SEQUOYAH FUELS
A GENERAL ATOMICS COMPANY

RE: 0515-N

February 25, 2005

FedEx

U.S. Nuclear Regulatory Commission
ATTN: Mr. Myron Fliegel, Senior Project Manager
Fuel Cycle Facilities Branch
Division of Fuel Cycle Safety
And Safeguards, NMSS
Two White Flint North
11545 Rockville Pike
Rockville, MD 20852-2738

Subject: Sequoyah Fuels Corporation, Docket – 40-8027
Update of Ground Water Monitoring Plan (TAC L52529)

Dear Mike,

Sequoyah Fuels Corporation submitted a Groundwater Monitoring Plan (GWMP) to the Nuclear Regulatory Commission (NRC) on June 12, 2003 as required by Condition 49 of NRC License No. SUB-1010. Since that date SFC has responded to requests for additional information from NRC and made revisions to the GWMP to satisfy NRC concerns. These revisions have been completed and are enclosed for incorporation into the GWMP. Please follow the enclosed instructions to update your copy of the GWMP.

If you have any questions or wish to discuss our proposed changes to the GWMP, don't hesitate to call me at (918) 489-5511, ext. 13.

Sincerely,

John H. Ellis

John H. Ellis
President

XC: Bill Von Till, NRC
Rita Ware, EPA
Alvin Gutterman, MLB
Jim Barwick, OAG
Saba Tahmassebi, ODEQ
Julian Fite, CN

NMSS01

HIGHWAY 10 & I-40 PO BOX 610, GORE, OKLAHOMA 74435 (918) 489-5511 FAX: (918) 489-2291

SISP Review Complete - MLF

Instructions To Update Groundwater Monitoring Plan
Sequoyah Fuels Corporation

1. Remove cover insert and spine dated May 2003 and replace with enclosed versions dated February 2005.

2. Remove title sheet and Table of Contents and replace with enclosed title sheet and Table of Contents.

3. Remove plan text from behind the tab labeled "Groundwater Monitoring Plan" and replace with enclosed version.

4. Remove Tables 4, 5 and 6 and insert enclosed Tables 4, 5 and 6.

5. Remove Figures 17 - 26 and insert enclosed Figures 17 - 23.

6. Remove contents from Appendix B and replace with the enclosed Appendix B.

7. Insert Appendix C and Appendix D. Labeled tab sheets are also provided for inclusion with each appendix.

SEQUOYAH FUELS
A GENERAL ATOMICS COMPANY

Groundwater Monitoring Plan
Sequoyah Facility

Sequoyah Fuels Corporation
P.O. Box 610
Gore, Oklahoma 74435

February 2005

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1 Introduction

Sequoyah Fuels Corporation (SFC) has collected hydrogeological and geochemical information at the Facility for more than 25 years. During this period SFC has characterized the groundwater impacts and conducted many groundwater investigations. The most significant field investigations conducted at the Facility were the Facility Environmental Investigation (FEI) conducted in 1990 through 1991 and the RCRA Facility Investigation / Site Characterization conducted during 1995. Groundwater monitoring results have been submitted to the Nuclear Regulatory Commission (NRC) and Environmental Protection Agency (EPA) on an annual basis since January 1995. During October 2002 SFC submitted a "Hydrogeological and Geochemical Site Characterization Report," (HGSCR) to NRC and EPA. The objective of the HGSCR is to estimate the long-term, post closure chemical conditions of groundwater and surface water surrounding the Facility.

SFC currently conducts groundwater monitoring through a comprehensive monitoring well system as part of requirements imposed by the Facility license, other commitments with the NRC and in accordance with the Groundwater Monitoring Interim Measures (GMIM) Work Plan approved by EPA. NRC-required groundwater investigations have resulted in additional groundwater monitoring commitments outside the current license-imposed requirements. Commitments for groundwater monitoring include a system of 162 monitoring wells covering much of SFC's 250-acre industrial site. SFC has continued to monitor 25 additional wells; including Cherokee Nation wells and recently installed wells, to gain additional information about the groundwater quality at the Facility.

Amendment 29 to the Facility NRC license was issued on December 11, 2002 and includes a condition that requires SFC to prepare a groundwater monitoring plan and submit it to NRC. This Groundwater Monitoring Plan (Plan) satisfies the license condition imposed in Amendment 29, and supersedes the groundwater monitoring requirements contained in Chapter 5 of the NRC license and the GMIM Work Plan. SFC has utilized information contained in previous sampling events, investigations and reports to design the groundwater monitoring program described in this Plan. The number of monitoring wells in this Plan has been reduced based on an evaluation of more than 10 years of monitoring data, a new Facility groundwater model and well locations that will be impacted by and need to be plugged in preparation for decommissioning.

2 Scope

A very large amount of data has been obtained and used to characterize the hydrogeological and geochemical conditions at the Facility. This information has been submitted to regulatory agencies in a number of reports. This Groundwater Monitoring Plan is designed to be compatible with Facility decommissioning and reclamation. For example, many of the monitoring wells that are monitored under the current program are located under the disposal cell footprint that is described in the proposed reclamation plan. These and other monitoring wells that are no longer useful need to be plugged. Some of these wells will be maintained until the reclamation plan requires that they be plugged and abandoned. Additional monitoring well locations are proposed for long term monitoring following completion of decommissioning and reclamation.

SFC has prepared this Groundwater Monitoring Plan to satisfy the requirements of NRC, EPA and the Oklahoma Department of Environmental Quality (ODEQ). Chemical specific monitoring at SFC includes those chemicals identified in the groundwater during previous investigations. This Groundwater Monitoring Program includes all constituents of concern (radionuclides, RCRA and non-RCRA regulated chemicals) identified during site characterization investigations to provide a comprehensive program in a single document.

The goal of the Groundwater Monitoring Plan is to provide comprehensive information regarding the constituents of concern present in groundwater at the Facility. This information will be used to help identify actions that should be taken to protect the health and safety of the public and the environment. In order to meet this goal, the following specific objectives have been established for the plan:

- Establish a comprehensive groundwater monitoring system,
- Monitor existing impacted groundwater,
- Gather information useful for developing additional interim measures,
- Evaluate the effectiveness of groundwater cleanup and control activities; and
- Monitor compliance with groundwater cleanup standards.

3 Background

3.1 Site History

Sequoyah Fuels Corporation (SFC) first established a groundwater monitoring program for portions of its' 85-acre processing area in the 1970's. During the decade of the 80's, the monitoring system expanded within the processing area and also to new areas of the 250-acre industrial site. In 1990, after a thorough review of the groundwater monitoring system which had evolved at the plant site, SFC expanded its well system applying state-of-the-art construction methods and standards. The new monitoring system was associated with an environmental study of the Facility known as the Facility Environmental Investigation (FEI), developed in response to the Order Modifying License issued to SFC by the NRC. The FEI was reported in the "FEI Findings Report" which was submitted to the NRC in July, 1991. Among other things, the FEI resulted in a more complete understanding of the geological and hydrogeological conditions at the Facility.

The findings of the FEI served as a basis for a new Facility groundwater monitoring plan. The FEI characterized the groundwater systems, the presence and extent of licensed material and other constituents associated with processing operations found to be present in those systems, and established monitoring locations of both impacted and unimpacted areas from past and present operational activities. These new wells were routinely monitored by commitment, but were never incorporated into the license.

In February of 1993, SFC notified the NRC of its intention to discontinue production and submitted a preliminary plan for completion of decommissioning (PPCD) for the Facility to the NRC. To properly decommission the Facility, SFC determined the extent of contamination throughout the Facility and developed a hydrogeologic transport model to determine future migration of contaminants.

