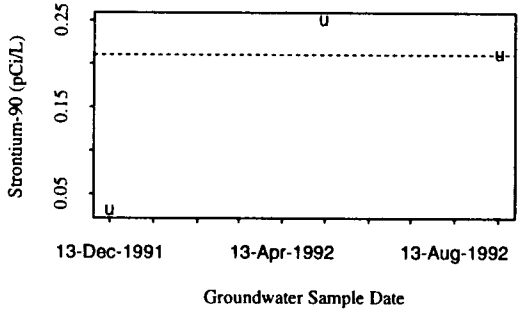
Segment 20-Phosphate
Well 399-4-7



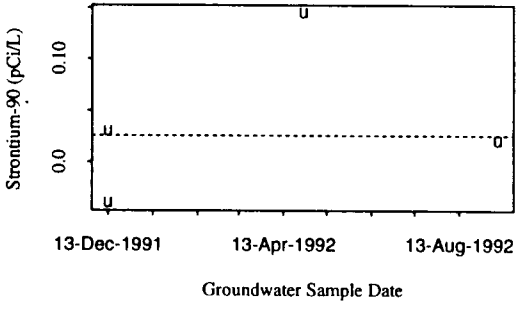
Segment 20-Phosphate
Well 399-4-9



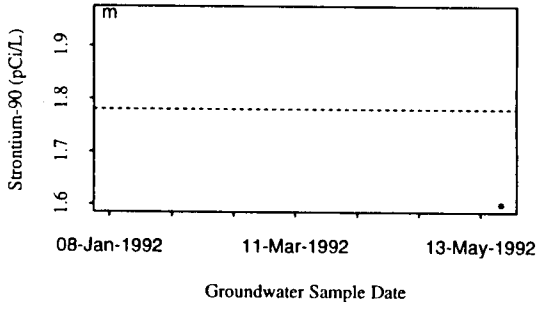
Segment 20-Strontium-90
Well 399-1-10A



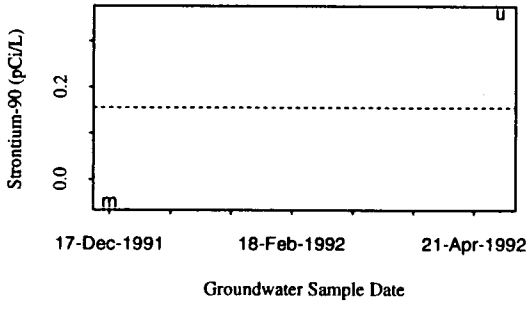
Segment 20-Strontium-90
Well 399-1-10B



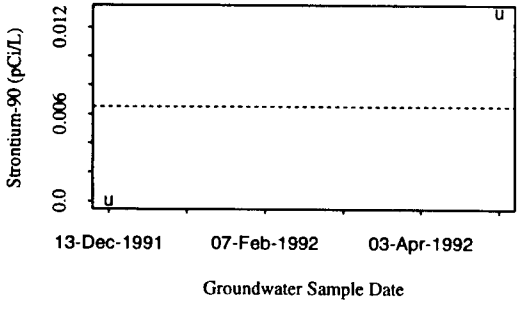
Segment 20-Strontium-90
Well 399-1-11



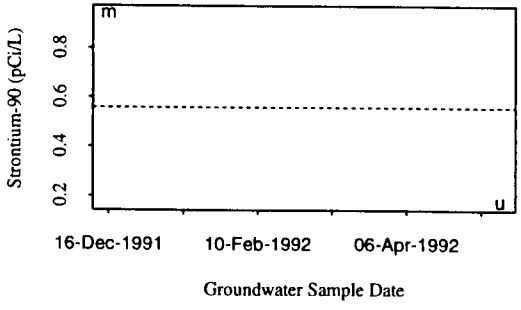
Segment 20-Strontium-90
Well 399-1-12



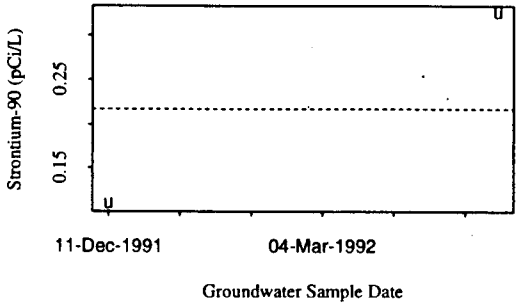
Segment 20-Strontium-90
Well 399-1-15



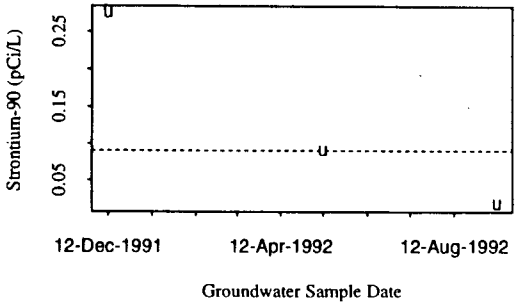
Segment 20-Strontium-90
Well 399-1-16A



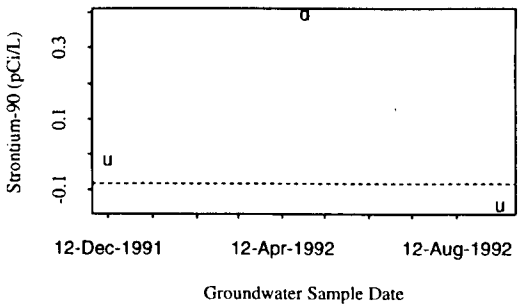
Segment 20-Strontium-90
Well 399-2-1



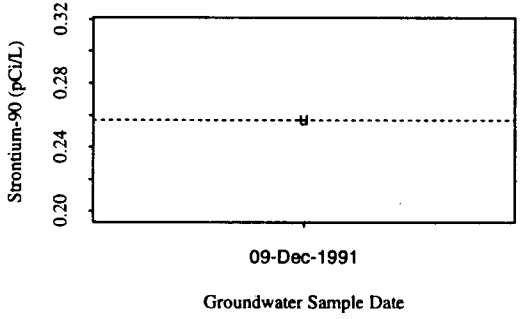
Segment 20-Strontium-90
Well 399-2-2



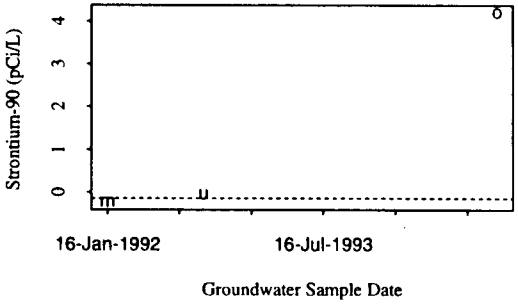
Segment 20-Strontium-90
Well 399-2-3



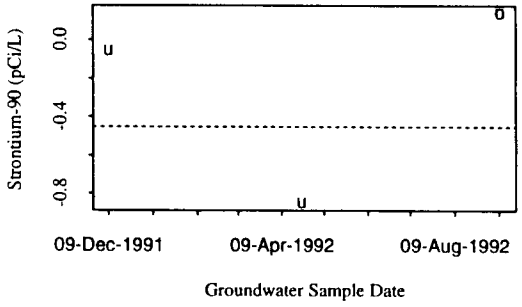
Segment 20-Strontium-90
Well 399-3-10



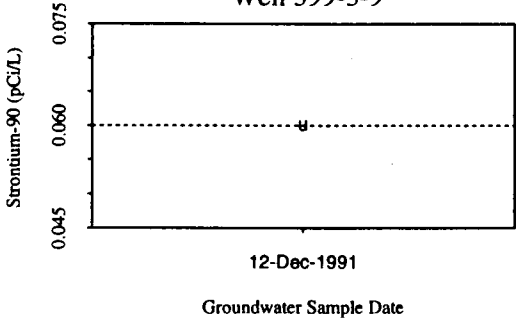
Segment 20-Strontium-90
Well 399-3-11



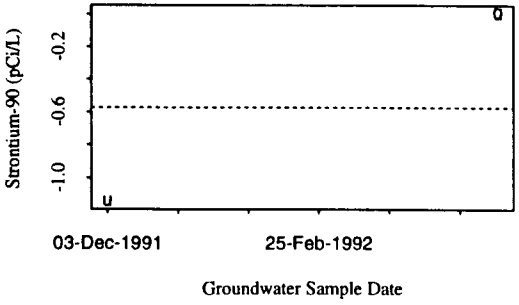
Segment 20-Strontium-90
Well 399-3-12



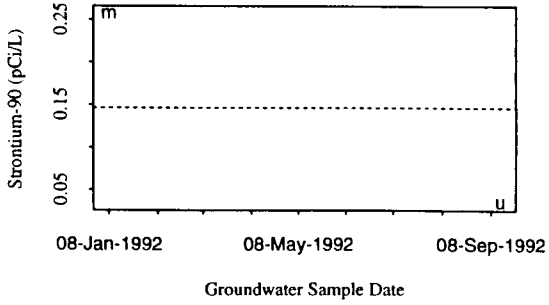
Segment 20-Strontium-90
Well 399-3-9



Segment 20-Strontium-90
Well 399-4-1

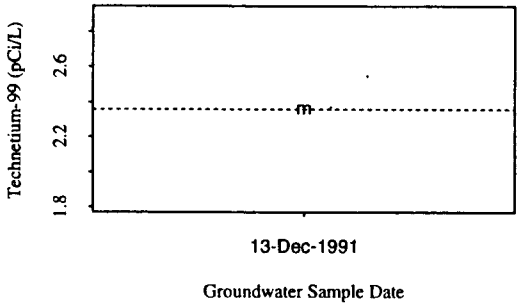


Segment 20-Strontium-90
Well 399-4-10

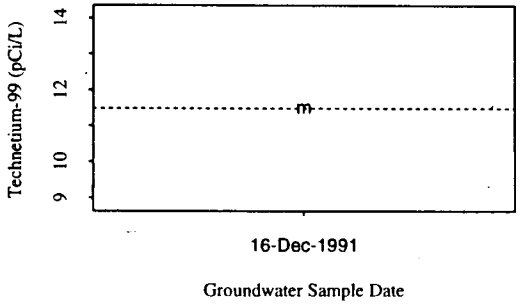


9615146.1726

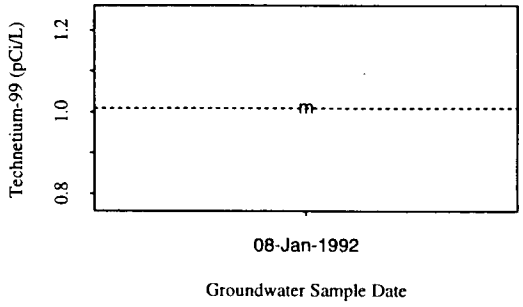
Segment 20-Technetium-99
Well 399-1-3



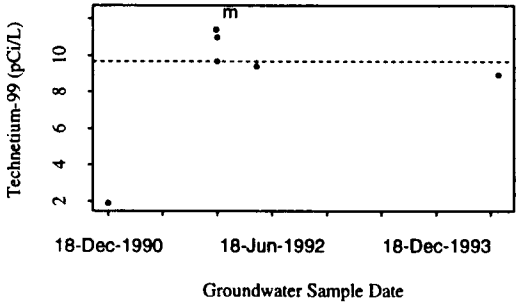
Segment 20-Technetium-99
Well 399-1-4



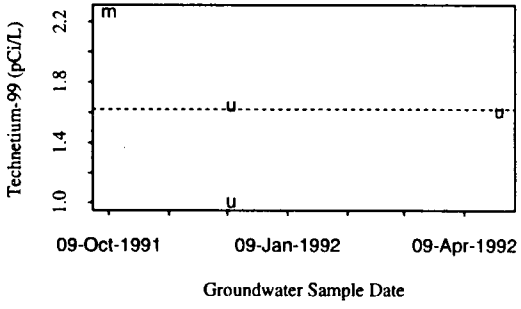
Segment 20-Technetium-99
Well 399-1-5



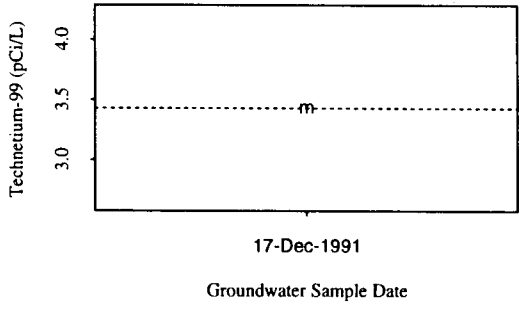
Segment 20-Technetium-99
Well 399-1-6



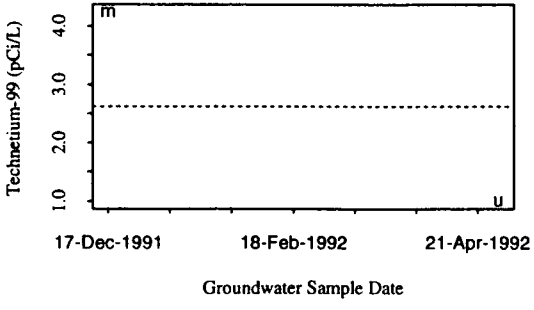
Segment 20-Technetium-99
Well 399-1-8



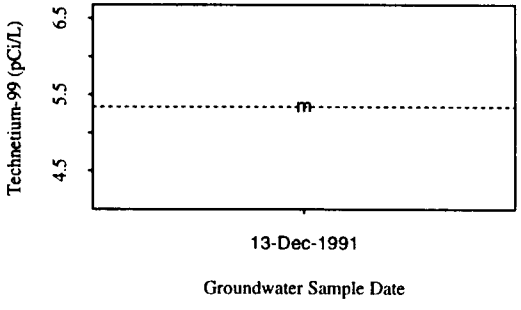
Segment 20-Technetium-99
Well 399-2-2



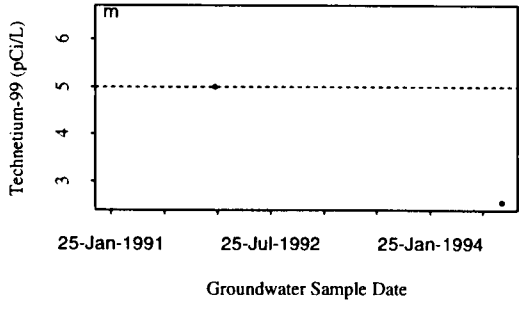
Segment 20-Technetium-99
Well 399-2-3



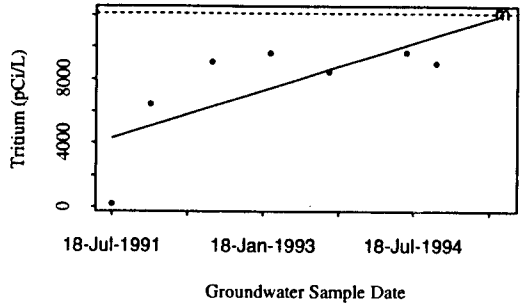
Segment 20-Technetium-99
Well 399-3-1



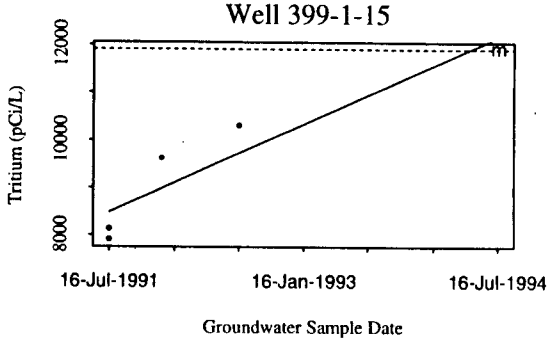
Segment 20-Technetium-99
Well 399-3-11



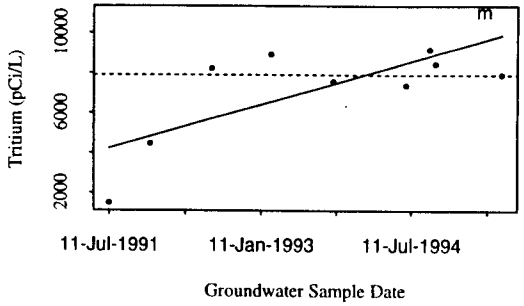
Segment 20-Tritium
Well 399-1-12



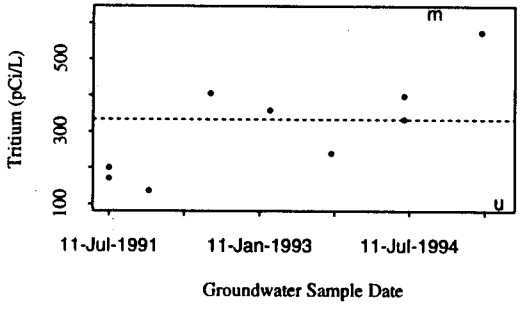
Segment 20-Tritium
Well 399-1-15



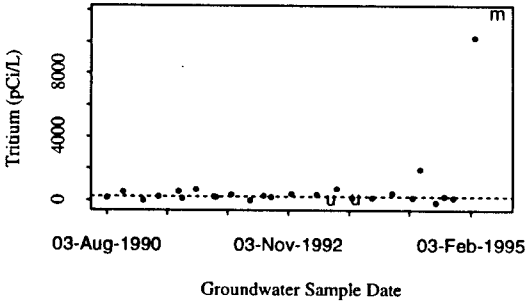
Segment 20-Tritium
Well 399-1-16A



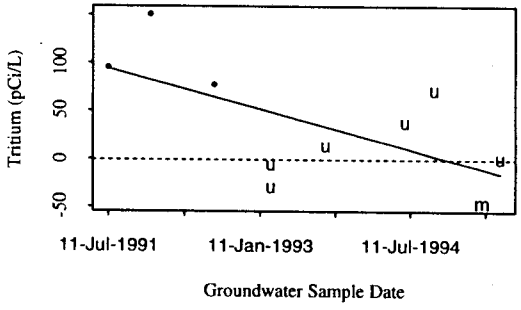
Segment 20-Tritium
Well 399-1-16B



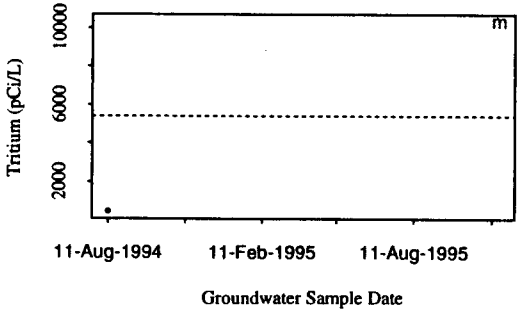
Segment 20-Tritium
Well 399-1-17A



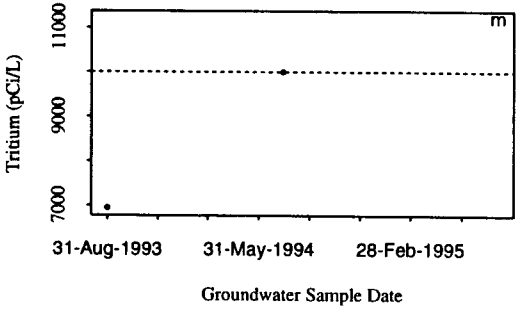
Segment 20-Tritium
Well 399-1-17B



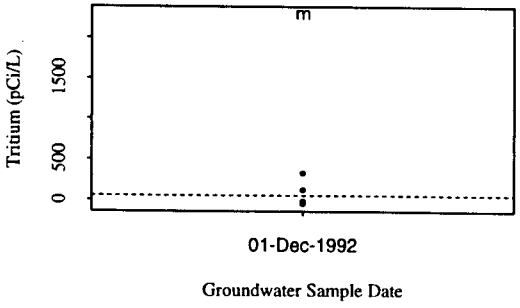
Segment 20-Tritium
Well 399-1-19



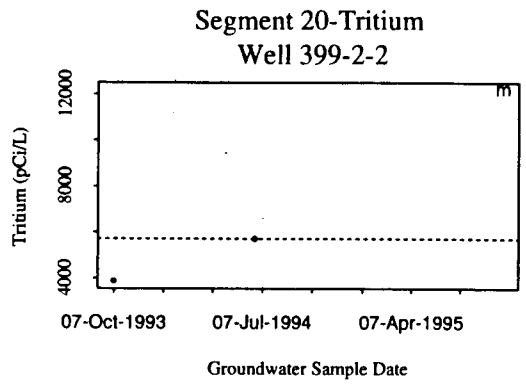
Segment 20-Tritium
Well 399-1-2

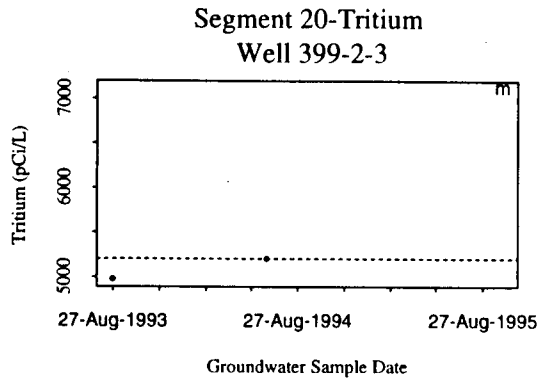


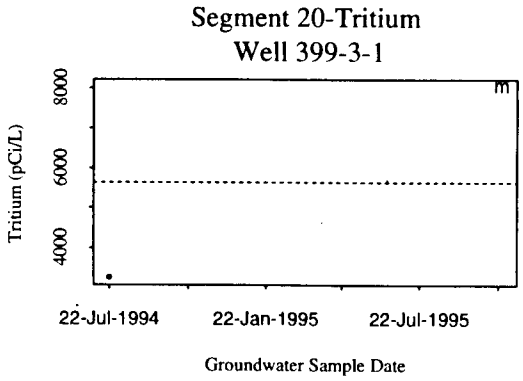
Segment 20-Tritium
Well 399-1-20

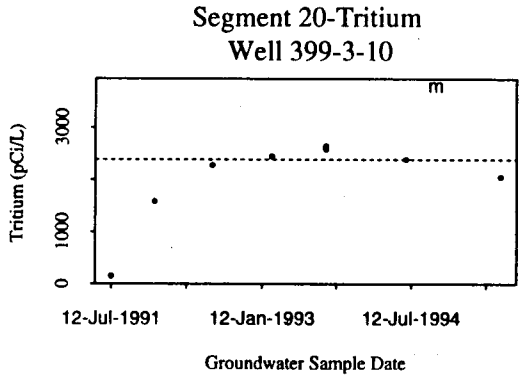


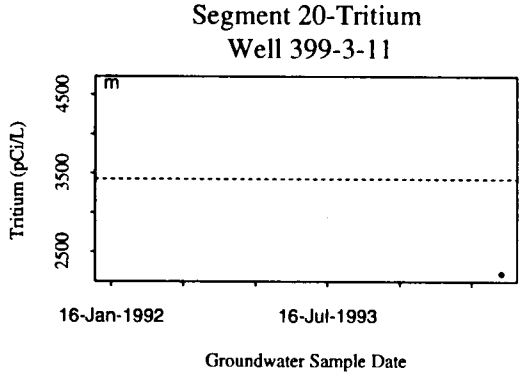
9614148.1751

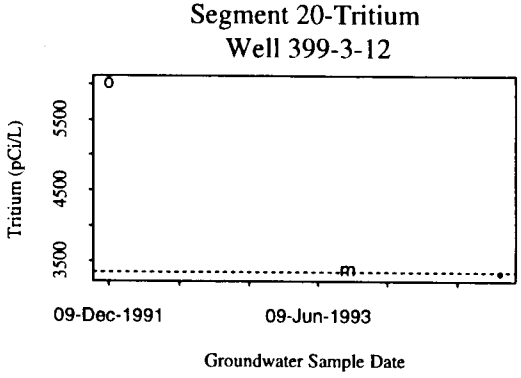

Segment 20-Tritium
Well 399-2-2
Tritium (pCi/L)
4000
8000
12000
m
07-Oct-1993
07-Jul-1994
07-Apr-1995
Groundwater Sample Date

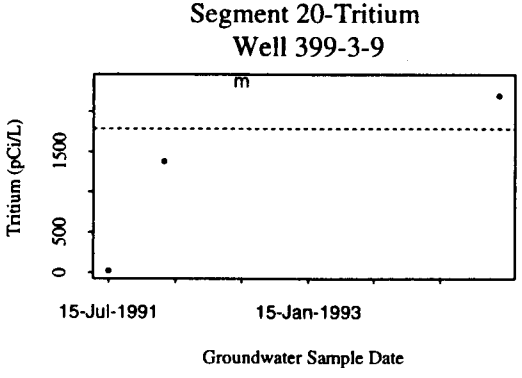

Segment 20-Tritium
Well 399-2-3
Tritium (pCi/L)
5000
6000
7000
m
27-Aug-1993
27-Aug-1994
27-Aug-1995
Groundwater Sample Date

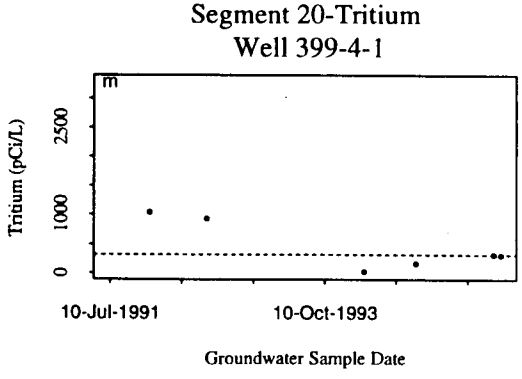

Segment 20-Tritium
Well 399-3-1
Tritium (pCi/L)
4000
6000
8000
m
22-Jul-1994
22-Jan-1995
22-Jul-1995
Groundwater Sample Date

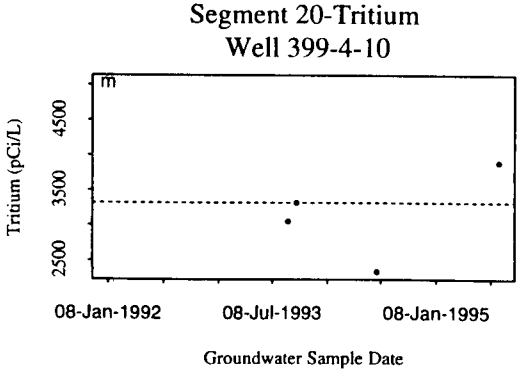

Segment 20-Tritium
Well 399-3-10
Tritium (pCi/L)
0
1000
3000
m
12-Jul-1991
12-Jan-1993
12-Jul-1994
Groundwater Sample Date

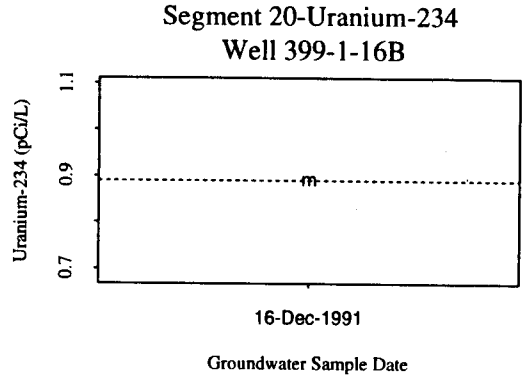

Segment 20-Tritium
Well 399-3-11
Tritium (pCi/L)
2500
3500
4500
m
16-Jan-1992
16-Jul-1993
Groundwater Sample Date

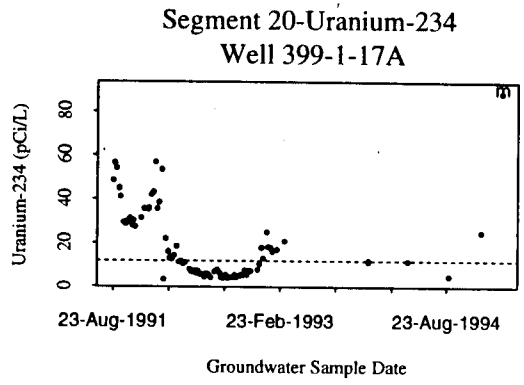

Segment 20-Tritium
Well 399-3-12
Tritium (pCi/L)
3500
4500
5500
o
m
09-Dec-1991
09-Jun-1993
Groundwater Sample Date

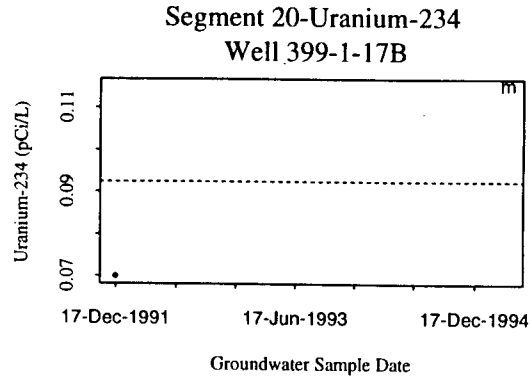

Segment 20-Tritium
Well 399-3-9
Tritium (pCi/L)
0
500
1500
m
15-Jul-1991
15-Jan-1993
Groundwater Sample Date

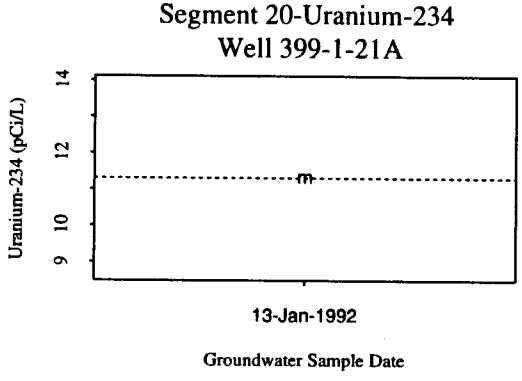

Segment 20-Tritium
Well 399-4-1
Tritium (pCi/L)
0
1000
2500
m
10-Jul-1991
10-Oct-1993
Groundwater Sample Date

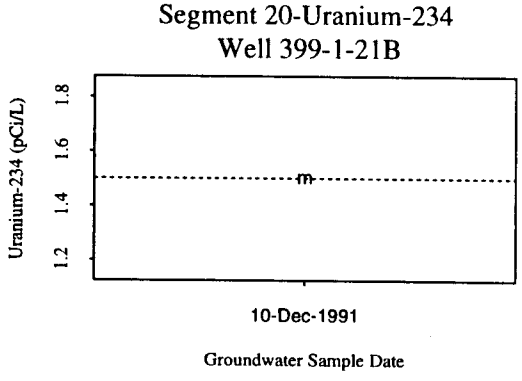

Segment 20-Tritium
Well 399-4-10
Tritium (pCi/L)
2500
3500
4500
m
08-Jan-1992
08-Jul-1993
08-Jan-1995
Groundwater Sample Date

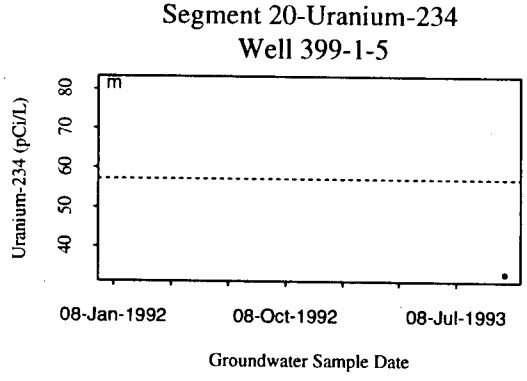


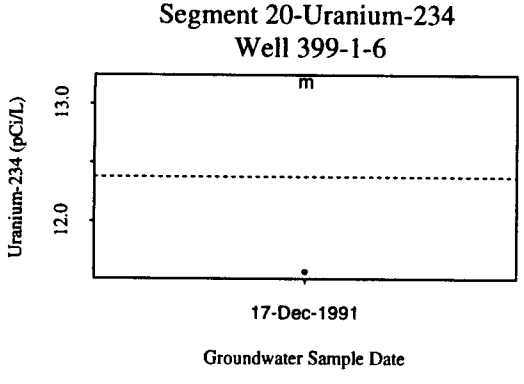


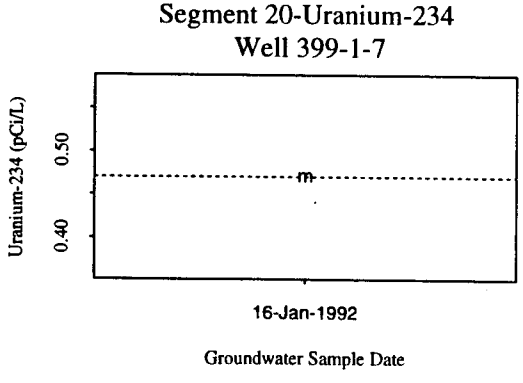


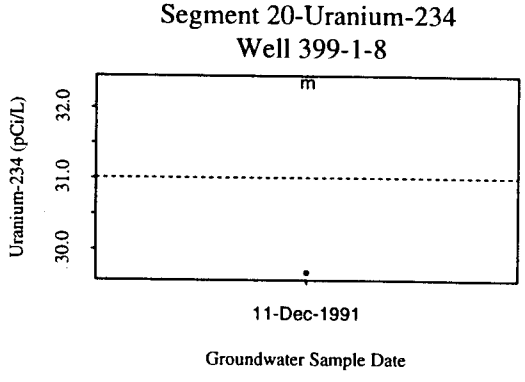






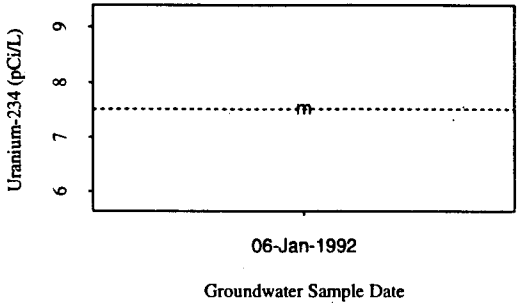




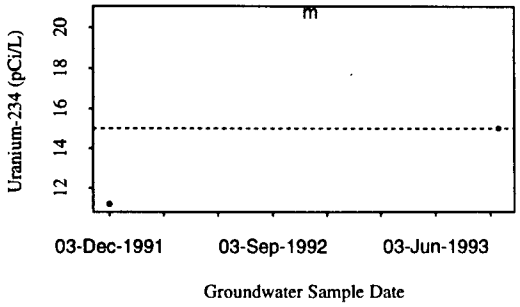


9413148.1753

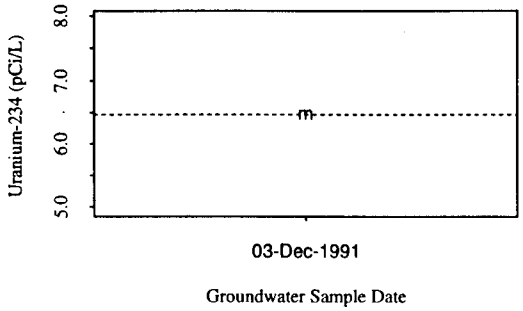
Segment 20-Uranium-234
Well 399-4-12



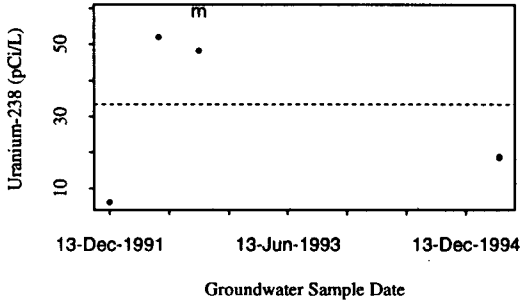
Segment 20-Uranium-234
Well 399-4-7



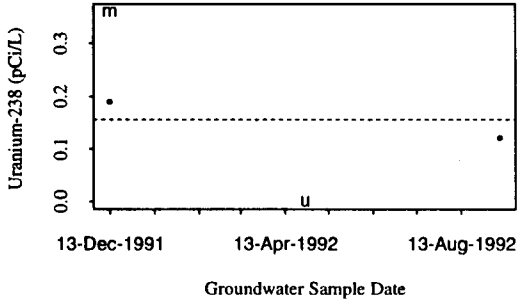
Segment 20-Uranium-234
Well 399-4-9



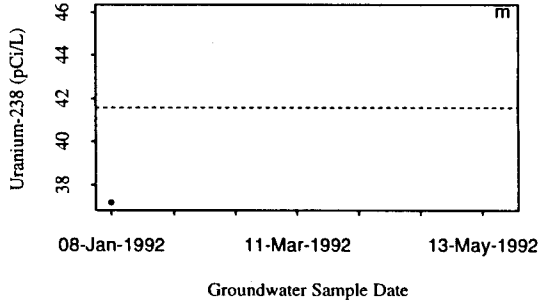
Segment 20-Uranium-238
Well 399-1-10A



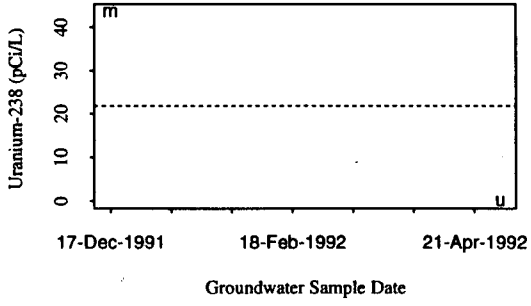
Segment 20-Uranium-238
Well 399-1-10B



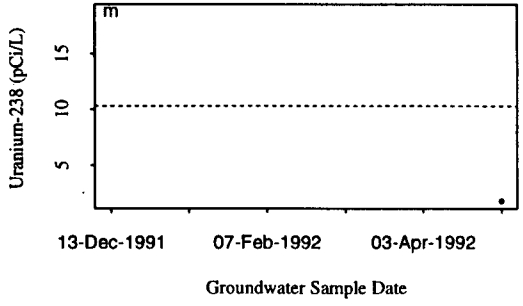
Segment 20-Uranium-238
Well 399-1-11



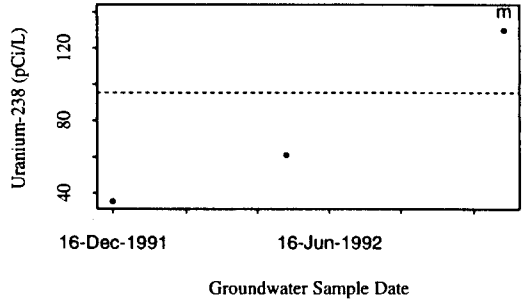
Segment 20-Uranium-238
Well 399-1-12



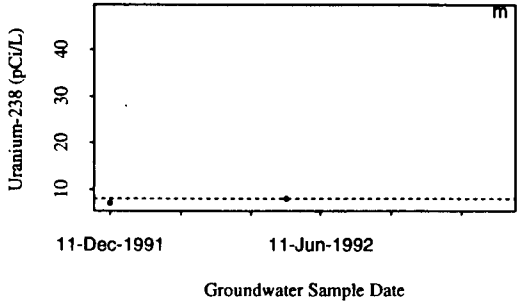
Segment 20-Uranium-238
Well 399-1-15



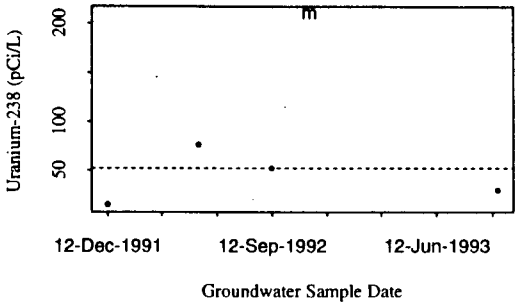
Segment 20-Uranium-238
Well 399-1-16A



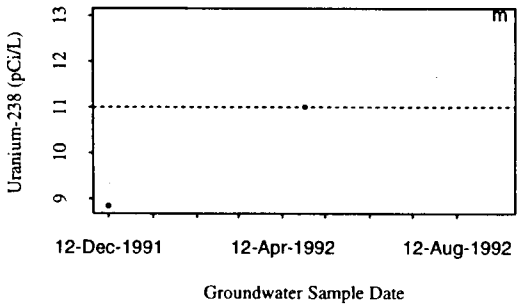
Segment 20-Uranium-238
Well 399-2-1



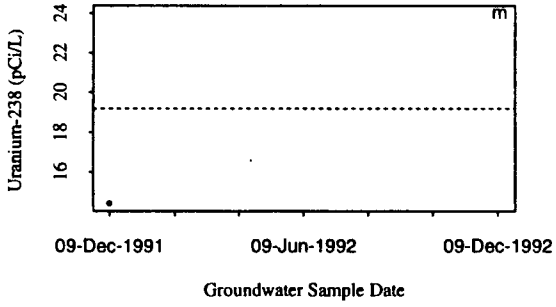
Segment 20-Uranium-238
Well 399-2-2



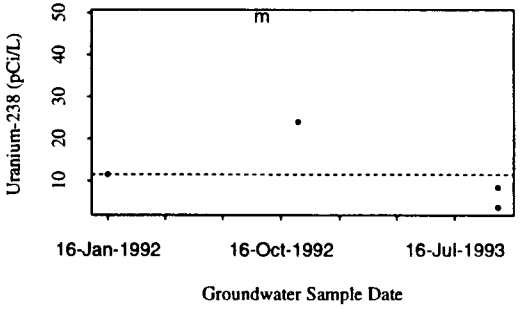
Segment 20-Uranium-238
Well 399-2-3



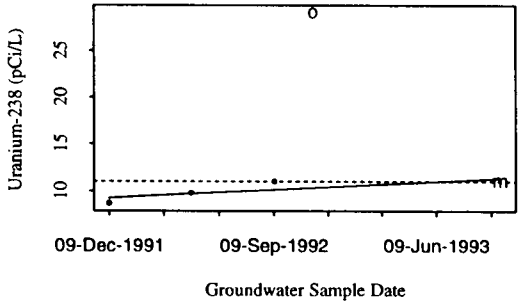
Segment 20-Uranium-238
Well 399-3-10



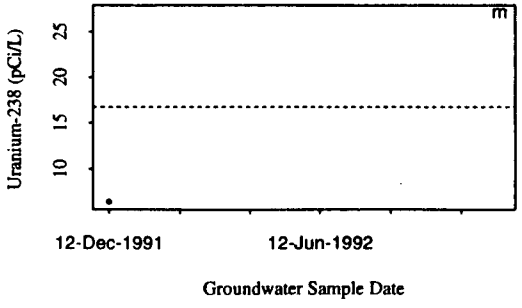
Segment 20-Uranium-238
Well 399-3-11



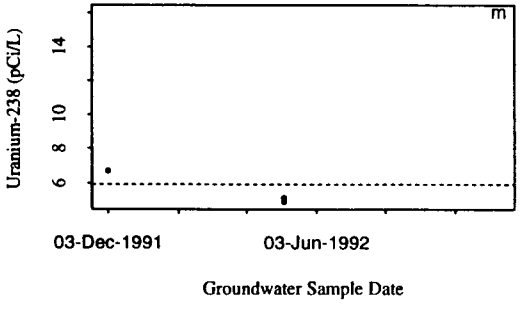
Segment 20-Uranium-238
Well 399-3-12



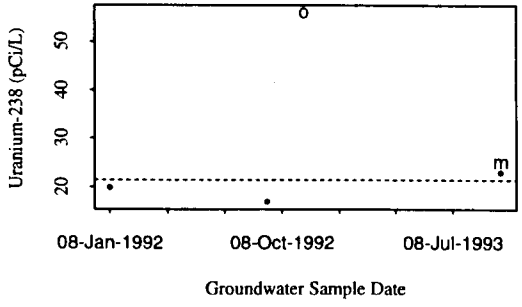
Segment 20-Uranium-238
Well 399-3-9



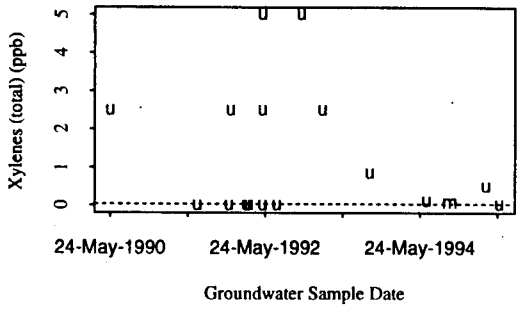
Segment 20-Uranium-238
Well 399-4-1



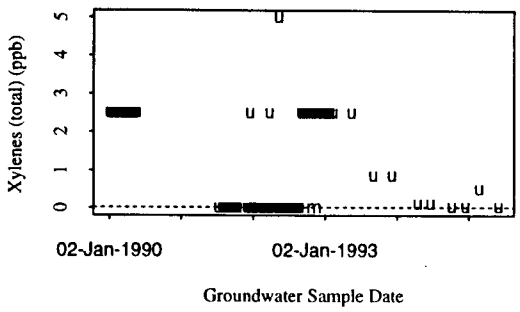
Segment 20-Uranium-238
Well 399-4-10



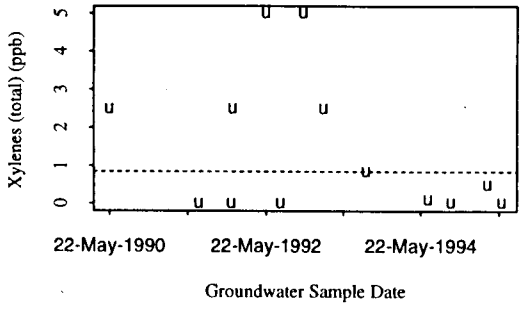
Segment 20-Xylenes (total)
Well 399-1-16B