In August of 1993, SFC signed a Resource Conservation Recovery Act (RCRA) Section 3008(h) Administrative Order on Consent (AOC) with the Environmental Protection Agency

(EPA). As a result, SFC was required to conduct a RCRA Facility Investigation (RFI) to the following objectives:

- Characterize the potential pathways of comtaminant migration.
- Characterize the source(s) of contamination.
- Define the degree and extent of contamination.
- Identify actual or potential receptors.
- Support the development of alternatives from which a corrective measure will be selected by EPA.

The RFI Report, published in 1997, includes detailed information on Facility description and history, local geology and hydrogeology, monitoring activities, extent and concentration of Facility contamination, and the effects of contamination on the surrounding area and its inhabitants.

In December of 1998, SFC completed a Site Characterization Report (SCR) to address the NRC objectives of:

- Quantifying physical, radiological and non-RCRA chemical contamination characteristics and the extent of contaminant distribution.
- Quantifying environmental parameters affecting potential human exposure for both existing and possible future contamination.
- Supporting evaluation of decommissioning action alternatives and detailed planning of the selected decommissioning and remediation approach.

Activities for the SCR were designed to obtain information to characterize the source(s) of contamination, establish the level of contamination in the environment where releases had occurred, and finalize environmental setting characterization to support decommissioning planning.

By February 2001, SFC determined that the site hydrogeological model was inadequate, and retained Shepherd Miller, Inc. ([SMI], now MFG, Inc. [MFG]) to re-evaluate the conceptual model to assess its deficiencies.

In March 2001, SMI submitted the Database Review and Conceptual Model Revision Report to SFC. In the report, SMI first reviewed the content of the SFC hydrogeologic and geochemical databases to better understand the hydrogeologic and geochemical transport system at the Facility. Several previous investigations provided a significant amount of hydrogeologic and geochemical data. These investigations included: 1) the FEI , 2) the SCR, and 3) the SFC Final RCRA Facility Investigation. Furthermore, routine groundwater monitoring at the Facility has been ongoing for more than 20 years as part of SFC's source materials license. This groundwater monitoring created a large database that SMI used to evaluate the site conceptual model.

Subsequent to the review of the SFC databases, SMI updated the geochemical conceptual model by preparing two-dimensional contour maps of the key constituents (uranium, arsenic, and nitrate) within the key hydrostratigraphic units. As a result of this review, SMI determined that additional site characterization efforts were needed to obtain the data necessary to support groundwater flow and constituent modeling at the Facility, and to refine the geochemical and hydrogeological site conceptual models. These characterization efforts included hydrogeologic, geochemical, and geophysical investigations. The site hydrogeologic investigation was performed to acquire additional data on the extent and depths of the various stratigraphic units, and to acquire data to characterize the hydrologic properties of the various hydrogeologic units. Data collected during the site characterization efforts supplemented data from previous studies to help refine the hydrogeologic physical and conceptual model. The geochemical investigation included the collection of data needed to understand the geochemical processes controlling constituent migration and to determine site-specific distribution coefficients for arsenic and uranium to support geochemical transport modeling. Additional site characterization efforts included a geophysical investigation to determine the existence and location of a suspected paleochannel at the Facility.

The results of the on-site investigation, the geochemical testing and analysis and the development and results of the hydrogeologic physical and conceptual model were submitted to regulatory agencies on October 30, 2002 in a report titled "Hydrogeological and Geochemical Site Characterization Report (HGSCR)," and incorporated into the Reclamation Plan as Appendix B. The data and analysis obtained in this study has supported the development of a groundwater flow and transport model, allowing the delineation of the impact of key constituents on the environment, both in the present and in the future.

3.2 Site Geological, Hydrogeologic and Geochemical Conditions

Based on data from recent site investigations and previous studies, the following describes the current understanding of the geologic, hydrogeologic and geochemical conditions at the Facility. This description is taken from the HGSCR.

3.2.1 Regional Physiographic and Geologic Setting

The Sequoyah Fuels Corporation property is located near the northern edge of the Arkoma Basin, on the southwest flank of the Ozark Uplift (See Figure 1). The Arkoma Basin is an arcuate structural depression that extends from the Gulf coastal plain in central Arkansas westward to the Arbuckle Mountains in south central Oklahoma. The Ozark Uplift is a large structural feature extending from east central Missouri to northeast Arkansas and northeast Oklahoma. For geographic reference, the Ouachita Mountains are about 50 miles south of the site. Bedrock formations underlying the area consist of Ordovician, Silurian, Devonian, Mississippian, and Pennsylvanian- aged rocks, mostly limestones, shales, and sandstones. A regional geologic map is presented in Figure 2. A regional stratigraphic column correlating upper Mississippian and lower Pennsylvanian formations and members in Arkansas and Oklahoma is presented in Figure 3. The Facility lies in an area of facies transition from the southwestern Ozark region to the Arkoma Basin. A passive, continental margin existed in the area of the Facility between the Cambrian through Mississippian, and rocks deposited during that time represent shallow continental shelf sediments, mostly limestones and dolomites with some terrestrial clastic sediments derived from the Ozark region to the north. By Pennsylvanian time, a northward-advancing continental terrain to the south created a convergent plate margin, and the region was warped, creating a foreland basin above the stable continental craton. Sandstones, siltstones, and shales accumulated in fluvial, delta, and tidal flat systems that prograded southwestward from sources to the north and the northeast (the Ozark region).

Geological formations regionally dip southwest to southeast, at dips of less than 20°, and commonly at only one or four degrees. The most prominent structural feature in the immediate area of the Facility is the Carlile School Fault (CSF), which trends northeast to southwest and is located approximately 5,000 feet southeast of the MPB (See Figure 4). The CSF is a nearly vertical normal fault, downdropped to the south. The fault is less than one mile in length, and has a displacement of less than 100 feet. The plane of the fault is not exposed, but it is revealed as a series of low, hummocky, parallel erosional ridges, consisting of nearly vertical beds of sandstone. The fault lies hydrologically upgradient and geologically up-dip from the Process Area. There is no surface evidence that the CSF connects with any other faults. The Marble City Fault, located approximately 2.5 miles south of the MPB (See Figure 4), is in the area of the Mulberry Fault, one of the primary structural features identified by the Oklahoma Geological Survey. Both structures were developed in early Pennsylvanian time, and are not considered to be capable faults. The most recent documented subsurface movement in the region has occurred within the last 2,000 years along the Meers Fault System in southwest Oklahoma. This fault system is consistent with measured seismic events, and is approximately 200 miles from the Facility. Measured seismic activity is concentrated in south-central Oklahoma corresponding with the Meers Fault System and the central Oklahoma Fault Zone, over 150 miles from the Facility. The most significant recent regional tectonic movement occurred in the New Madrid area of Missouri, during the first half of the 19th century. Based on general seismicity information, the Facility is within a region of low seismicity, classified as a Zone 1 area by COE.

3.2.2 Site Physiography and Geology

The Facility is situated on gently rolling to level land, bounded on the west by the Arkansas and Illinois Rivers and to the north by the Salt Branch. Elevations on or near the Facility range from 460 feet amsl at the Illinois River to about 585 feet amsl near the northeast corner of the property (See Figure 5). The Process Area is situated on a broad, local topographic high that extends eastward from the Process Area and has elevations of greater than 540 feet. The land surface drops steeply to the north, west, and southwest of the Process Area. Slopes on upland areas are generally less than about seven percent. The steeper slopes in the creek ravines and on hillsides surrounding the Industrial Area average about 28 percent. Several small, intermittent streams that flow outward from the Process Area bisect the property. Most of the streams that flow westward from the Industrial Area are relatively short and incise deep ravines before reaching the Robert S. Kerr Reservoir. Streams that trend southward from the Facility tend to form relatively shallow channels before turning westward towards the Robert S. Kerr Reservoir. Relatively low-lying and level land occurs south and west of the Fertilizer Pond Area.