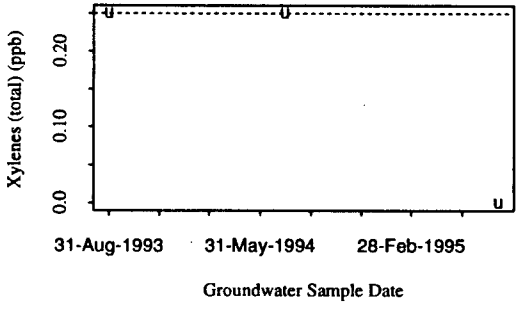
Segment 20-Xylenes (total)
Well 399-1-17A



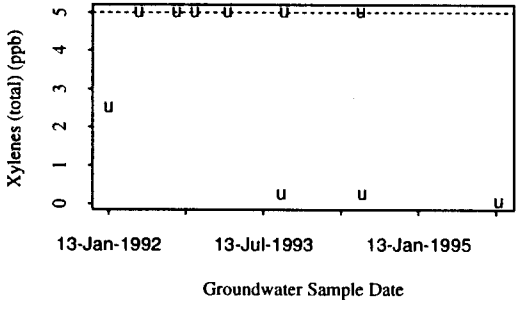
Segment 20-Xylenes (total)
Well 399-1-17B



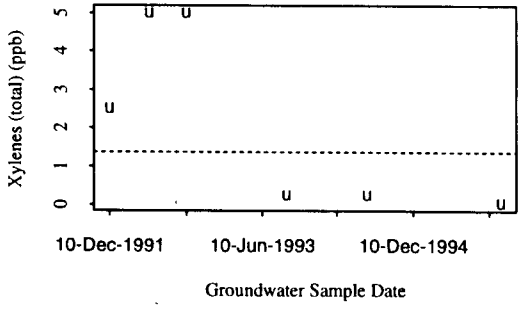
Segment 20-Xylenes (total)
Well 399-1-2



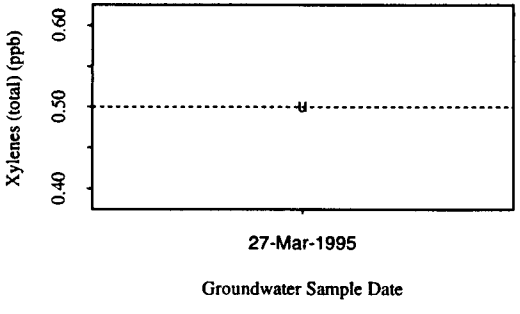
Segment 20-Xylenes (total)
Well 399-1-21A



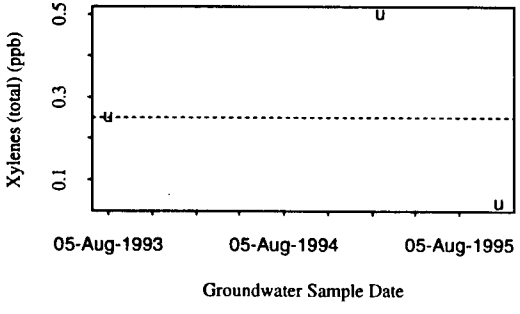
Segment 20-Xylenes (total)
Well 399-1-21B



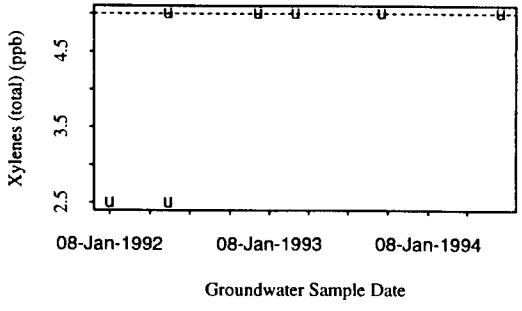
Segment 20-Xylenes (total)
Well 399-1-3



Segment 20-Xylenes (total)
Well 399-1-4

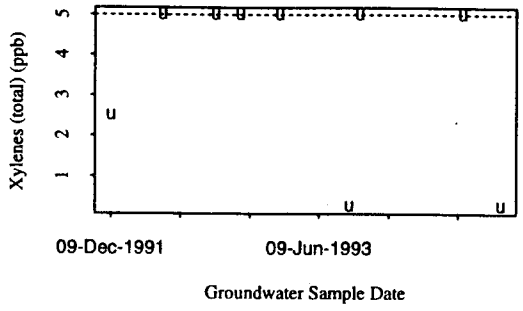


Segment 20-Xylenes (total)
Well 399-1-5

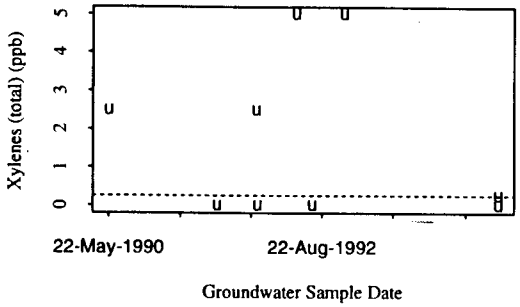


9413448.1756

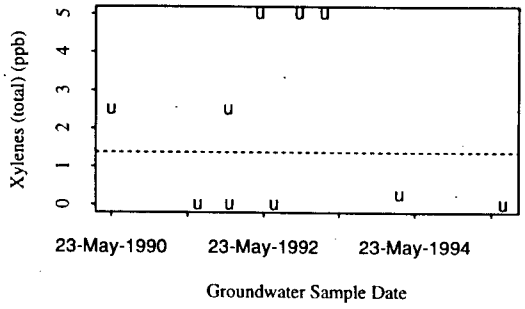
Segment 20-Xylenes (total)
Well 399-3-12



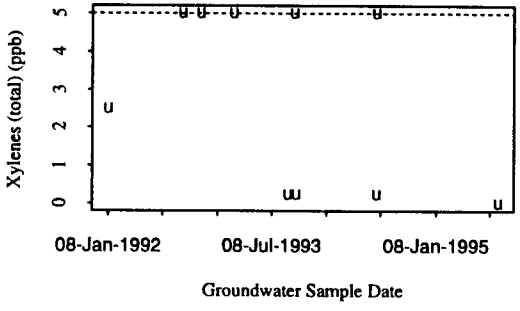
Segment 20-Xylenes (total)
Well 399-3-9



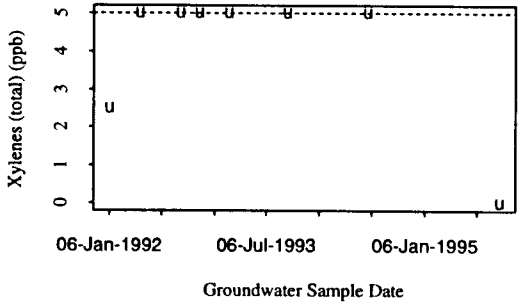
Segment 20-Xylenes (total)
Well 399-4-1



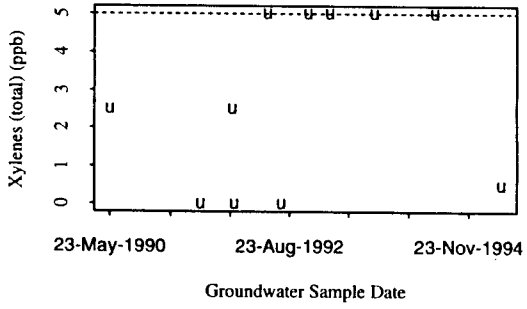
Segment 20-Xylenes (total)
Well 399-4-10



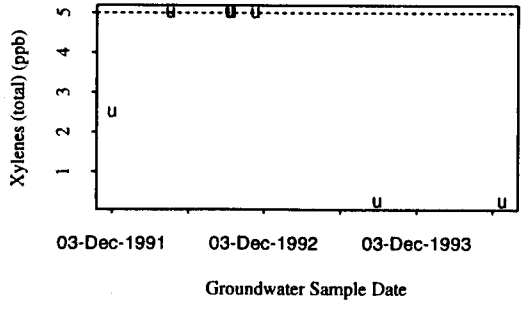
Segment 20-Xylenes (total)
Well 399-4-12



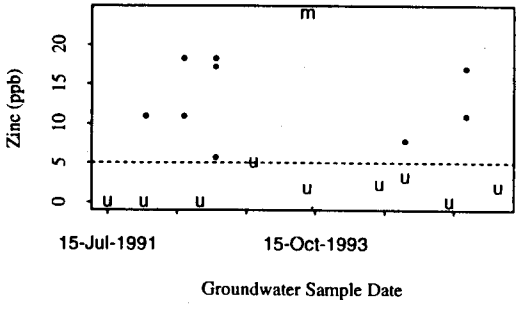
Segment 20-Xylenes (total)
Well 399-4-7



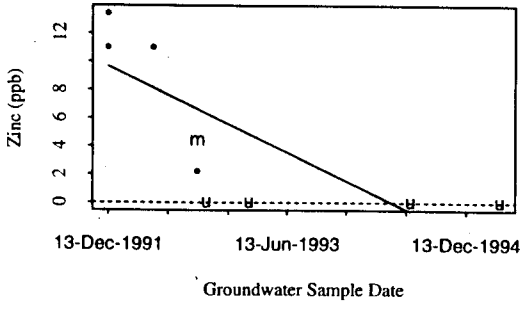
Segment 20-Xylenes (total)
Well 399-4-9



Segment 20-Zinc
Well 399-1-10A

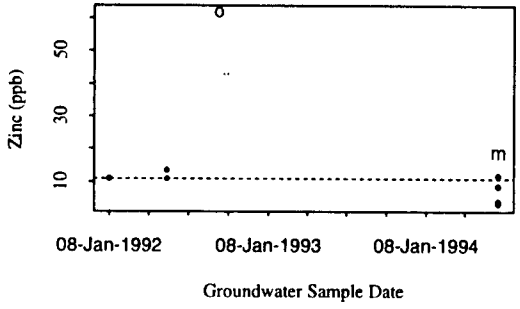


Segment 20-Zinc
Well 399-1-10B

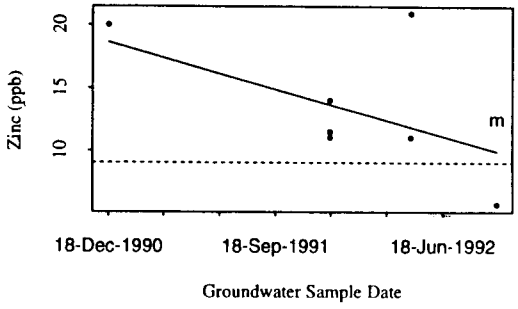


9618748.1757

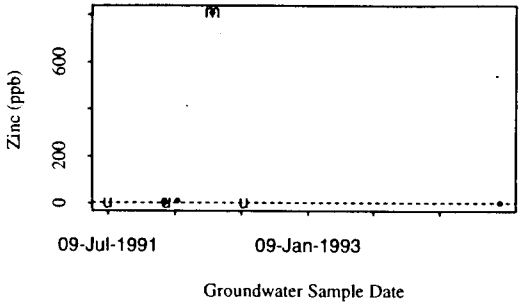
Segment 20-Zinc
Well 399-1-5



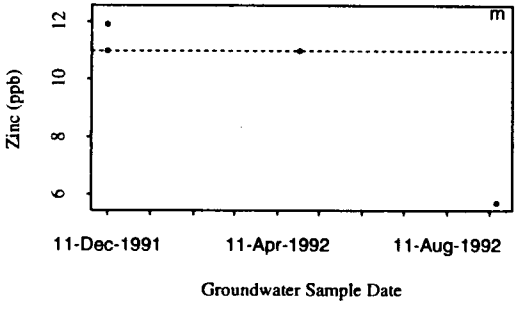
Segment 20-Zinc
Well 399-1-6



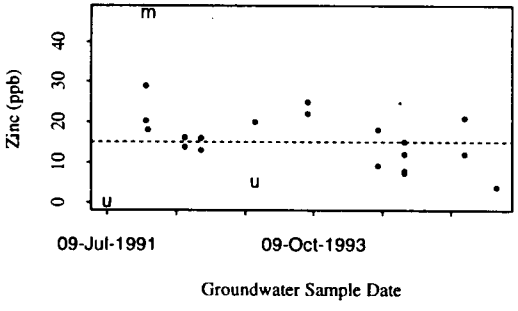
Segment 20-Zinc
Well 399-1-7



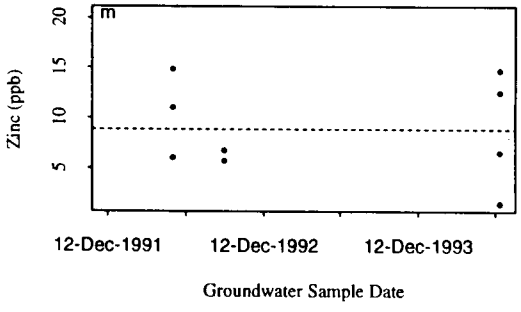
Segment 20-Zinc
Well 399-1-8



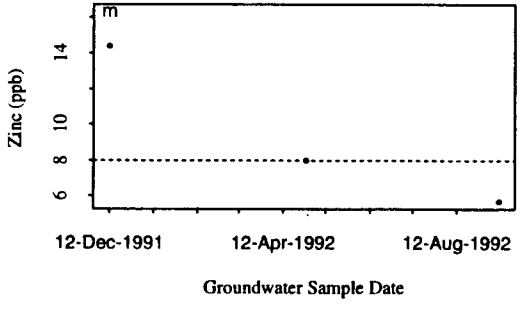
Segment 20-Zinc
Well 399-2-1



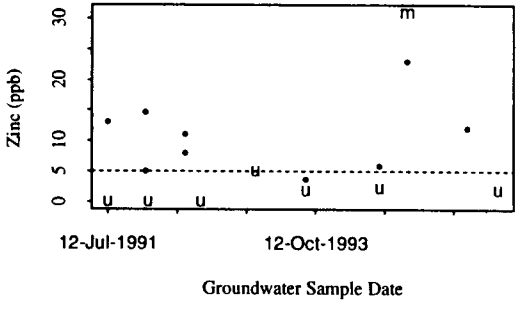
Segment 20-Zinc
Well 399-2-2



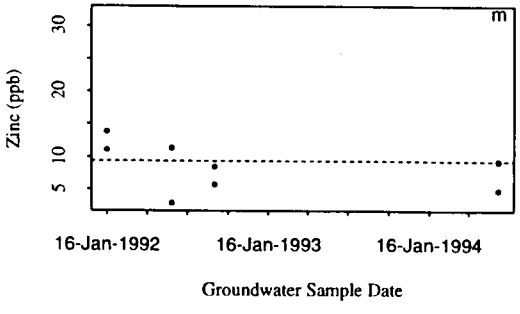
Segment 20-Zinc
Well 399-2-3



Segment 20-Zinc
Well 399-3-10

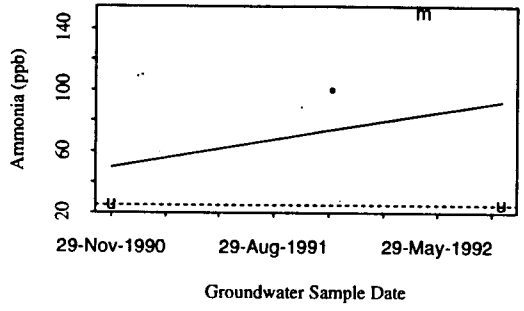


Segment 20-Zinc
Well 399-3-11

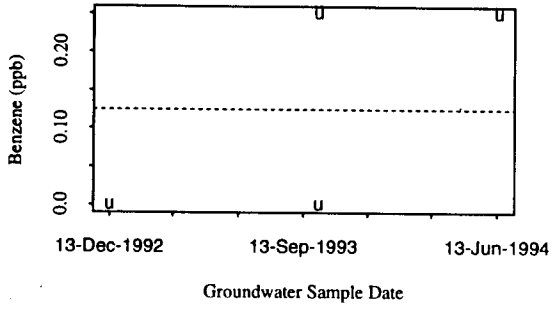


96134817.1 28

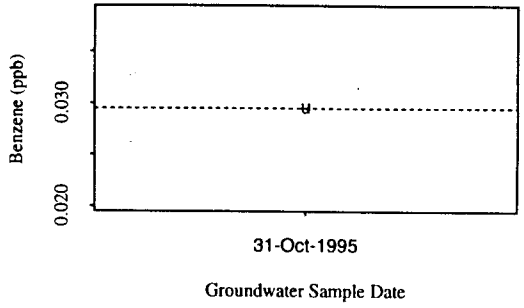
Segment 21-Ammonia
Well 699-S30-E15A



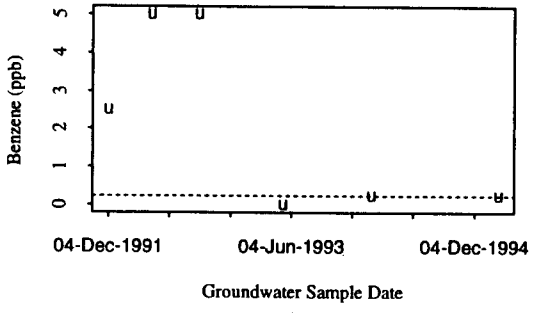
Segment 21-Benzene
Well 3099-42-16



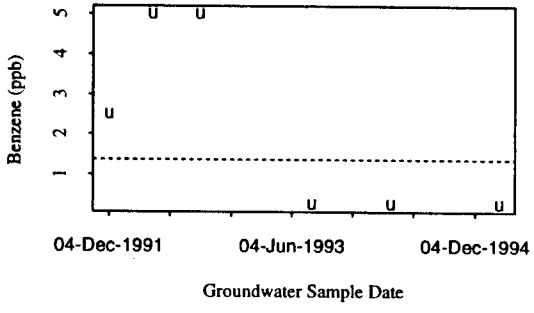
Segment 21-Benzene
Well 3099-47-18B



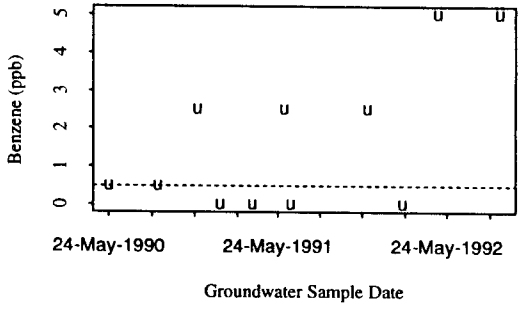
Segment 21-Benzene
Well 699-S29-E16A



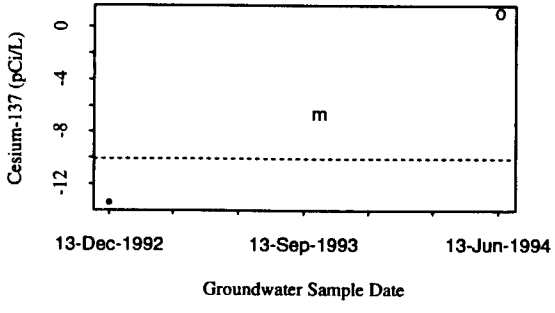
Segment 21-Benzene
Well 699-S29-E16B



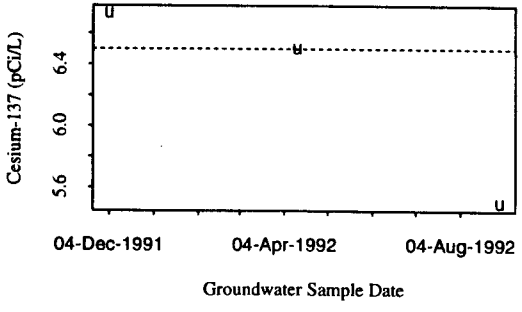
Segment 21-Benzene
Well 699-S30-E15A



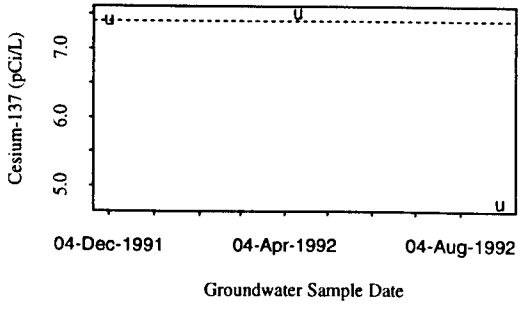
Segment 21-Cesium-137
Well 3099-42-16



Segment 21-Cesium-137
Well 699-S29-E16A

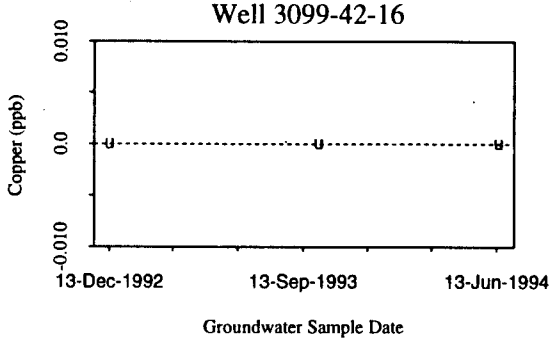


Segment 21-Cesium-137
Well 699-S29-E16B

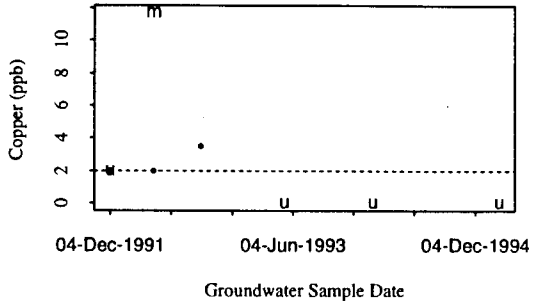


9618448.1739

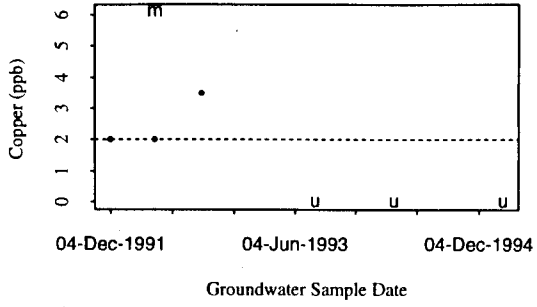
Segment 21-Copper
Well 3099-42-16



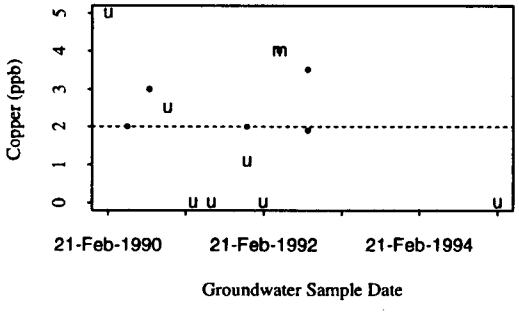
Segment 21-Copper
Well 699-S29-E16A



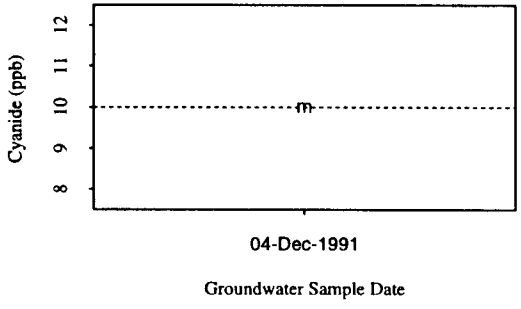
Segment 21-Copper
Well 699-S29-E16B



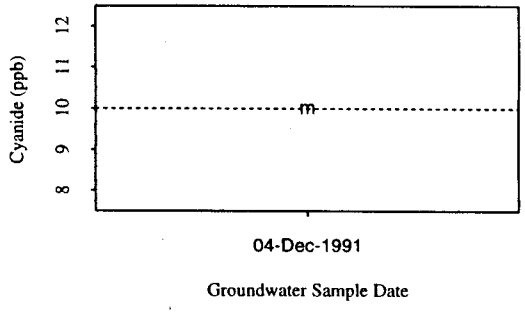
Segment 21-Copper
Well 699-S30-E15A



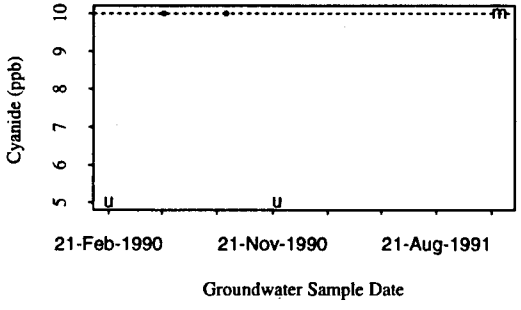
Segment 21-Cyanide
Well 699-S29-E16A



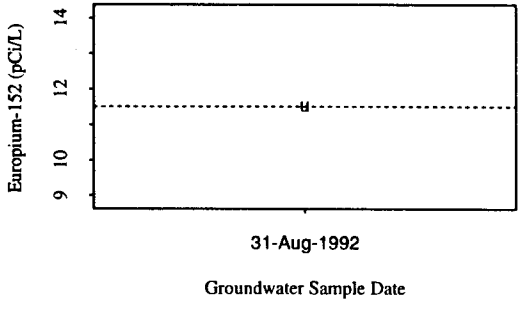
Segment 21-Cyanide
Well 699-S29-E16B



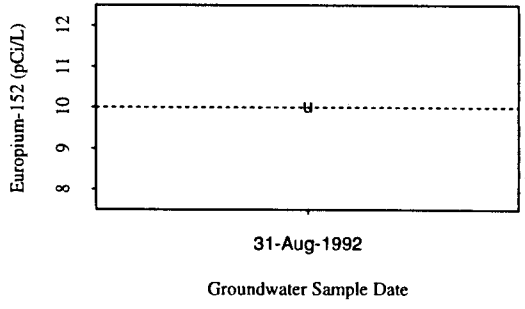
Segment 21-Cyanide
Well 699-S30-E15A



Segment 21-Europium-152
Well 699-S29-E16A

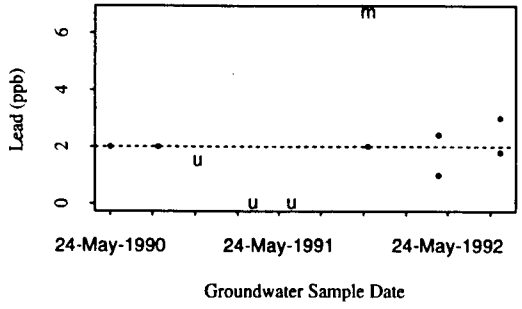


Segment 21-Europium-152
Well 699-S29-E16B

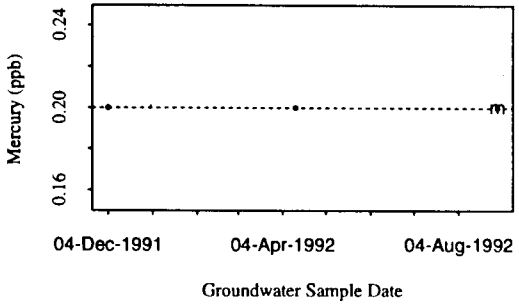


9413148.1740

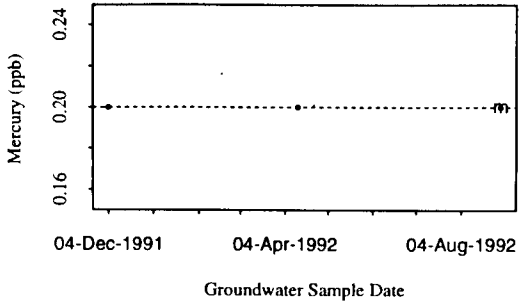
Segment 21-Lead
Well 699-S30-E15A



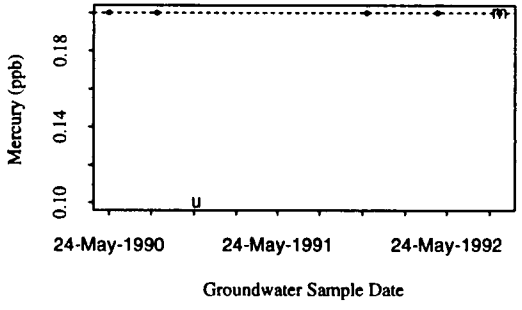
Segment 21-Mercury
Well 699-S29-E16A



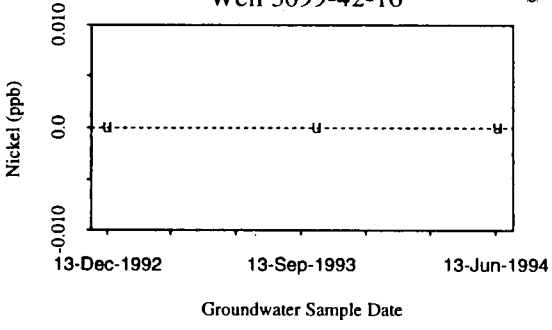
Segment 21-Mercury
Well 699-S29-E16B



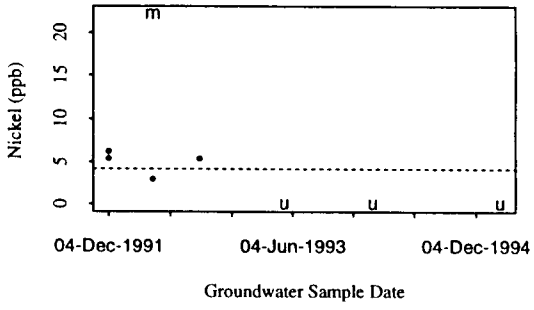
Segment 21-Mercury
Well 699-S30-E15A



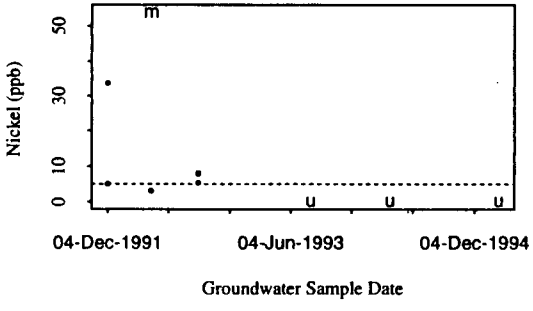
Segment 21-Nickel
Well 3099-42-16



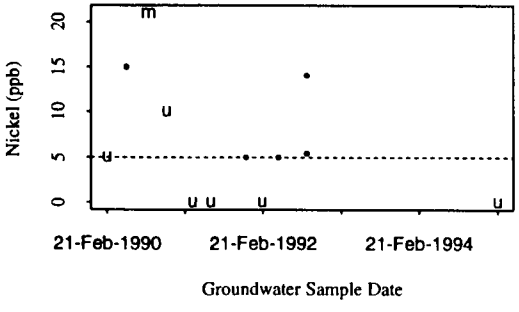
Segment 21-Nickel
Well 699-S29-E16A



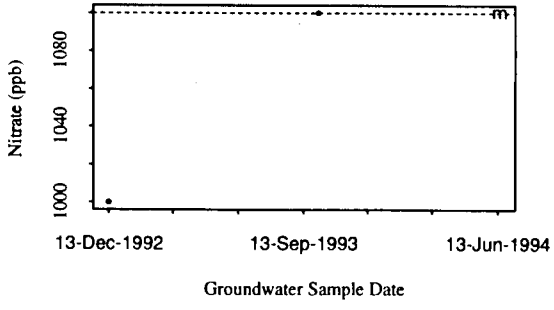
Segment 21-Nickel
Well 699-S29-E16B



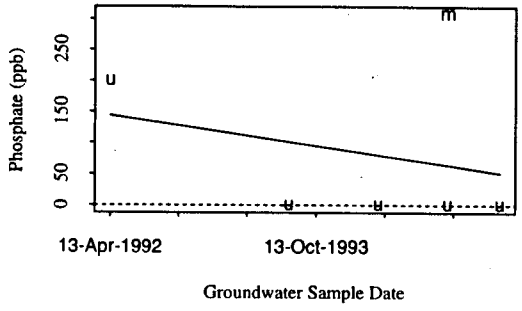
Segment 21-Nickel
Well 699-S30-E15A



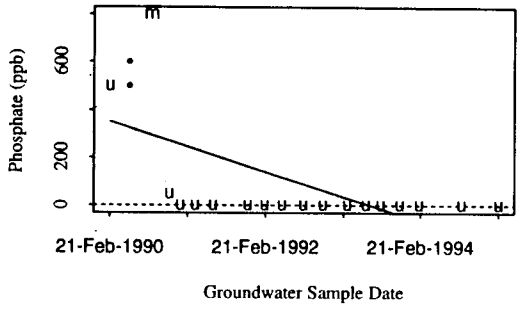
Segment 21-Nitrate
Well 3099-42-16



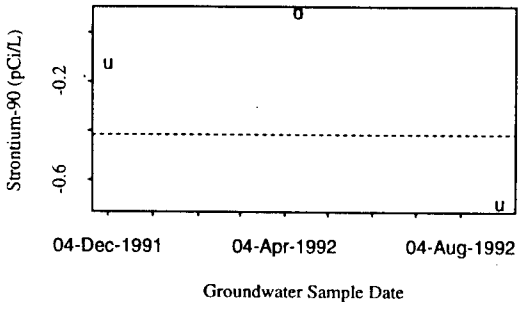
Segment 21-Phosphate
Well 699-S29-E16B



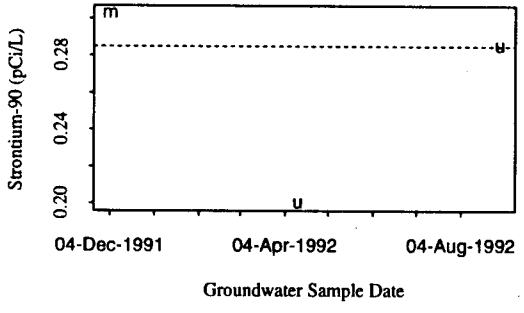
Segment 21-Phosphate
Well 699-S30-E15A



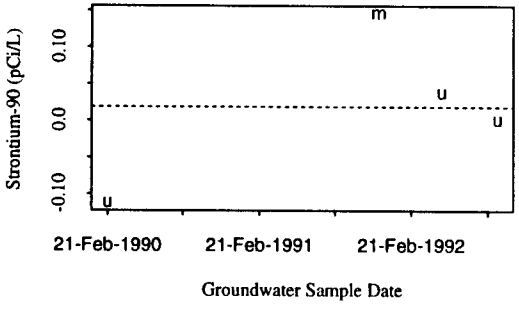
Segment 21-Strontium-90
Well 699-S29-E16A



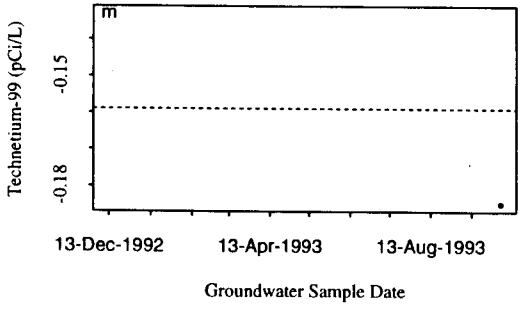
Segment 21-Strontium-90
Well 699-S29-E16B



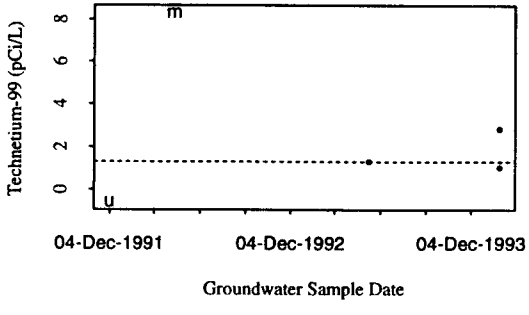
Segment 21-Strontium-90
Well 699-S30-E15A



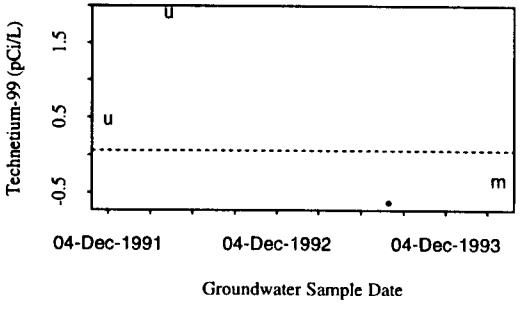
Segment 21-Technetium-99
Well 3099-42-16



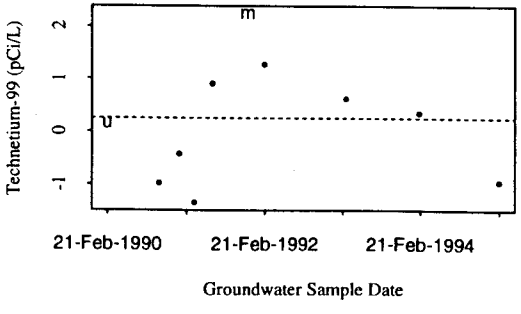
Segment 21-Technetium-99
Well 699-S29-E16A



Segment 21-Technetium-99
Well 699-S29-E16B

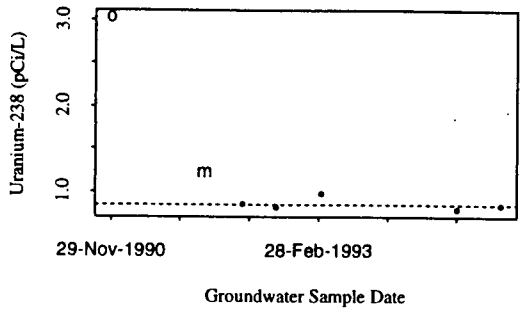


Segment 21-Technetium-99
Well 699-S30-E15A

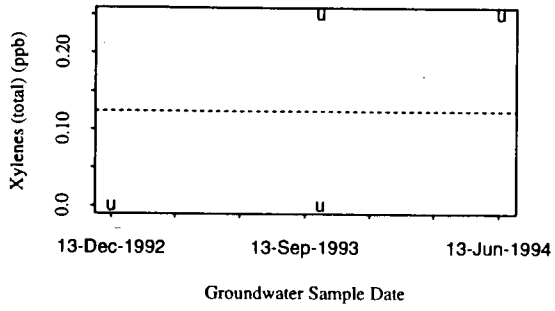


9613148.1742

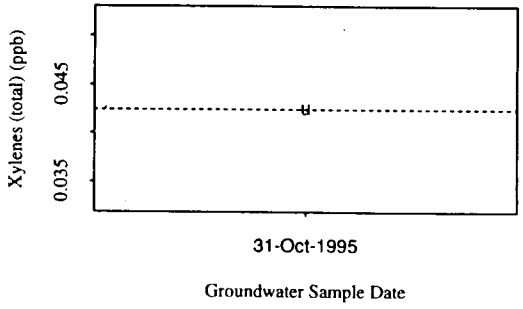
Segment 21-Uranium-238
Well 699-S30-E15A



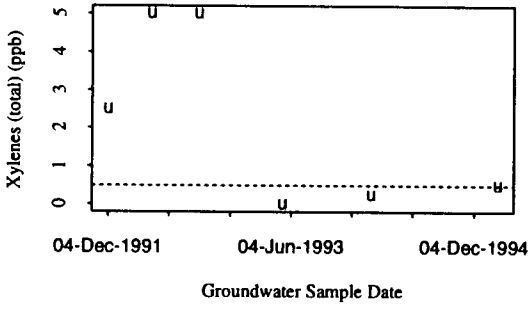
Segment 21-Xylenes (total)
Well 3099-42-16



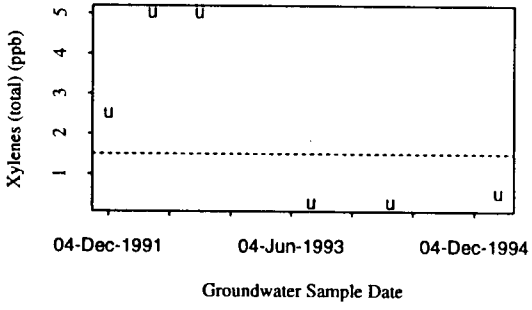
Segment 21-Xylenes (total)
Well 3099-47-18B



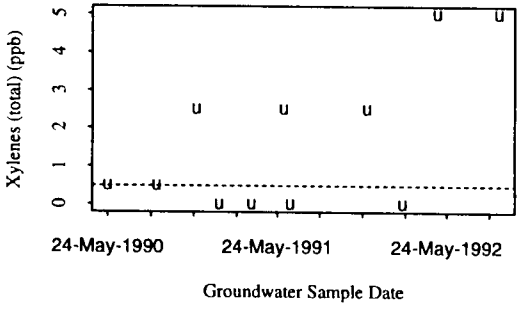
Segment 21-Xylenes (total)
Well 699-S29-E16A



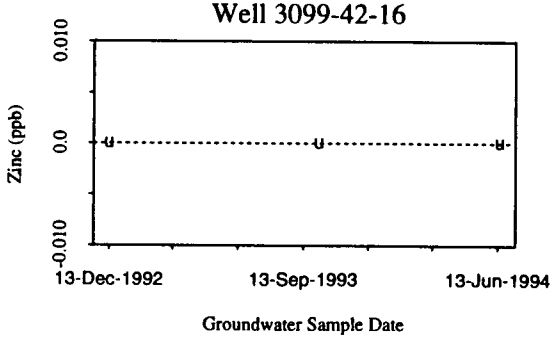
Segment 21-Xylenes (total)
Well 699-S29-E16B



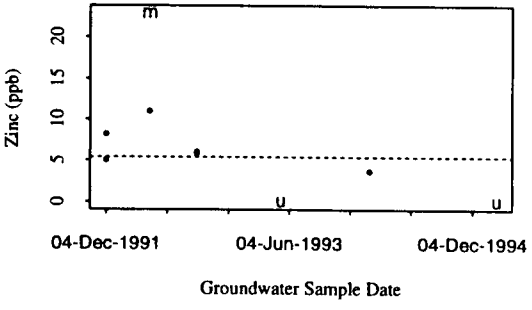
Segment 21-Xylenes (total)
Well 699-S30-E15A



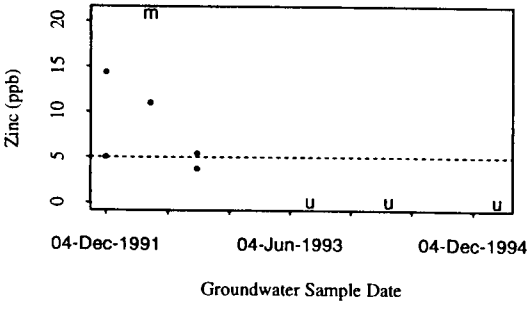
Segment 21-Zinc
Well 3099-42-16



Segment 21-Zinc
Well 699-S29-E16A



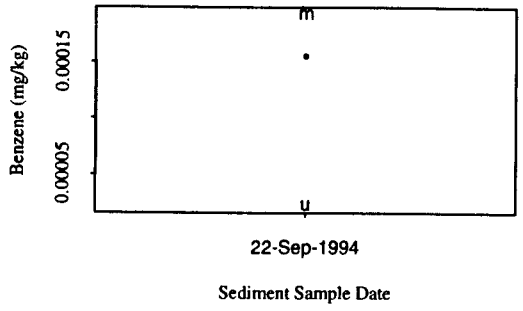
Segment 21-Zinc
Well 699-S29-E16B



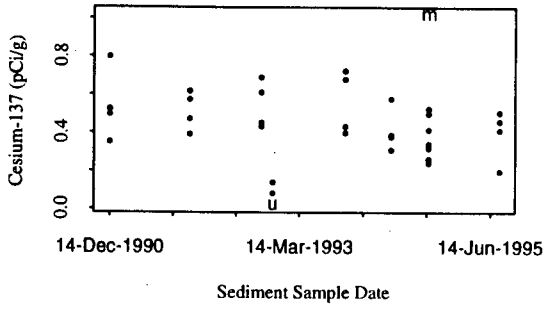
9613448.1744

Sediment Plots and Maximum Representative Values for the Contaminants of Interest