The bedrock immediately underlying the site includes the sandstones, siltstones, and shales of the Pennsylvanian-age Atoka Formation (See Figure 2). The Pennsylvanian-age Wapanuka Limestone underlies the Atoka Formation. The Atoka Formation is overlain by Quaternary-age unconsolidated sediments, including terrace deposits, which occur primarily in the Process Area, colluvium on the slopes extending outward from the Process Area, and alluvial deposits adjacent to the Arkansas River. Soils are ubiquitous throughout the site, consisting mostly of loams and silty loams up to about six feet thick. Man-made fill material is present in various areas, mostly in the Process Area and as surface impoundment material south of the Process Area.

Soils

Soils on the site consist mostly of loams and silty loams. Soil thicknesses range from zero to approximately six feet, and are commonly about one to two feet. A detailed description of Facility soils is given in the Final RFI. The soils consist mostly of clay and silt, and are similar lithologically to underlying terrace, alluvium, or colluvium deposits. Because of this similar lithology, the hydrologic properties of the soils are believed to be similar to the underlying terrace, alluvium, or colluvium deposits, and the soils were not differentiated from the underlying deposits.

Fill Material

Small amounts of fill material are found in various locations on the Facility. Fill material within the Process Area is found within buried utility lines, and as a sub-base to concrete floors, concrete and asphalt roads, and concrete storage pads. The fill material within buried trenches ranges from 0 to 20 feet thick, and consists mostly of silty sand and silty gravel, overlain by silty clays and/or weathered shale fill. Fill material beneath concrete floors, concrete pads, and roadways have a maximum thickness of about 1.5 feet, and consists mostly of silty sand, sandy clay, sandy gravel, silty clays, and weathered shale. Fill material is also found in surface impoundment dikes throughout the property. Impoundment dikes reach a thickness of up to 20 feet and consist mostly of clayey silts with minor amounts of gravel in some impoundments. The fill material consists mostly of clay and silt, and is similar lithologically to underlying terrace, alluvium, or colluvium deposits.

Terrace Deposits

Unconsolidated deposits overlying Unit 1 Shale are identified as terrace deposits. Quaternary-age terrace deposits consist mostly of clay and silts, with lesser amounts of sandy silts, silty clays, gravelly silty clays, gravelly sandy clays, gravelly clays, and silty sandy clays. Terrace deposits are remnants of alluvial deposition during Pleistocene high water stages of the Illinois and Arkansas Rivers. Subsequent downcutting of these river systems has left these deposits high above present day river valleys. Terrace deposits range from 0 to 16.5 feet thick, averaging about 8 feet thick throughout the Process Area. Terrace deposits are relatively thicker just to the southwest of the MPB, but thin rapidly to less than 2 feet north of the MPB. Terrace deposits exceed 10 feet in thickness in the north-central part of the Process Area, including the Sanitary Lagoon, Emergency Basin, North Ditch, the Interim Storage Cell, and the DUF4 Building. Terrace deposits also exceed 10 feet in thickness in the area of the Sub-Station and extending eastward from the

Process Area.

Alluvium

Fluvial deposits associated with recent (Holocene) activity of the Illinois and Arkansas Rivers are identified as alluvium. Alluvium is found primarily in the southwest portions of the site, adjacent to the Illinois/Arkansas River. Alluvium consists mostly of silt, silty clay, and sandy gravel, with lesser amounts of silty sand and gravel. Alluvium thickness ranges from 0 feet to greater than 35 feet thick, with the greatest thickness found near the westernmost extent of the site boundaries. The alluvium ranges from about 15 to about 25 feet thick in the Agland area west and southwest of the Fertilizer Pond Area.

Colluvium

Colluvium deposits include all unconsolidated sediment in the site not identified as either terrace or alluvium deposits. These deposits include, but are not limited to, fluvial deposits along smaller streams and outflows, subaerial sediment gravity flows and mass waste deposits, found mostly on the slopes surrounding the Process Area and in outfall drainages, and in-situ deposits formed by breakdown of older rocks by weathering and erosion. Colluvium typically consists of silts, clays, and/or sands with varying amounts of gravel. Colluvium thickness ranges from 0 to over 20 feet; most colluvium deposits are less than 6 feet thick. The colluvium deposits with the maximum thickness are found in stream drainages south of the Fertilizer Pond Area. Colluvium deposits found on the slopes adjacent to the Industrial Area tend to be fairly thin, and are generally less than 3 feet thick.

Atoka Formation

The geologic units that directly underlie the Facility are a series of alternating shale and sandstone units of the Atoka Formation. Locally, the near surface members of the Atoka Formation have been named, in order of descending stratigraphic position, Unit 1 Shale, Unit 1 Sandstone, Unit 2 Shale, Unit 2 Sandstone, Unit 3 Shale, Unit 3 Sandstone, Unit 4 Shale, Unit 4 Sandstone, and Unit 5 Shale. Data from injection monitor well, 2331, located just east of Clarifier A, indicates a series of alternating shales, sandstones, and siltstones to approximately 390 feet bgs. The Spiro Sandstone is the basal member of the Atoka Formation, and locally occurs from about 300 to 390 feet bgs and is a salt-water bearing unit. The base of the Atoka Formation lies unconformably on the Wapanucka limestone (See Figure 3). The nearest surface exposure of the Wapanucka limestone occurs approximately 10 miles northeast of the facility.

The Unit 1 Shale is grayish black to dark grayish brown, soft, fissile, typically silty and sandy near contact with underlying sandstone. Typically Unit 1 Shale is highly weathered, weathering to a brownish or reddish yellow clay or silty clay with remnants of laminated, gray shale. XRD analysis shows Unit 1 Shale consists of quartz, chlorite, interstratified chlorite-smectite, and illite. Unit 1 Shale is laterally continuous under much of the central and eastern portion of the Industrial Area, and extends eastward from the Industrial Area. Unit 1 Shale attains a maximum thickness of approximately 14 feet in the northeast corner of the Yellowcake Storage Area. Unit 1 Shale exceeds 10 feet thick in most of the Yellowcake Storage Area, centered on and northeast of the MPB, and in a small area east of the south guardhouse. An outlier, up to 15.5 feet thick, of Unit 1 Shale is found near the northern end of the Facility. This outlier and two other thin outliers in the Fertilizer Pond Area are clearly isolated from the main body of Unit 1 Shale residing in the Industrial Area.

The Unit 1 Sandstone is a quartz arenite, consisting of greater than 90 percent very fine to medium grained, subrounded to rounded quartz, with occasional minor silt and gravel. Unit 1 Sandstone is typically pale brown to dark gray, hard to very hard, and is highly cemented with calcite, iron oxide, and/or silica cement. Near contact with underlying Unit 2 Shale, Unit 1 Sandstone commonly becomes silty, poorly cemented, and soft. The Unit 1 Sandstone ranges from very slightly to highly fractured, with the most intensely fractured sandstone containing closely spaced (<2 cm spacing) wide (0.5-1mm) fractures. Fractures are unfilled or calcite filled. Unit 1 Sandstone underlies most of the Industrial Area, extends eastward from the Industrial Area, and is found as an isolated outlier under the Fertilizer

Pond Area. Unit 1 Sandstone is thickest in the SX Building area. Unit 1 Sandstone exceeds four feet in thickness in an area centered on the SX Building and extending southeastward to the south guardhouse, and in another small area centered on the northeast corner of Pond 2. Typically Unit 1 Sandstone is between 2 and 3 feet thick, and thins rapidly at its outer edges.

Unit 2 Shale is dark gray to grayish black, soft, fissile, and commonly silty or sandy, with occasional, thin sandstone lenses. Unit 2 Shale is highly weathered, weathering to a yellow brown or brownish gray clay or silty clay with remnants of laminated, gray shale. The clay tends to be very soft, plastic, and moist. XRD analysis shows that Unit 2 Shale consists of quartz, chlorite, and illite. Unit 2 Shale is laterally continuous under most of the Industrial Area, extending westward to the Facility boundary, south to the Fertilizer Pond Area, and east and southeast of Highway 10. Unit 2 Shale is partially bisected by the 001, 005, and 007 streams. Unit 2 Shale is commonly between 4 and 6 feet thick, with a maximum thickness east of the Industrial Area. Unit 2 Shale exceeds 8 feet in thickness in an area along the northernmost part of the site, and in a small area in the northeast portion of the Fertilizer Pond Area. Unit 2 Shale is generally thinner than 3 feet in the easternmost portions of the Industrial Area.