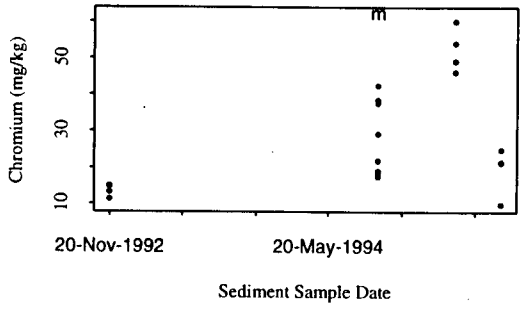
Segment 1-Benzene



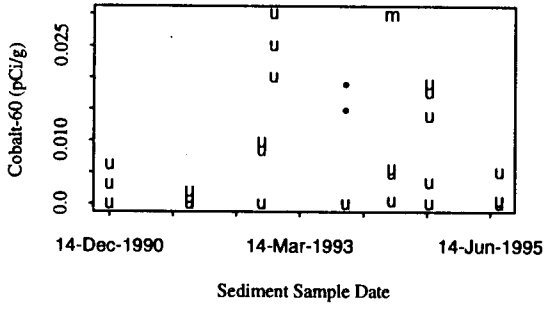
Segment 1-Cesium-137



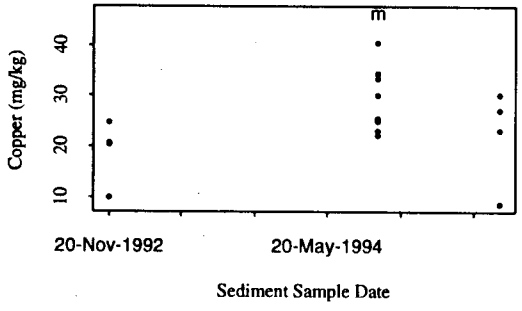
Segment 1-Chromium



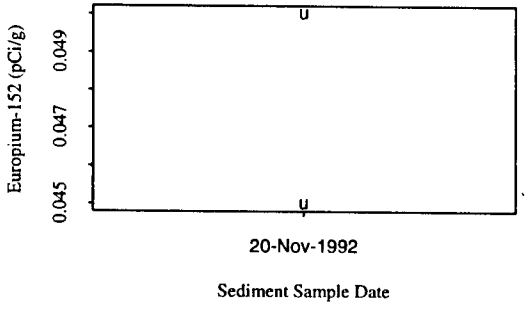
Segment 1-Cobalt-60



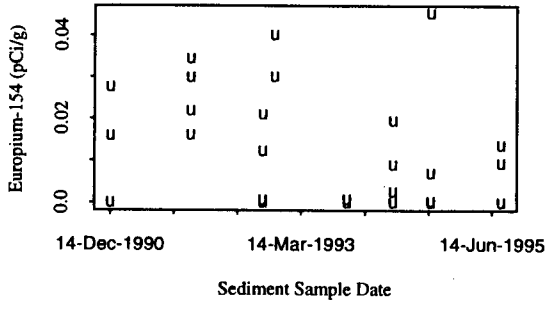
Segment 1-Copper



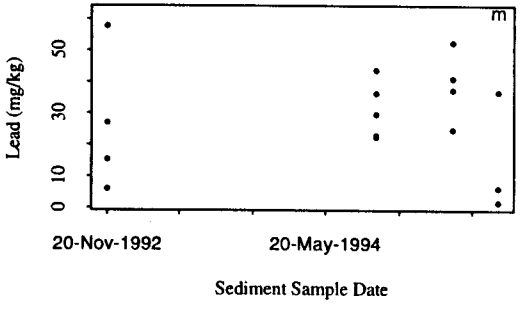
Segment 1-Europium-152



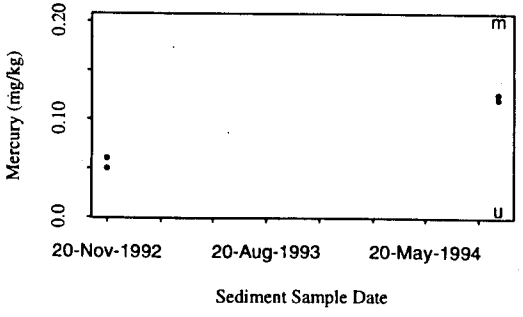
Segment 1-Europium-154



Segment 1-Lead

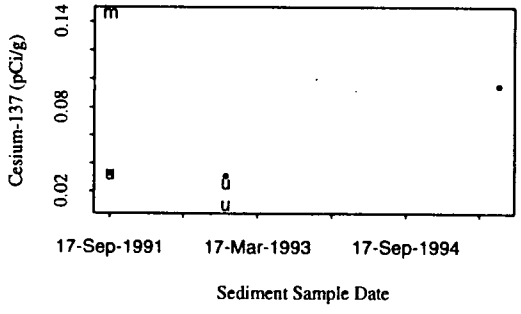


Segment 1-Mercury

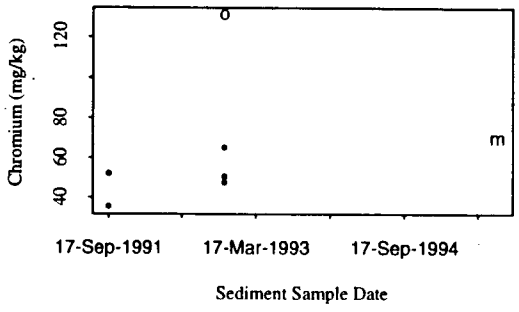


96184748.1745

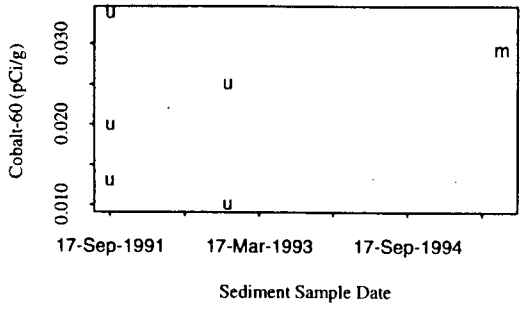
Segment 2-Cesium-137



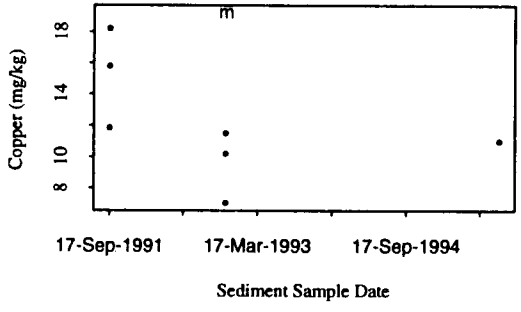
Segment 2-Chromium



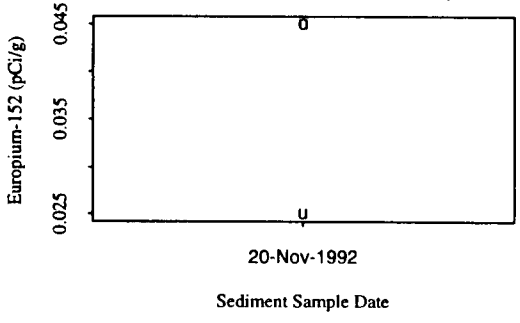
Segment 2-Cobalt-60



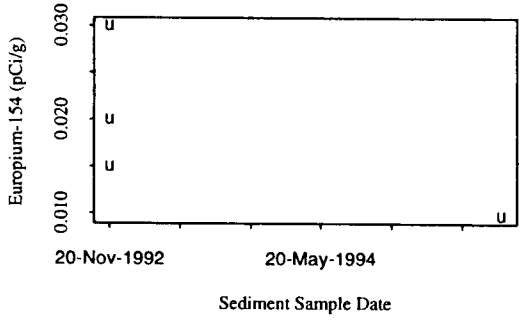
Segment 2-Copper



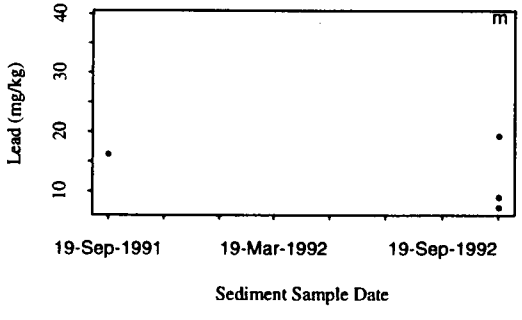
Segment 2-Europium-152



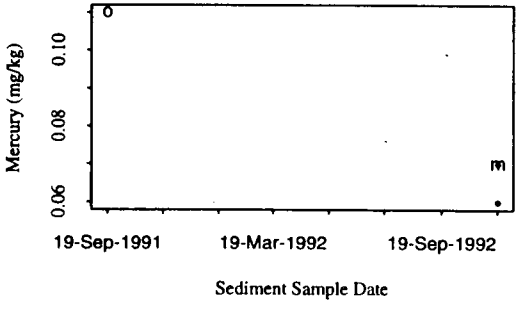
Segment 2-Europium-154



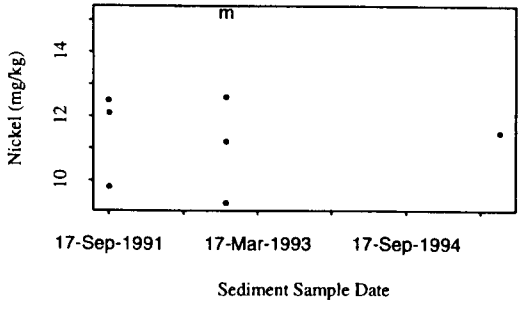
Segment 2-Lead



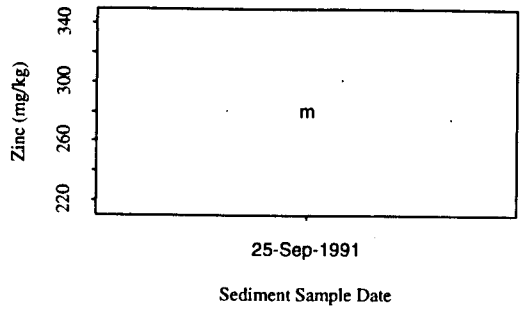
Segment 2-Mercury



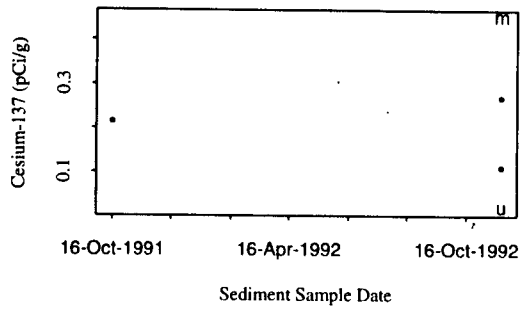
Segment 2-Nickel



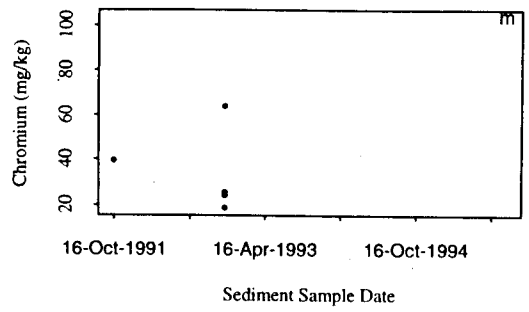
Segment 3-Zinc



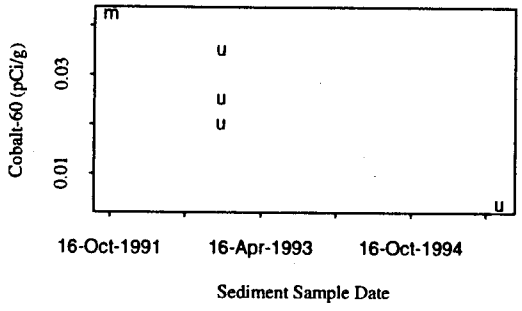
Segment 4-Cesium-137



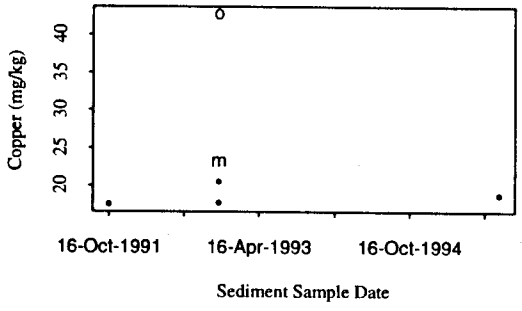
Segment 4-Chromium



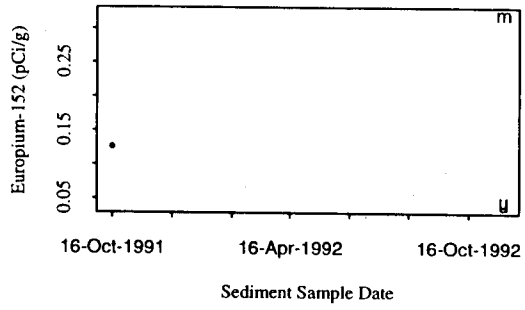
Segment 4-Cobalt-60



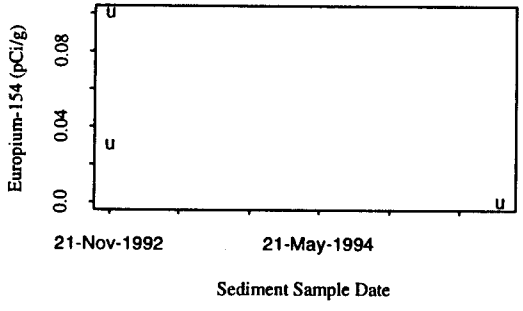
Segment 4-Copper



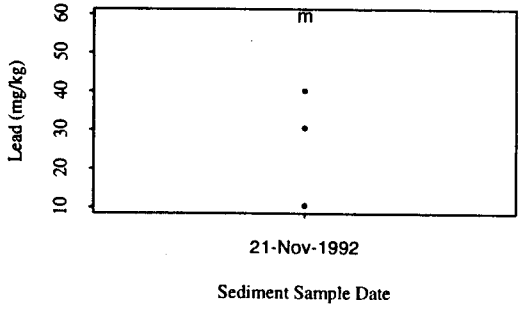
Segment 4-Europium-152



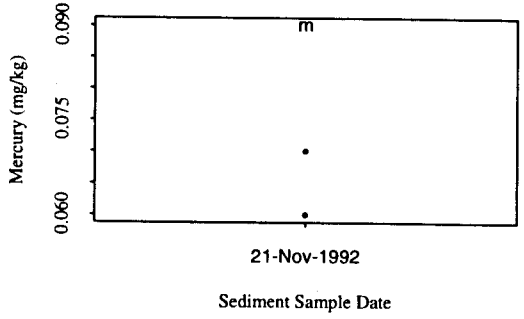
Segment 4-Europium-154



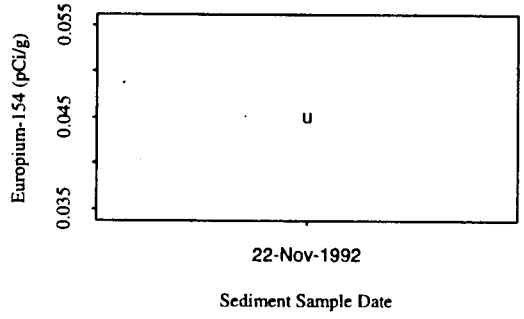
Segment 4-Lead



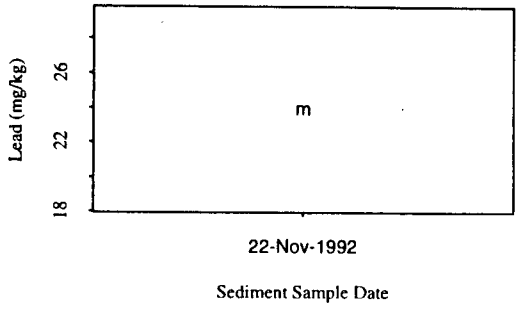
Segment 4-Mercury



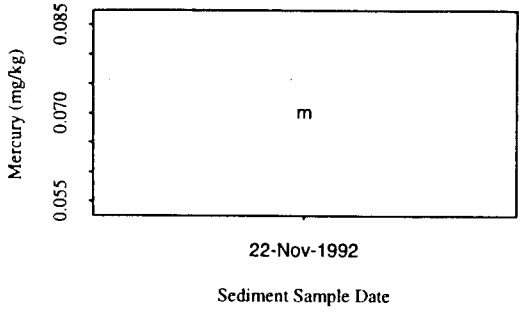
Segment 5-Europium-154



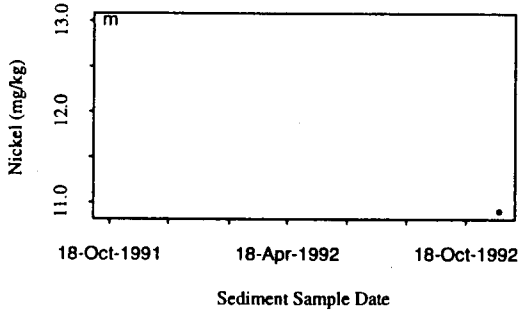
Segment 5-Lead



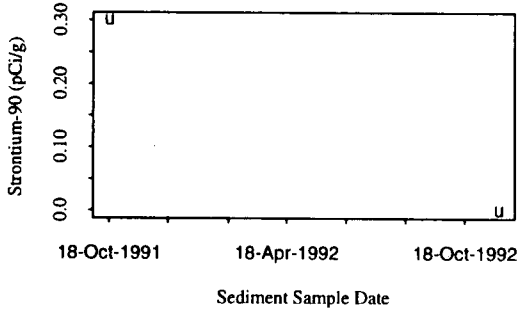
Segment 5-Mercury



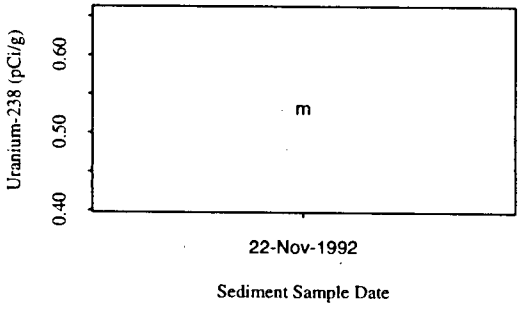
Segment 5-Nickel



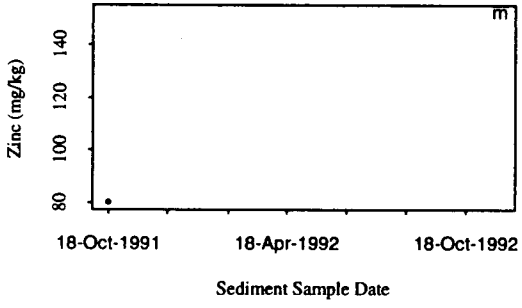
Segment 5-Strontium-90



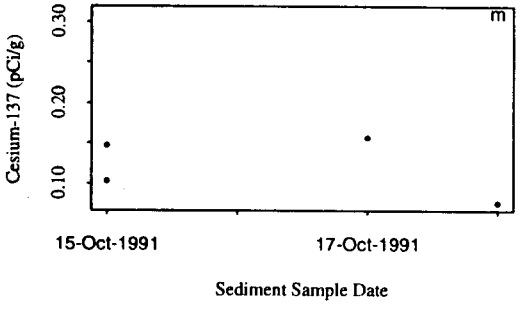
Segment 5-Uranium-238



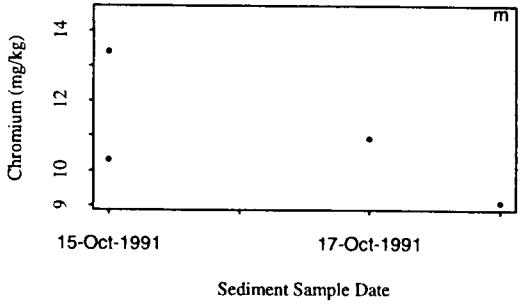
Segment 5-Zinc



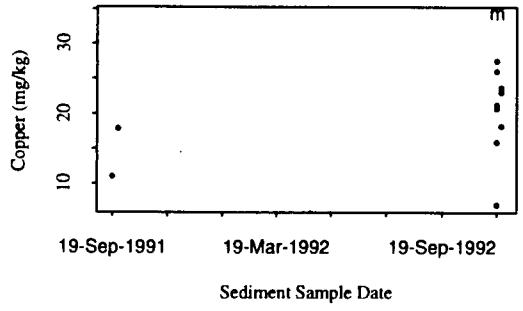
Segment 6-Cesium-137



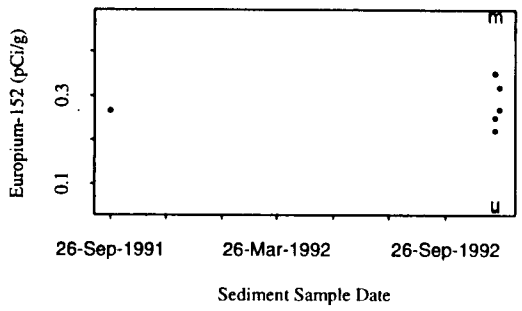
Segment 6-Chromium



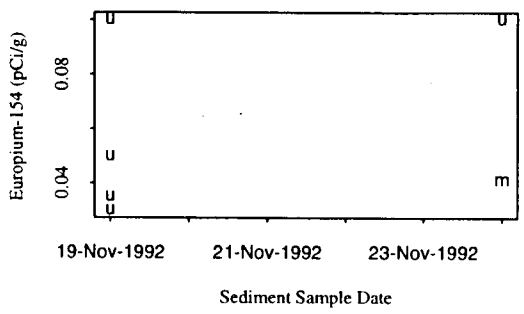
Segment 8-Copper



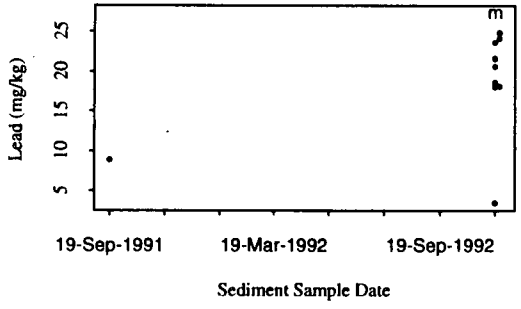
Segment 8-Europium-152



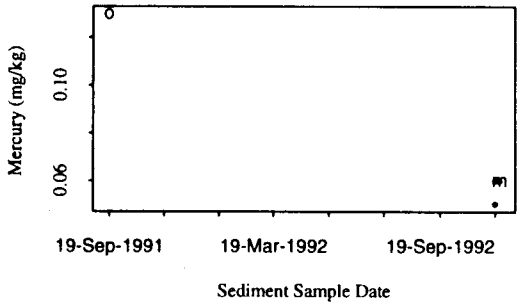
Segment 8-Europium-154



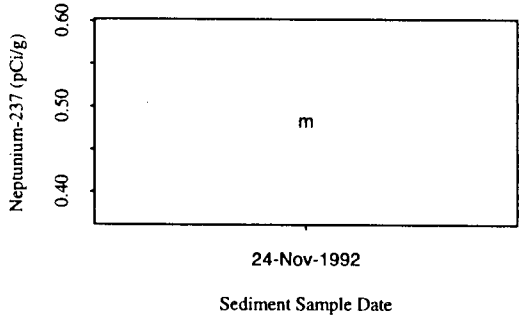
Segment 8-Lead



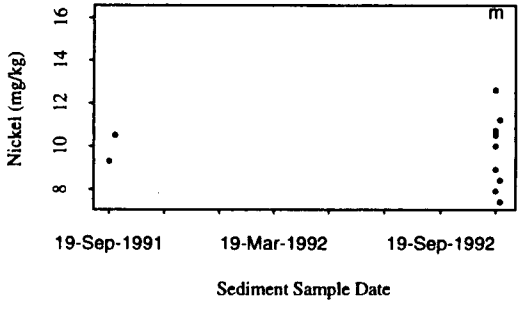
Segment 8-Mercury



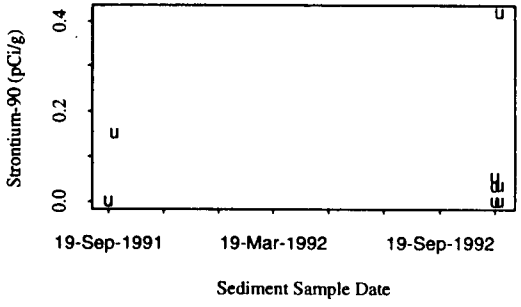
Segment 8-Neptunium-237



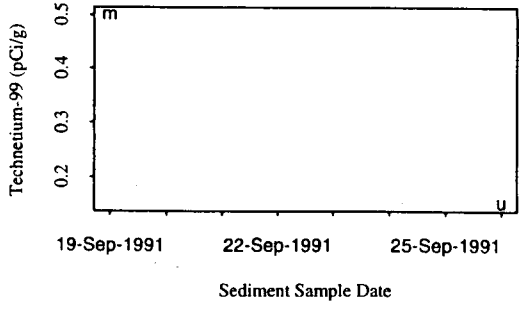
Segment 8-Nickel



Segment 8-Strontium-90

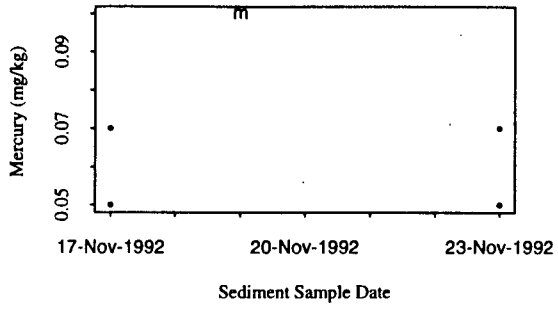


Segment 8-Technetium-99

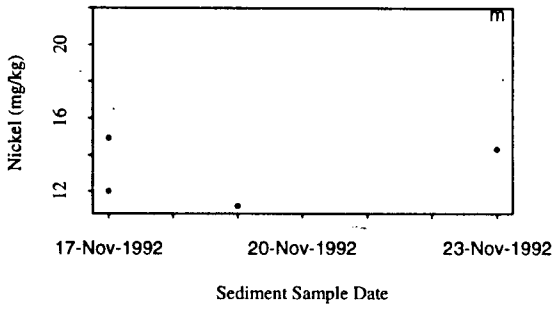


96 5448 1749

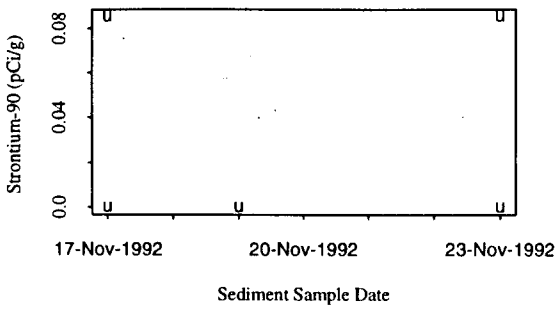
Segment 9-Mercury



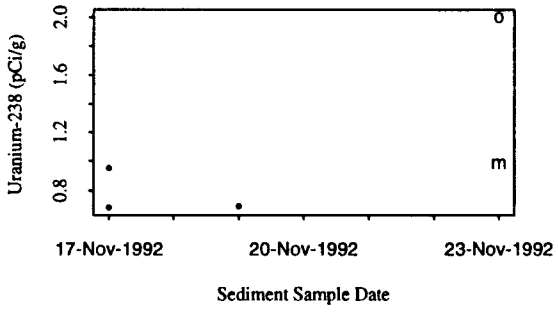
Segment 9-Nickel



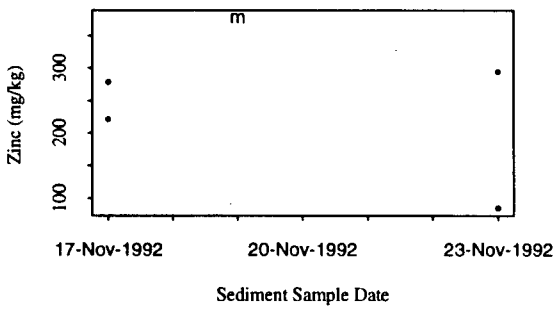
Segment 9-Strontium-90



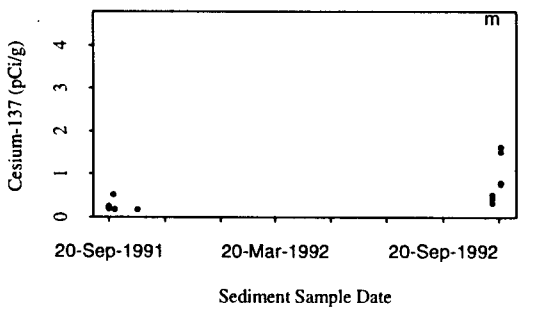
Segment 9-Uranium-238



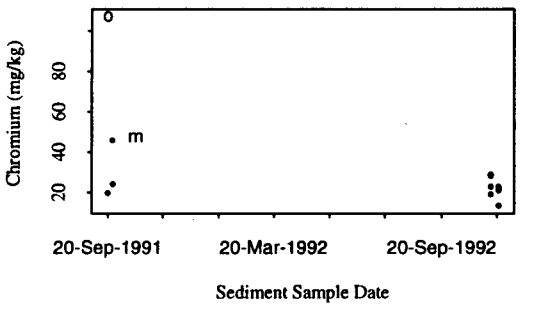
Segment 9-Zinc



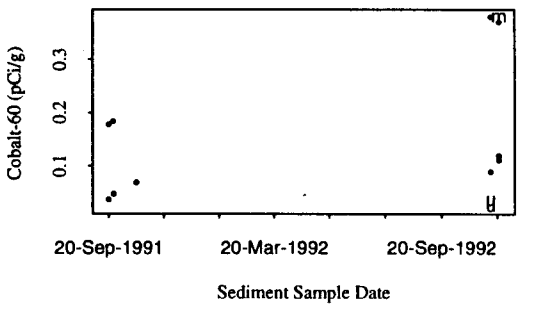
Segment 10-Cesium-137



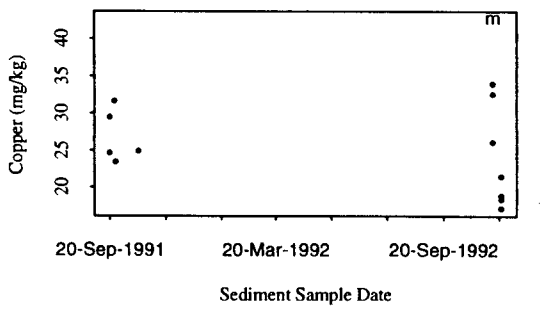
Segment 10-Chromium



Segment 10-Cobalt-60

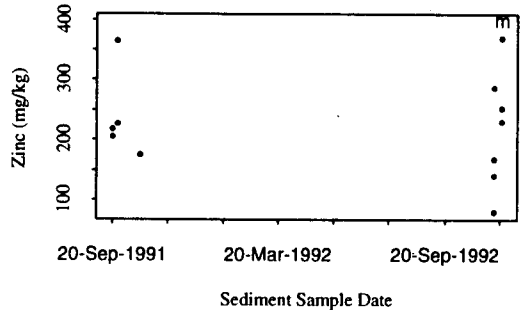


Segment 10-Copper

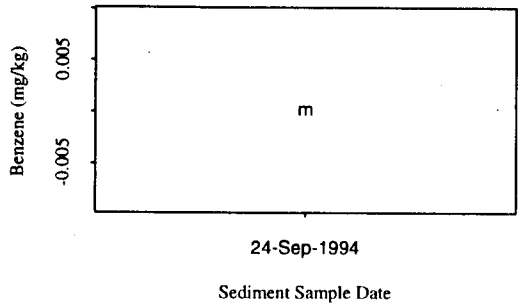


9613448.1750

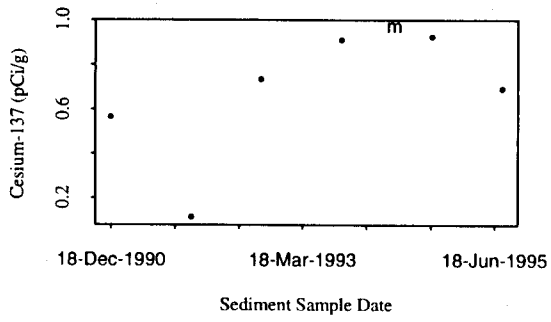
Segment 10-Zinc



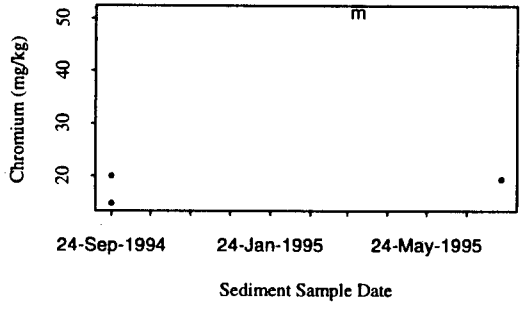
Segment 12-Benzene



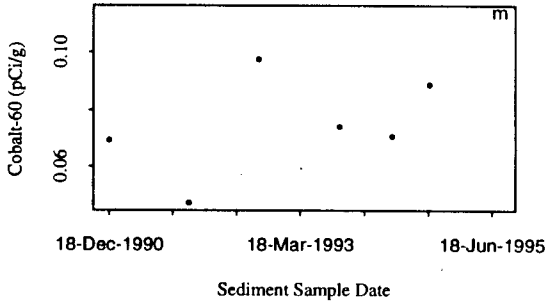
Segment 12-Cesium-137



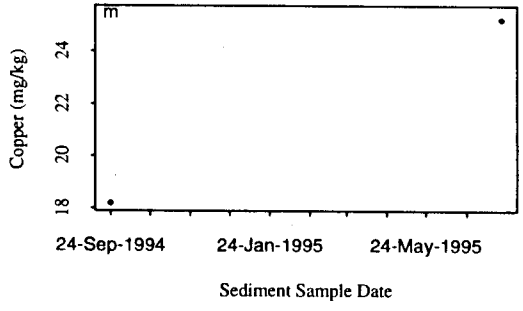
Segment 12-Chromium



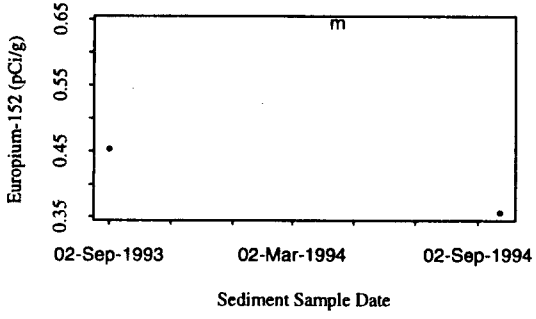
Segment 12-Cobalt-60



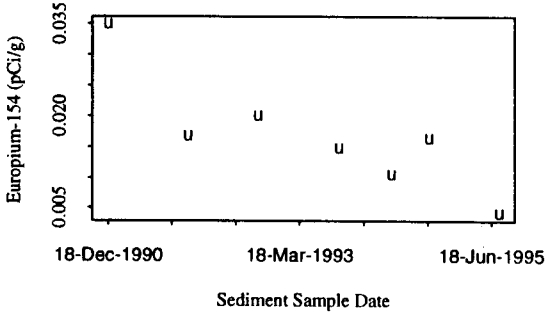
Segment 12-Copper



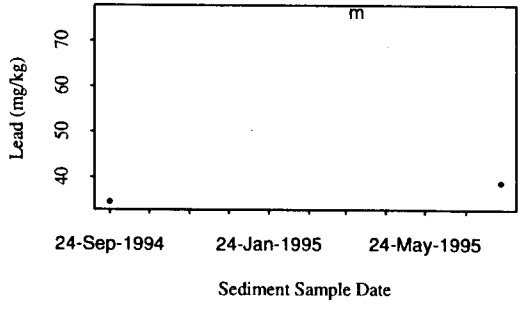
Segment 12-Europium-152



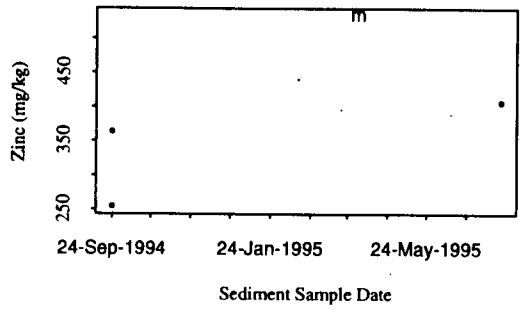
Segment 12-Europium-154



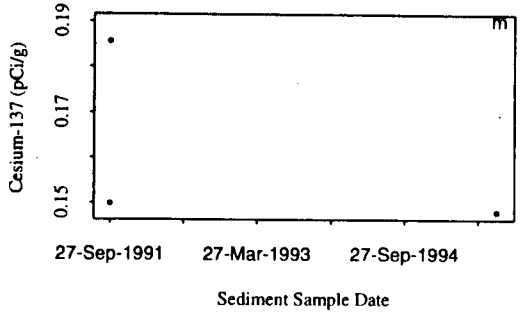
Segment 12-Lead



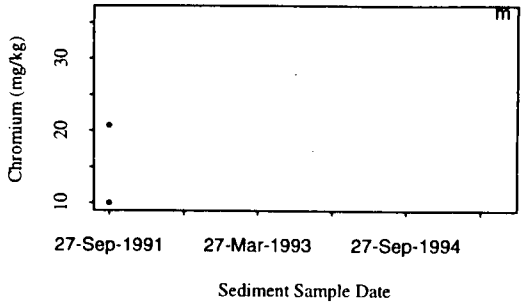
Segment 12-Zinc



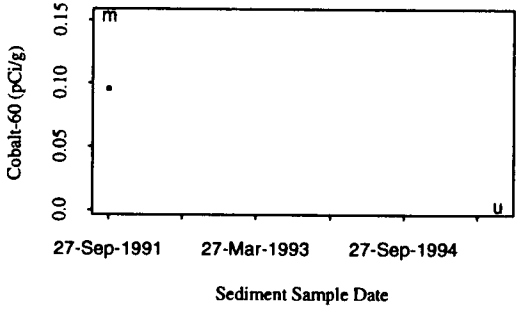
Segment 13-Cesium-137



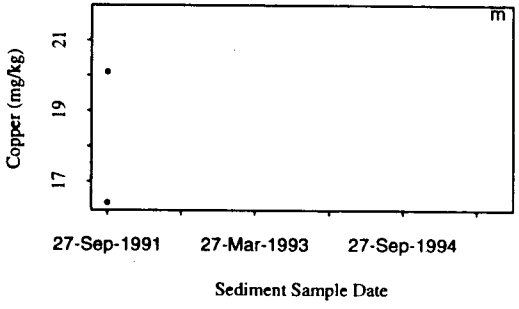
Segment 13-Chromium



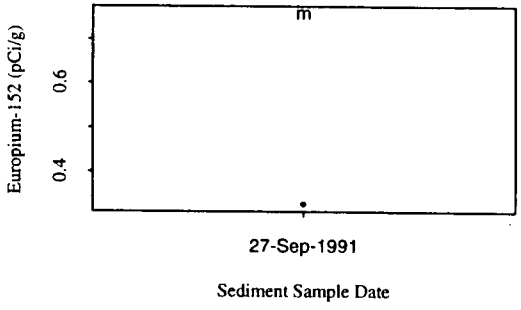
Segment 13-Cobalt-60



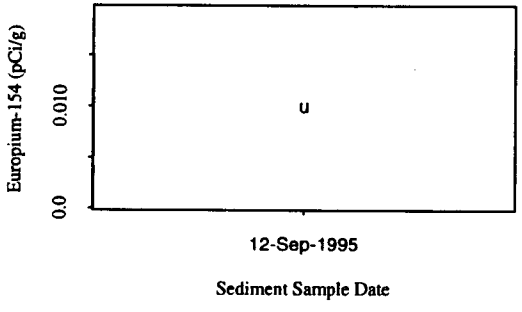
Segment 13-Copper



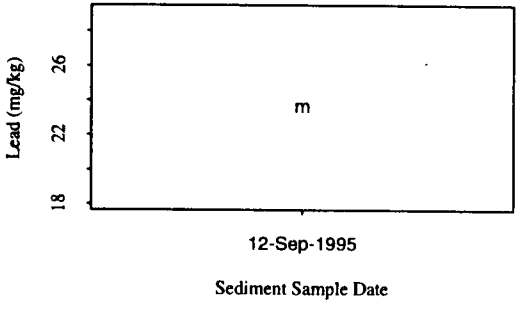
Segment 13-Europium-152



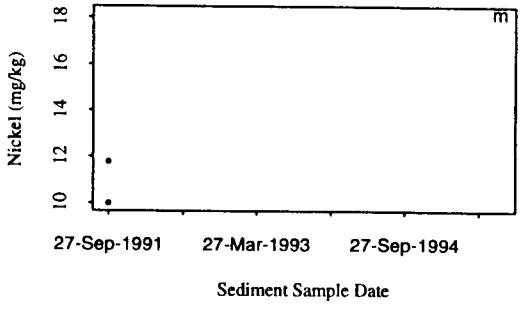
Segment 13-Europium-154



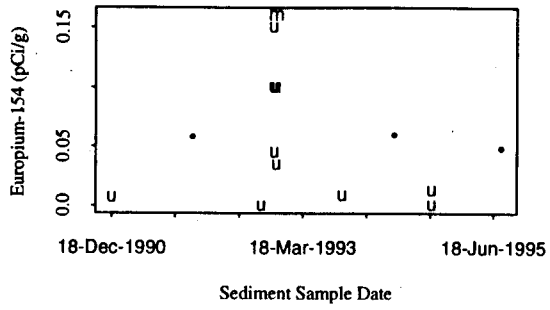
Segment 13-Lead



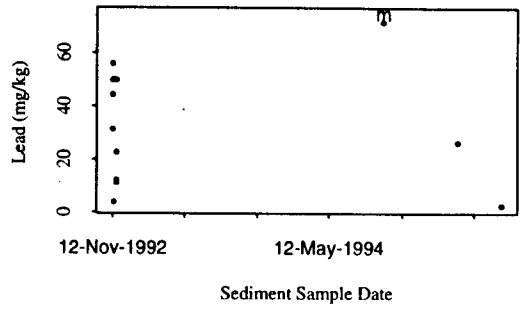
Segment 13-Nickel



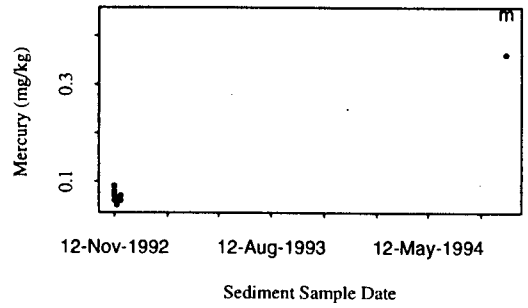
Segment 14-Europium-154



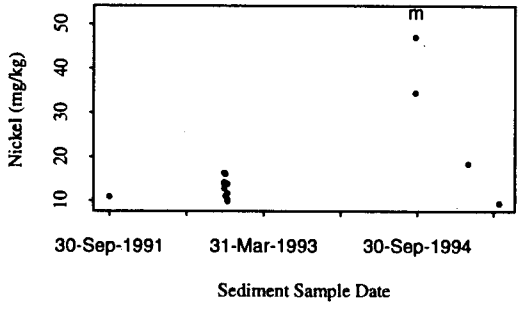
Segment 14-Lead



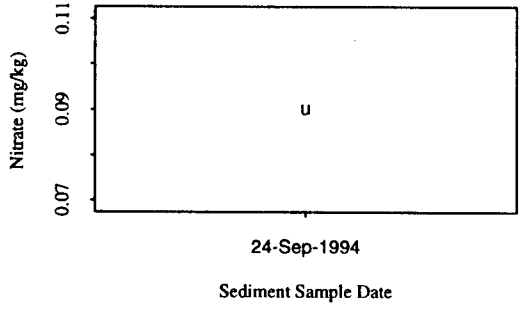
Segment 14-Mercury



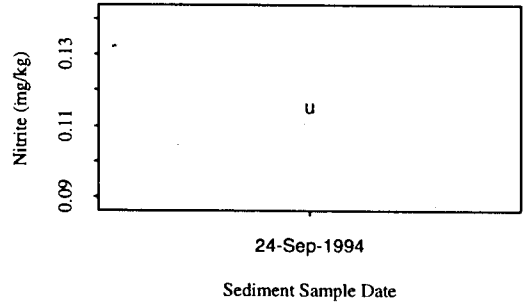
Segment 14-Nickel



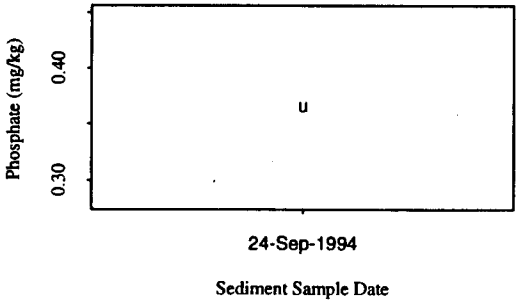
Segment 14-Nitrate



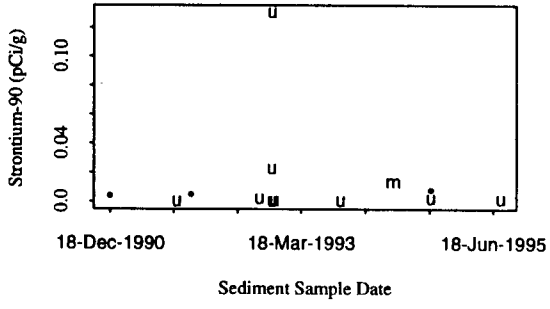
Segment 14-Nitrite



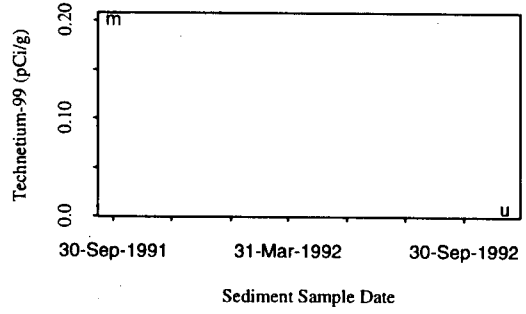
Segment 14-Phosphate



Segment 14-Strontium-90

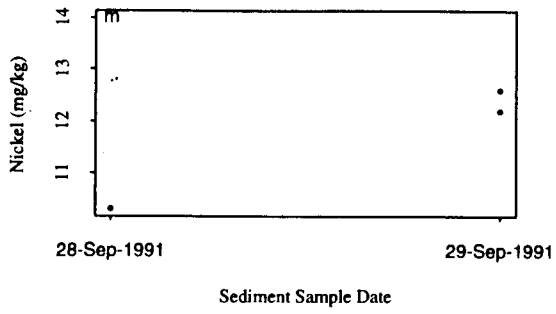


Segment 14-Technetium-99

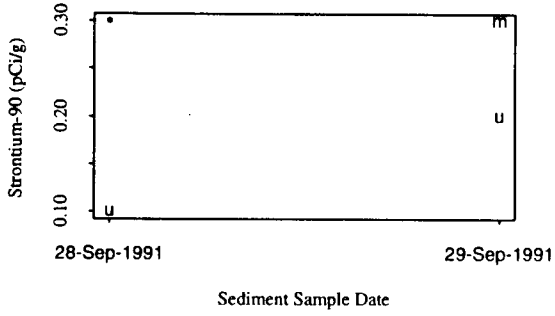


9618948.1753

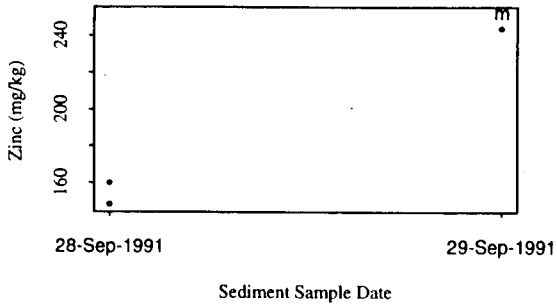
Segment 15-Nickel



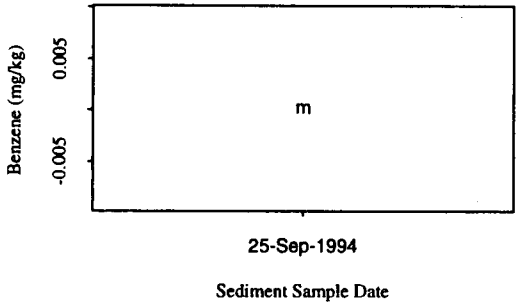
Segment 15-Strontium-90



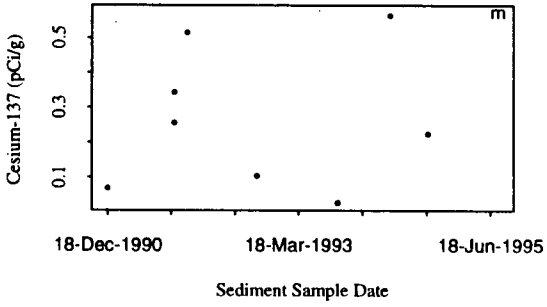
Segment 15-Zinc



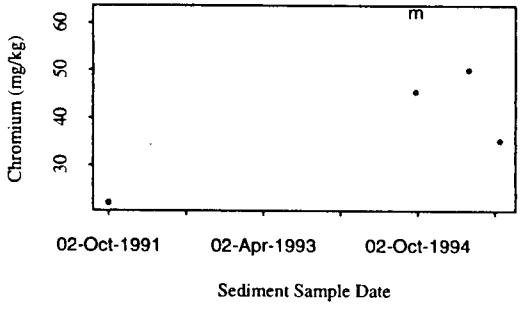
Segment 16-Benzene



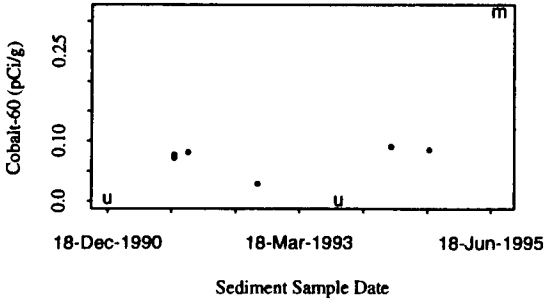
Segment 16-Cesium-137



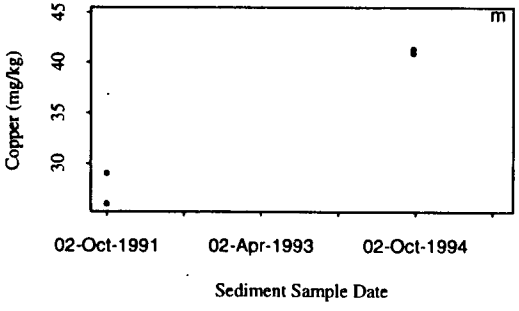
Segment 16-Chromium



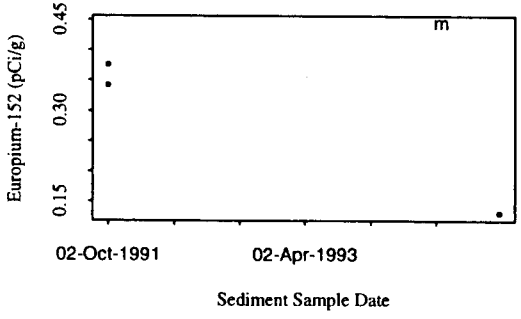
Segment 16-Cobalt-60



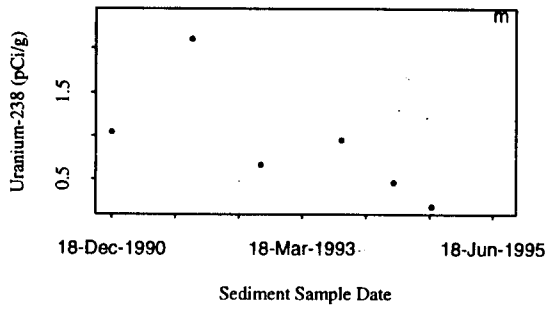
Segment 16-Copper



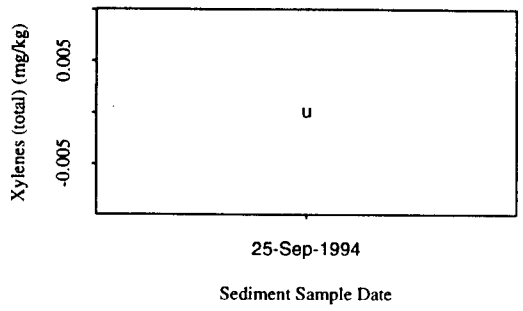
Segment 16-Europium-152



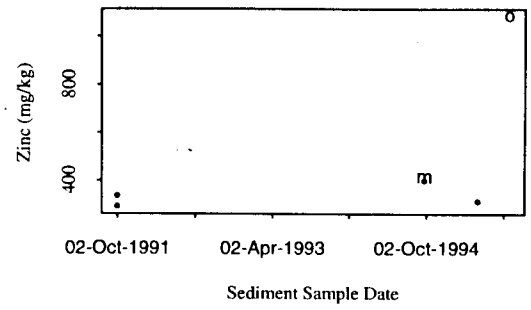
Segment 16-Uranium-238



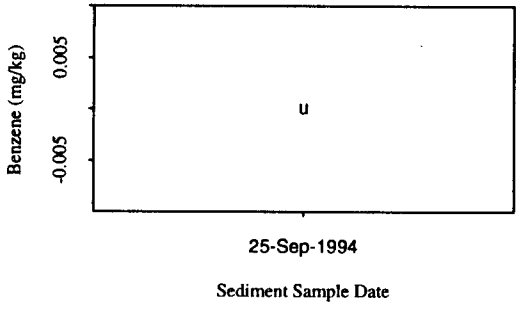
Segment 16-Xylenes (total)



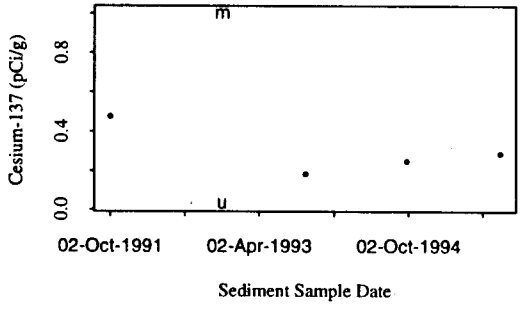
Segment 16-Zinc



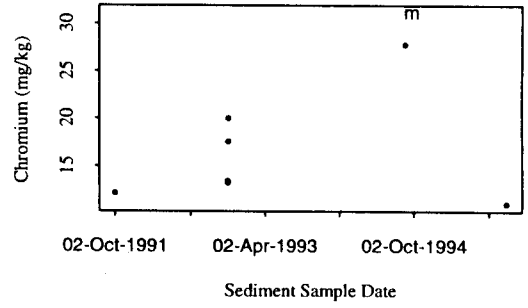
Segment 17-Benzene



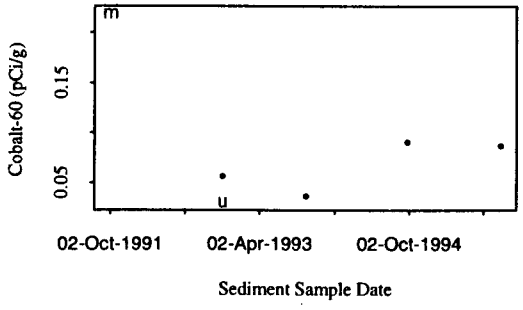
Segment 17-Cesium-137



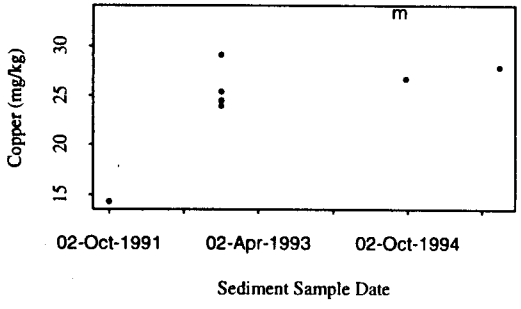
Segment 17-Chromium



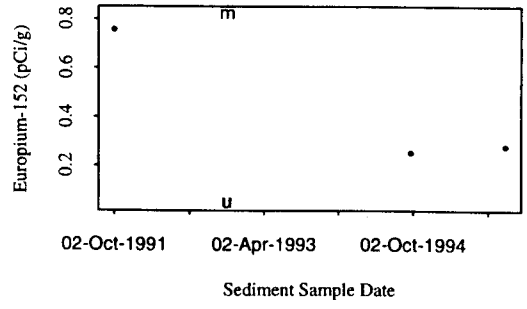
Segment 17-Cobalt-60



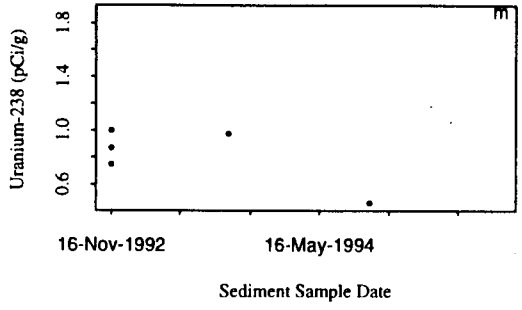
Segment 17-Copper



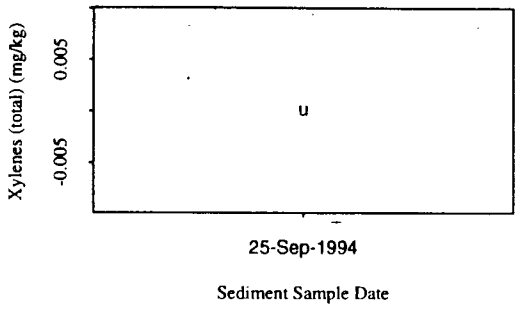
Segment 17-Europium-152



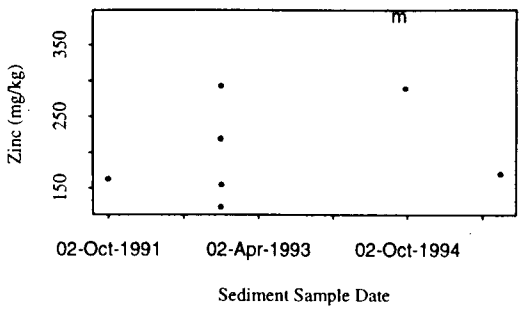
Segment 17-Uranium-238



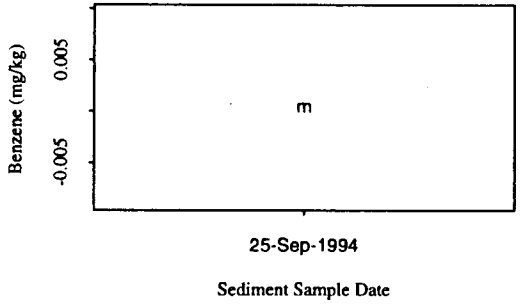
Segment 17-Xylenes (total)



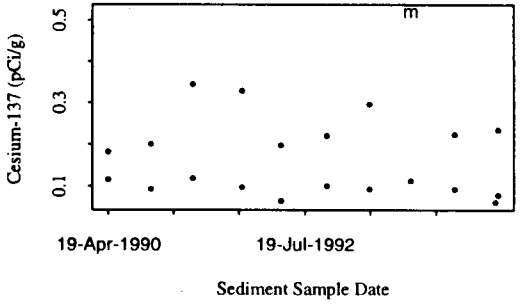
Segment 17-Zinc



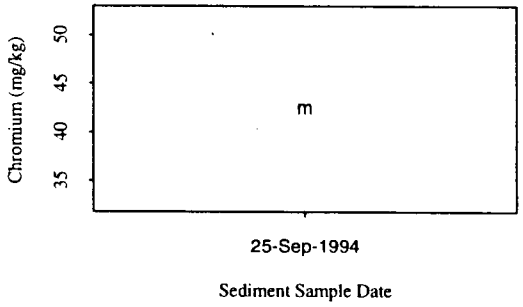
Segment 18-Benzene



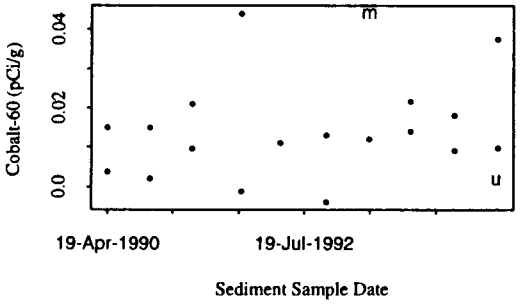
Segment 18-Cesium-137



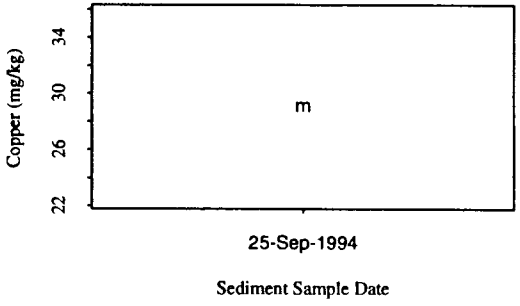
Segment 18-Chromium



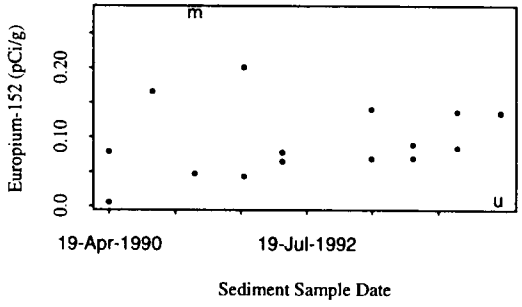
Segment 18-Cobalt-60



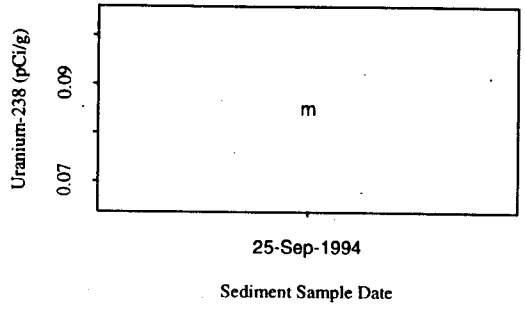
Segment 18-Copper



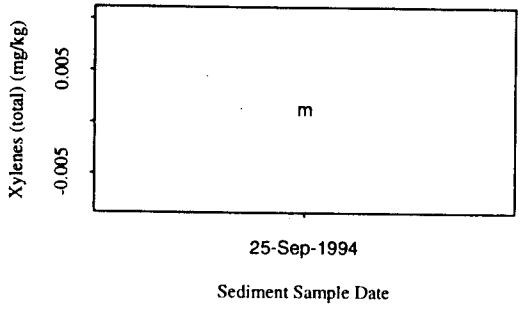
Segment 18-Europium-152



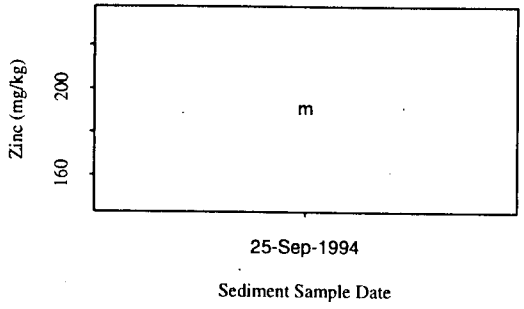
Segment 18-Uranium-238



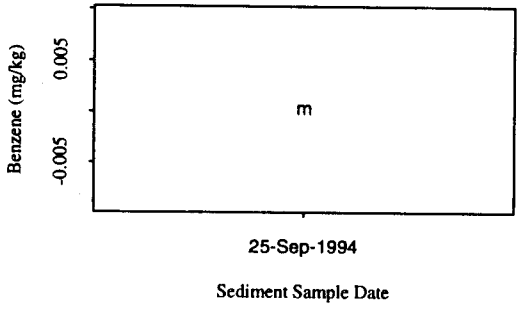
Segment 18-Xylenes (total)



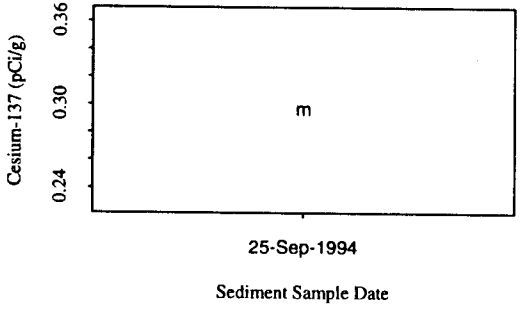
Segment 18-Zinc



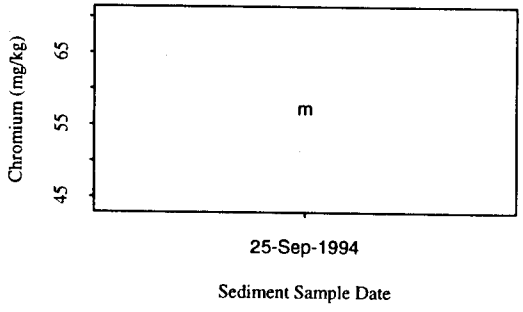
Segment 19-Benzene



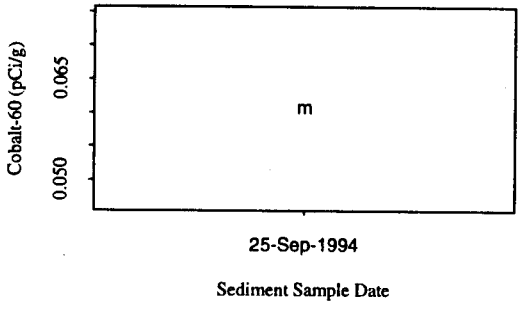
Segment 19-Cesium-137



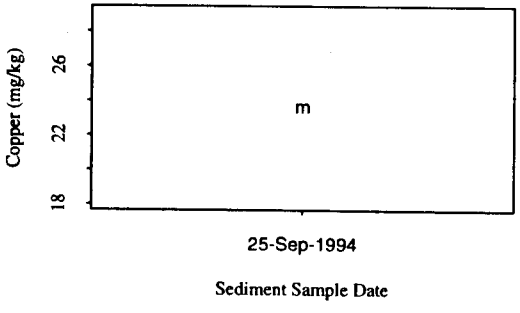
Segment 19-Chromium



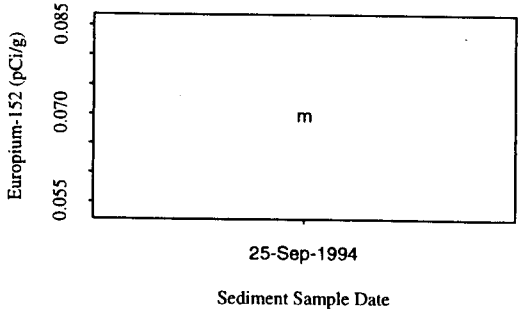
Segment 19-Cobalt-60



Segment 19-Copper

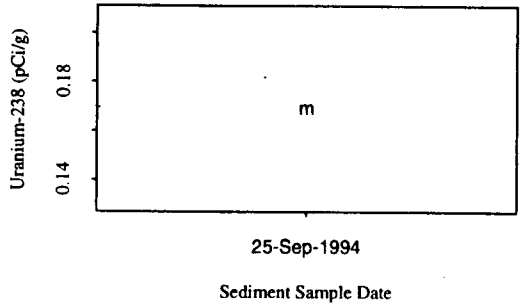


Segment 19-Europium-152

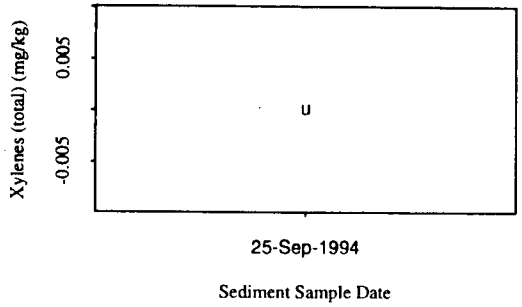


96148.757

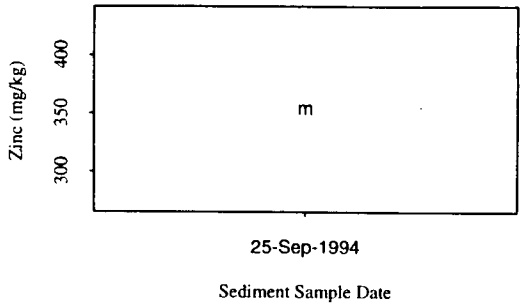
Segment 19-Uranium-238



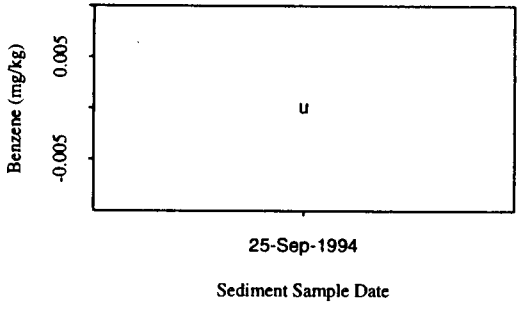
Segment 19-Xylenes (total)



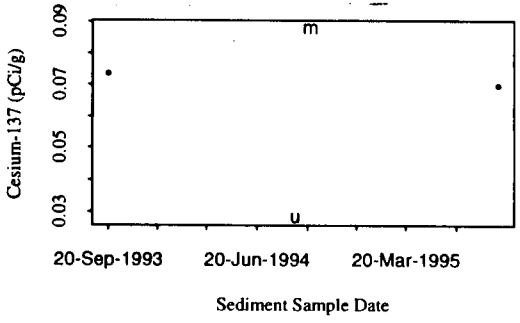
Segment 19-Zinc



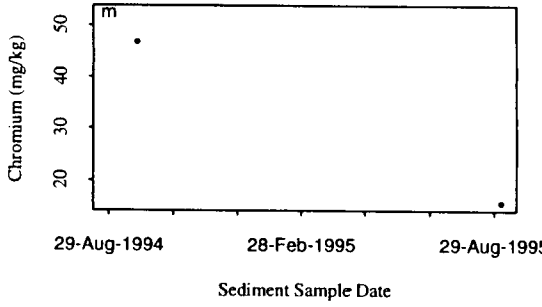
Segment 20-Benzene



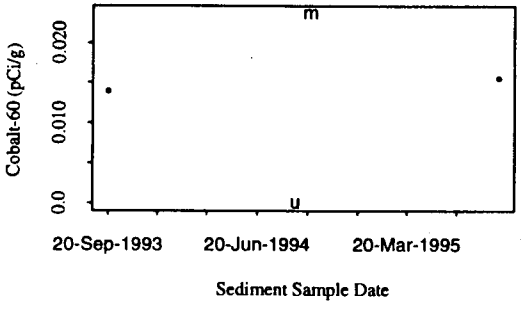
Segment 20-Cesium-137



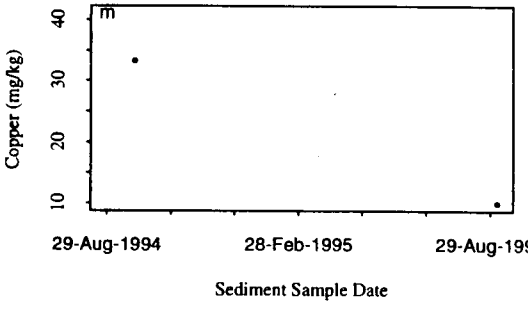
Segment 20-Chromium



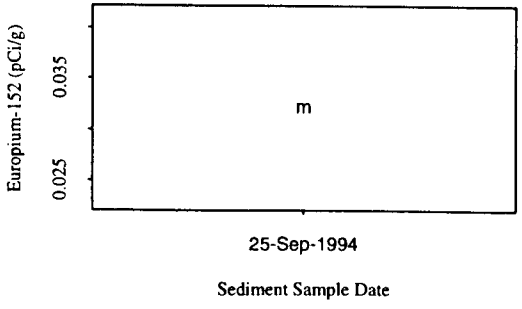
Segment 20-Cobalt-60



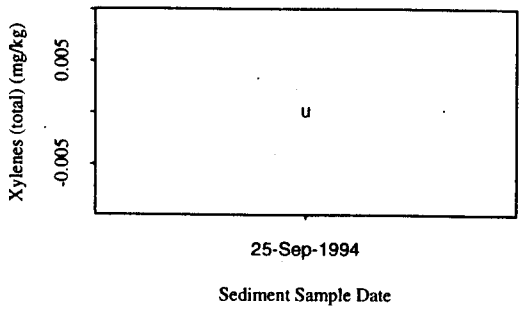
Segment 20-Copper



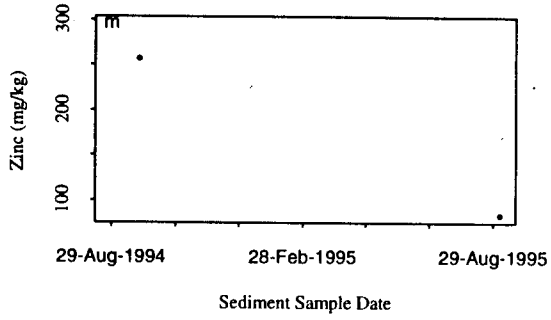
Segment 20-Europium-152



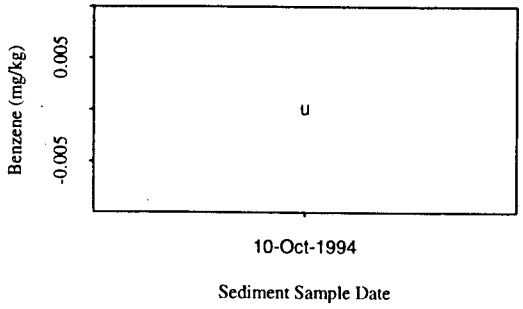
Segment 20-Xylenes (total)



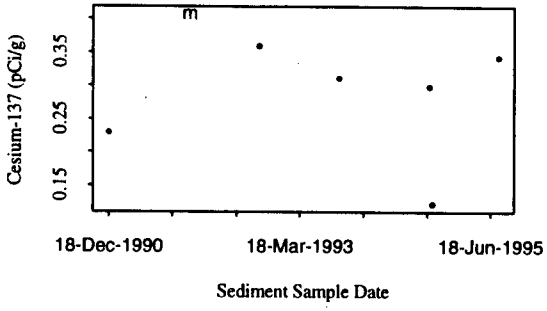
Segment 20-Zinc



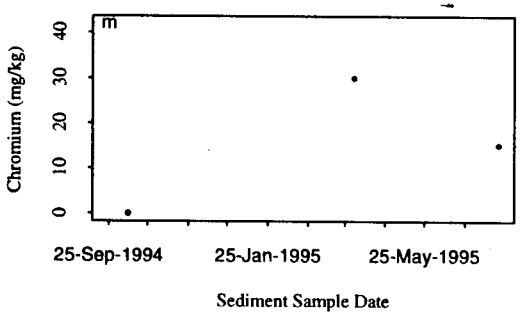
Segment 21-Benzene



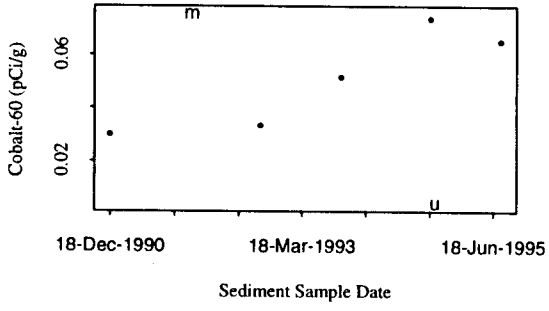
Segment 21-Cesium-137



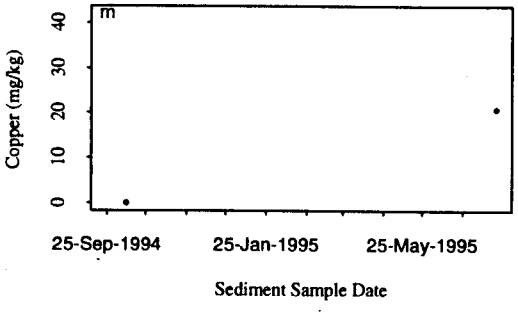
Segment 21-Chromium



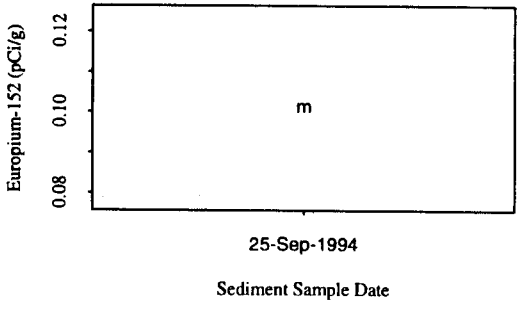
Segment 21-Cobalt-60



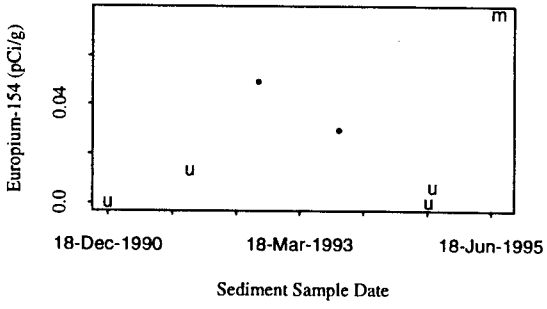
Segment 21-Copper



Segment 21-Europium-152

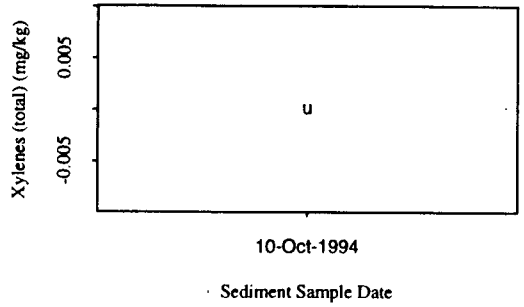


Segment 21-Europium-154

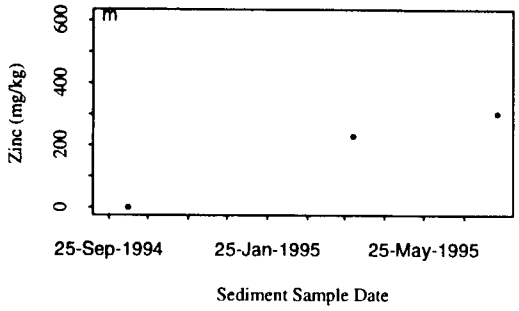


9613148.1789

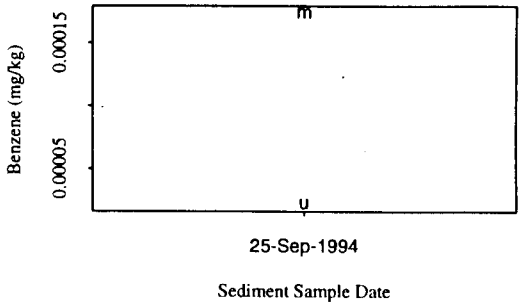
Segment 21-Xylenes (total)



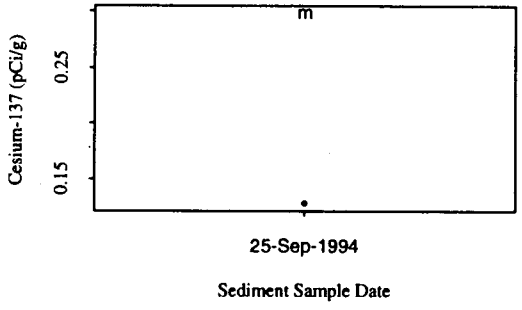
Segment 21-Zinc



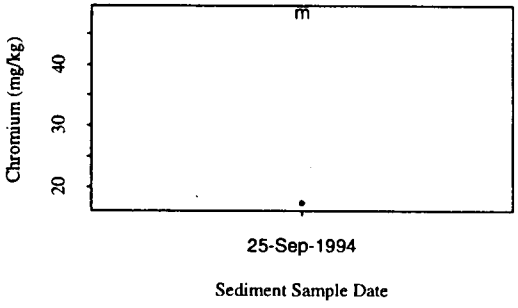
Segment 22-Benzene



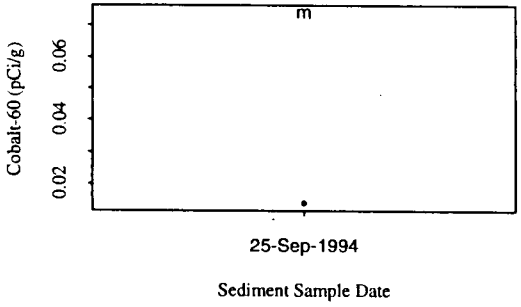
Segment 22-Cesium-137



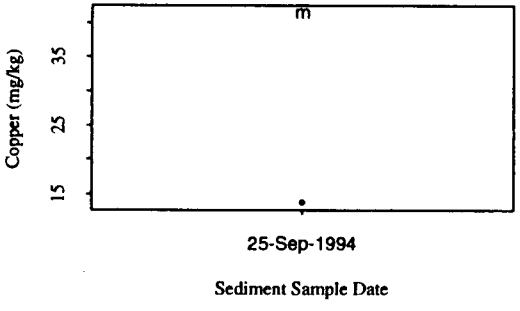
Segment 22-Chromium



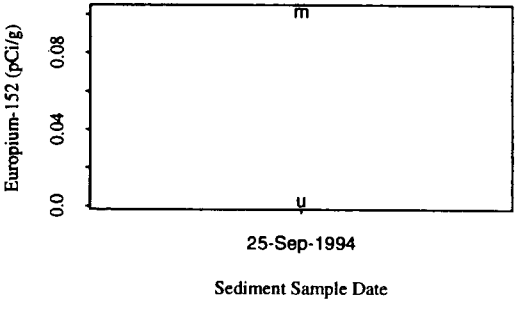
Segment 22-Cobalt-60



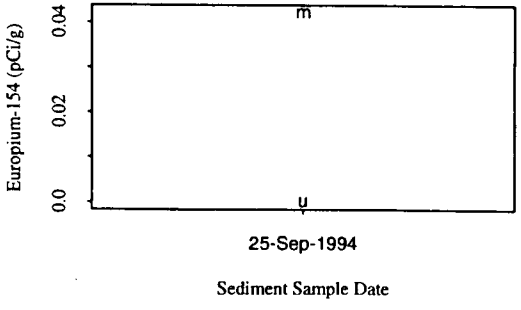
Segment 22-Copper



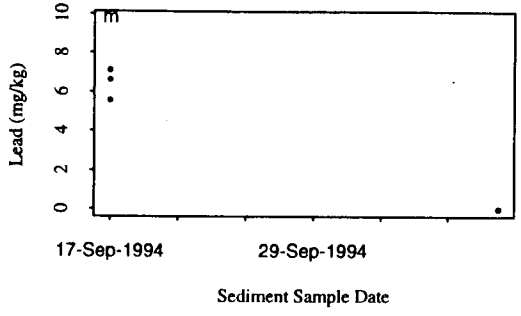
Segment 22-Europium-152



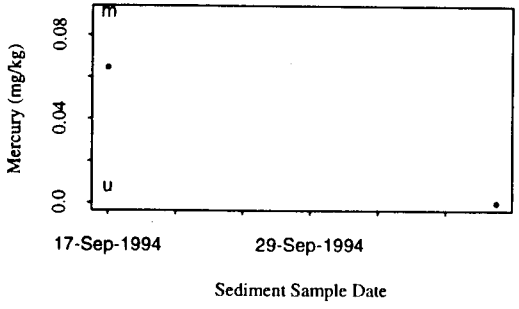
Segment 22-Europium-154



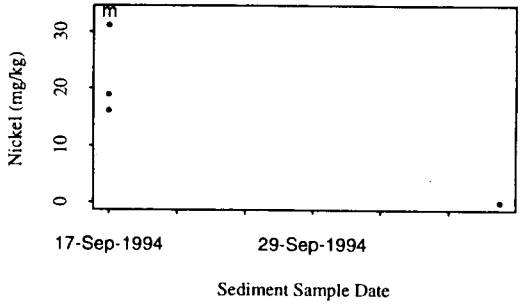
Segment 23-Lead



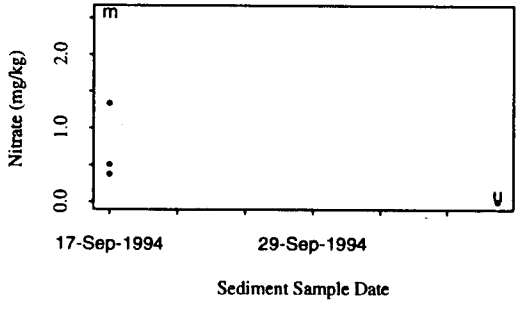
Segment 23-Mercury



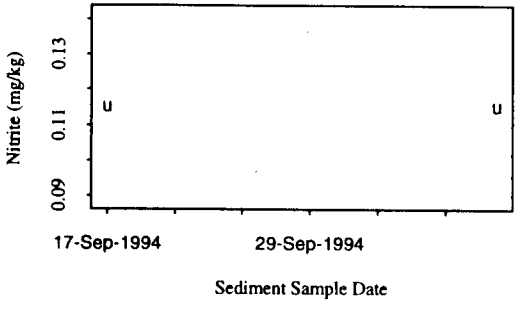
Segment 23-Nickel



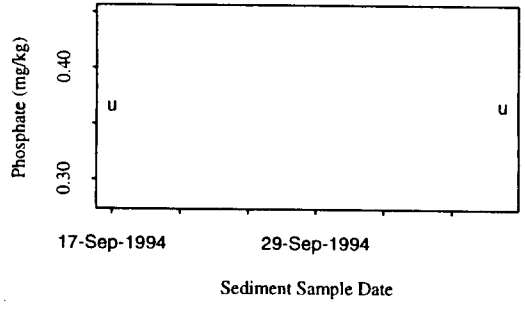
Segment 23-Nitrate



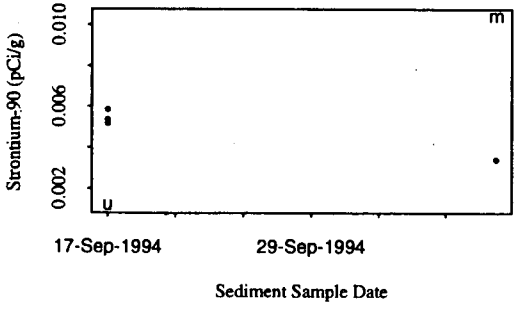
Segment 23-Nitrite



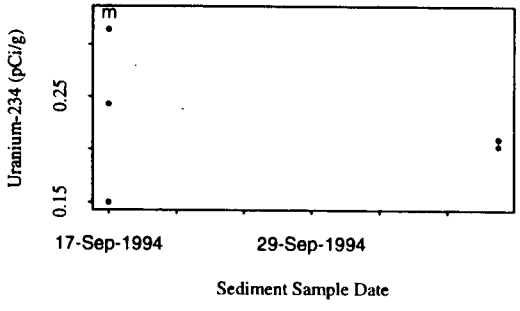
Segment 23-Phosphate



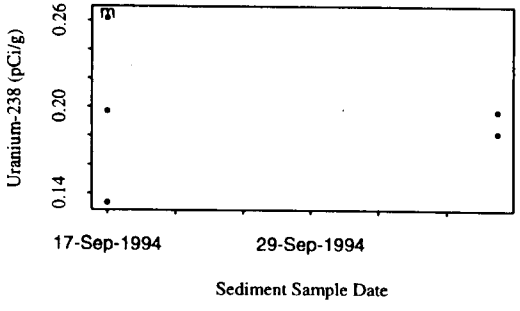
Segment 23-Strontium-90



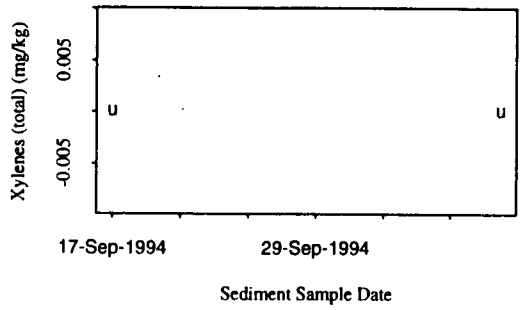
Segment 23-Uranium-234



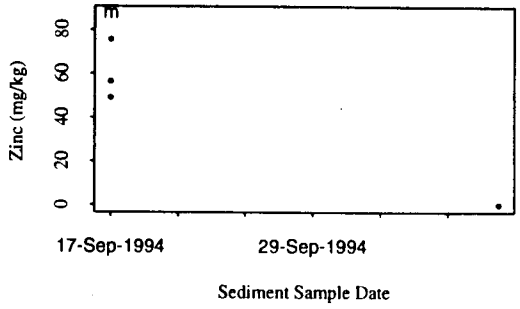
Segment 23-Uranium-238



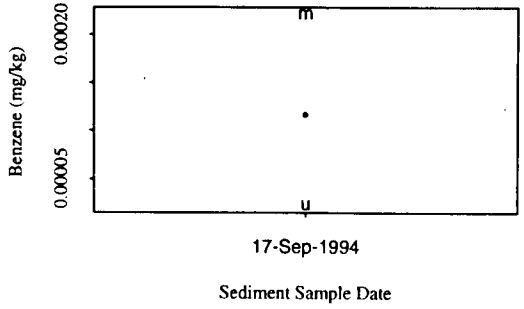
Segment 23-Xylenes (total)