Unit 2 Sandstone is a quartz arenite, consisting of greater than 90 percent very fine to fine grained, subrounded to rounded quartz, with little to no silt or gravel. Unit 2 Sandstone is typically brownish gray to very dark gray, moderately hard to very hard, and is highly cemented, mostly with silica cement. Unit 2 Sandstone becomes shaley near the contact with the underlying Unit 3 Shale. Unit 2 Sandstone ranges from slightly to highly fractured, with the most intensely fractured sandstone containing closely spaced (<2 cm spacing) wide (0.5-1mm) fractures. Fractures are unfilled or filled with clay or calcite. Like Unit 2 Shale, Unit 2 Sandstone is laterally continuous under most of the Industrial Area, extending westward to the Facility boundary, south to the Fertilizer Pond Area, and east and southeast of Highway 10. Unit 2 Sandstone is partially bisected by the 001, 005; and 007 streams and is generally thickest along the eastern boundary of the Facility. The thickness exceeds 10 feet near Fertilizer Pond 4 (maximum thickness of 14 feet), south of the

Decorative Pond, south of the DUF4 building, and just north of the northeast corner of the Industrial Area. Unit 2 Sandstone is over 6 feet thick in large areas near the Fertilizer Pond Area, south and southeast of the Decorative Pond, and in the northern portions of the Industrial Area. Unit 2 Sandstone is generally less than 4 feet thick west and southwest of the SX Building, and on site east of the Facility boundary.

Unit 3 Shale is dark gray to grayish black, soft, fissile, and commonly silty or sandy, with occasional, thin sandstone lenses. Unit 3 Shale weathers to a yellow brown or olive brown clay or silty clay with remnants of laminated, gray shale. The clay tends to be very soft, plastic, and wet. XRD analysis shows that Unit 3 Shale consists of quartz, chlorite, and illite. Unit 3 Shale is laterally discontinuous within its aereal limits, commonly grading laterally to a shaley sandstone before pinching out entirely in some locations. Unit 3 Shale extends westward to the Facility boundary, south to the Fertilizer Pond Area, and east and southeast of Highway 10. Unit 3 Shale is partially bisected by the 001, 005, and 007 streams, is commonly between 2 and 4 feet thick, and is thickest south of the DUF4 building (maximum 18.5 feet thick). Unit 3 Shale exceeds 6 feet thick in only two other locations, an area west and southwest of Pond 2, and in the Yellowcake Storage Area. Unit 3 Shale pinches out and is completely missing in a large area extending southward from the southeast corner of the Industrial Area, and in smaller areas centered on the Fluoride Clarifier, the Emergency Basin, the northwest corner of Pond 2, and Pond 6.

Unit 3 Sandstone is a quartz arenite, consisting of greater than 90 percent very fine subrounded to rounded quartz, with little to no silt or gravel. Unit 3 Sandstone is typically gray to very dark gray, moderately hard to very hard, and is highly cemented, mostly with silica cement. Unit 3 Sandstone is generally massive with occasional, very tight fractures, commonly calcite cemented. Unit 3 Sandstone commonly becomes shaley near the contact with the underlying Unit 4 Shale. Unit 3 Sandstone is laterally continuous under most of site, except for the southwest and southernmost portions of the property, where it is not found. Unit 3 Sandstone is slightly bisected by the 005 and 007 streams, and is bisected by the 001 Stream under the storm water reservoir (See Figure 6). Unit 3 Sandstone is commonly between about 4 and 8 feet thick, and is thickest in the central and eastern portions of the Industrial Area, where it exceeds 10 feet. Maximum thickness (15.6 feet) of Unit 3 Sandstone is found near the northeast corner of the Administration Building. Unit 3 Sandstone also exceeds 10 feet thick southwest of the Pond 2 and in the easternmost portions of the site.

Unit 4 Shale is dark gray to black, soft to very soft, and very thinly laminated to fissile. Unit 4 Shale weathers to a yellow brown to light brown silty clay with remnants of laminated, gray shale. Unit 4 Shale commonly becomes hard, brittle, and sandy near its base. Thin intervals of very hard, pyritized Unit 4 Shale are found at widely scattered locations, mostly east of the Industrial Area and south of the Fertilizer Pond Area. XRD analysis shows Unit 4 Shale consists of quartz, chlorite, and illite. Unit 4 Shale is laterally continuous throughout most of the site, and ranges from 0 feet thick at the southwest corner of the property, to almost 40 feet thick under the hill at the southernmost Facility boundary. Under most of the Industrial Area Unit 4 Shale is between 16 and 18 feet thick, and is between 13 and 19 feet thick under most of the Fertilizer Pond Area. Unit 4 Shale exceeds 20 feet thick in the following areas, in the southernmost Pond 2, the Agland area, the northwest corner of the property, and in the southernmost portions of the property.

Unit 4 Sandstone is a quartz arenite, consisting of greater than 90 percent very fine, subrounded to rounded quartz, with little to no silt or gravel. Unit 4 Sandstone is typically light gray to dark gray, hard to very hard and dense. Unit 4 Sandstone is slightly to moderately fractured, and most commonly contains widely to very widely spaced, thin, calcite filled fractures. Unit 4 Sandstone is laterally continuous under most of site, and is commonly between about 8 and 14 feet thick. Unit 4 Sandstone is thickest (about 18 feet thick) along the Illinois River just south of the 005 Stream, and is less than 8 feet thick north of the Fluoride Holding Basin No. 2, and at the southwestern portion of the property.
Unit 5 Shale is dark gray to grayish black, soft, and fissile. Unit 5 Shale is laterally continuous under the site. Ten boreholes have penetrated Unit 5 Shale, and based on this limited lithological data, the thickness of Unit 5 Shale exceeds 22 feet under the entire Facility.

3.2.3 Regional Hydrogeology

Regional groundwater flow in the area of the Facility is generally westward towards the Illinois or Arkansas Rivers. Groundwater in the region occurs principally in alluvium along the Arkansas and Illinois rivers and some terrace deposits along the Arkansas River. Water quality in alluvium and terrace deposits is generally good to excellent, but most of the water samples are hard to very hard (median hardness 255 parts per million [ppm]), making the water suitable for irrigation. The only major bedrock hydrological unit near the Facility occurs approximately 10 miles northeast of the Facility in the Mississippian-age Keokuk and Reed Springs formations (See Figure 7 and 7a). This hydrological unit is considered to be moderately favorable for groundwater supplies, yielding as much as 20 gpm, locally more. The Akota Formation produces limited quantities of groundwater. Most wells in the Akota Formation yield only a fraction of a gallon per minute to a few gallons per minute. Water quality is generally considered poor to fair, with 57 percent of the wells tested containing more than 250 ppm sulfate, 10 percent contained more than 250 ppm chloride, and 53 percent contained more than 500 ppm total dissolved solids.

4 Groundwater Quality

This section describes the current groundwater conditions at the Facility. Information contained in the 2002 Annual Groundwater Report has been used to describe the current conditions at the Facility.