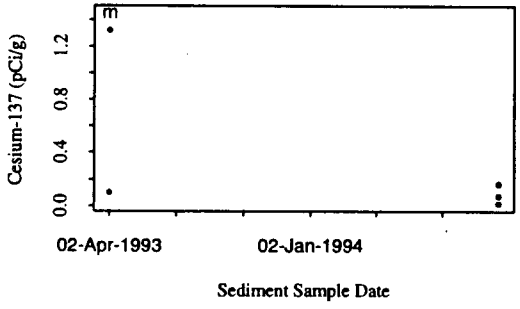
Segment 23-Zinc



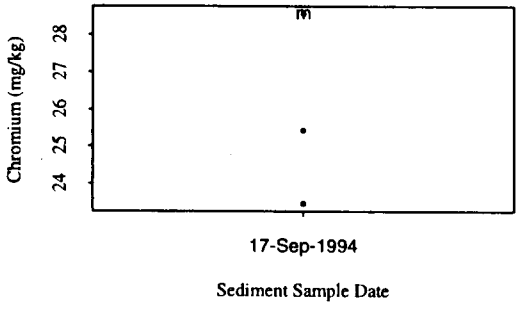
Segment 24-Benzene



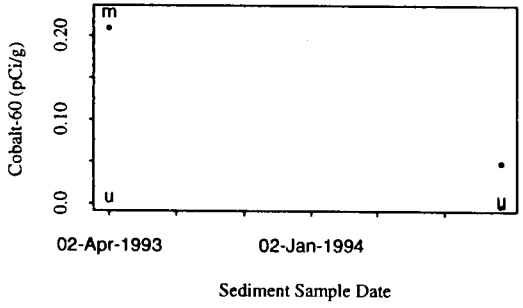
Segment 24-Cesium-137



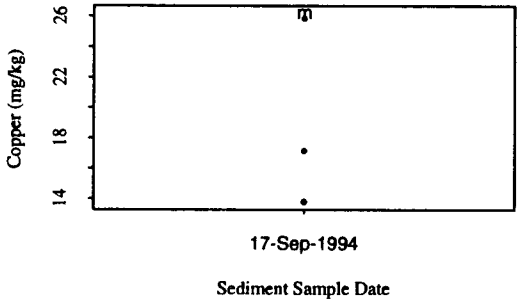
Segment 24-Chromium



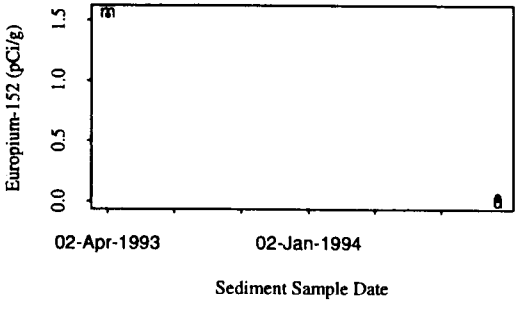
Segment 24-Cobalt-60



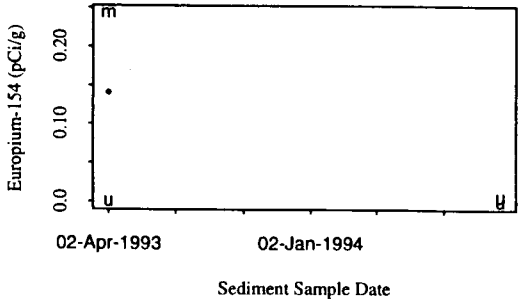
Segment 24-Copper



Segment 24-Europium-152

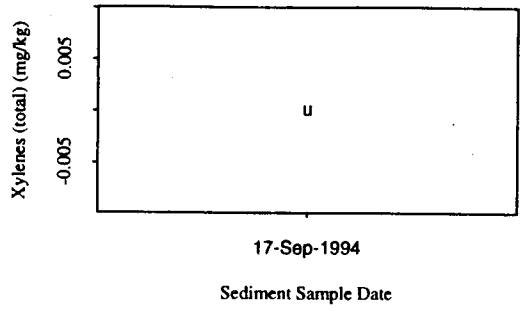


Segment 24-Europium-154

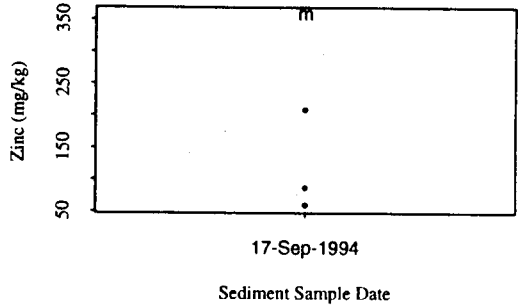


96348.1762

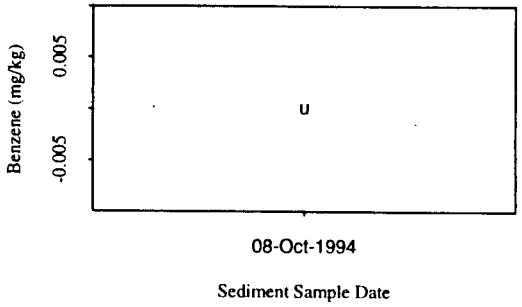
Segment 24-Xylenes (total)