Groundwater investigations conducted since 1990 have resulted in a comprehensive groundwater monitoring system at the Facility. A map of the site showing locations of monitoring wells in relation to major surface structures is presented in Figure 8. The monitoring wells are normally found in clusters at each location. Each well in the cluster is completed at different depths to monitor separate groundwater systems. Wells monitoring the Terrace Groundwater System (Terrace and Shale 1 Units) are identified as "MWXXX" (MW072). Well identifications which end with an "A"(MW072A), monitor the Shallow Bedrock Groundwater System (Shale 2 through Shale 4 Units) and well identifications ending with a "B" (MW072B) designation monitor the Deep Bedrock Groundwater System (Shale 5). The exception to this system of designation is the pre-FEI wells that were incorporated into the groundwater monitoring network. The pre-FEI wells have four digit numerical identifications (there are no "MW" prefixes) and the A and B designations do not indicate the zone being monitored (i.e. 2301A and 2301B). The groundwater monitoring zone for those wells can be determined by their grouping in Table 1.

Routine groundwater sampling normally occurs in April and October of each year. Table 1 provides a list of wells and selected parameters for each event. The "Annual" sampling event is typically conducted during April if each year. The "Semi-Annual" sampling event is typically conducted during October of each year. Eleven new wells were installed by SMI during 2001 and were sampled during April 2002. Samples were collected by SFC employees using procedures and protocols defined in the SFC RFI Workplan. Laboratory analyses were conducted by Outreach Laboratory (EPA Lab Number OK00922 and ODEQ ID Number 9517) located in Broken Arrow, Oklahoma.

4.1 Constituents of Concern

The list of parameters to be monitored under the Groundwater Monitoring Plan has been based on the guidance contained in 10 CFR Part 40, Appendix A, Criterion 5B(2). A constituent is included if the constituent is reasonably expected to be in or derived from the byproduct material at the Facility, has been detected in the groundwater and is listed in Part 40, Appendix A, Criterion 13.

SFC personnel familiar with the process reviewed the parameters listed in Appendix A, Criterion 13 and identified those constituents reasonably expected to be present in materials processed at the Facility. This list included antimony, arsenic, barium, beryllium, cadmium, chromium, fluoride, lead, mercury, molybdenum, nickel, nitrate, radium-226, selenium, silver, thallium, thorium-230, uranium, trchloroethane, trichlorofluoromethane, and PCB's. Mercury, silver, trichloroethane, trichlorofluoromethane and PCB's have been eliminated from the list of constituents to be included in the plan because they have not been detected in groundwater in significant concentrations.

SFC has identified antimony, arsenic, barium, beryllium, cadmium, chromium, fluoride, lead, molybdenum, nickel, nitrate, radium-226, selenium, thallium, thorium-230 and uranium as constituents of concern.

4.2 Impacted Areas and Extent of Impact

Groundwater flow has remained fairly consistent since 1990. Groundwater flow at the Facility is described as generally westward with some northwesterly and southwesterly movement. This generalization is true for all the groundwater zones currently being monitored. The major constituents of concern at the Facility have been established as arsenic, uranium, nitrate (as N), and fluoride. The routine monitoring program data for 1991 through 2002 are presented in Table 2. Figures have been developed for those wells sampled for each parameter listed above and are provided for monitoring year 2002. Each well has been color coded according to the concentration of each constituent present in the well. Where two or more samples were collected for an individual well during 2002 the average concentration was used. Analyses are updated each year and reported to regulatory agencies in an Annual Groundwater Report. The most recent Annual Groundwater Report should be reviewed for current data.

4.2.1 Arsenic

Arsenic has been part of the routine monitoring program for select wells since being identified in Facility groundwater during the FEI. Total arsenic continues to be detected above the maximum contaminant level (MCL) of 0.05 mg/l in both the Terrace Groundwater System and the Shallow Bedrock Groundwater System. Arsenic was not detected above the MCL in the Deep Bedrock Groundwater System.

The arsenic levels found in the terrace groundwater varied from <0.009 mg/l to 1.28 mg/l. The high of 1.28 mg/l occurred in MW075 located south of the incinerator. This is an overall decrease over previous years where arsenic concentrations reached a high of 7.7 mg/l in MW042 in 1993. The arsenic concentration in MW042 was 0.301 mg/l in 2002. Terrace groundwater monitoring wells with arsenic values in 2002 above the MCL were MW017, MW032, MW040, MW042, MW054, MW058, MW065, and MW075. Arsenic impacts to the terrace groundwater are present north of the Main Process Building (MPB), north of the Clarifier Basins, south of the Fluoride Settling Basins and north of the Emergency Basin. The Terrace Groundwater System wells sampled for arsenic in 2002 are shown on Figure 9.

The total arsenic found in the shallow bedrock groundwater system varied from <0.009 mg/l to 3.87 mg/l. The high of 3.87 mg/l occurred in MW064A located east of Fluoride Sludge Basin No. 1 South. Shallow bedrock groundwater monitoring wells with arsenic values in 2002 above the MCL were MW031A, MW032A, MW042A, MW046A, MW051A, MW057A, MW058A, MW059A, MW060A, MW061A, MW064A, MW065A, MW082A, MW087A, MW095A, MW102A and MW103A. The arsenic analysis for the sample collected in 2001 from MW061A was less than 0.05 mg/l but was not consistent with historical data for this location. The sample analysis obtained during 2002 from MW061A was 1.96 mg/l and is consistent with historical data.. Arsenic impacts to the shallow bedrock groundwater are present south of the MPB, southwest corner of Pond 2, the Fluoride Holding Basin No. 1 area and north of the Emergency Basin. The Shallow Groundwater System wells sampled for arsenic in 2002 are shown on Figure 10.

4.2.2 Uranium

Uranium has been a common parameter monitored in groundwater at SFC for many years. Uranium impacts continue to be centered near the MPB and the Solvent Extraction Building (SX Building). Automated recovery systems continue to influence groundwater movement and act to limit the movement of the plumes away from their present locations.

Total uranium continues to be detected above the MCL of 30 μg/l in the Terrace Groundwater System and the Shallow Bedrock Groundwater System. Uranium has not been detected above the MCL in the Deep Bedrock Groundwater System.

The total uranium found in the Terrace Groundwater System varied from <1.0 μg/l in several wells to 95,000 μg/l. The high of 95,000 μg/l occurred in well MW025 located north of the SX Building. Monitor well MW025 has decreased from 1997, however the heavy influence of groundwater recovery efforts nearby continues to influence this well. One well with uranium levels above the MCL outside the Process Area boundary is MW010, located at the southwest corner of the MPB. A recovery well has also been operating in this area since 1991. Terrace wells that exceeded the MCL for uranium were MW010, MW012, MW014, MW018, MW025, MW055, MW078 and MW087. Uranium impacts continue to be monitored in groundwater southwest, west and northwest of the MPB, north and west of the SX Building, north and west of the Emergency Basin, in the Clarifier Basins area and the Solid Waste Burial Areas. The Terrace Groundwater System wells sampled for uranium in 2002 are shown on Figure 11.

The total uranium concentrations found in the shallow bedrock groundwater varied from

<1.0 µg/l in several wells to 3,710 µg/l. The high of 3,710 µg/l occurred in MW012A located at the northwest corner of the MPB. Shallow bedrock wells where uranium in groundwater exceeded the MCL were 2301B, MW012A, MW014A, MW025A, MW050A, MW067A, MW076A, MW081A and MW087A. Uranium impacts continue to be monitored in groundwater at the northwest corner of the MPB, north of the SX Building, northwest of the Emergency Basin, east of the Solid Waste Burial Area No.2, the Clarifier Basins area, and north of Fluoride Holding Basin No.2. The Shallow Bedrock Groundwater System wells sampled for uranium in 2002 are shown on Figure 12.

4.2.3 Nitrates

Nitrate has also been a common parameter monitored early on in groundwater at SFC. Nitrate continues to be detected above the MCL of 10 mg/l in the Terrace Groundwater System and the Shallow Bedrock Groundwater System. Nitrate was detected above the MCL at MW012B (11.1 mg/l) in the Deep Bedrock Groundwater System in 2002.