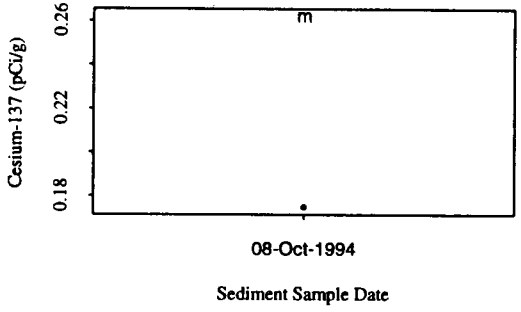
Segment 24-Zinc



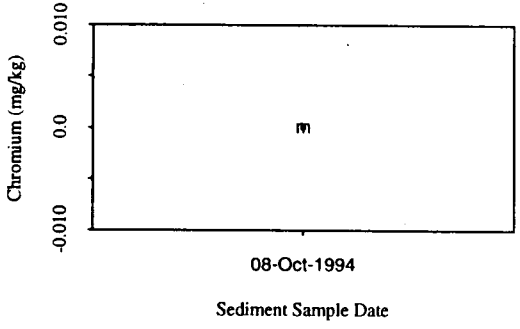
Segment 25-Benzene



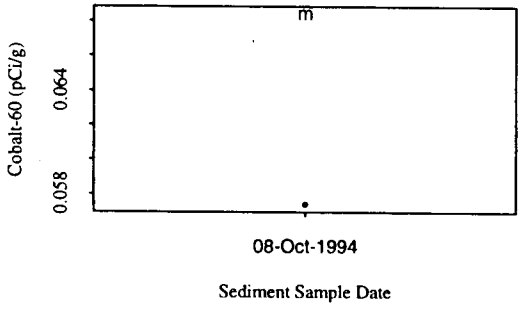
Segment 25-Cesium-137



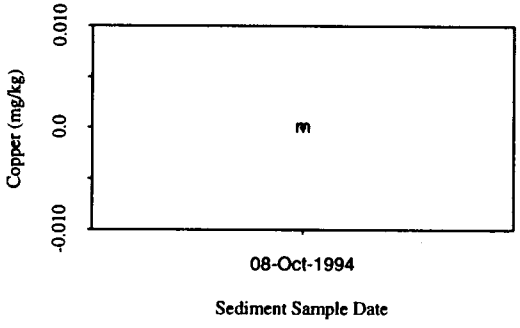
Segment 25-Chromium



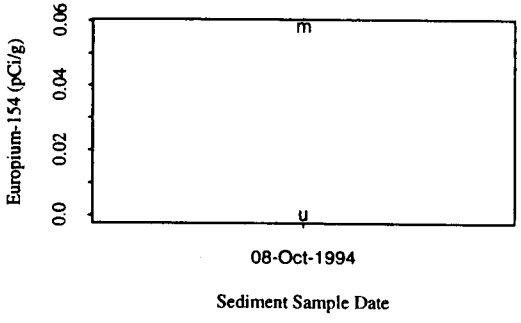
Segment 25-Cobalt-60



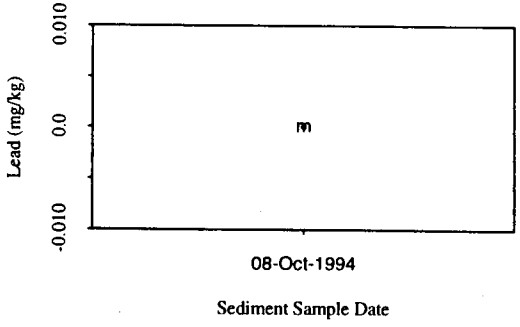
Segment 25-Copper



Segment 25-Europium-154

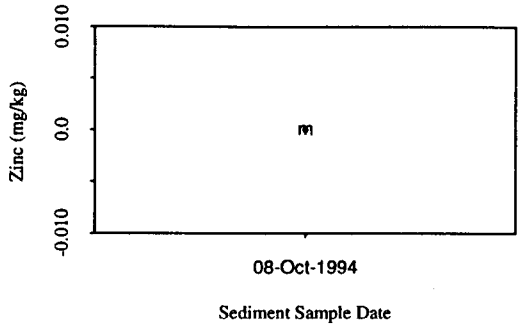


Segment 25-Lead

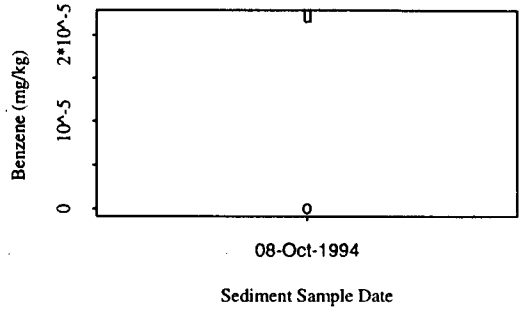


9618148.1763

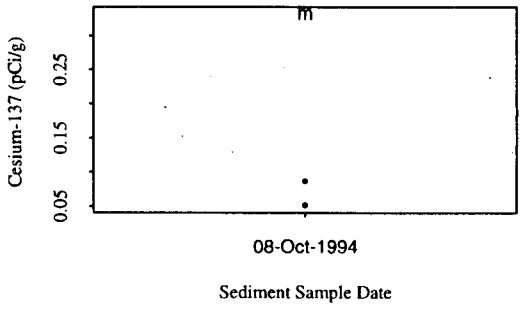
Segment 25-Zinc



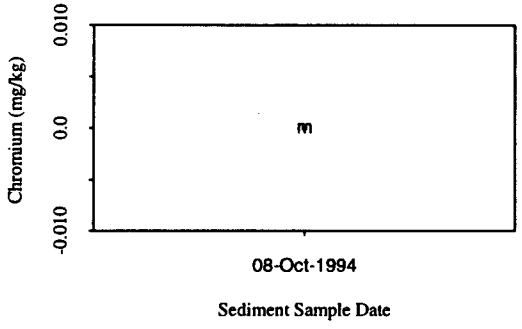
Segment 26-Benzene



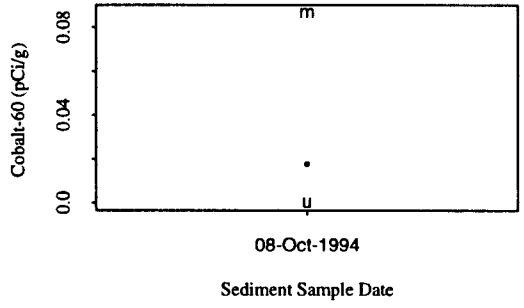
Segment 26-Cesium-137



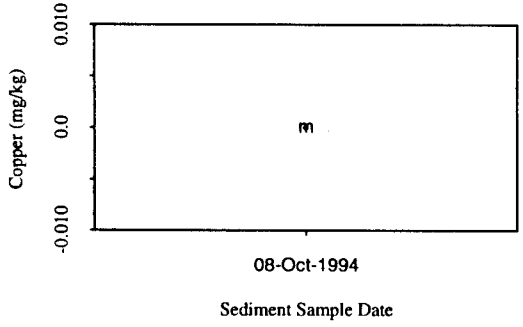
Segment 26-Chromium



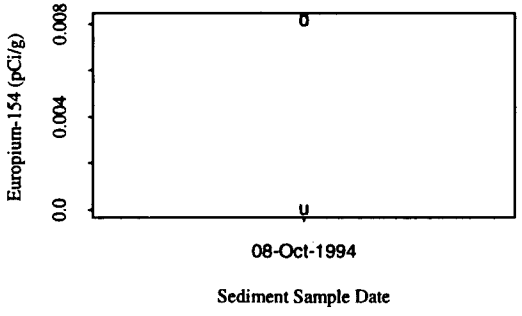
Segment 26-Cobalt-60



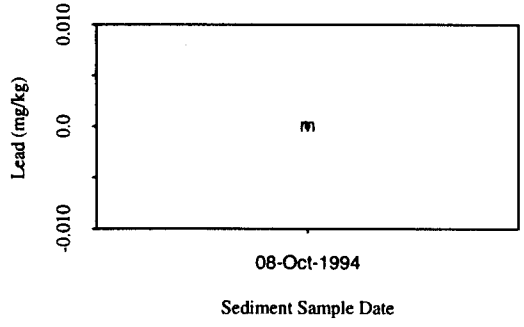
Segment 26-Copper



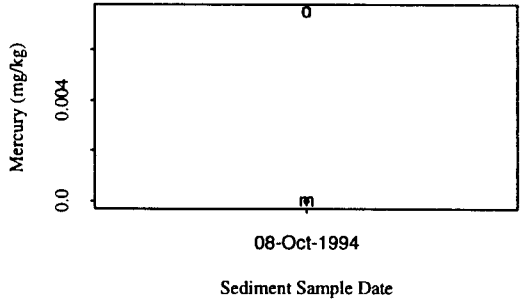
Segment 26-Europium-154



Segment 26-Lead

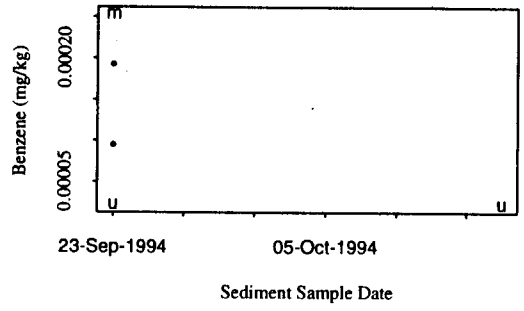


Segment 26-Mercury

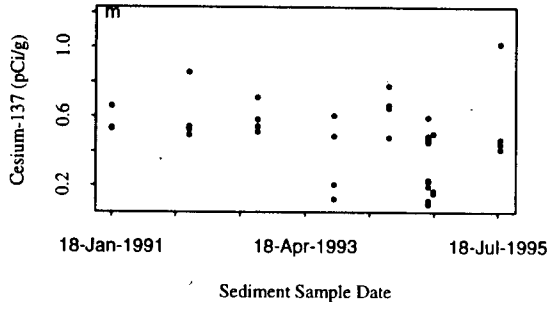


96 3448 1764

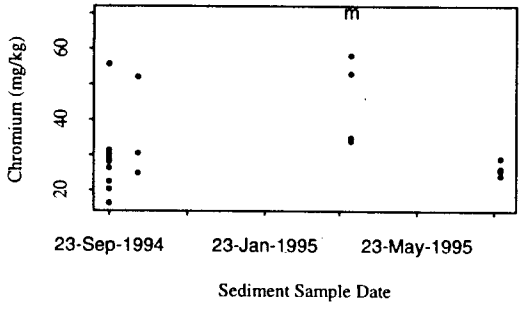
Segment 27-Benzene



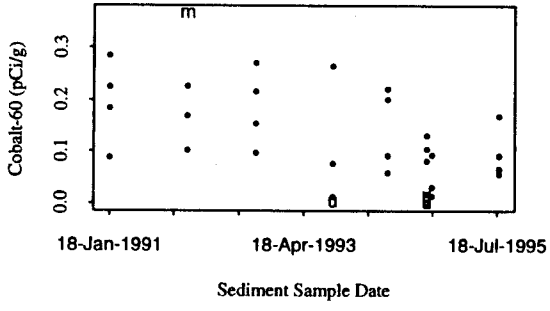
Segment 27-Cesium-137



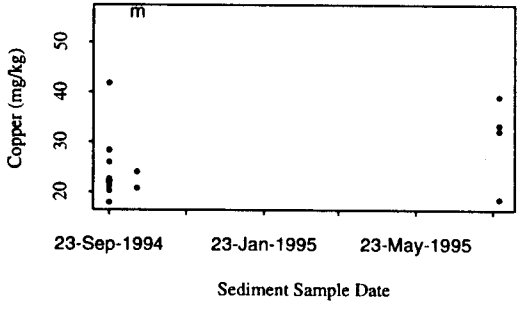
Segment 27-Chromium



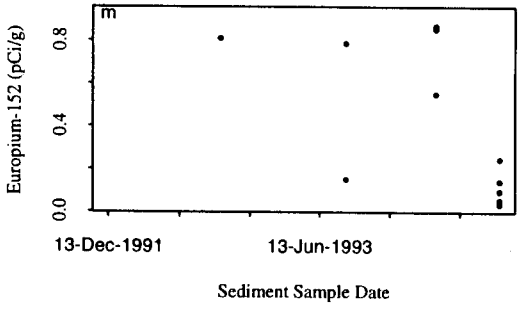
Segment 27-Cobalt-60



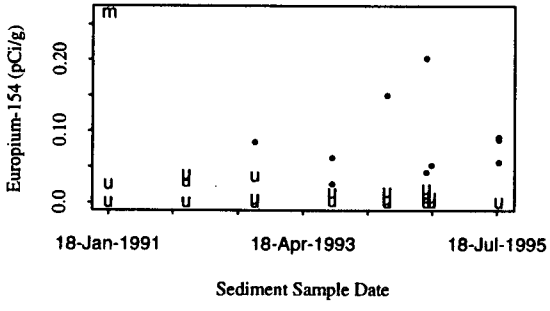
Segment 27-Copper



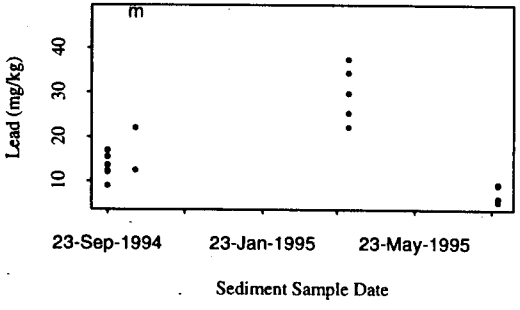
Segment 27-Europium-152



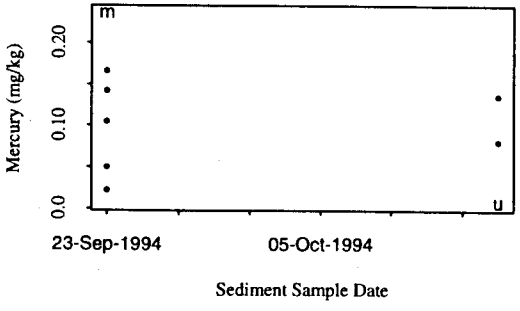
Segment 27-Europium-154



Segment 27-Lead



Segment 27-Mercury

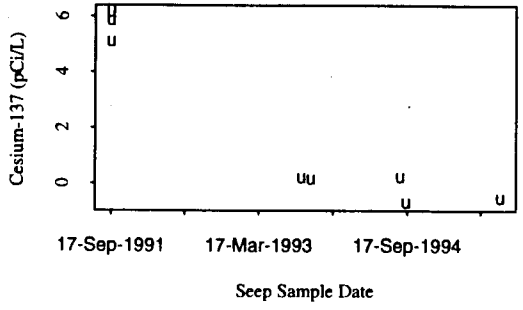


9518448.1755

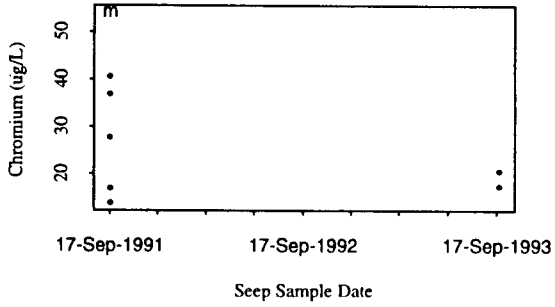
9613448.1766

Seep Plots and Maximum Representative Values for the Contaminants of Interest

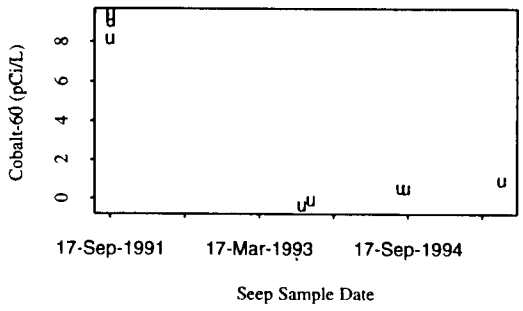
Segment 2-Cesium-137



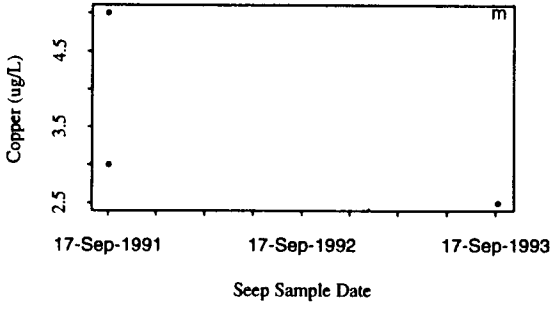
Segment 2-Chromium



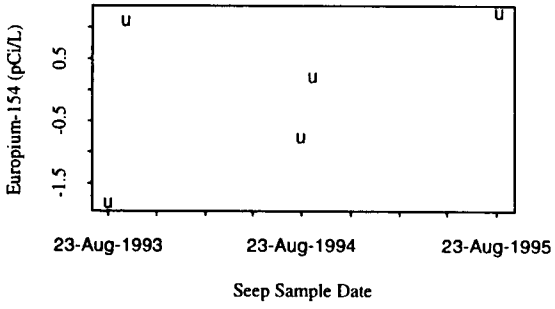
Segment 2-Cobalt-60



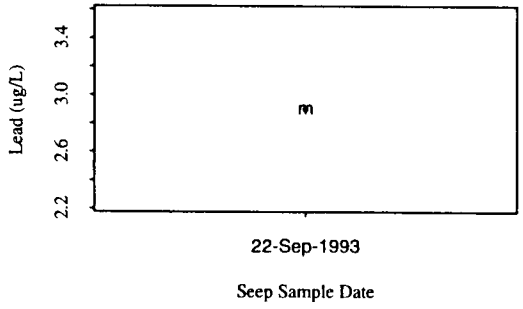
Segment 2-Copper



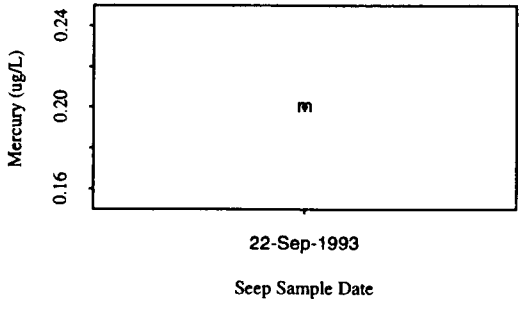
Segment 2-Europium-154



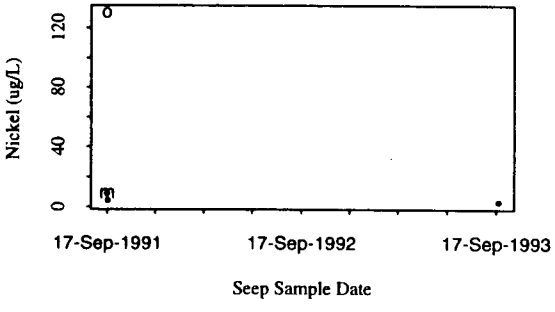
Segment 2-Lead



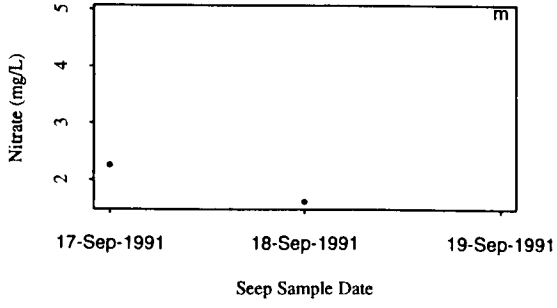
Segment 2-Mercury



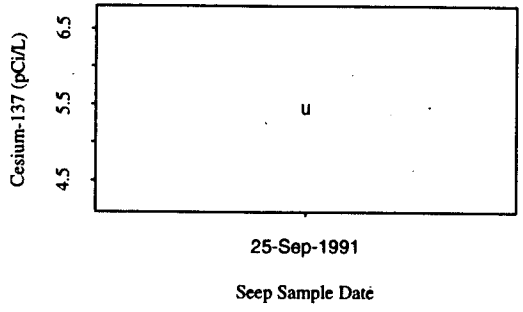
Segment 2-Nickel



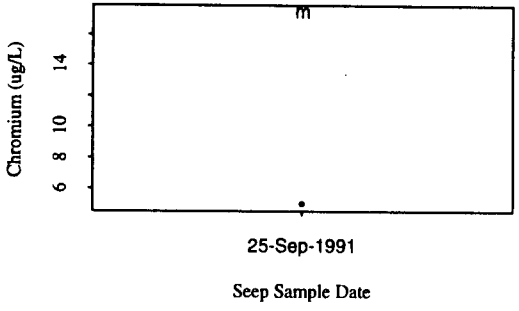
Segment 2-Nitrate



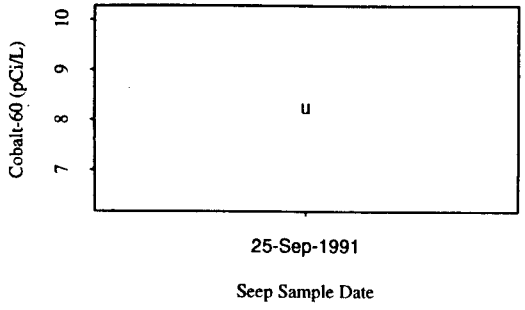
Segment 3-Cesium-137



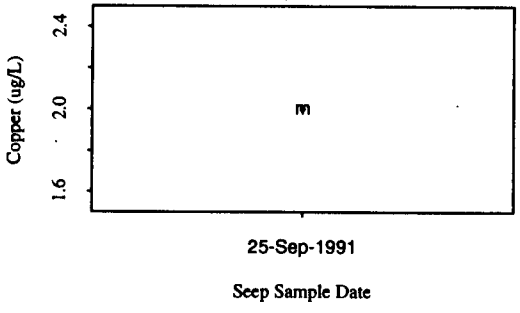
Segment 3-Chromium



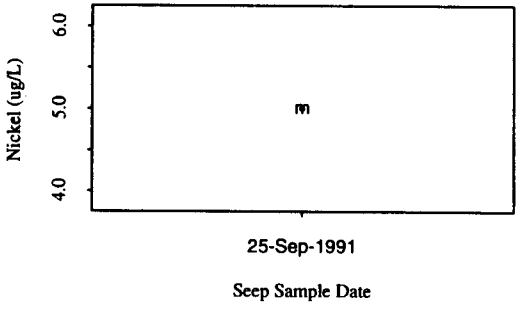
Segment 3-Cobalt-60



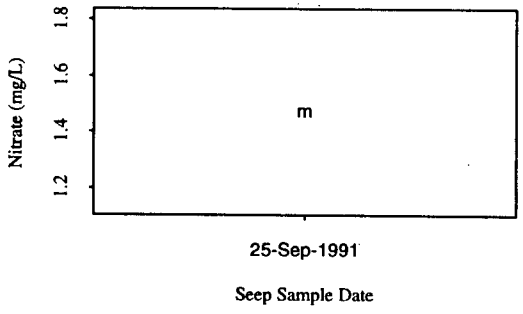
Segment 3-Copper



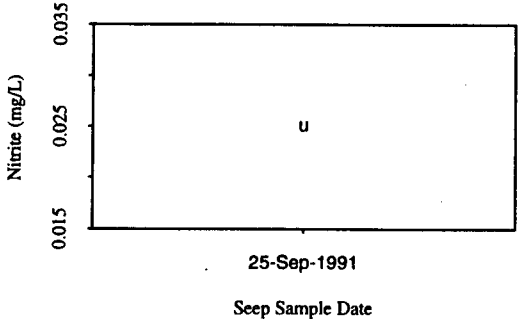
Segment 3-Nickel



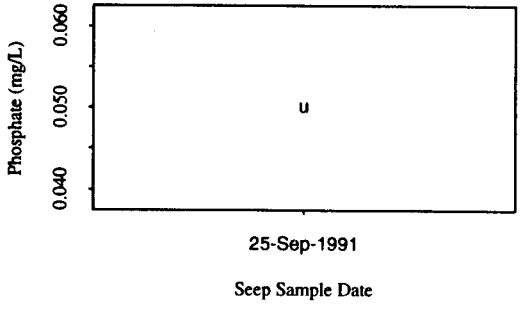
Segment 3-Nitrate



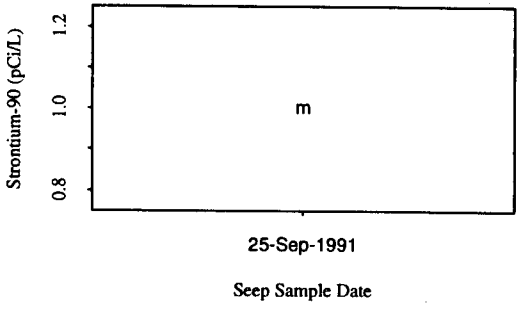
Segment 3-Nitrite



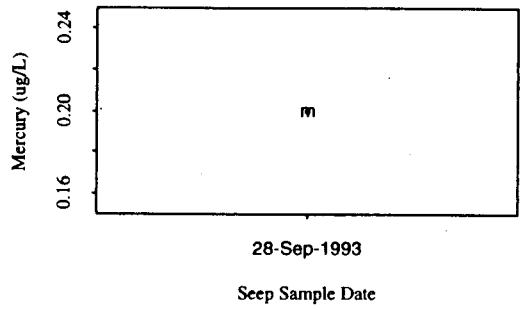
Segment 3-Phosphate



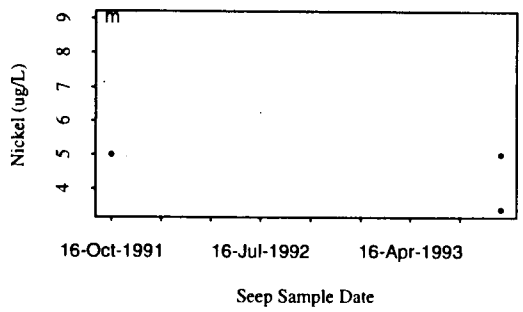
Segment 3-Strontium-90



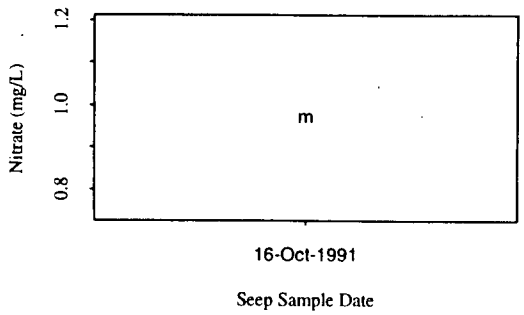
Segment 4-Mercury



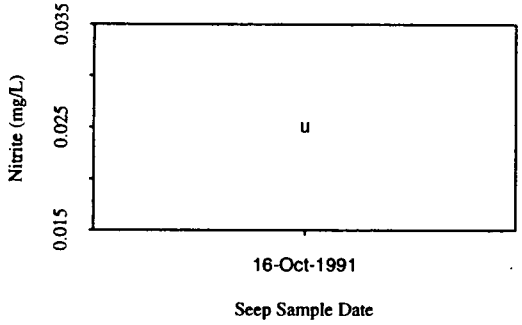
Segment 4-Nickel



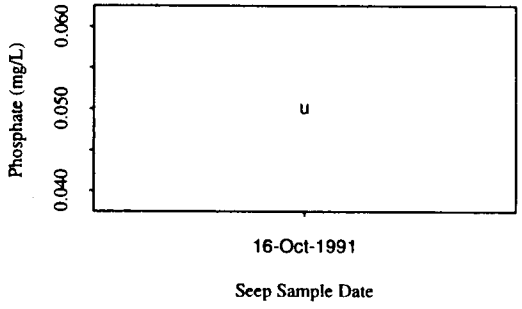
Segment 4-Nitrate



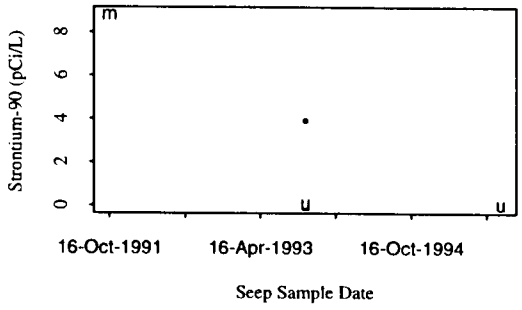
Segment 4-Nitrite



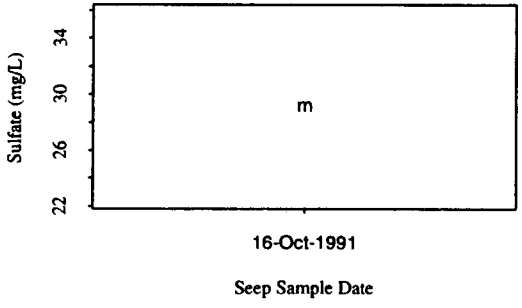
Segment 4-Phosphate



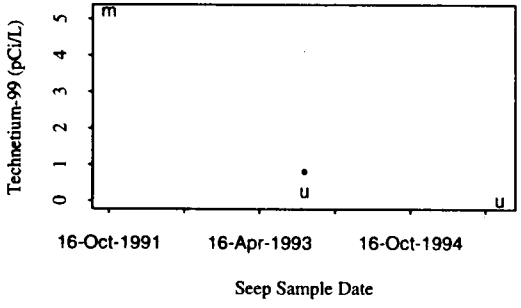
Segment 4-Strontium-90



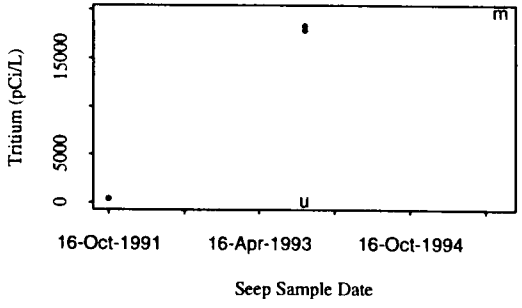
Segment 4-Sulfate



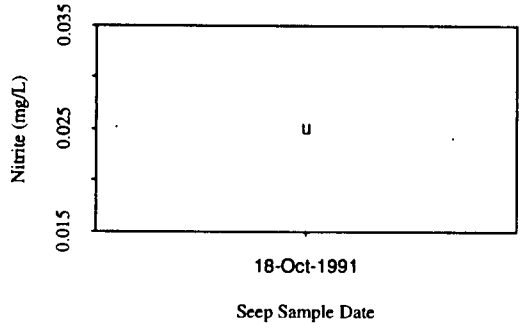
Segment 4-Technetium-99



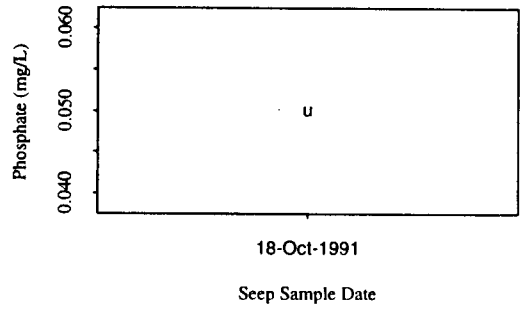
Segment 4-Tritium



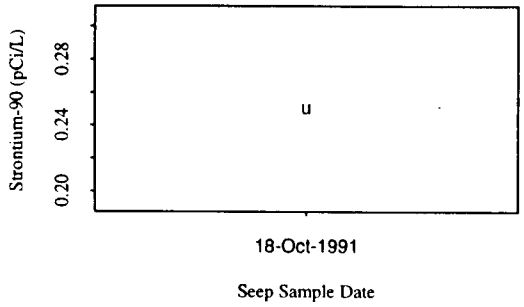
Segment 5-Nitrite



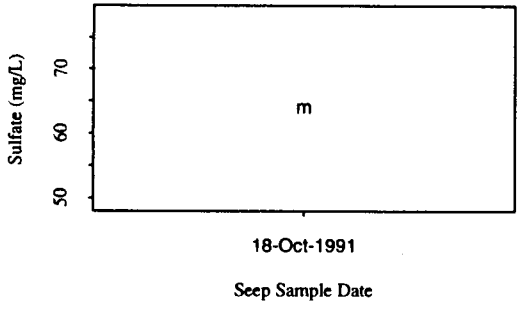
Segment 5-Phosphate



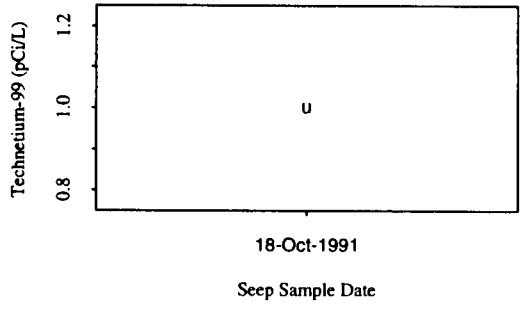
Segment 5-Strontium-90



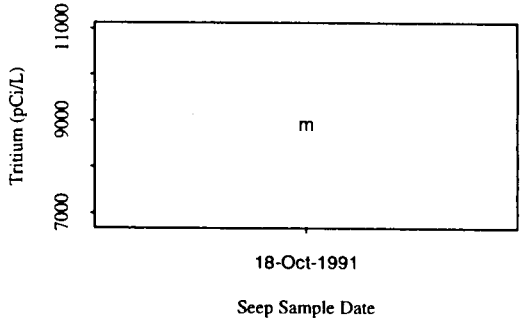
Segment 5-Sulfate



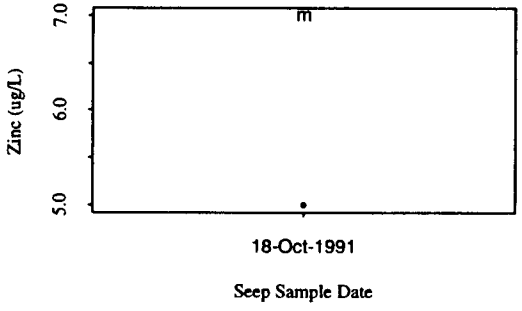
Segment 5-Technetium-99



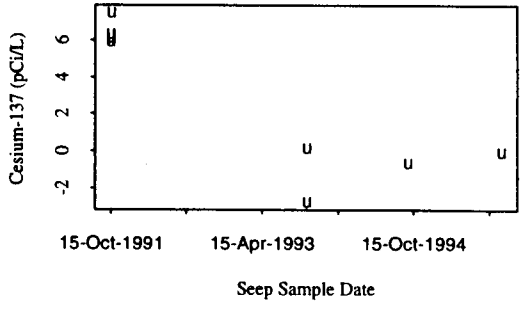
Segment 5-Tritium



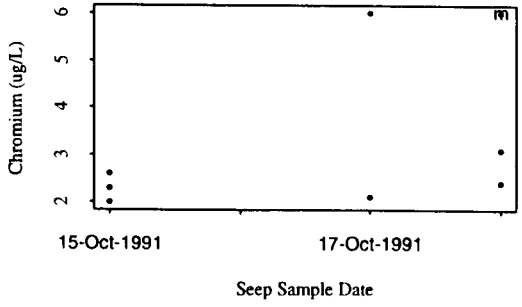
Segment 5-Zinc



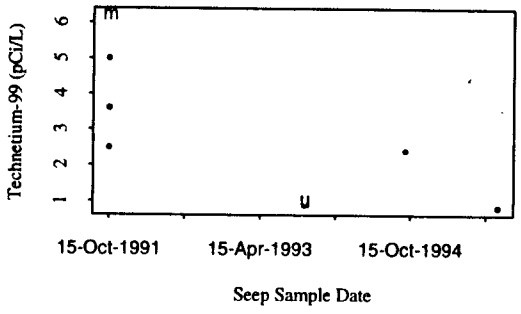
Segment 6-Cesium-137



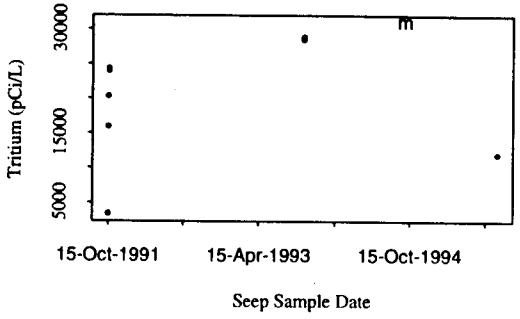
Segment 6-Chromium



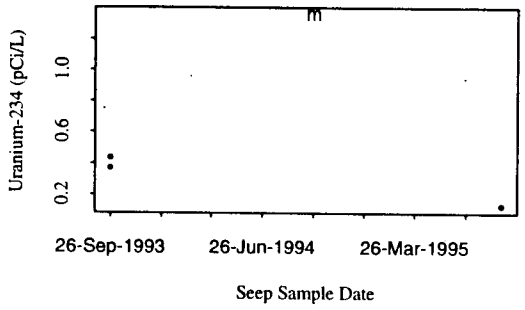
Segment 6-Technetium-99



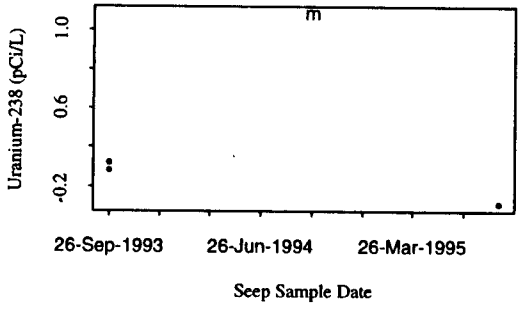
Segment 6-Tritium



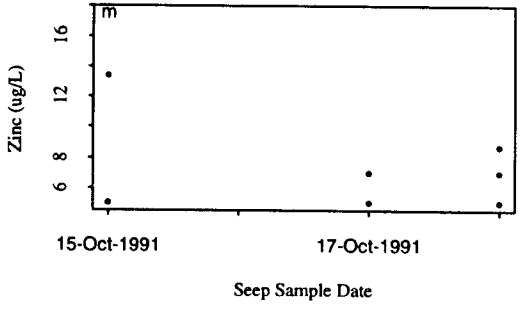
Segment 6-Uranium-234



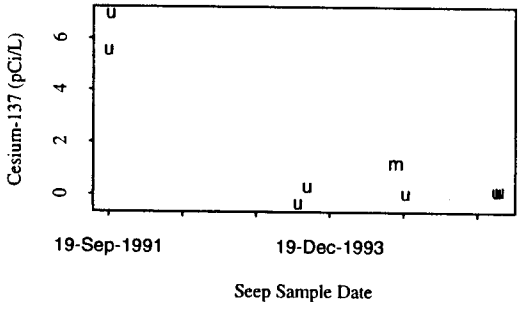
Segment 6-Uranium-238



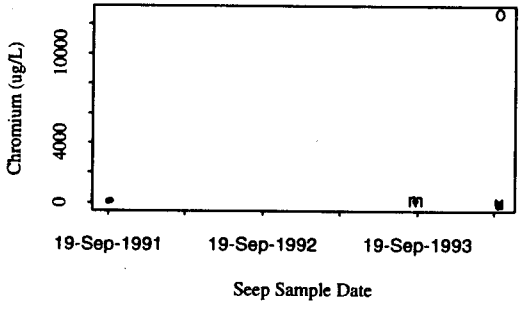
Segment 6-Zinc



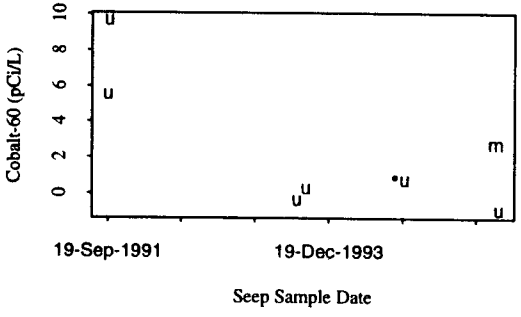
Segment 8-Cesium-137



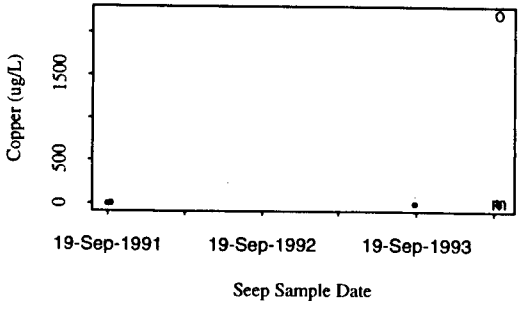
Segment 8-Chromium



Segment 8-Cobalt-60

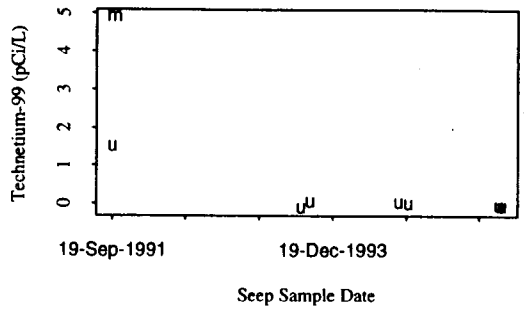


Segment 8-Copper

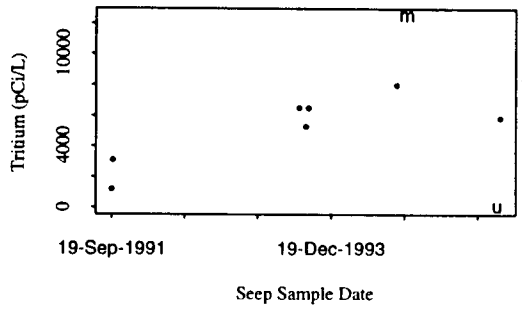


9615448.171

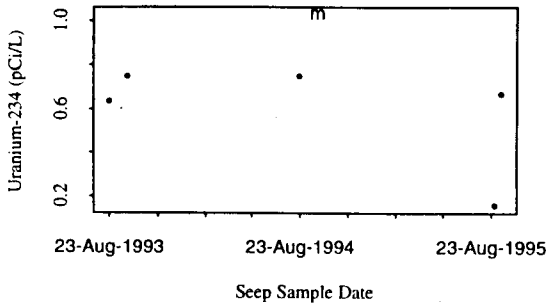
Segment 8-Technetium-99



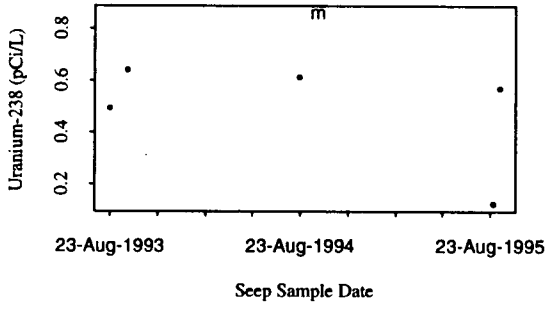
Segment 8-Tritium



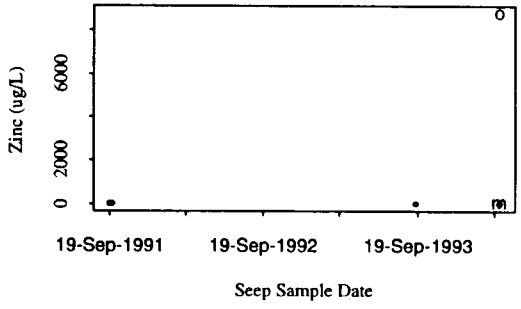
Segment 8-Uranium-234



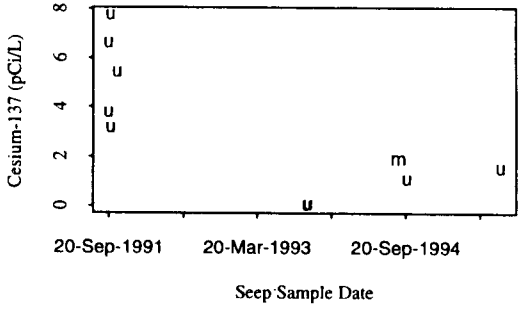
Segment 8-Uranium-238



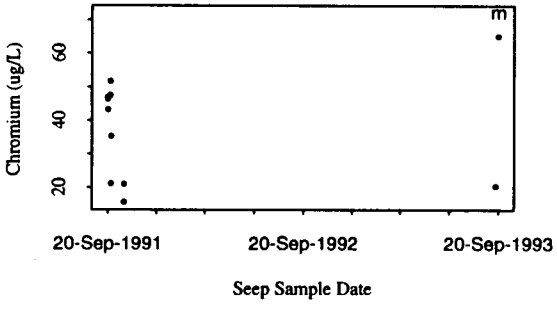
Segment 8-Zinc



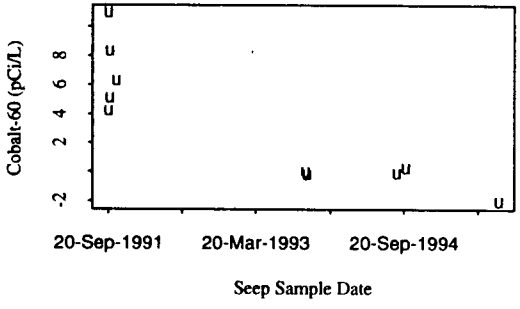
Segment 10-Cesium-137



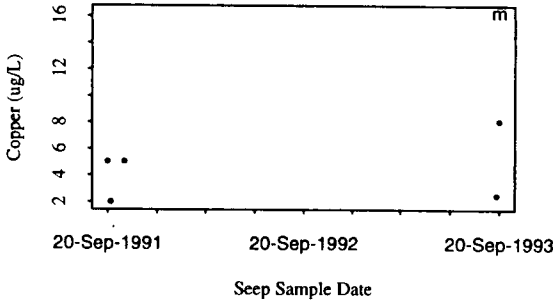
Segment 10-Chromium



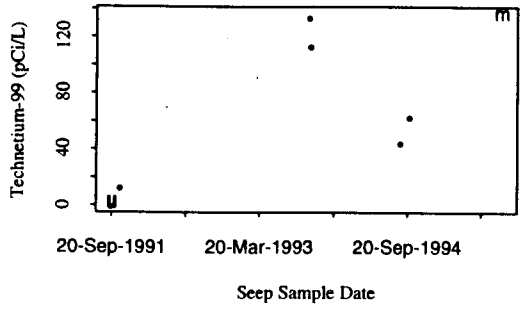