The nitrate levels found in the Terrace Groundwater System varied from 0.5 mg/l to 820 mg/l. The high of 820 mg/l occurred in well MW025 located north of the SX Building. Terrace wells with nitrate levels above the MCL were 2302A, MW008, MW012, MW014, MW015, MW024, MW025, MW035, MW036, MW040, MW045, MW054, MW066, MW103, MW107 MW108 and MW120. The nitrate impacts to the terrace groundwater are mostly found around the MPB, Clarifier Basins and Pond 2 area. The Terrace Groundwater System wells sampled for nitrate (as N) in 2002 are shown on Figure 13.

The nitrate levels found in the Shallow Bedrock Groundwater System varied from < 0.2 mg/l to 8,230 mg/l. The high of 8,230 mg/l occurred in well MW057A located at the southwest corner of Pond 2. Shallow bedrock wells with nitrate values in 2002 above the MCL were 2301B, 2302B, 2303A, 2322A, 2340A, 2341, 2342, 2443, 2344, 2346, 2348, 2349, 2351, 2352, 2353, 2354, 2355, 2356, MW012A, MW013A, MW014A, MW024A, MW025A, MW035A, MW036A, MW039A, MW040A, MW041A, MW042A, MW046A, MW047A, MW049A, MW050A, MW051A, MW052A, MW053A, MW057A, MW058A, MW059A,

MW065A, MW066A, MW075A, MW076A, MW082A, MW093A, MW095A, MW102A, and MW116A. The nitrate impact to shallow bedrock groundwater continues to occur adjacent to and west of Pond 2, west of the Pond 1 Spoils Pile, in the SX Building area, west of the MPB, the North Ditch and Emergency Basin area, the Fertilizer Pond Area and the Agland Fertilizer Application Area. The Shallow Bedrock Groundwater System wells sampled for nitrate (as N) in 2002 are shown on Figure 14.

4.2.4 Fluorides

Fluoride has been a common parameter monitored early on in groundwater at SFC. Although fluoride concentrations for the most part have decreased since 1991, fluoride continues to be detected above the MCL of 4.0 mg/l in the Terrace Groundwater System and the Shallow Bedrock Groundwater System. Fluoride has not been detected above the MCL in the Deep Bedrock Groundwater System.

The fluoride levels in the terrace groundwater varied from <0.2 mg/l in numerous wells to 8.1 mg/l. The high of 8.1 mg/l occurred in MW014 located north of the MPB. Terrace wells in which the fluoride level was above the MCL were MW014, MW040 and MW063. The fluoride impacts to the terrace groundwater are north of the MPB, north of the clarifier basins and south of the old lime neutralization area. The Terrace Groundwater System wells sampled for fluoride in 2002 are shown on Figure 15.

The fluoride found in the Shallow Bedrock Groundwater varied from < 0.2 mg/l to 7.7 mg/l. The high of 7.7 mg/l occurred in well MW064A located east of Fluoride Sludge Holding Basin #1. Shallow bedrock wells in which the fluoride level was above the MCL were MW057A, MW061A and MW064A. The fluoride impacts to the shallow bedrock groundwater are at the southwest corner of Pond 2, east of Fluoride Holding Basin No.I and west of Fluoride Holding Basin No. 1. The Shallow Bedrock Groundwater System wells sampled for fluoride in 2002 are shown on Figure 16.

5 Groundwater Monitoring System

5.1 Proposed Monitoring System

This groundwater monitoring plan is based on the extensive amount of groundwater monitoring data that has been collected at the Facility since 1990 from over 200 monitoring wells.

Hydrogeological units at the Facility have been developed based on a three-dimensional hydrostratigraphic model of the shallow geology and surrounding watershed. This model is described in detail in the HGSCR. The hydrogeological units are defined as Terrace, Colluvium, Alluvium, Unit 1 Shale, Unit 2 Shale, Unit 3 Shale, Unit 4 Shale and Unit 5 Shale. The presence of the bedrock units is strongly dependent upon surface topography. The stratigraphically higher units (Unit 1 Shale through Unit 3 Sandstone) are only found in areas of relatively high elevation, such as in the vicinity of the Process Area. In the lower lying portions of the Facility, such as the Agland and the bottoms of drainages adjacent to the Robert S. Kerr Reservoir, the stratigraphically higher units have been eroded away, leaving stratigraphically low units (Unit 4 Shale through Unit 5 Shale) as the uppermost bedrock units.

The Terrace and Unit 1 Shale groundwater are hydrologically connected over most of the Facility, where Unit 1 Shale exists. The other units are considered to be partially confined by the interceding sandstone units and are not fully hydraulically connected. Units have been partially hydraulically connected by geological investigation borings or monitoring wells that have been completed in multiple units. In addition, groundwater from various units may become co-mingled on the western portion of the site where water exits the erosional faces of each unit.

In general, the stratigraphically higher units, Unit 1 Shale, Unit 1 Sandstone, Unit 2 Shale, Unit 2 Sandstone, Unit 3 Shale and Unit 3 Sandstone, are relatively thin and are not laterally extensive across the Facility. Unit 1 Shale, where present, is typically about six feet thick, however near the Emergency Basin and the Yellowcake Storage Pad Unit 1 Shale is greater than 10 feet thick. The stratigraphic units from Unit 1 Sandstone downward through Unit 3 Sandstone are each generally less than three feet thick. The Unit 3 Shale frequently pinches out entirely, and the other stratigraphically upper units commonly thin to less than one foot thick. In contrast, the deeper units, Unit 4 Shale, Unit 4 Sandstone, and Unit 5 Shale, are laterally extensive across the Facility domain, and typically have thicknesses greater than 10 feet.

The primary source for technical information used to design this groundwater monitoring plan has been the HGSCR. The HGSCR includes the identification of those wells that have been completed in a single groundwater unit. Many of the current groundwater monitoring wells at the Facility are completed over more that one groundwater unit.

Another source of information used for preparation of this groundwater monitoring plan is a report prepared by Titan Environmental Corporation titled "Groundwater Monitoring Program" dated June 1996. The Titan report, included as Appendix A to this Plan, presented a recommended groundwater monitoring program for SFC including updating the total number of monitoring wells, refining the constituents to be analyzed at each well, sampling frequency and installing wells in locations warranting additional monitoring.

Sequoyah Fuels Corporation environmental database includes well completion information for the monitoring wells and notes the unit or units within which the wells are completed. Annual groundwater reports prepared by SFC have also been utilized for information regarding groundwater analyses and impacted areas.

The reports and information described above have been used to determine which groundwater monitoring wells are completed in a single water bearing unit. These wells were considered as potential monitoring wells that could be utilized for this new groundwater monitoring plan. Wells that are completed across multiple groundwater units will be used on a limited basis. Table 3 summarizes the results of this evaluation. A "Y" for yes in the fourth column, labeled "Use for Eval," indicates that a well may be utilized.

The fifth column labeled "Unit Assigned" indicates which unit a well is completed in. The sixth column indicates where the Titan Environmental groundwater monitoring program evaluation report issued in June 1996 recommended that a well be eliminated from the sampling program. A "Y" for yes indicated that Titan recommended that the well be eliminated. The seventh column indicates if the monitor well is currently required to be monitored and which agency (NRC or EPA) requires the monitoring. In many instances both the NRC and EPA require that a well be monitored. Columns eight through ten summarize the results of various efforts conducted to assign wells to groundwater units. The information presented in Table 3 was utilized to identify which wells would be selected for this Groundwater Monitoring Plan.

To aid in the selection of monitoring well locations a figure has been prepared for each groundwater unit that includes the wells that can be utilized in that unit and the contaminants present in the unit. Colored lines are used to represent areas that are impacted with the indicated contaminants. Figures 17 through 21 are monitoring well locations for wells completed in the Terrace/Shale 1, Shale 2, Shale 3, Shale 4 and Shale 5 units, respectively. The location of the waste containment cell is also shown on each figure.