Segment 10-Cobalt-60



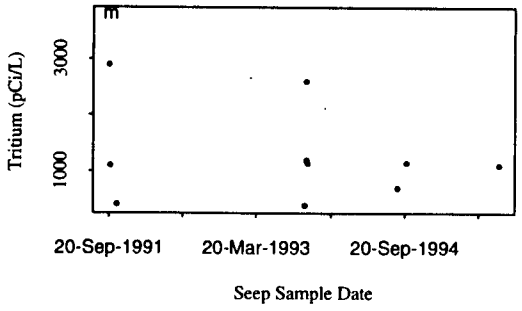
Segment 10-Copper



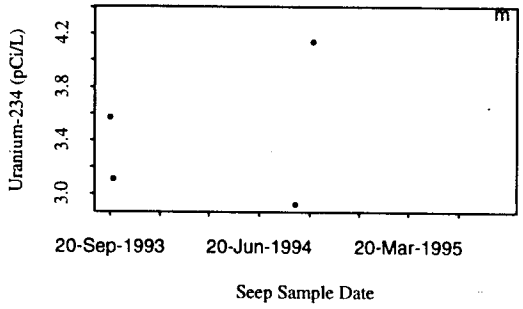
Segment 10-Technetium-99



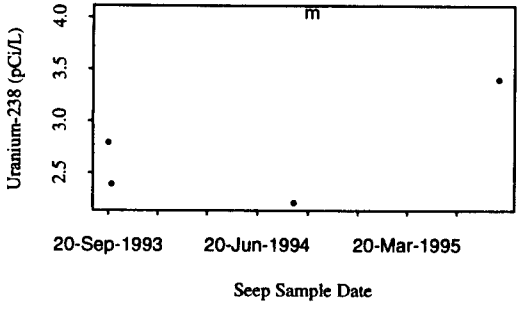
Segment 10-Tritium



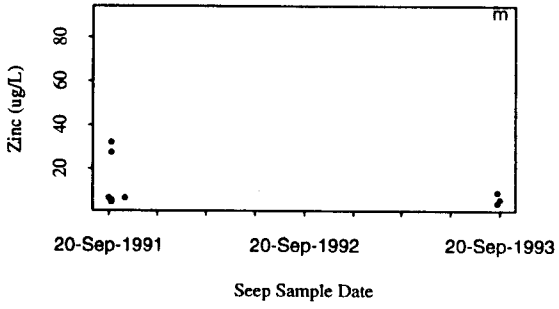
Segment 10-Uranium-234



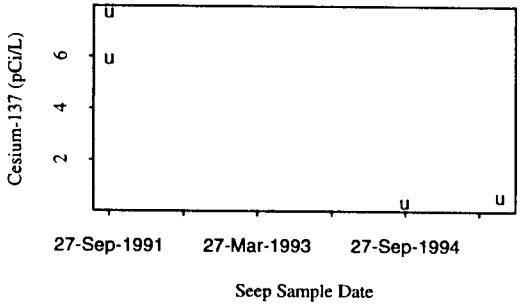
Segment 10-Uranium-238



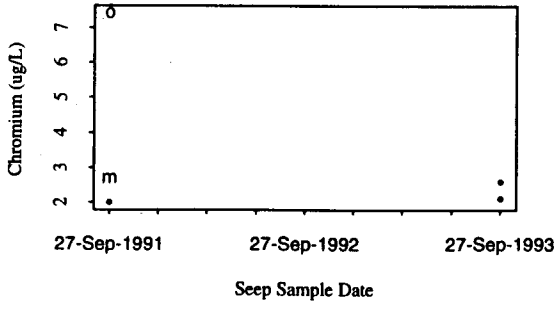
Segment 10-Zinc



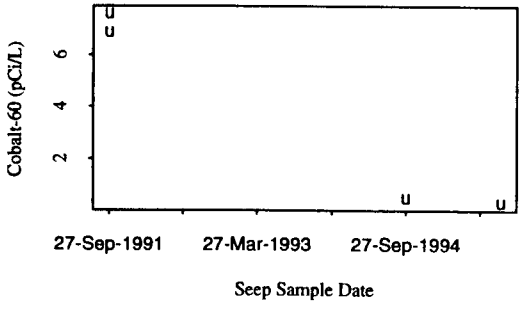
Segment 13-Cesium-137



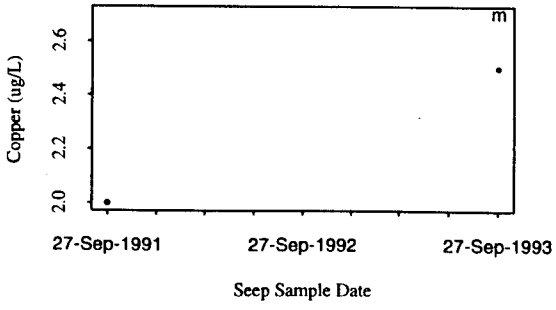
Segment 13-Chromium



Segment 13-Cobalt-60

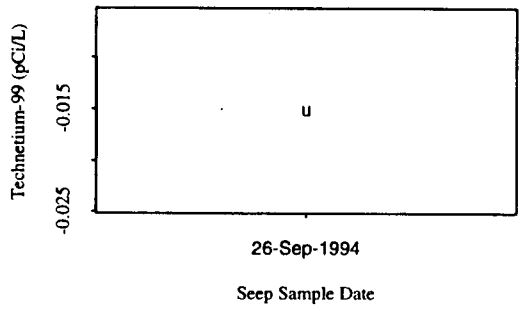


Segment 13-Copper

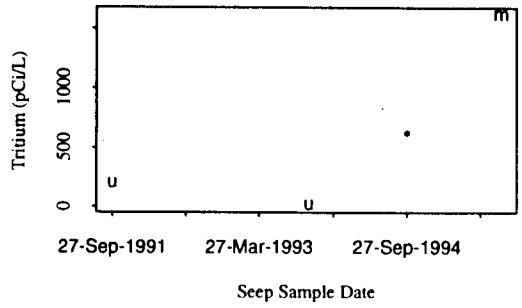


96130148.173

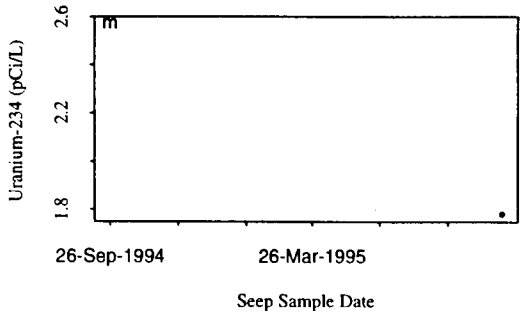
Segment 13-Technetium-99



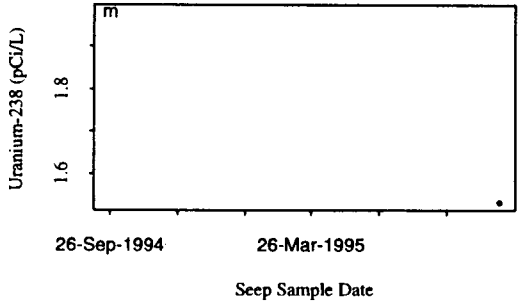
Segment 13-Tritium



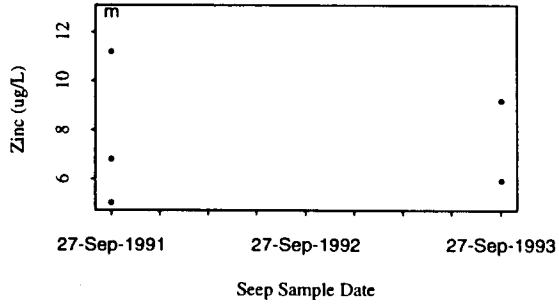
Segment 13-Uranium-234



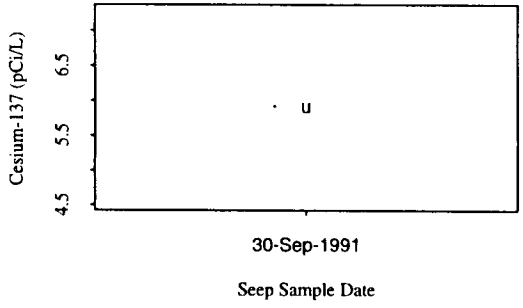
Segment 13-Uranium-238



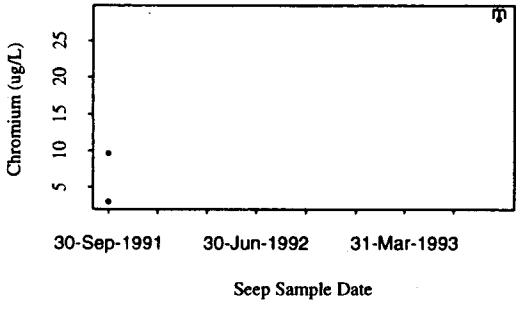
Segment 13-Zinc



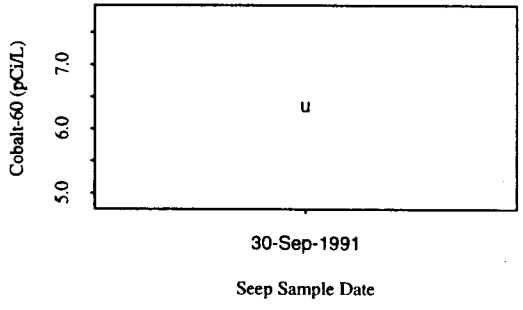
Segment 14-Cesium-137



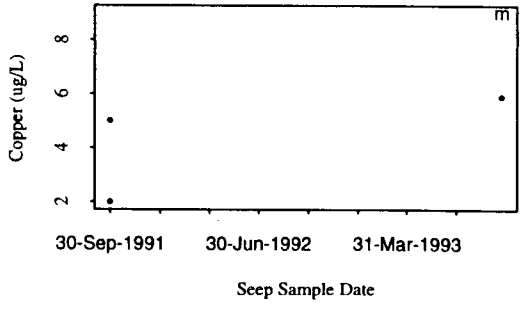
Segment 14-Chromium



Segment 14-Cobalt-60

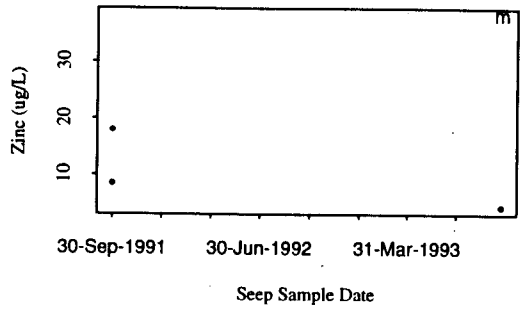


Segment 14-Copper

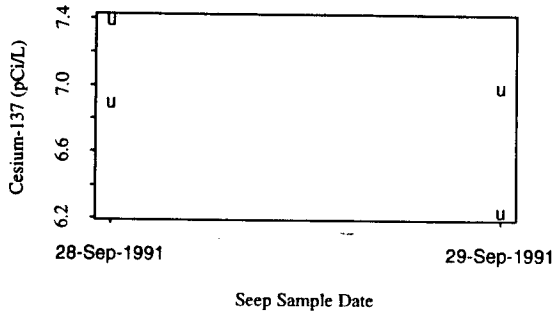


9413440.1774

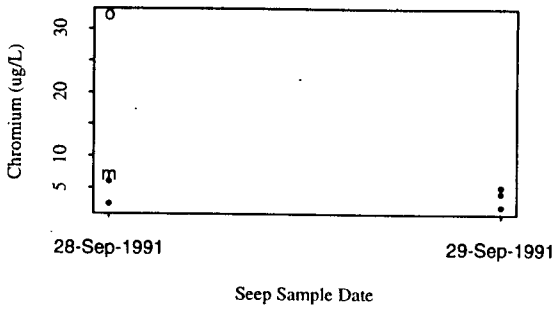
Segment 14-Zinc



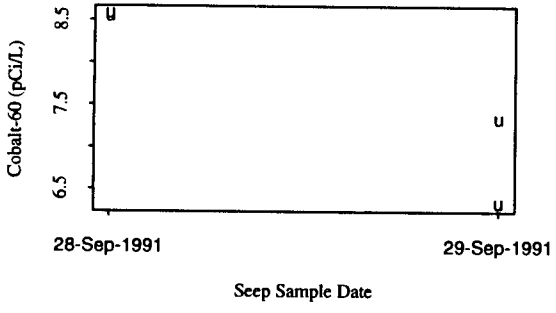
Segment 15-Cesium-137



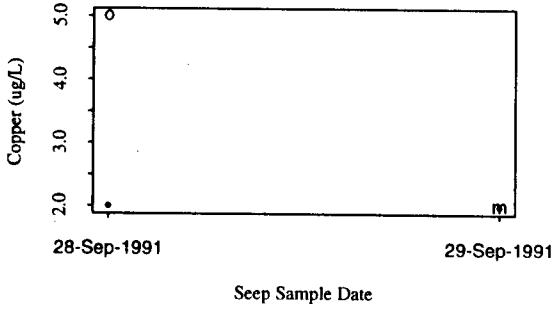
Segment 15-Chromium



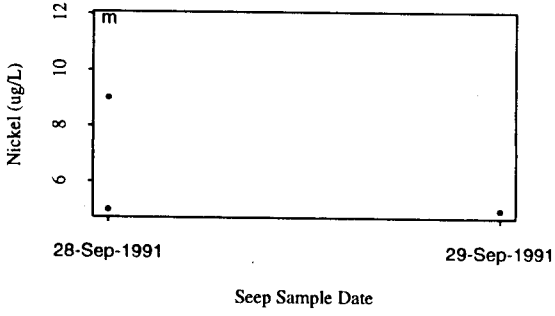
Segment 15-Cobalt-60



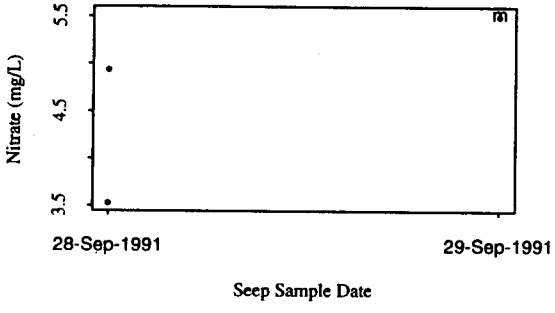
Segment 15-Copper



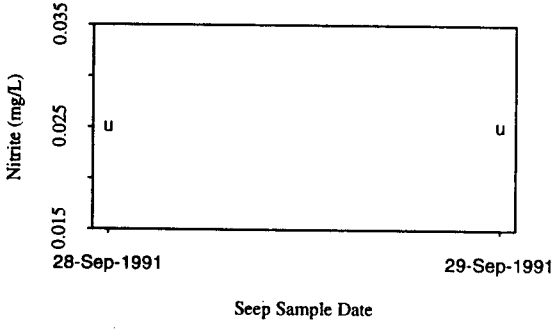
Segment 15-Nickel



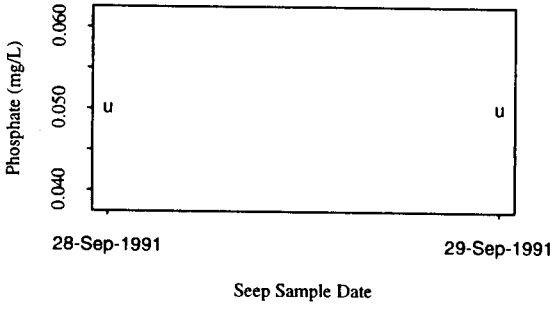
Segment 15-Nitrate



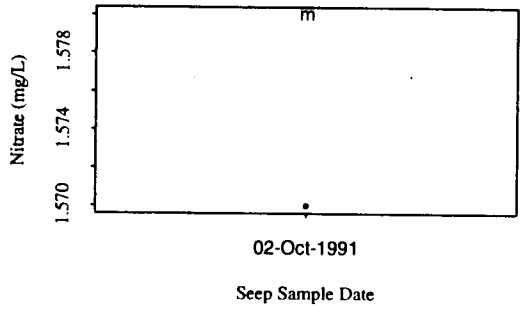
Segment 15-Nitrite



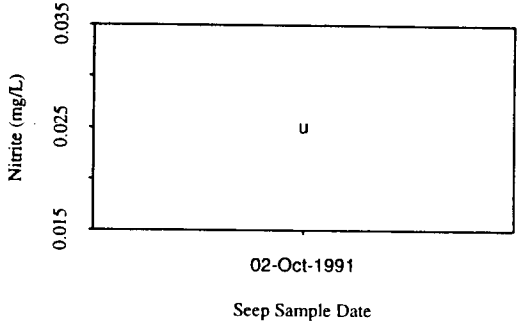
Segment 15-Phosphate



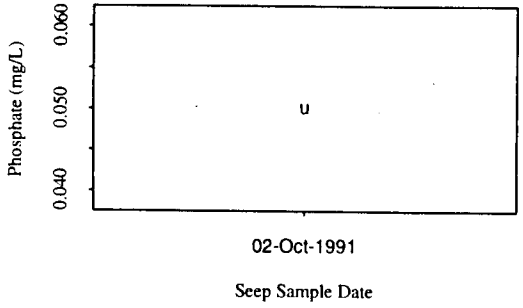
Segment 16-Nitrate



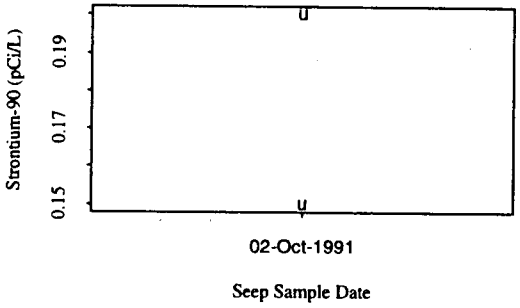
Segment 16-Nitrite



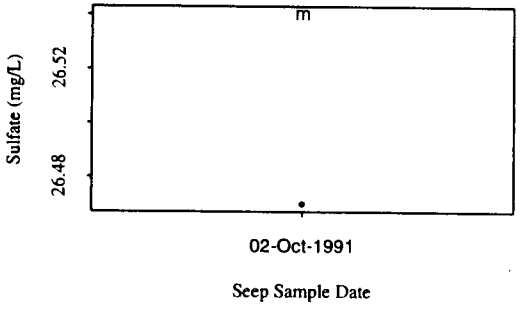
Segment 16-Phosphate



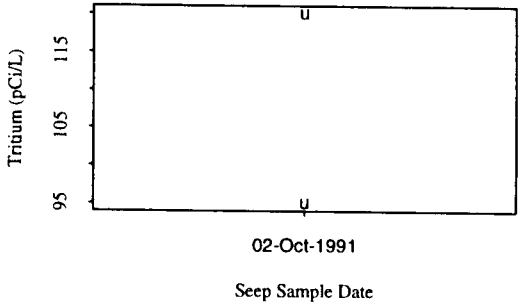
Segment 16-Strontium-90



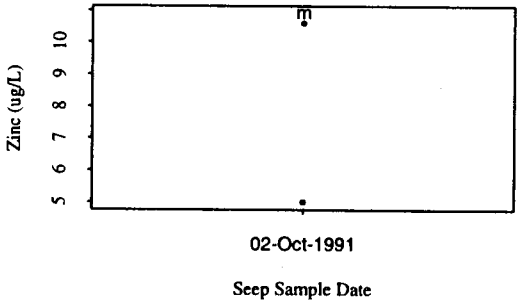
Segment 16-Sulfate



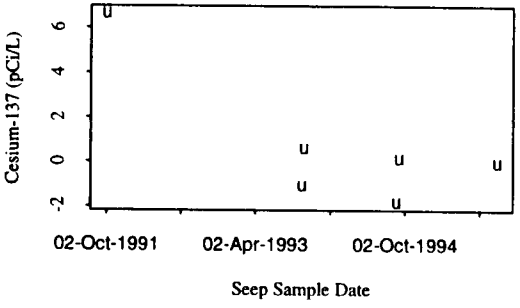
Segment 16-Tritium



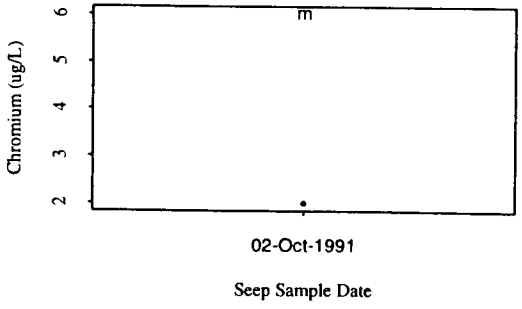
Segment 16-Zinc



Segment 17-Cesium-137

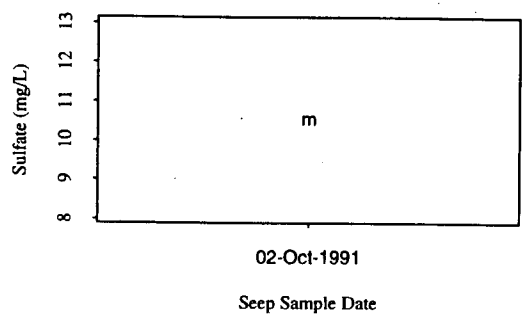


Segment 17-Chromium

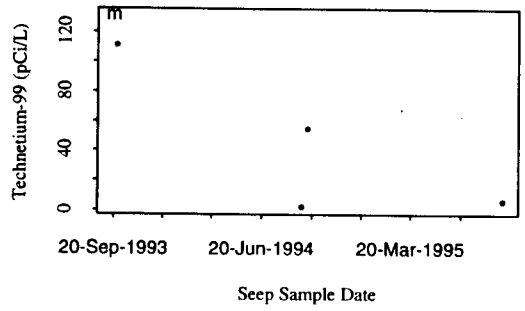


9413148.776

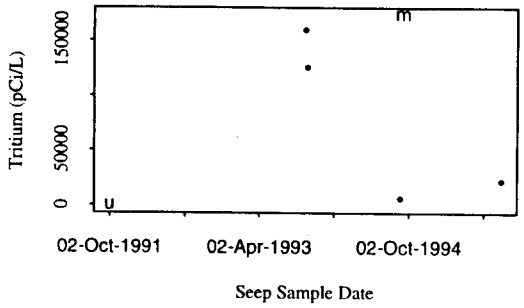
Segment 17-Sulfate



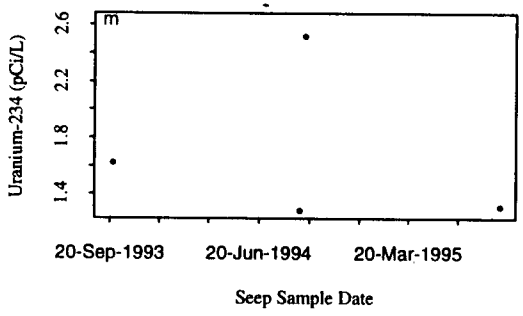
Segment 17-Technetium-99



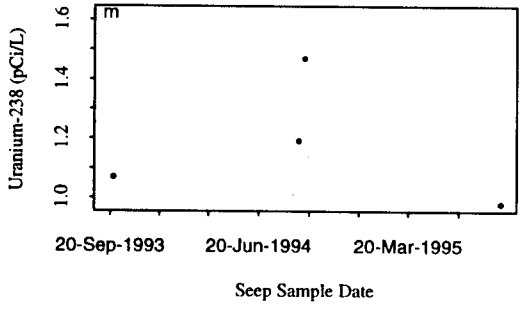
Segment 17-Tritium



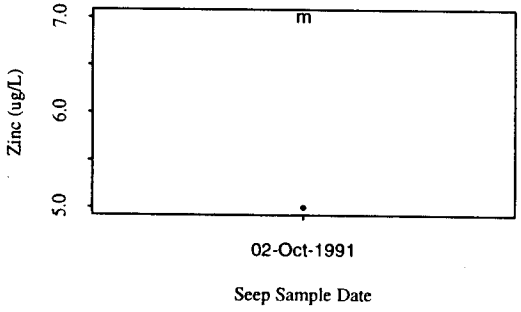
Segment 17-Uranium-234



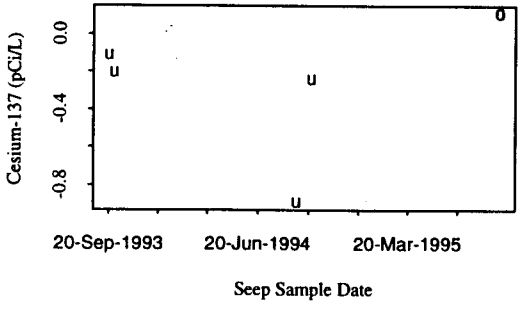
Segment 17-Uranium-238



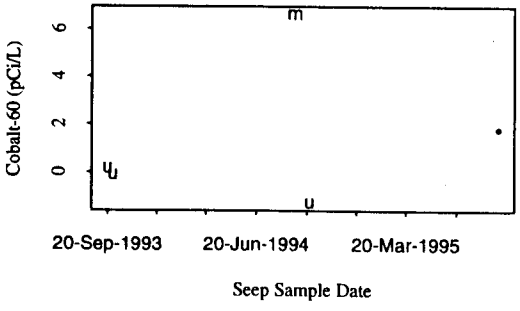
Segment 17-Zinc



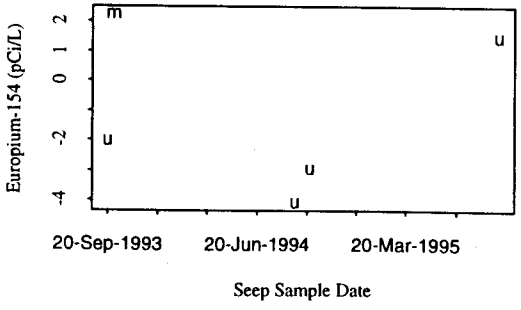
Segment 20-Cesium-137



Segment 20-Cobalt-60



Segment 20-Europium-154

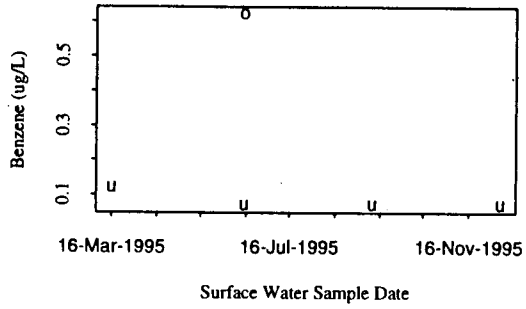


9624148.1777

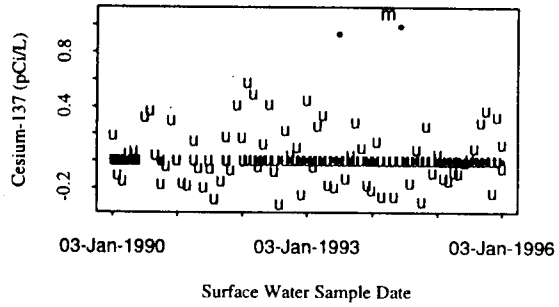
9613448.1778

Surface Water Plots and Maximum Representative Values for the Contaminants of Interest

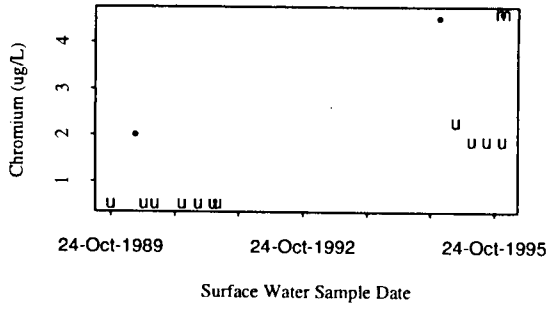
Segment 1-Benzene



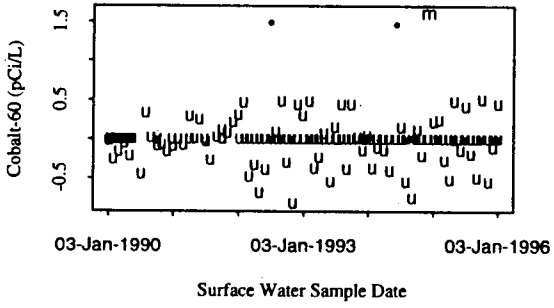
Segment 1-Cesium-137



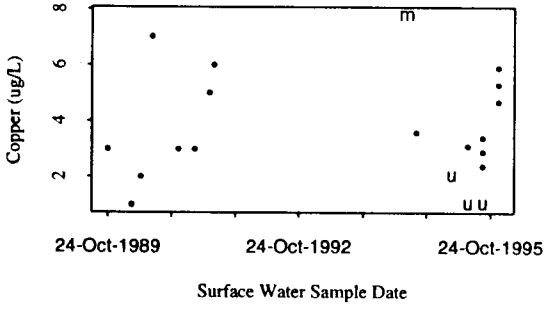
Segment 1-Chromium



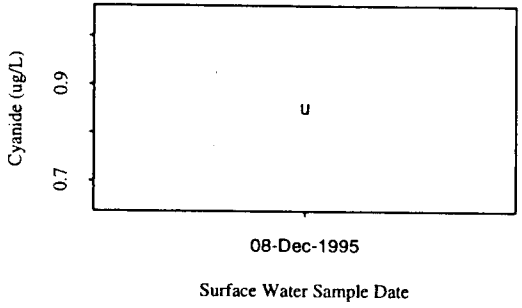
Segment 1-Cobalt-60



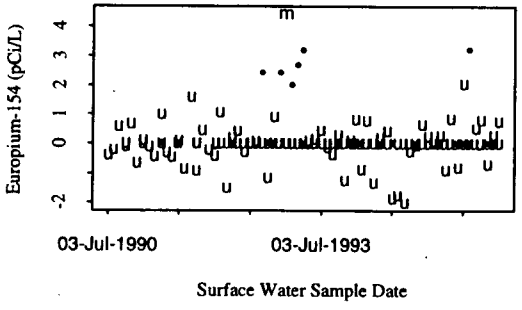
Segment 1-Copper



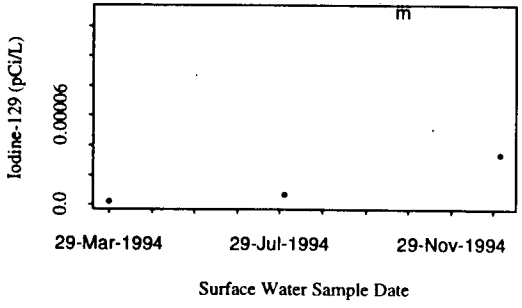
Segment 1-Cyanide



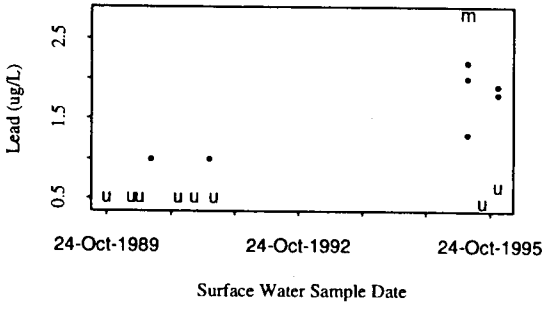
Segment 1-Europium-154



Segment 1-Iodine-129

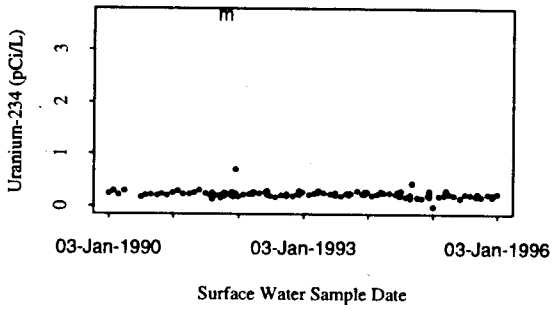


Segment 1-Lead

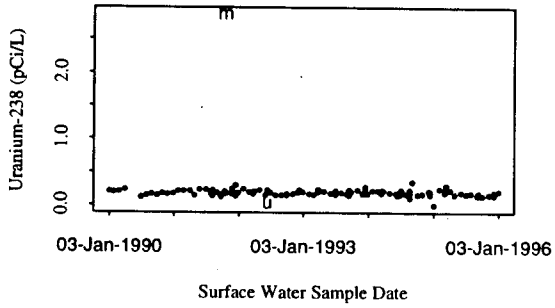


96123148.1779

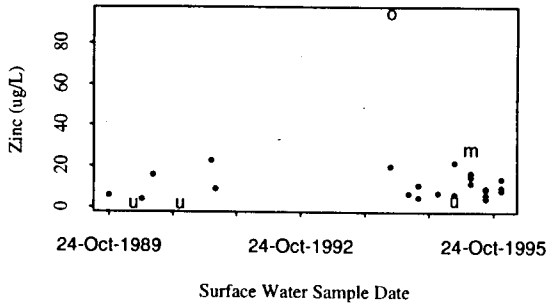
Segment 1-Uranium-234



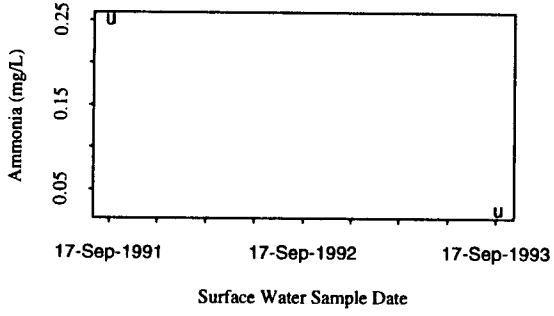
Segment 1-Uranium-238



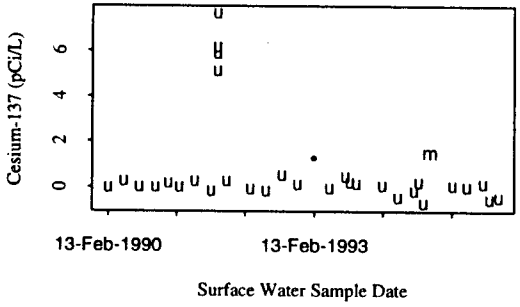
Segment 1-Zinc



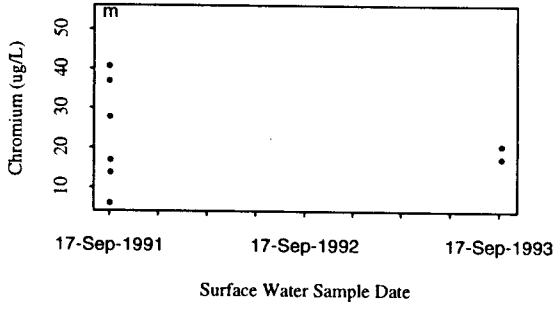
Segment 2-Ammonia



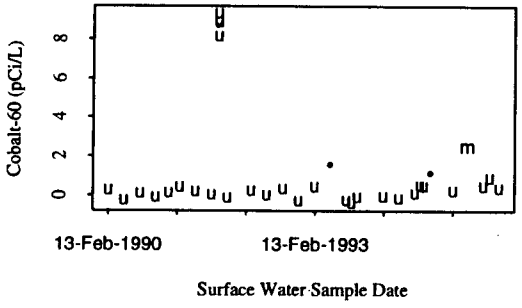
Segment 2-Cesium-137



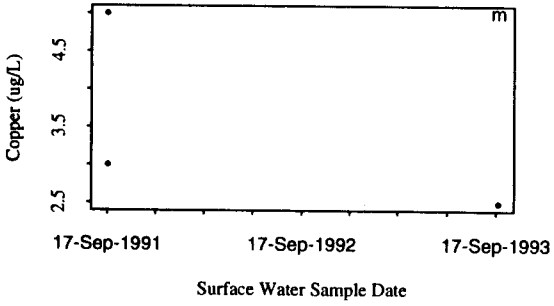
Segment 2-Chromium



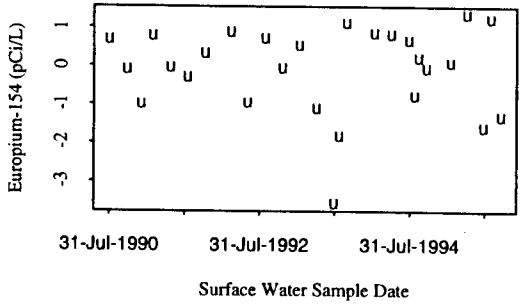
Segment 2-Cobalt-60



Segment 2-Copper

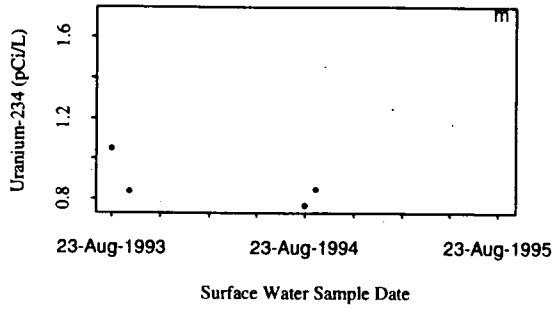


Segment 2-Europium-154

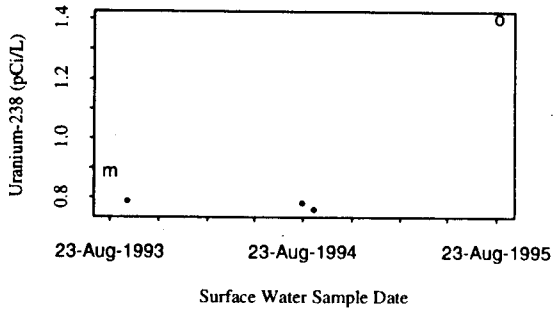


9318148.1780

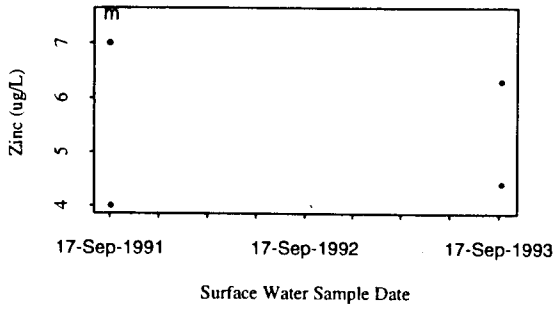
Segment 2-Uranium-234



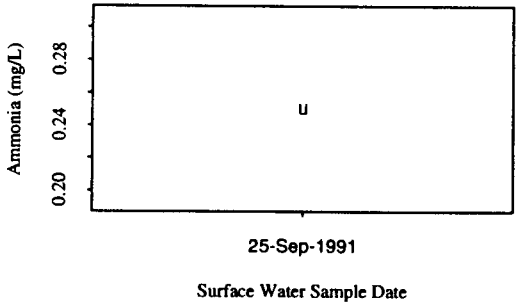
Segment 2-Uranium-238



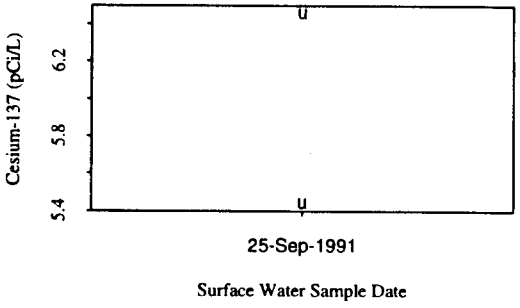
Segment 2-Zinc



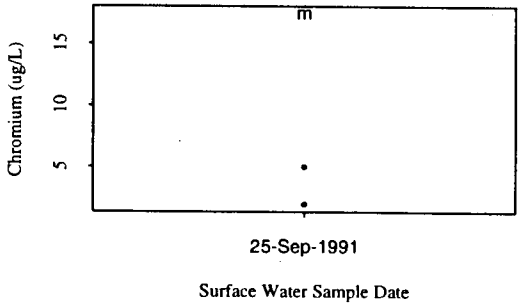
Segment 3-Ammonia



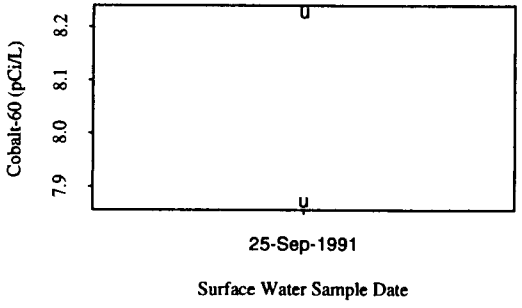
Segment 3-Cesium-137



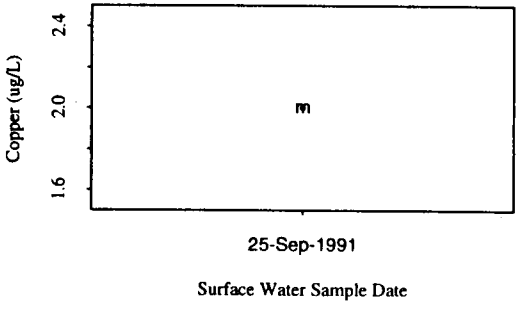
Segment 3-Chromium



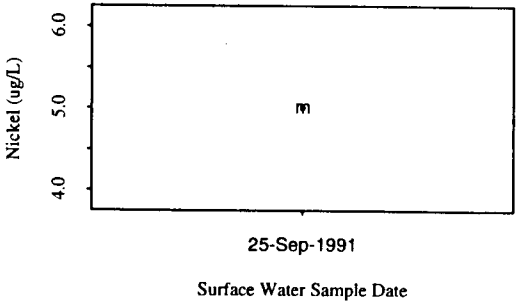
Segment 3-Cobalt-60

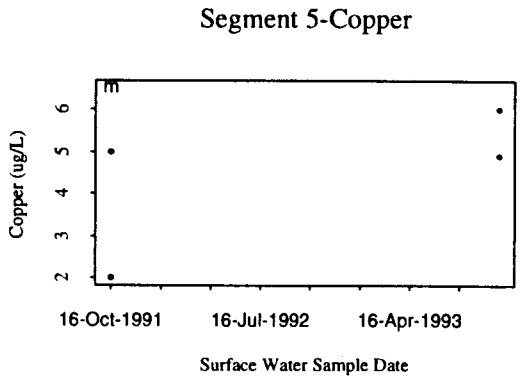


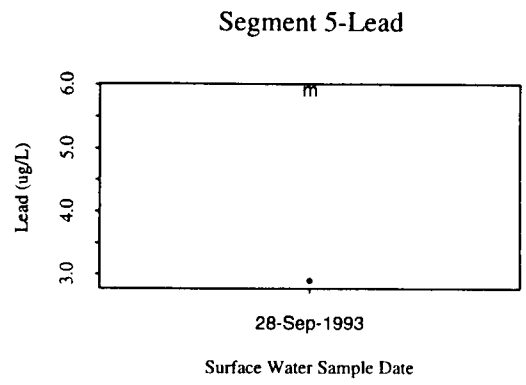
Segment 3-Copper

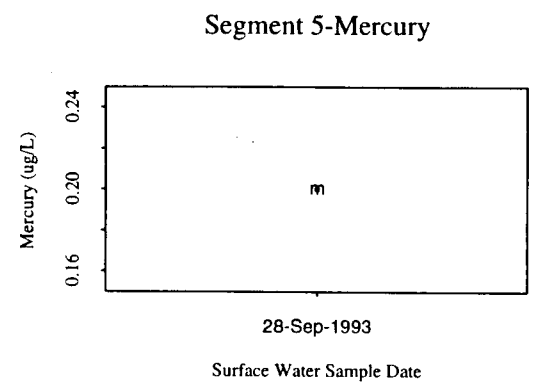


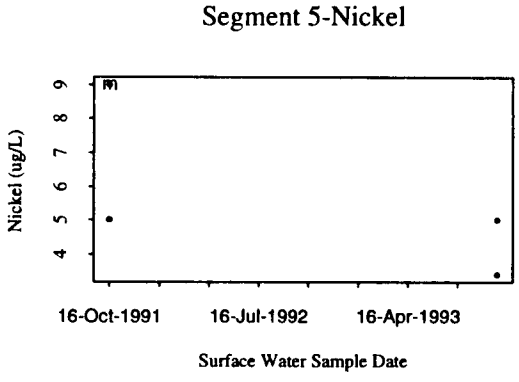
Segment 3-Nickel

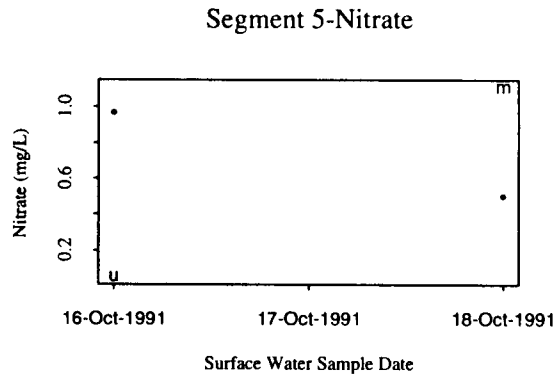


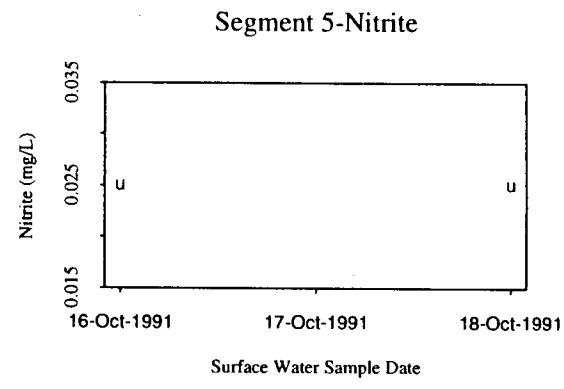

Segment 5-Copper
Copper (ug/L)
2
3
4
5
6
m
16-Oct-1991
16-Jul-1992
16-Apr-1993
Surface Water Sample Date