5.1.1 Background Groundwater Quality

Six monitoring wells (MW007, MW070, MW073, MW007A, MW110A and MW007B) have been selected up gradient from the Facility to obtain information regarding background groundwater quality. These wells were selected from the Terrace/Shale 1, Shale 3, Shale 4 and Shale 5 units. Historical results for the six proposed background monitoring wells is provided in Table 2. Table 4 includes a listing of the monitoring locations, groundwater units monitored, sampling frequencies and parameters to be analyzed.

An evaluation of data collected at background groundwater monitoring wells located up gradient of the Facility is included as Appendix B. This evaluation establishes a framework by which statistical evaluations of the background monitoring data will be completed at the

Sequoyah Facility.

5.1.2 Compliance Monitoring

As part of the HGSCR arsenic, natural uranium, nitrate and fluoride were identified as the constituents of concern at the Facility. The current distributions of these constituents of concern were estimated for each groundwater unit using data collected during April, June and August 2001 as part of the geochemical study described in the HGSCR. Isopleth contour maps showing the distribution of these constituents of concern were also provided in the HGSCR.

To aid in the selection of the locations for wells needed to monitor groundwater contamination the isopleth contours for each constituent of concern identified in the HGSCR has been shown on a figure for each groundwater unit (See Figures 17 - 21). If an existing well is present in an area where sampling is indicated this well will be utilized. Otherwise, a new well will be installed.

Terrace / Shale 1

Twenty-one wells have been selected to monitor groundwater conditions in the Terrace / Shale 1 unit. Fourteen of these are located in areas that are either under the footprint of the proposed cell or in areas where soil will be removed as part of the cleanup effort. SFC will monitor these wells until the soil cleanup and cell construction requires them to be abandoned. Seven wells will be maintained for long term monitoring. Table 4 lists the wells to be used to monitor each groundwater unit, the frequency for sampling the wells and the parameters to be analyzed.

Figure 17 shows the location of monitoring wells that will be used to monitor the Terrace / Shale 1 unit. Note that different symbols have been used on Figure 17 to indicate if a well will be used for short term or long term monitoring. This labeling convention is also used on Figures 18 - 21, monitor well locations for Shale 2 through Shale 5.

Shale 2

Eleven wells have been selected to monitor groundwater conditions in the Shale 2 unit. Five of these wells will be used on a short term basis until soil cleanup and cell construction requires them to be abandoned. Six wells will be used for long term monitoring. One of the six long term wells (MW121A) is a new well that will be installed as soon as the Groundwater Monitoring Plan is approved. Figure 18 shows the location of monitoring wells that will be used to monitor the Shale 2 unit.

Shale 3

Fourteen wells have been selected to monitor groundwater conditions in the Shale 3 unit. Five of these wells will be used on a short term basis until soil cleanup and cell construction requires them to be abandoned. Nine wells will be used for long term monitoring. Five of the nine long term wells (MW122A, MW123A, MW124A, MW127A, and MW130A) are new wells that will be installed as soon as the Groundwater Monitoring Plan is approved. Figure 19 shows the location of monitoring wells that will be used to monitor the Shale 3 unit.

Shale 4

Eleven wells have been selected to monitor groundwater conditions in the Shale 4 unit. All eleven wells will be used for long term monitoring. Three of the eleven long term wells (MW125A, MW126A and MW129A) are new wells that will be installed as soon as the Groundwater Monitoring Plan is approved. Figure 20 shows the location of monitoring wells that will be used to monitor the Shale 4 unit.

Shale 5

Seven wells have been selected to monitor groundwater conditions in the Shale 5 unit. All seven wells will be used for long term monitoring. One of the seven long term wells

(MW128B) is a new well that will be installed as soon as the Groundwater Monitoring Plan is approved. Figure 21 shows the location of monitoring wells that will be used to monitor the Shale 5 unit.

5.1.3 Corrective Action Monitoring

SFC has installed three groundwater recovery trenches that will be monitored. These locations are 2224A (005 Collection Trench), 2247 (MW095A Collection Trench) and 2248 (MW010 Collection Trench). In addition, a short trench was installed in the bottom of the 005 Drainage down gradient of 2224A and is identified as 2224B (005 Monitor Trench). The locations of the collection trenches and the 005 Monitor Trench are shown on Figure 22. Table 4 includes a listing of the monitoring locations, groundwater units monitored, sampling frequencies and parameters to be analyzed.

5.1.4 Seep and Drainage Monitoring

SFC has identified six seep and drainage locations that are used to monitor seepage from Shale 4 and Shale 5. The locations are 2241 (005 Drainage about 25 feet east of the Corps of Engineers property boundary fence), 2242 (005 Drainage from a pool near MW100B), 2243 (007 Drainage north of Fluoride Holding Basin No. 2), 2244 (004 Drainage about 20 feet east of the Corps of Engineers property boundary fence), 2245 (seep north of Port Road Bridge and east of 001 Drainage) and 2246 (001 Drainage north of Port Road Bridge). The locations of the seep and drainage monitoring locations are shown on Figure 22. Table 4 includes a listing of the monitoring locations, groundwater units monitored, sampling frequencies and parameters to be analyzed.

5.1.5 Surface Water Monitoring

SFC has identified four locations that are used to monitor surface water in the Illinois River (Headwaters of Robert S. Kerr Reservoir) and Arkansas River. The locations are 2201 (Illinois River about 1600 feet upstream of 001 confluence), 2202 (Illinois River about 600 feet downstream of 001 confluence), 2203 (Arkansas River upstream towards the Highway 64 bridge) and 2204 (downstream near I-40 bridge). The locations of the surface water monitoring locations are shown on Figure 22. Table 4 includes a listing of the monitoring locations, sampling frequencies and parameters to be analyzed.

5.2 Monitoring Well Construction Criteria

The monitoring wells installed during and subsequent to the FEI utilized criteria that meet requirements as described herein for monitoring well construction. Monitoring wells selected for use in this Groundwater Monitoring Plan are known to meet these construction standards.

The installation of each monitoring well will be supervised by a qualified geologist. Drilling methods will be utilized that minimized subsequent sampling interferences including the use of either hollow-stem auger or air-rotary drilling methods. All drilling and sampling equipment will be cleaned prior to use in each boring. Sufficient formation samples will be taken during drilling to allow for adequate characterization of all geologic strata penetrated. Detailed geologic logs of all borings are recorded by a qualified geologist and subsequently retained in SFC files.

Monitoring wells will be constructed with a minimum 2-inch threaded PVC casing with factory-slot screen. Screen slot size will be selected to minimize the entry of particulates into the well, normally 0.010 inch slot-size screens were used. Screen intervals will be placed so as to monitor discrete zones of no more than 20 feet, and preferably of 10 feet or less. If the screen is placed at the water table, the screen will be positioned so the water table is within the screened zone with the screen extending sufficiently above the water table, found at the time of drilling, to accommodate any anticipated changes in water level. A clean, sand filter pack will be placed in the annular space surrounding the screen. The sand will be suitably graded to minimize the flow of particulates into the well and will not extend beyond two feet above the top of the screen itself. A 2-foot thick sodium bentonite seal will be placed above the top of the sand pack, and hydrated with distilled water. A bentonite/cement grout mix will be used to fill the remaining annular space. The grout will be placed using a tremie pipe unless the well is shallow enough to allow placement of grout by other means.

Wells that are installed in deeper groundwater systems will be constructed with conductor casing to prevent possible cross communication of deeper zones from soil or groundwater found in shallower units. A pre-cleaned, PVC surface conductor casing will be cemented in an oversized annulus space anywhere from six-inches to two-feet into the underlying bedrock by using a tremie line. After the conductor cement set up, usually 24-hours, the casing will be drilled out to the desired monitored strata. The deeper wells will be constructed of a pre-cleaned, threaded PVC casing with factory slotted screen.