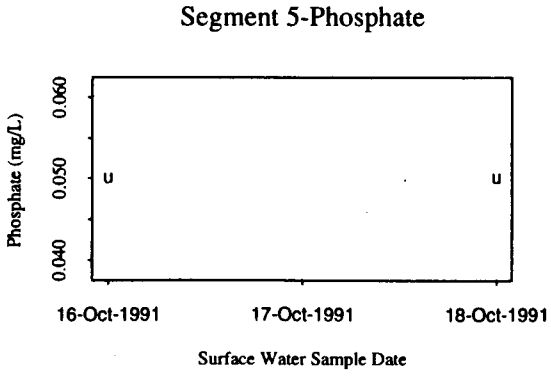

Segment 5-Lead
Lead (ug/L)
3.0
4.0
5.0
6.0
m
28-Sep-1993
Surface Water Sample Date

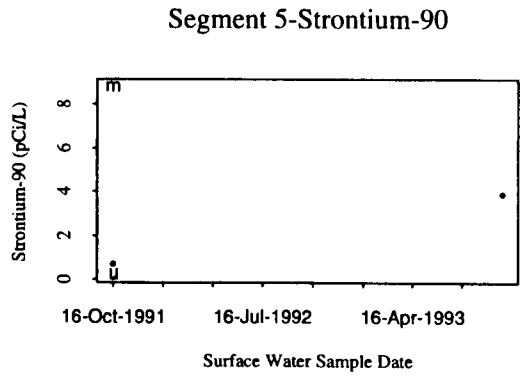

Segment 5-Mercury
Mercury (ug/L)
0.16
0.20
0.24
m
28-Sep-1993
Surface Water Sample Date

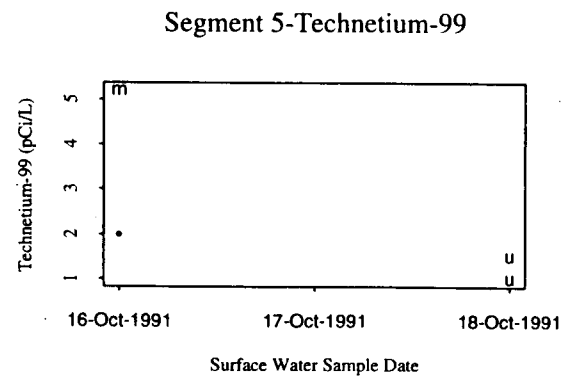

Segment 5-Nickel
Nickel (ug/L)
4
5
6
7
8
9
m
16-Oct-1991
16-Jul-1992
16-Apr-1993
Surface Water Sample Date


Segment 5-Nitrate
Nitrate (mg/L)
0.2
0.6
1.0
m
u
16-Oct-1991
17-Oct-1991
18-Oct-1991
Surface Water Sample Date

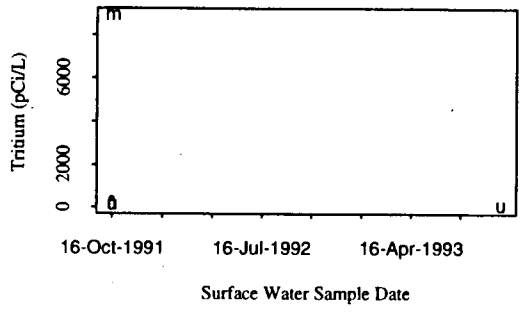

Segment 5-Nitrite
Nitrite (mg/L)
0.015
0.025
0.035
u
u
16-Oct-1991
17-Oct-1991
18-Oct-1991
Surface Water Sample Date


Segment 5-Phosphate
Phosphate (mg/L)
0.040
0.050
0.060
u
u
16-Oct-1991
17-Oct-1991
18-Oct-1991
Surface Water Sample Date

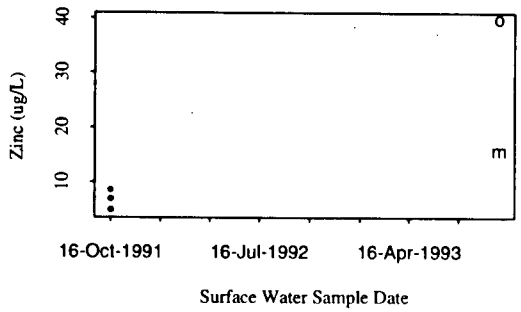

Segment 5-Strontium-90
Strontium-90 (pCi/L)
0
2
4
6
8
m
u
16-Oct-1991
16-Jul-1992
16-Apr-1993
Surface Water Sample Date


Segment 5-Technetium-99
Technetium-99 (pCi/L)
1
2
3
4
5
m
u
u
16-Oct-1991
17-Oct-1991
18-Oct-1991
Surface Water Sample Date

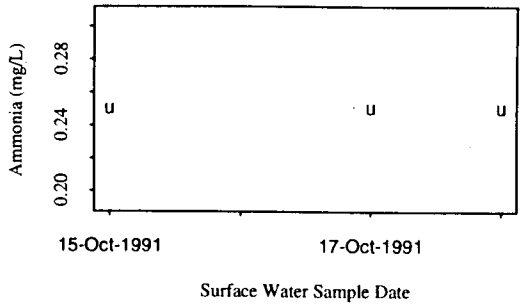
Segment 5-Tritium



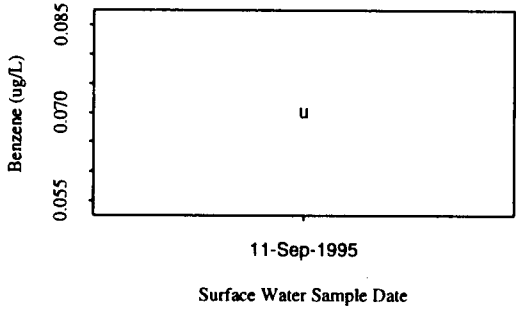
Segment 5-Zinc



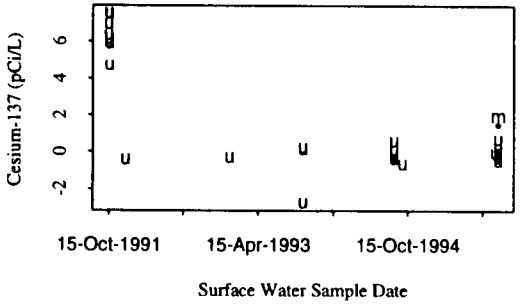
Segment 6-Ammonia



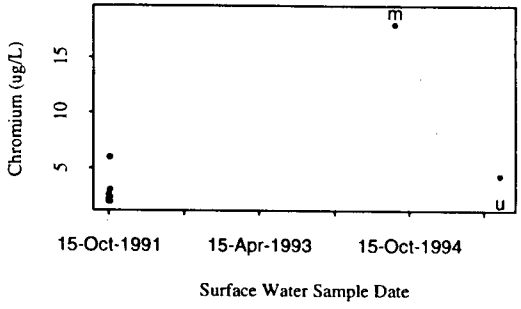
Segment 6-Benzene



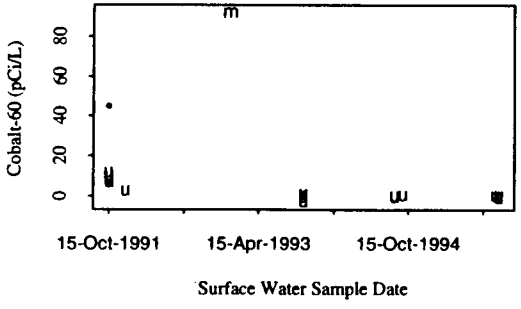
Segment 6-Cesium-137



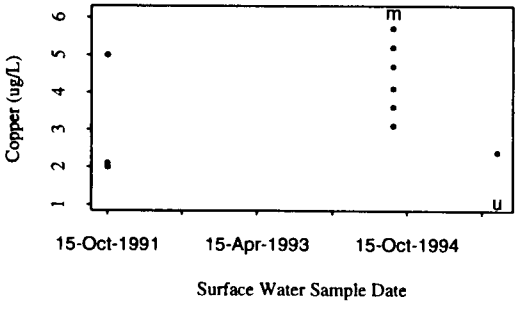
Segment 6-Chromium



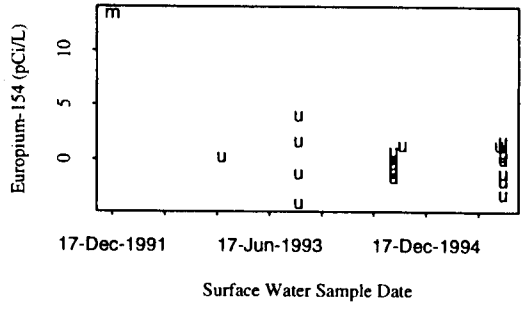
Segment 6-Cobalt-60



Segment 6-Copper

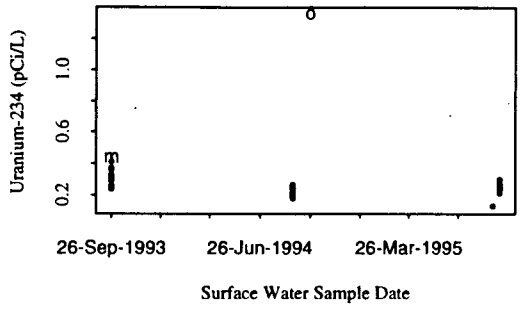


Segment 6-Europium-154

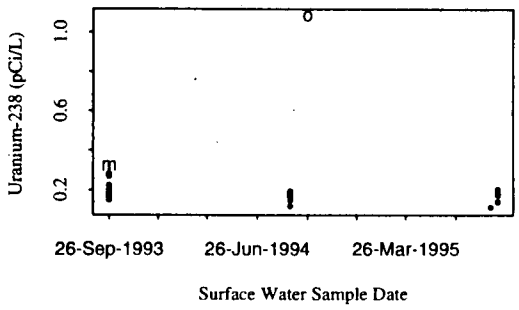


96134B.1/63

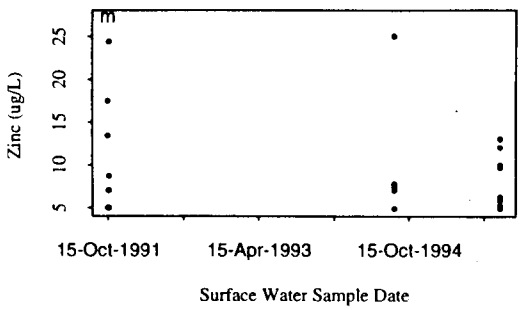
Segment 6-Uranium-234



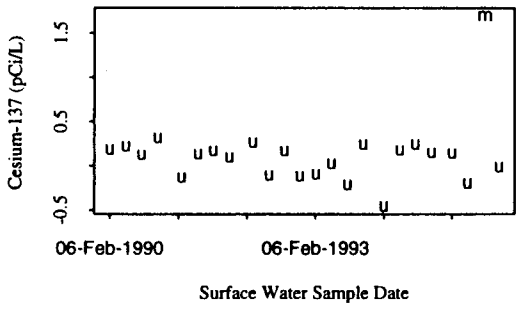
Segment 6-Uranium-238



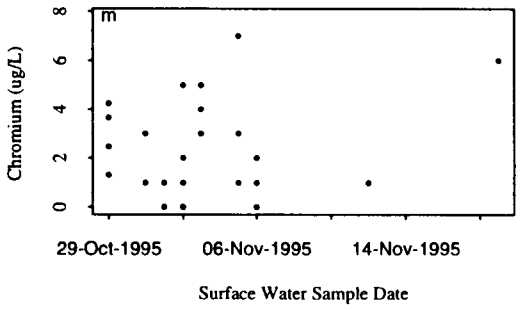
Segment 6-Zinc



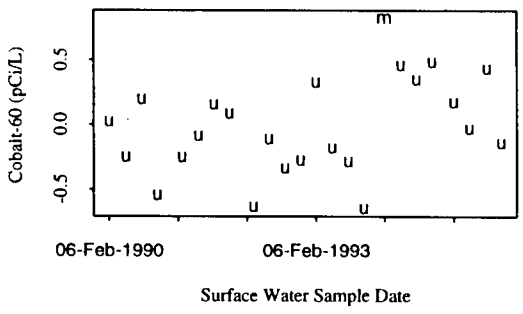
Segment 7-Cesium-137



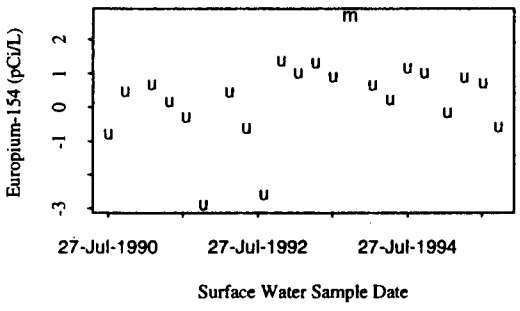
Segment 7-Chromium



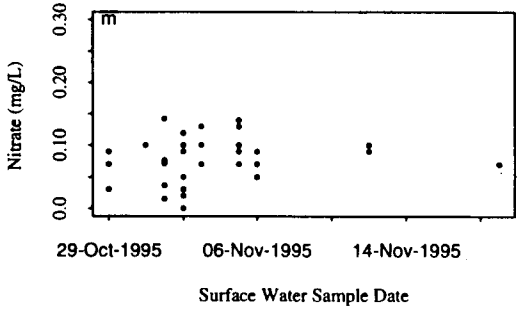
Segment 7-Cobalt-60



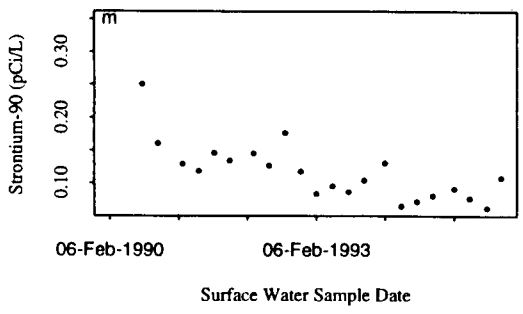
Segment 7-Europium-154



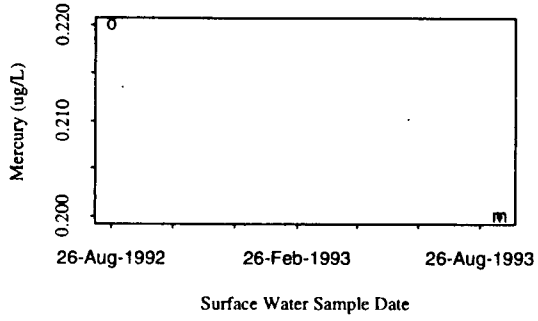
Segment 7-Nitrate



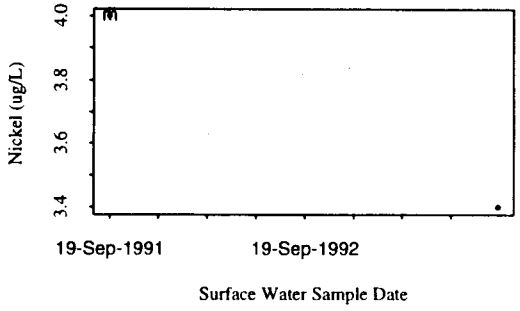
Segment 7-Strontium-90



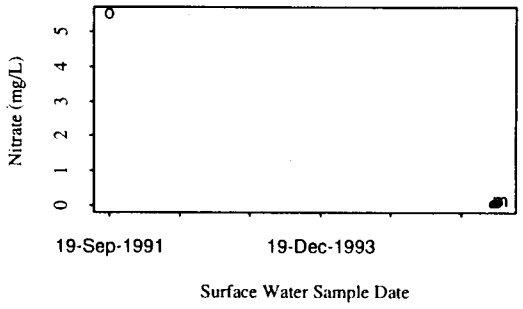
Segment 8-Mercury



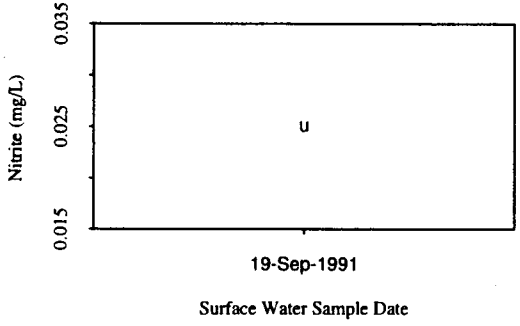
Segment 8-Nickel



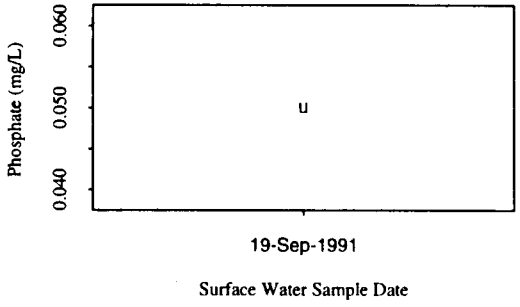
Segment 8-Nitrate



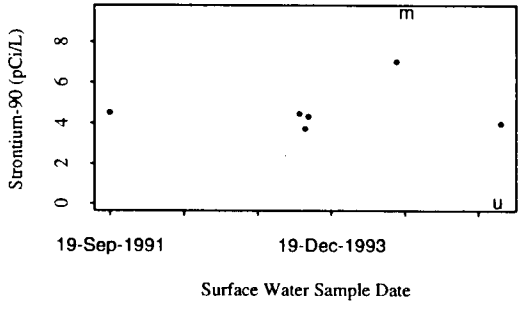
Segment 8-Nitrite



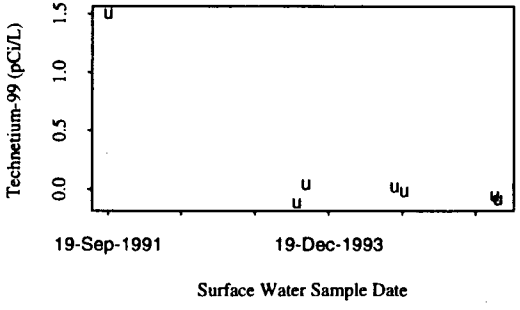
Segment 8-Phosphate



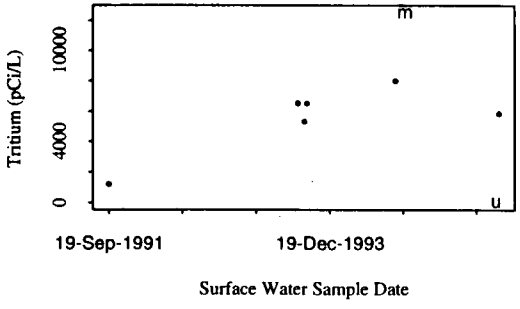
Segment 8-Strontium-90



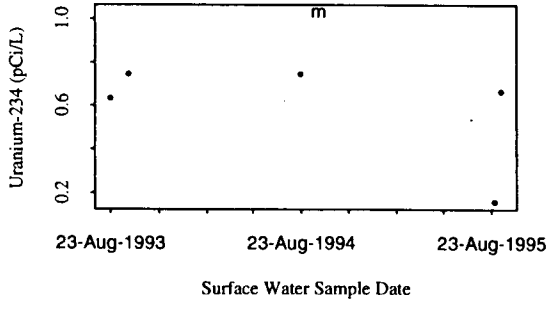
Segment 8-Technetium-99



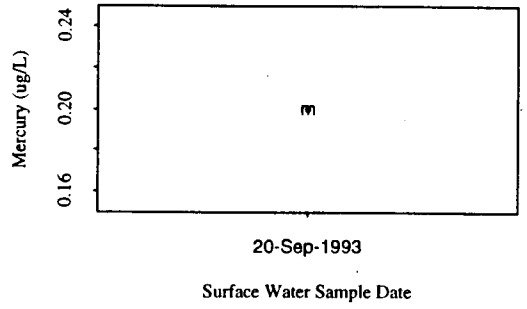
Segment 8-Tritium



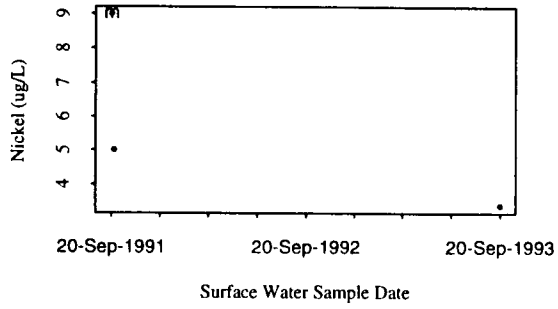
Segment 8-Uranium-234



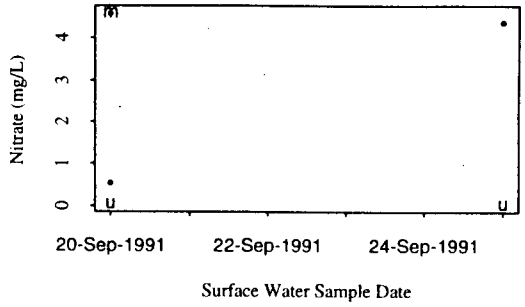
Segment 9-Mercury



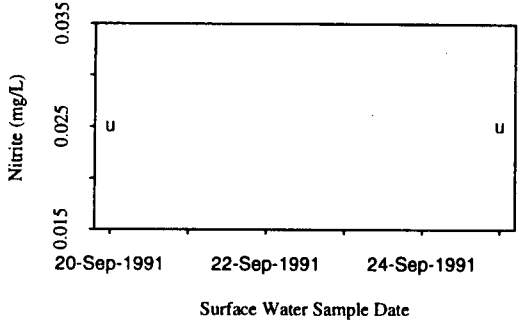
Segment 9-Nickel



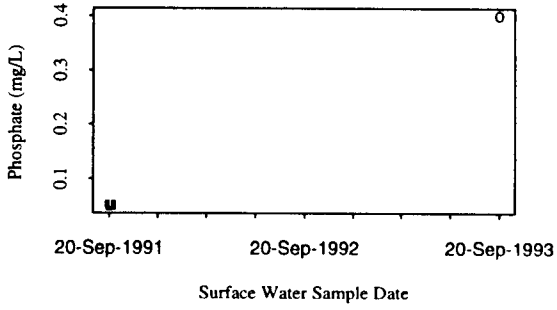
Segment 9-Nitrate



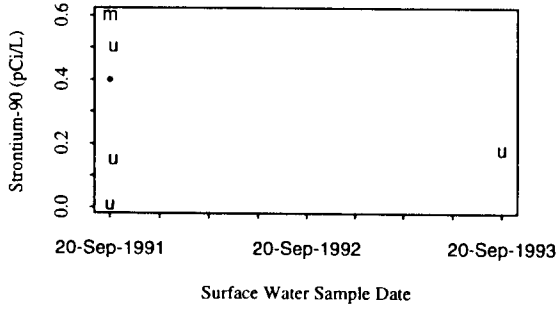
Segment 9-Nitrite



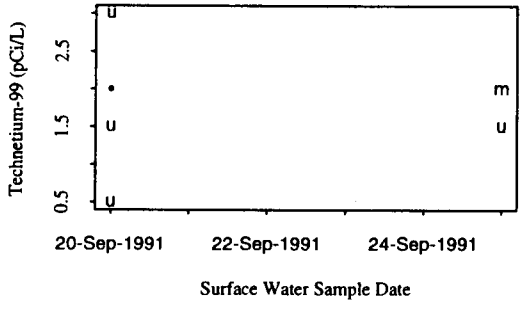
Segment 9-Phosphate



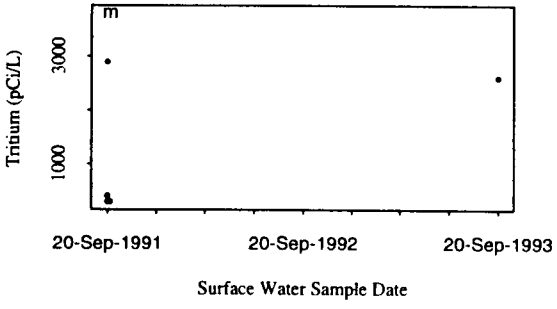
Segment 9-Strontium-90



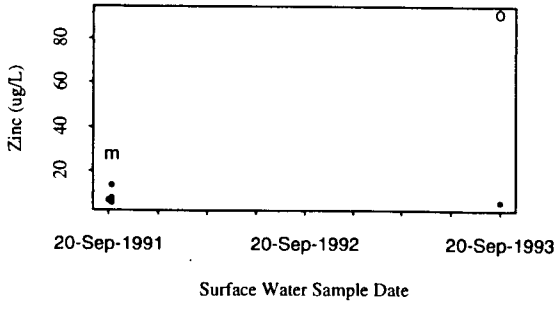
Segment 9-Technetium-99



Segment 9-Tritium

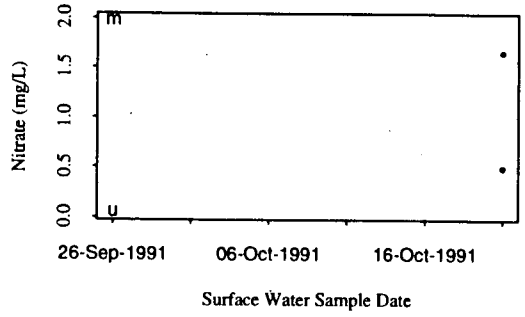


Segment 9-Zinc

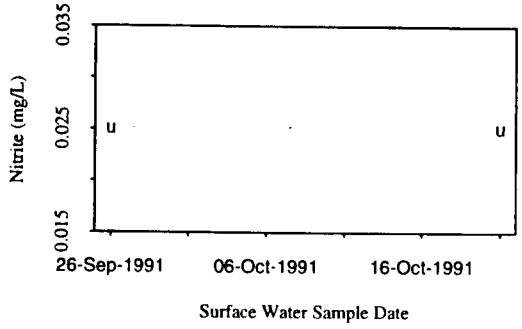


9318148.1768

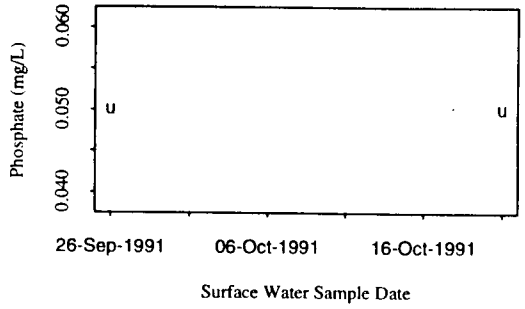
Segment 10-Nitrate



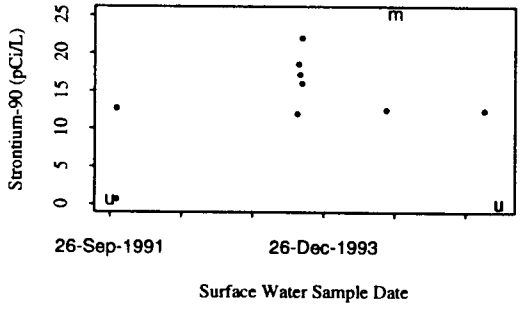
Segment 10-Nitrite



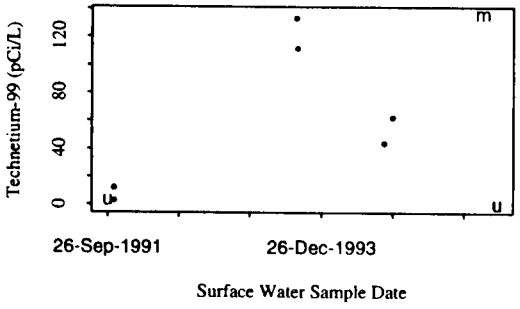
Segment 10-Phosphate



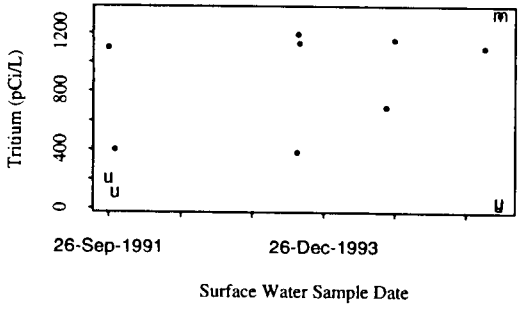
Segment 10-Strontium-90



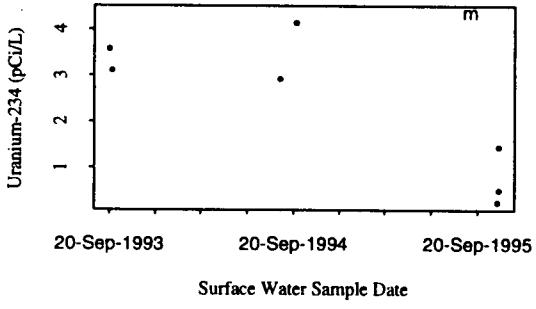
Segment 10-Technetium-99



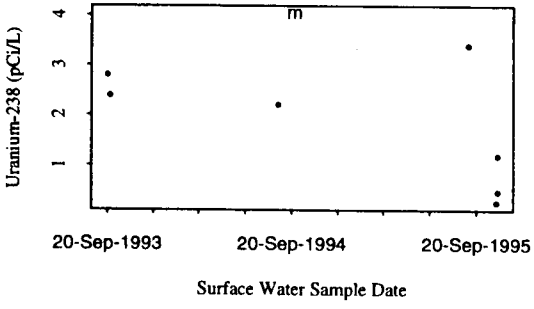
Segment 10-Tritium



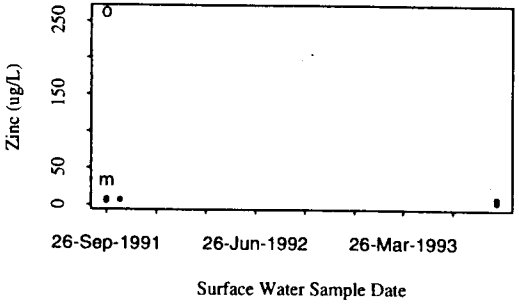
Segment 10-Uranium-234



Segment 10-Uranium-238

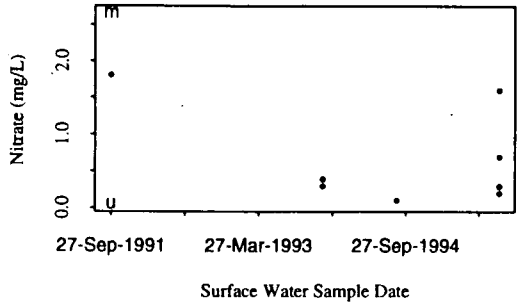


Segment 10-Zinc

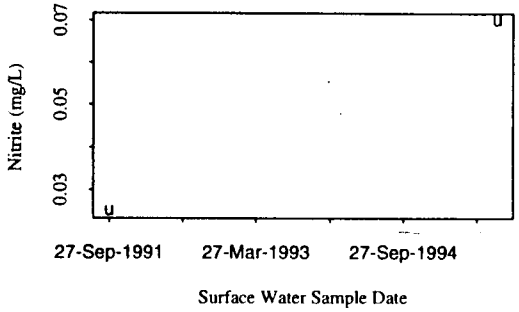


9513948.167

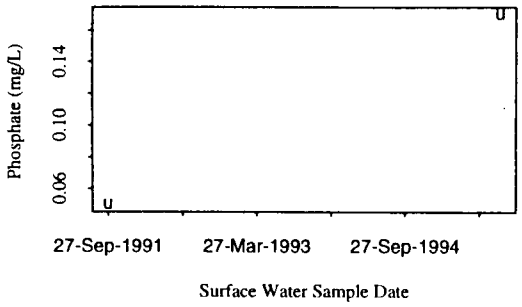
Segment 13-Nitrate



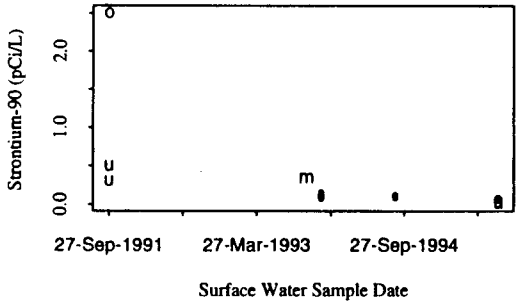
Segment 13-Nitrite



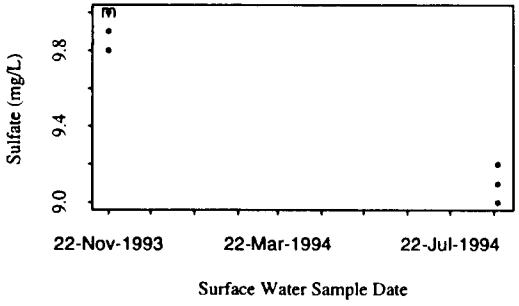
Segment 13-Phosphate



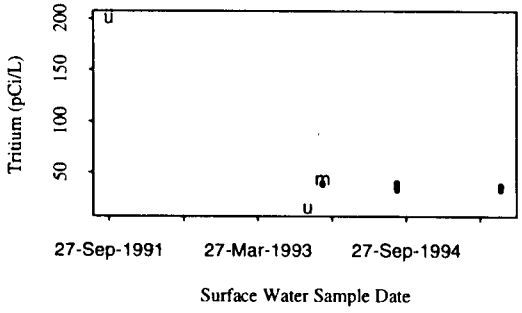
Segment 13-Strontium-90



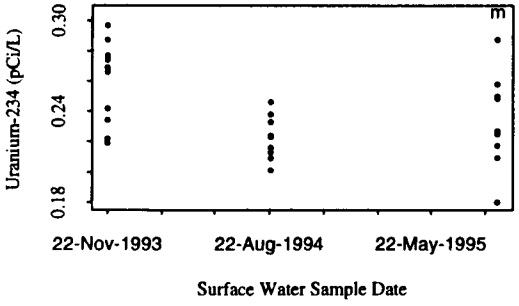
Segment 13-Sulfate



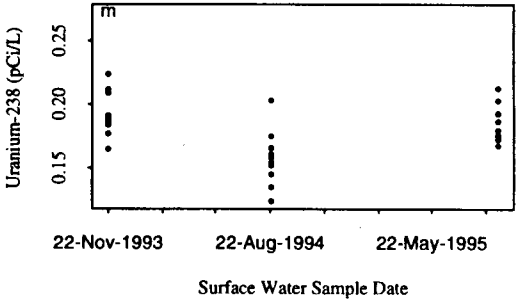
Segment 13-Tritium



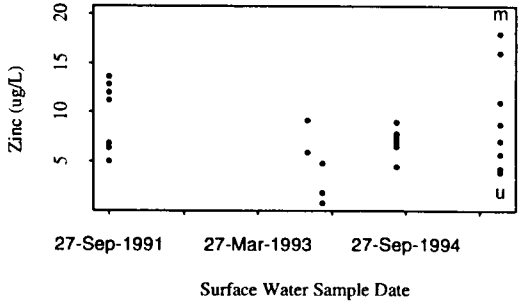
Segment 13-Uranium-234



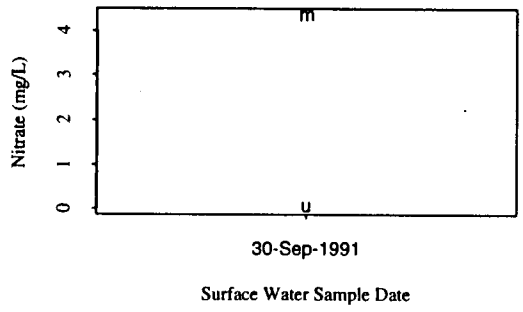
Segment 13-Uranium-238



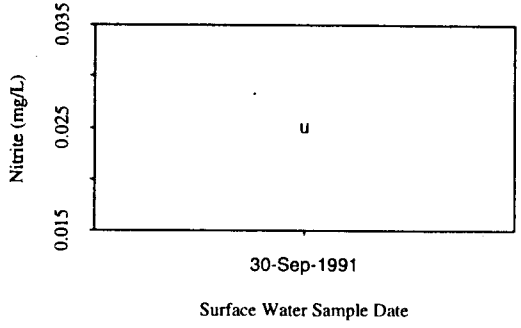
Segment 13-Zinc



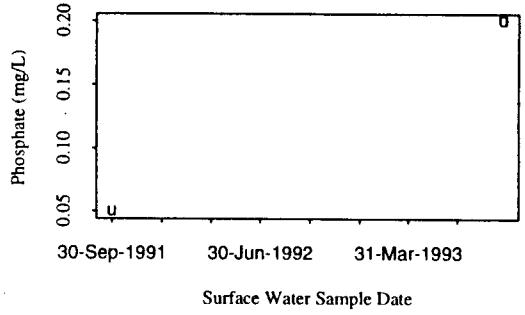
Segment 14-Nitrate



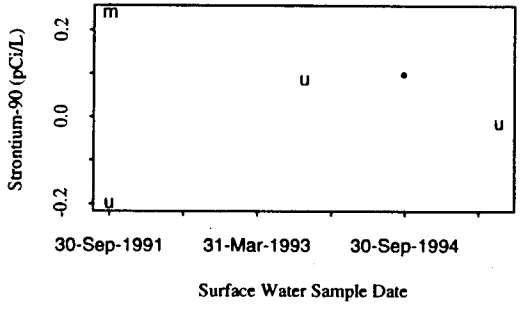
Segment 14-Nitrite



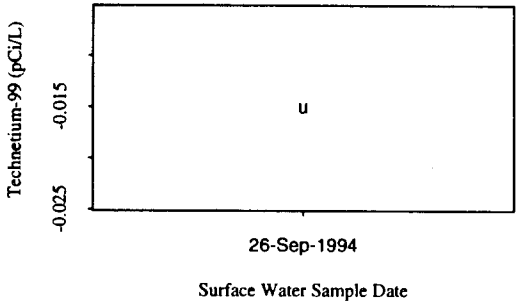
Segment 14-Phosphate



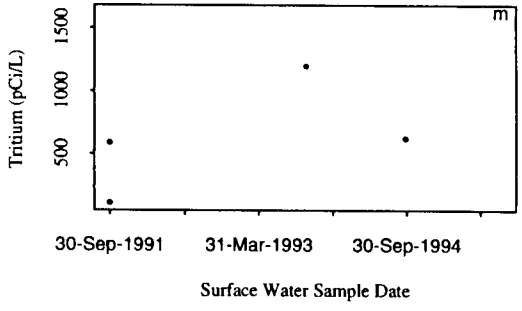
Segment 14-Strontium-90



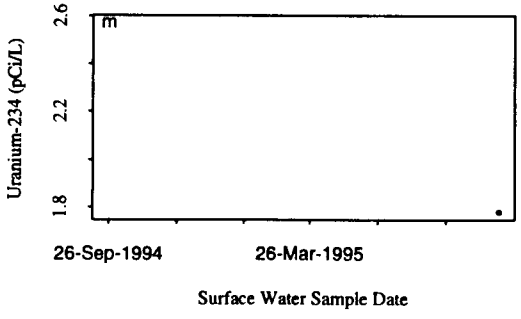
Segment 14-Technetium-99



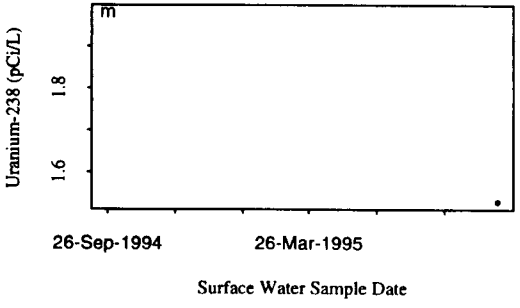
Segment 14-Tritium



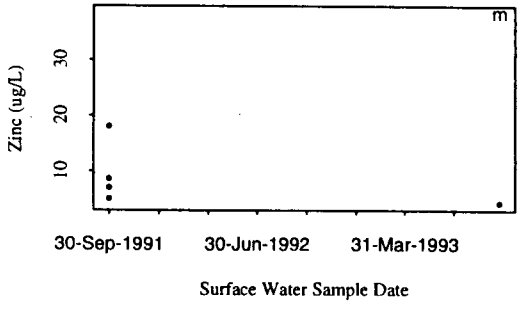
Segment 14-Uranium-234



Segment 14-Uranium-238

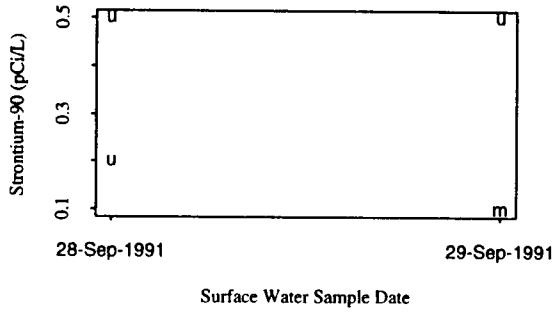


Segment 14-Zinc

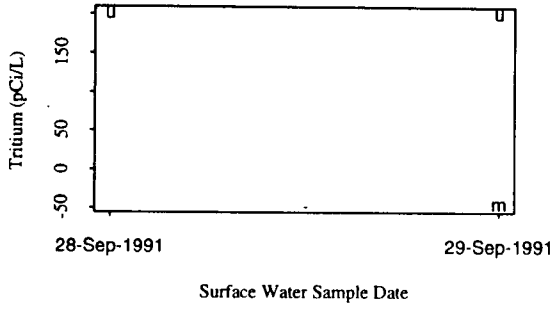


9612948.1789

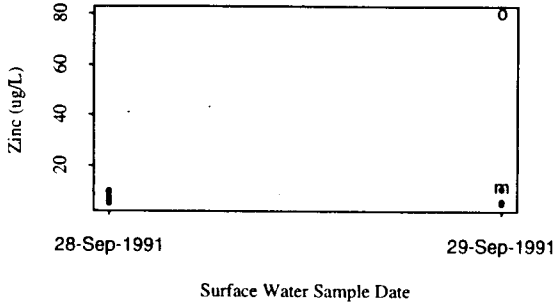
Segment 15-Strontium-90



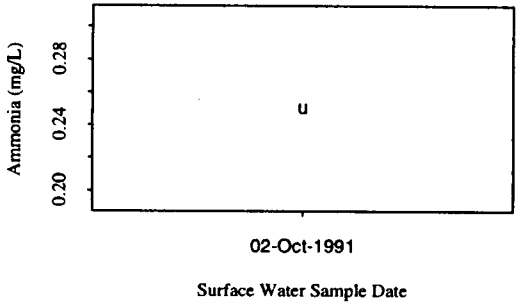
Segment 15-Tritium



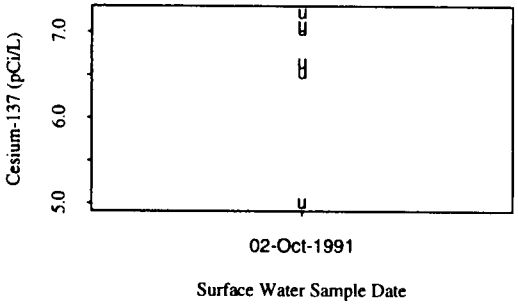
Segment 15-Zinc



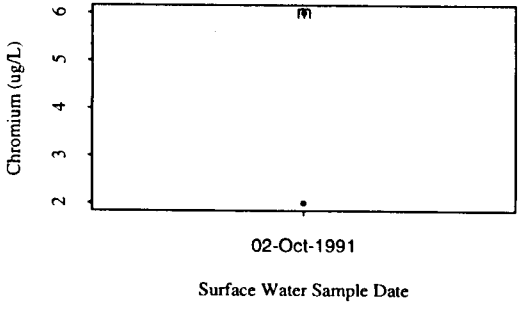
Segment 16-Ammonia



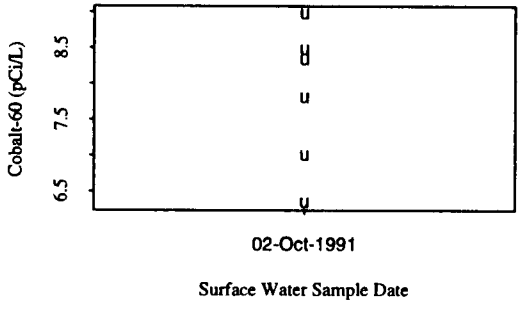
Segment 16-Cesium-137



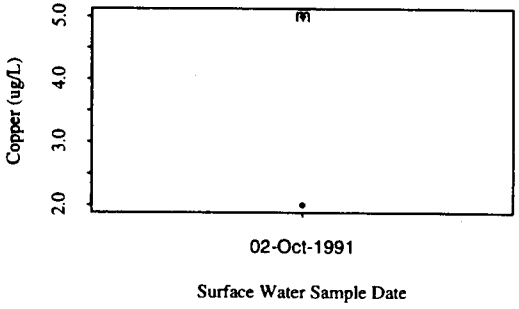
Segment 16-Chromium



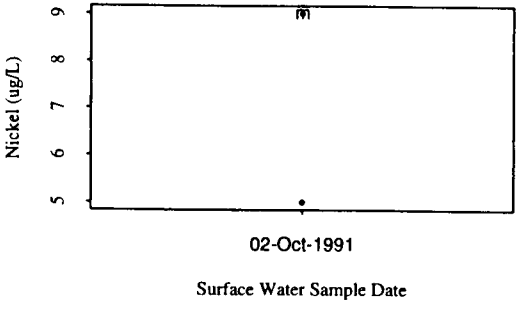
Segment 16-Cobalt-60



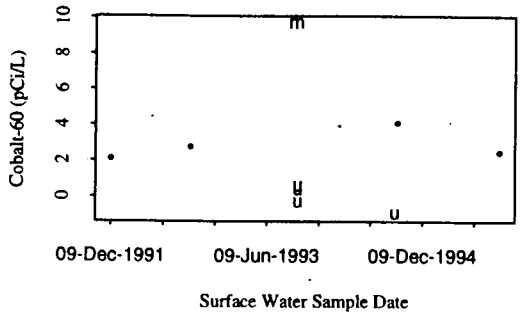
Segment 16-Copper



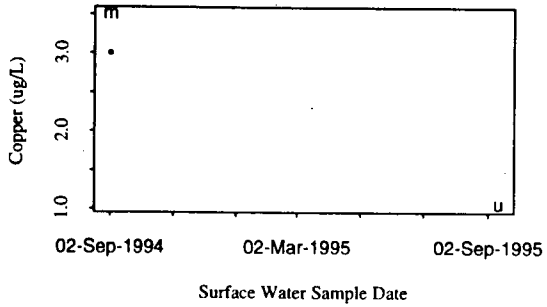
Segment 16-Nickel



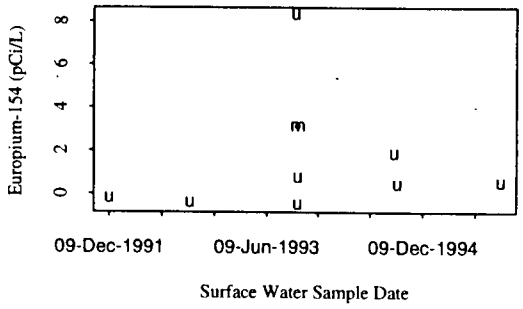
Segment 17-Cobalt-60



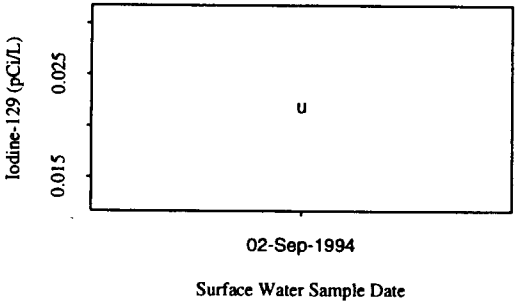
Segment 17-Copper



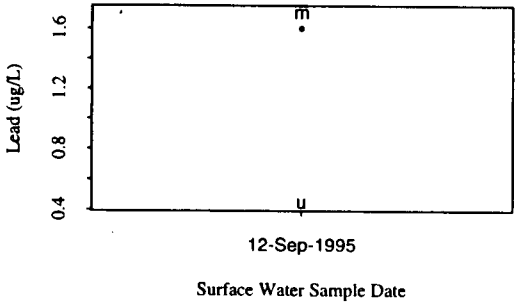
Segment 17-Europium-154



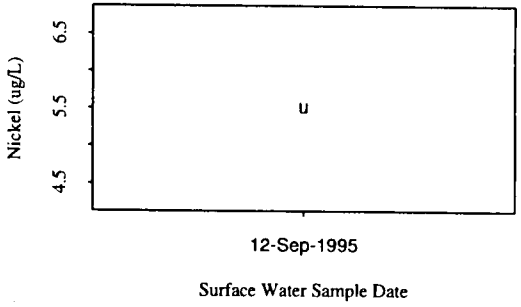
Segment 17-Iodine-129



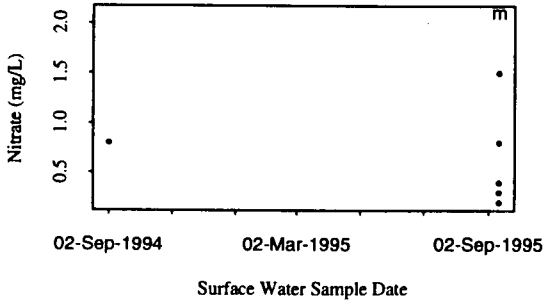
Segment 17-Lead



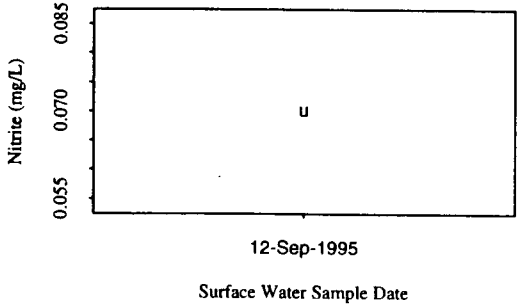
Segment 17-Nickel



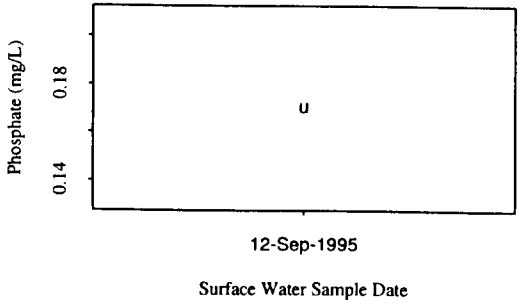
Segment 17-Nitrate



Segment 17-Nitrite

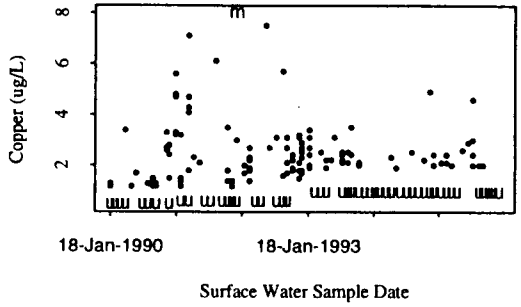


Segment 17-Phosphate

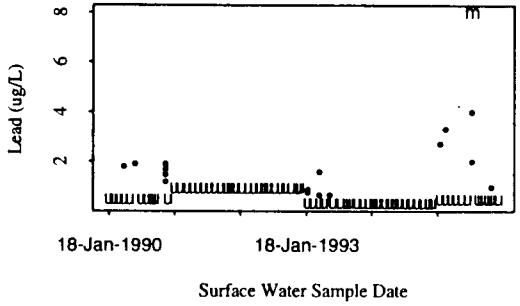


96 1948.179

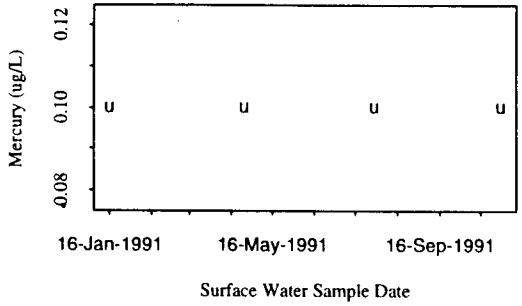
Segment 18-Copper



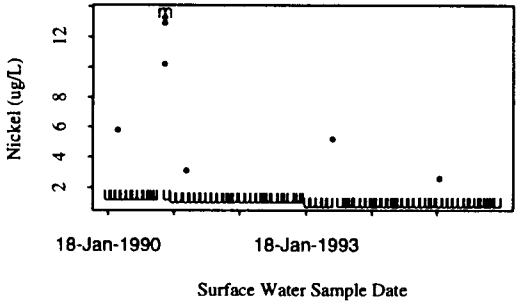
Segment 18-Lead



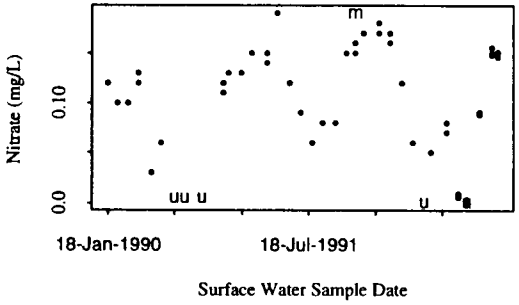
Segment 18-Mercury



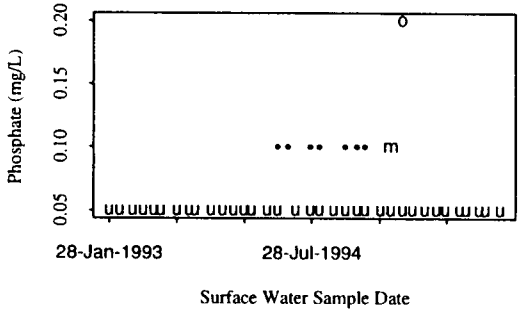
Segment 18-Nickel



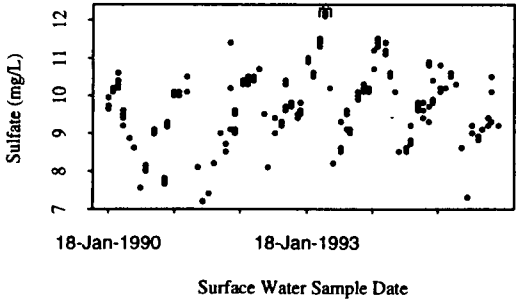
Segment 18-Nitrate



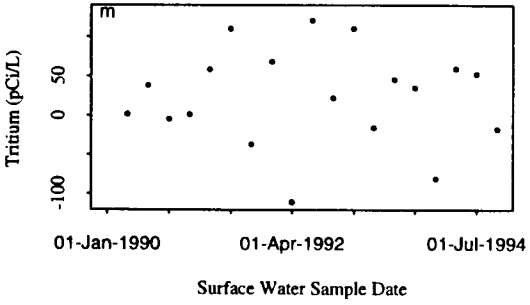
Segment 18-Phosphate



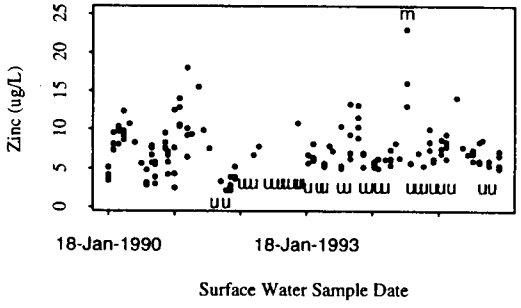
Segment 18-Sulfate



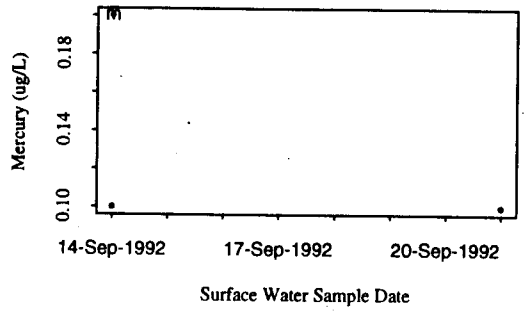
Segment 18-Tritium



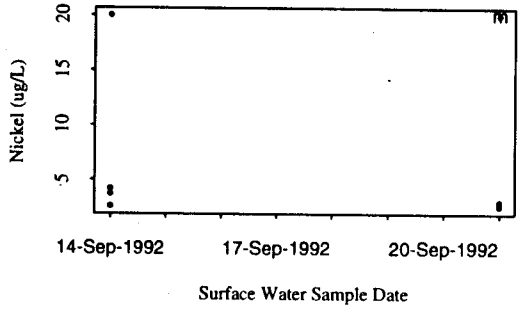
Segment 18-Zinc



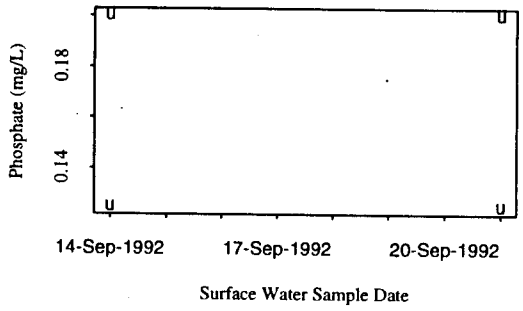
Segment 19-Mercury



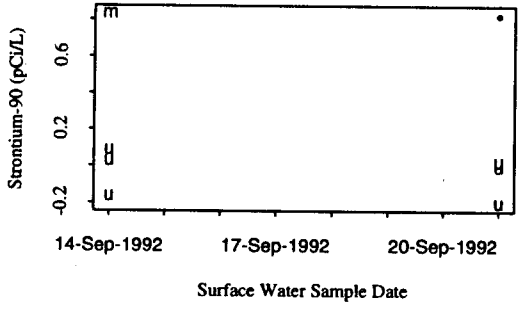
Segment 19-Nickel



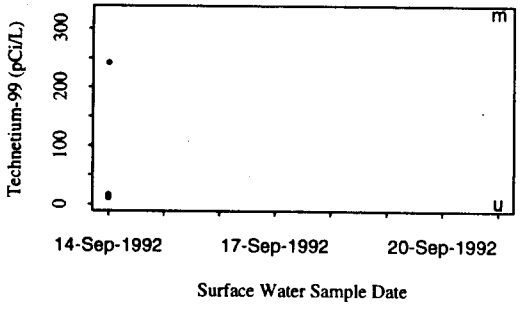
Segment 19-Phosphate



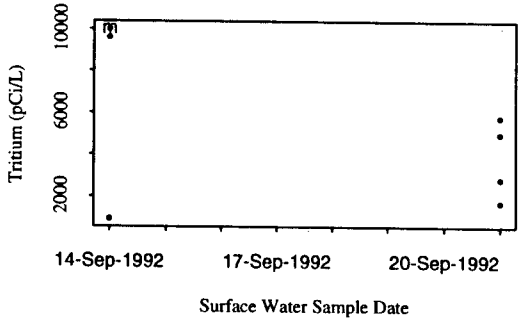
Segment 19-Strontium-90



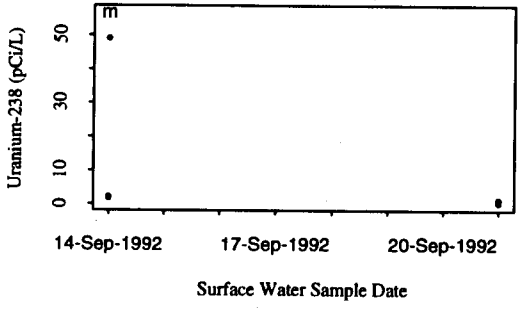
Segment 19-Technetium-99



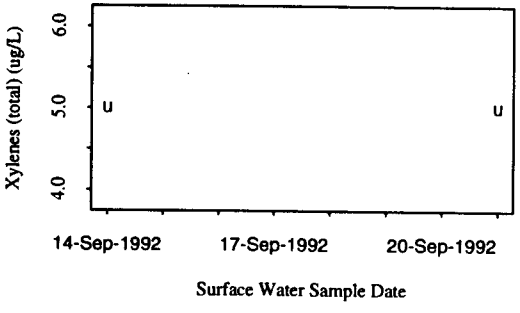
Segment 19-Tritium



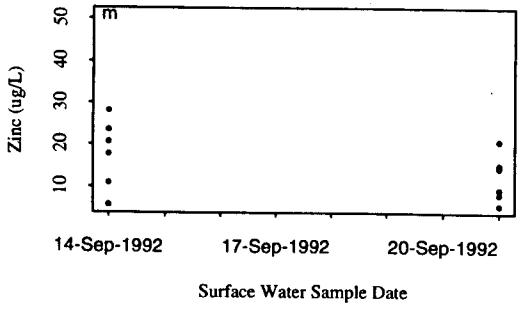
Segment 19-Uranium-238



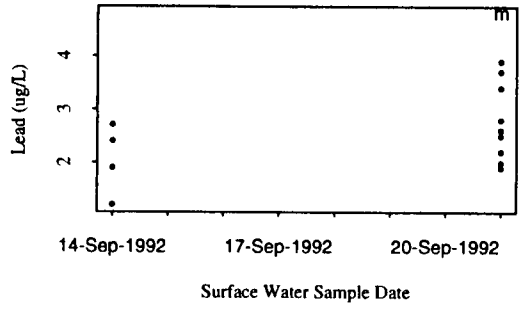
Segment 19-Xylenes (total)



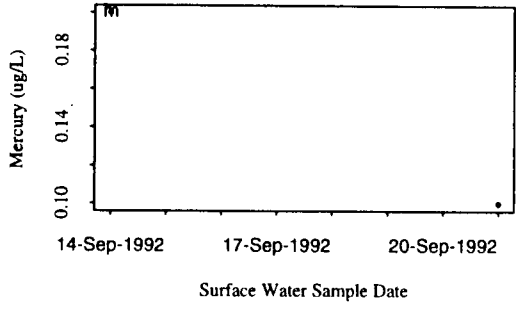
Segment 19-Zinc



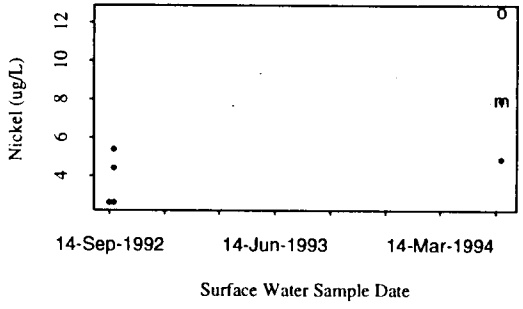
Segment 20-Lead



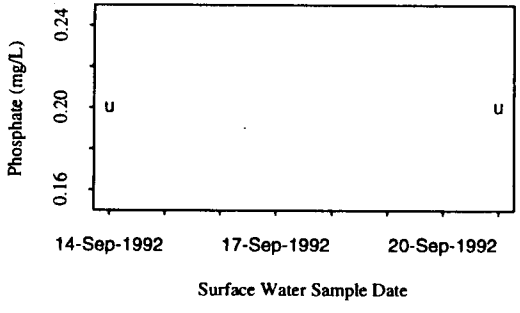
Segment 20-Mercury



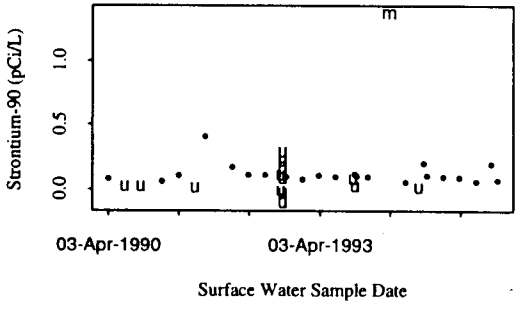
Segment 20-Nickel



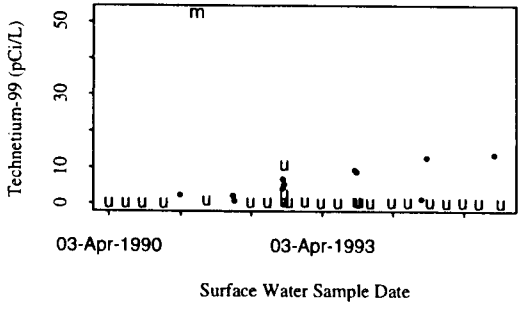
Segment 20-Phosphate



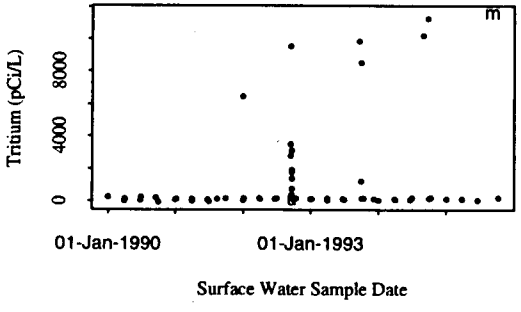
Segment 20-Strontium-90



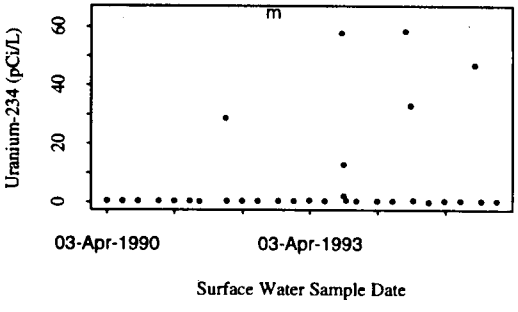
Segment 20-Technetium-99



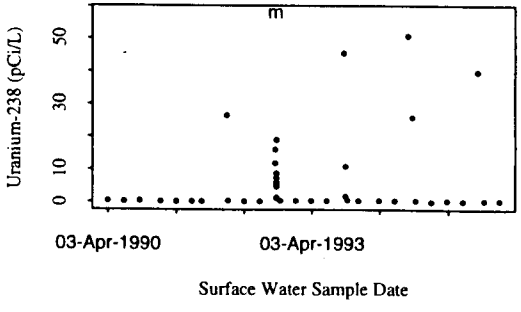
Segment 20-Tritium



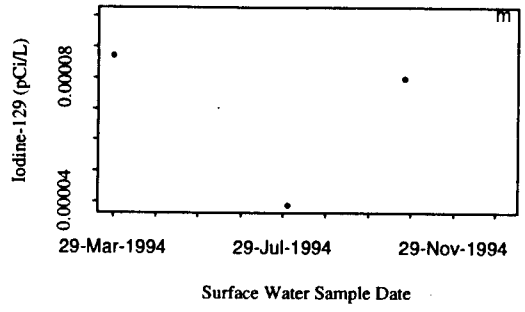
Segment 20-Uranium-234



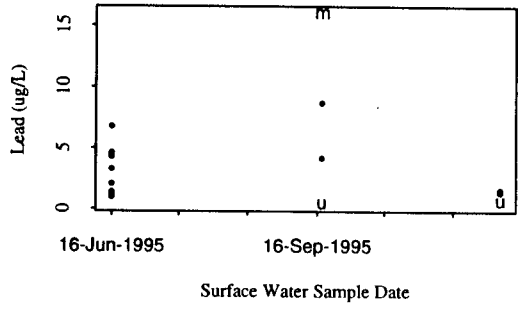
Segment 20-Uranium-238



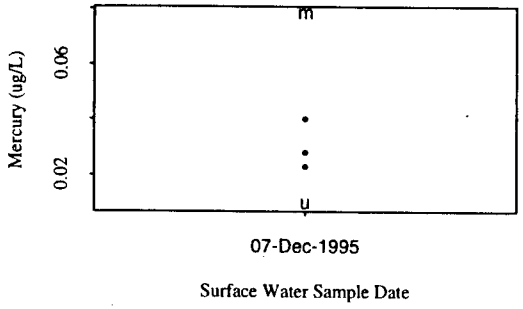
Segment 21-Iodine-129



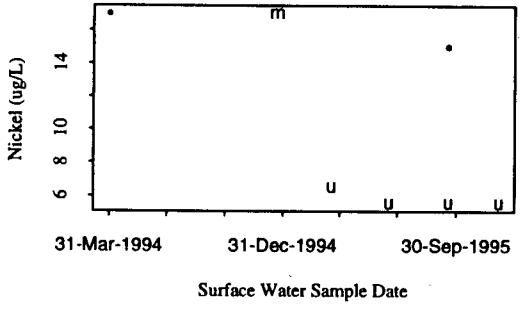
Segment 21-Lead



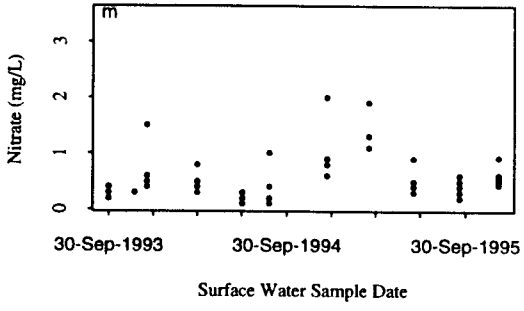
Segment 21-Mercury



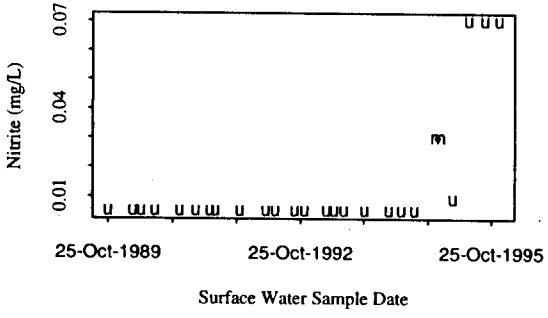
Segment 21-Nickel



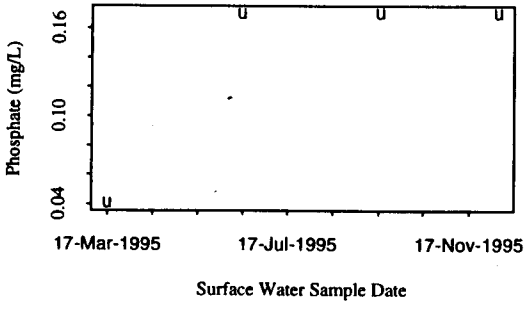
Segment 21-Nitrate



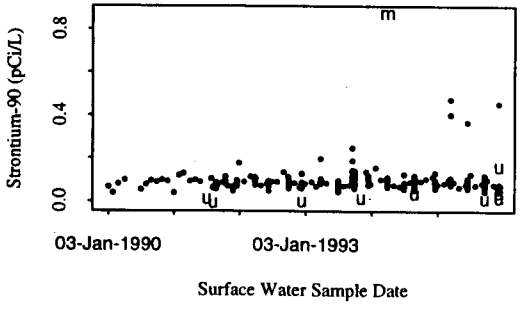
Segment 21-Nitrite



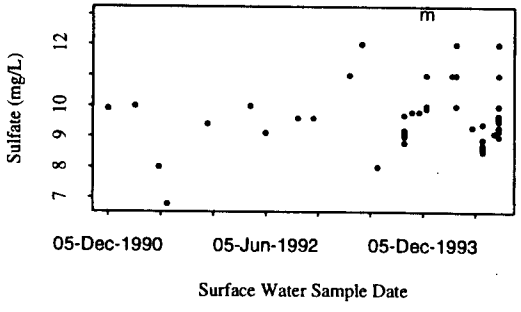
Segment 21-Phosphate



Segment 21-Strontium-90



Segment 21-Sulfate

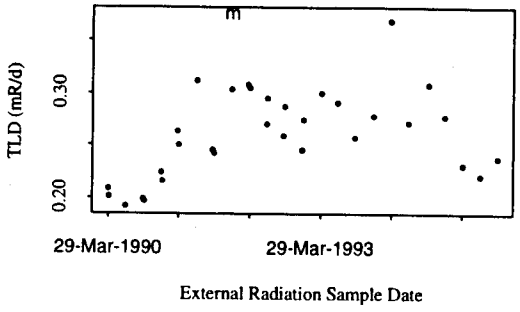


9516448.1795

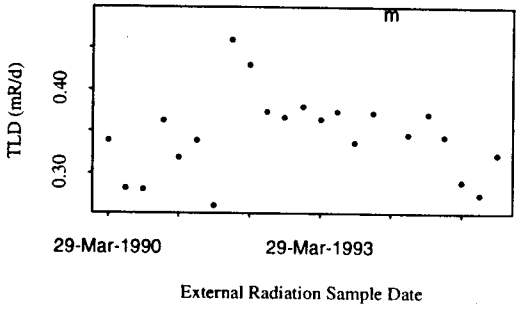
9613448.1796

External Radiation Plots and Maximum Representative Values for the Contaminants of Interest

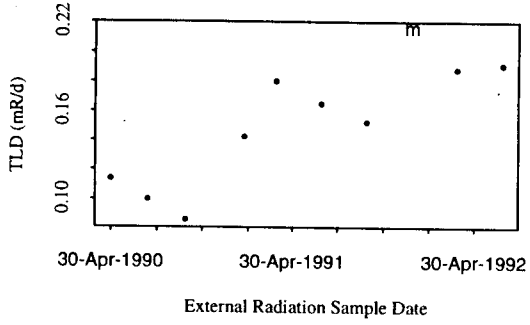
Segment 1-TLD



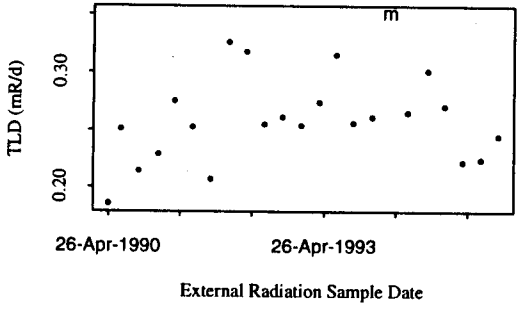
Segment 2-TLD



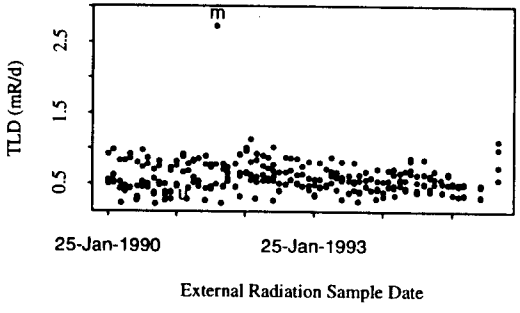
Segment 3-TLD



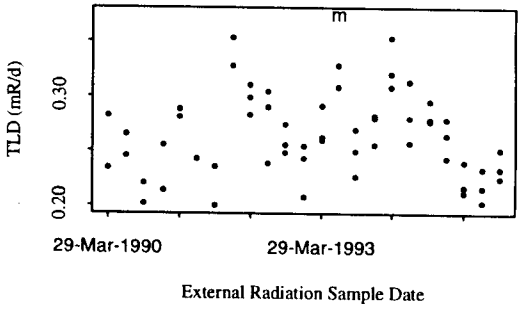
Segment 4-TLD



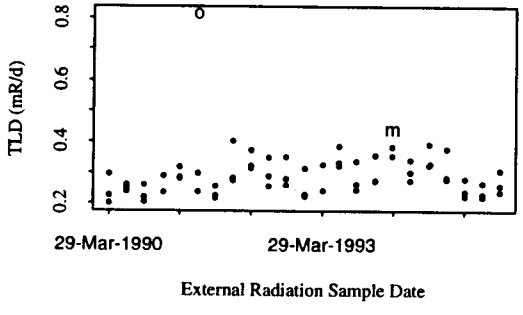
Segment 6-TLD



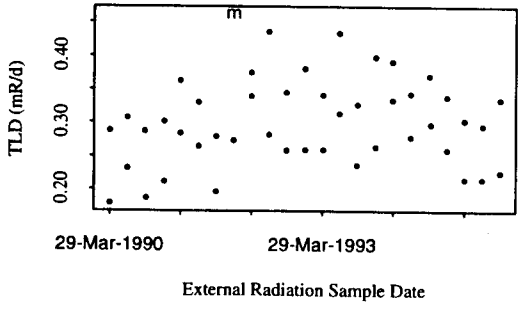
Segment 8-TLD



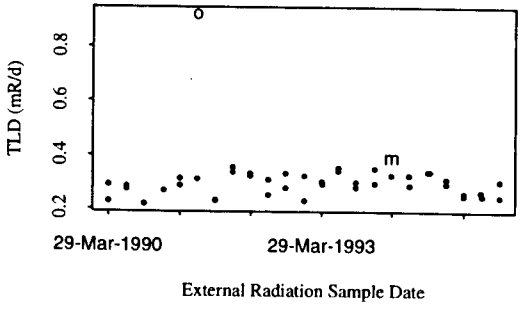
Segment 12-TLD



Segment 13-TLD



Segment 15-TLD



9616948.1797

9613448.1798

Appendix D

Media Files of Data for Use in the Screening Assessment of Risk to Human Health and the Environment

9613448.1799

Appendix D

Media Files of Data for Use in the Screening Assessment of Risk to Human Health and the Environment

The final data sets produced for input to the human health and ecological screening assessments are the media files. The media files were derived from the Microsoft Access database of raw files (see Appendix A). The media files are provided on diskette as part of this appendix. The media files are comma separated files that can be opened and read by Excel 5.0. Each medium is provided in a separate file. The media are groundwater (GW), sediment (SD), seeps (SP), surface water (SW), and external radiation (TLD). The file names on the diskette are xxfile.csv, where xx is the medium abbreviation.

Each media file contains a record for each contaminant in each segment. The records are sorted by contaminant first, then segment. For each medium, a file is constructed that contains the following information:

Media	Medium name
Segment_No	Segment number
Contaminant	Contaminant name
Units	Units of measurement
Max_Value	Maximum concentration
NA	Not applicable
Max_Samp_Num	Identifying number for the sample with the maximum concentration
Max_Samp_Date	Date of the sample with the maximum concentration
Max_Samp_Owner	Organization responsible for the sample with the maximum concentration
GM	Geometric mean
GSD	Geometric standard deviation
Num_Obs	Number of records for that contaminant/media combination

DOE/RL-96-16-c
Revision 0, Volume II
UC-630
Draft

Distribution

No. of Copies	
	Technical Peer Reviewers
2	Director, Technical Peer Reviewers W. H. Funk State of Washington Water Research Center Washington State University Pullman, WA 99164-3002
2	Director, Technical Peer Reviewers K. Williamson Oregon Water Resources Research Institute Oregon State University Strand Agricultural Hall 210 Corvallis, OR 97331-2208
	J. L. Creighton Creighton and Creighton Inc. Consultants P.O. Box 1030 Los Gatos, CA 95031-1030
	E. Faustman University of Washington 4225 Roosevelt Way NE Dept. of Environmental Health Room 208 Seattle, WA 98105-6099
	K. Goodman Enviros 25 Central Way, Suite 210 Kirkland, WA 98033
	K. A. Higley Oregon State University Dept. of Nuclear Engineering Radiation Center Corvallis, OR 97331-5902

No. of Copies	
	J. E. Hulla Dept. of Pharmacology and Toxicology Univ. of North Dakota School of Medicine P.O. Box 9037 Grand Forks, ND 58202-9037
	J. W. Massman Dept. of Civil Engineering University of Washington FX-10 MS 352700 Seattle, WA 98195
	M. H. O'Brien Environmental Research Foundation P.O. Box 12056 Eugene, OR 97440
	G. W. Suter II Oak Ridge National Laboratory Oak Ridge, TN 37831-6038
	F. R. Taub School of Fisheries Box 355100 University of Washington Seattle, WA 98195
	R. F. Weiner Dept. of Civil Engineering University of New Mexico Albuquerque, NM 87185-1341
	F. W. Whicker Dept. of Radiological Health Sciences Colorado State University 2954 Skimmerhorn Street Ft. Collins, CO 80526

No. of Copies		
	A. H. Thatcher Department of Health Division of Radiation Protection P.O. Box 47827 Olympia, WA 98504-7827	
11	**DOE Richland Operations Office**	
	K. M. Thompson	H0-12
	DIS (5)	H0-09
	DOE Public Reading Room (5)	H2-53
1	**Washington State Department of Ecology**	
	Ecology Library	B5-18
9	**Westinghouse Hanford Company**	
	Environmental Data Management Center	H6-08

No. of Copies		
24	**Pacific Northwest National Laboratory**	
	S. D. Cannon	K9-13
	S. M. Finch (10)	K9-26
	M. D. Freshley	K9-36
	R. O. Gilbert	K5-12
	T. B. Miley	K6-80
	T. K. O'Neil	K6-75
	T. B. Walters	K6-96
	Records Center (2)	K3-70
	Technical Library (5)	P8-55

9615448.1802

DOE/RL-96-16-c
Rev. 0, UC-630
Vol. II, Draft

Data for the Screening Assessment
Columbia River Comprehensive Impact Assessment

Appendix A - Diskette 1 of 5

Groundwater Raw Data for
Segments 1-7

File Name: gwseg**.csv
Comma separated file
Readable by Excel 5.0

June 1996

CH

DOE/RL-96-16-c
Rev. 0, UC-630
Vol. II, Draft

Data for the Screening Assessment
Columbia River Comprehensive Impact Assessment

Appendix A - Diskette 2 of 5
Groundwater Raw Data for
Segments 8-10, 12, 13, 15, 17, 19

File Name: gwseg**.csv
Comma separated file
Readable by Excel 5.0

June 1996

DOE/RL-96-16-c
Rev. 0, UC-630
Vol. II, Draft

Data for the Screening Assessment
Columbia River Comprehensive Impact Assessment

Appendix A - Diskette 3 of 5

Groundwater Raw Data for
Segments 20, 21

File Name: gwseg**.csv
Comma separated file
Readable by Excel 5.0

June 1996

CH

DOE/RL-96-16-c
Rev. 0, UC-630
Vol. II, Draft

Data for the Screening Assessment
Columbia River Comprehensive Impact Assessment

Appendix A - Diskette 4 of 5

Surface Water Raw Data

File Name: swraw.csv
Comma separated file
Readable by Excel 5.0

June 1996

CH

DOE/RL-96-16-c
Rev. 0, UC-630
Vol. II, Draft

Data for the Screening Assessment
Columbia River Comprehensive Impact Assessment
Appendix A - Diskette 5 of 5

Raw Data	File Name
sediment	sdraw.csv
seeps	spraw.csv
external radiation	tldraw.csv

June 1996

Comma separated file
Readable by Excel 5.0

DOE/RL-96-16-c
Rev. 0, UC-630
Vol. II, Draft

Data for the Screening Assessment
Columbia River Comprehensive Impact Assessment
Appendix A - Diskette 1 of 3

Data Values	File Name
Cobalt-60 Particles	o60val.csv
Drive Point Groundwater	pval.csv
N-Springs Punch Point Water	sprval.csv
Pore Water	porevl.csv

June 1996

Comma separated file
Readable by Excel 5.0

DOE/RL-96-16-c
Rev. 0, UC-630
Vol. II, Draft

Data for the Screening Assessment
Columbia River Comprehensive Impact Assessment
Appendix A - Diskette 3 of 3

Data Values	File Name
Biota from m-z	biovalmz.csv

June 1996

Comma separated file
Readable by Excel 5.0

DOE/RL-96-16-c
Rev. 0, UC-630
Vol. II, Draft

Data for the Screening Assessment
Columbia River Comprehensive Impact Assessment
Appendix D - Diskette 1 of 1

Media Files	File Name
groundwater	gwfile.csv
sediment	sdfile.csv
seeps	spfile.csv
surface water	swfile.csv
external radiation	tldfile.csv

June 1996

Comma separated file
Readable by Excel 5.0