After placement of the screen, filter pack, and bentonite seal, the remainder of the conductor casing will be sealed with volclay grout.

After completion, all wells will be developed in a manner which minimizes the flow of particulates into the well. Slug tests will be conducted after well development to determine the hydraulic properties of the well. Lockable above-grade or at-grade steel casing protectors will be placed over the PVC casing. Concrete surface seals which prevent the entry of surface water runoff will be set on each well. The wells will be surveyed by a Registered Surveyor for vertical elevation (within 0.01 foot) and horizontal location (within 1 foot).

Wells that currently exist at the Facility and will be utilized as part of this Groundwater Monitoring Plan have been installed in accordance with the above requirements.

5.3 Monitoring Schedule

Monitoring locations identified in Table 4 will be sampled at the frequencies and for the parameters indicated in the table. Background and compliance monitoring locations identified to be sampled at an annual frequency will typically be sampled during April.

Corrective action monitoring and seep and drainage monitoring locations identified to be sampled at a quarterly frequency will typically be sampled during January, April, July and October. Surface water monitoring to be sampled at an annual frequency will typically be sampled during June.

Sampling frequencies and parameters to be analyzed are included in Table 4. Wells not included in Table 4 will be plugged and abandoned after approval of the Groundwater Monitoring Plan is received. Table 5 lists all wells to be plugged and indicates which wells will be plugged immediately upon approval of this plan and which well will be plugged at a later date. Wells to be plugged at a later date will continue to be used to monitor groundwater conditions on a short term basis. These short term monitoring wells are under the footprint of the proposed location for the onsite waste disposal cell or are in areas where contaminated soil will be excavated. These wells will be plugged and abandoned prior to construction of the cell or removal of contaminated soil.

5.4 Sampling and Analytical Methods

Samples will be collected in accordance with approved written SFC procedures. These procedures are described in Section 6.0 of this Plan. Analytical methods used by the laboratory for each analysis completed will be included on results reports.

5.5 Proposed Groundwater Protection Standards

Proposed groundwater protection standards for the Facility are provided in Table 6. The cleanup goal listed in the right most column of Table 6 are the standards that SFC will utilize for groundwater monitoring. The cleanup goals were selected based on a review of the maximum values for groundwater protection from 10 CFR Part 40, Appendix A, Criterion 5C, EPA National Primary Drinking Water Standards (MCL) and site specific background concentrations. Analysis of leachate from several different samples of raffinate sludge are also included in Table 6 and represent what SFC believes to be the "worst case" material from leaching and potential impact of groundwater at the Facility.

SFC selected the maximum concentration from 10 CFR Part 40, Appendix A, Criterion 5C as the cleanup goal when a maximum concentration value is specified for a constituent. If a maximum concentration value was not specified the MCL was selected. If neither a maximum concentration value or MCL is specified, or the background concentration is greater than these, the 95% upper confidence level (UCL) for background is selected as the cleanup goal.

6 Quality Assurance and Control

6.1 Laboratory Quality Assurance

The purpose of the laboratory QA Plan is to assure that all information, data, and interpretations resulting from the analytical data are technically sound and provide accurate data. The following sections discuss sample handling, sample preservation, analytical procedures and chain of custody. All analyses will be performed by labs certified by the State of Oklahoma for the parameter of analysis and which also participate in EPA's laboratory quality control programs.

6.1.1 Field Quality Assurance Objectives and Procedures

Field duplicate samples will be collected and submitted to the analytical laboratory to assess the quality of the analytical data from the field sampling program. One (1) duplicate sample per day or one (1) duplicate sample per ten (10) samples will be collected and submitted for analysis of the same analytical parameters as the field samples.

6.1.2 Sample Handling

Samples shall be preserved in an appropriate container in accordance with the EPA publication "Test Methods for Evaluating Solid Waste" (EPA/SW-846), the RCRA Groundwater Monitoring Technical Enforcement Guidance Document (TEGD), or Standard Methods for the Examination of Water and Wastewater, 17th Edition.

6.2 Groundwater Sampling Quality Assurance

Groundwater samples will be collected in accordance with the Groundwater Sampling Plan included as Appendix C. This plan presents the procedures to be followed for groundwater monitoring well sampling, sample management and sample custody control.

6.3 Data Evaluation

Results and conclusions will require the review and assessment of the groundwater monitoring results. Anomalous and unanticipated results may be obtained from the program. Review and assessment activities must, therefore, be able to identify those anomalous occurrences and initiate the proper response to the monitoring results.

If SFC identifies statistically significant adverse changes in groundwater concentrations, other than changes that are clearly intended as a result of actions reflected in the Reclamation Plan or Groundwater Corrective Action Plan, and verifies the existence of these changes, SFC will increase the sampling frequency to monthly, notify the NRC within 60 days, and provide the NRC with an assessment of alternate actions.

6.3.1 Identification of Anomalous Values

If laboratory results are unexpectedly different, higher or lower, than previous sampling results, the data reviewer will verify the results with the laboratory, including a request that the sample be re-analyzed, if determined necessary. If the verification does not provide results in the expected range, the monitoring well will be resampled. The results of the resample will be assumed to be representative of the sampling location if resample results are found to be in the expected range.

7 Data Review and Reporting

7.1 Reporting Schedule

SFC will submit groundwater monitoring data to the Nuclear Regulatory Commission, Environmental Protection Agency and Oklahoma Department of Environmental Quality in an Annual Report. Copies will also be provided to other interested organizations, groups or individuals. The report shall be submitted by February 1st of each year.

7.2 Report Contents

The Annual Report will include all groundwater monitoring data generated during the previous calendar year for those monitoring locations described in this plan. An assessment of groundwater conditions during the reporting period will also be provided, along with supporting information used in the assessment.

7.2.1 Description of Current Conditions

A description of the groundwater conditions during the reporting period will be provided which focuses on changes since the previous reporting period. It will include discussions on rate and direction of groundwater flow, rate and extent of contaminant migration since the previous reporting period, program problems or deviations, new information which may be relevant for consideration in alteration of the program, and recommendations for changes to the monitoring program, if appropriate.

7.2.2 Data List

Tables of all groundwater monitoring locations and the monitoring data associated with each location shall be provided for the current reporting period and the previous reporting period. All monitoring data shall be listed in tables to allow for quick review. Quality control data shall also be reported to document the precision and accuracy of data.

8 Proposed Plugging and Abandonment

SFC has accumulated a very large amount of information regarding the groundwater conditions at the Facility. A review of groundwater quality, geological, and monitoring well completion records has been performed to evaluate the need for existing groundwater monitoring wells. The review is described in Section 5 of this plan. Existing wells that are not identified as being used as groundwater monitoring wells in this plan will be plugged and abandoned in accordance with the procedure outlined below.

8.1 Well Plugging Procedure

SFC will plug abandoned wells in accordance with the Project Plan for Plugging Abandoned Wells included as Appendix D.

8.2 Wells Identified for Plugging

Table 5 lists the wells to be plugged and indicates which wells will be plugged immediately upon approval of this plan and which wells will be plugged at a later date. Wells to be plugged at a later date will continue to be used to monitor groundwater conditions on a short term basis. These short term monitoring wells are located under the footprint of the proposed location for the onsite waste disposal cell or in areas where contaminated soil will be excavated. These wells will be plugged and abandoned prior to construction of the cell or removal of contaminated soil. Monitoring wells to be plugged and abandoned are depicted on Figure 23. Three different colored symbols are used to represent wells that will be maintained for long term monitoring, used for short term monitoring, or plugged after approval of the Groundwater Monitoring Plan.

8.3 Schedule

SFC will plug the wells in accordance with the schedule provided in Table 5. Monitoring wells have been designed to be plugged under two categories. The majority of the wells are scheduled to be plugged after approval of this Groundwater Monitoring Plan. SFC will complete the plugging and abandonment within a reasonable time frame. Other wells have been scheduled to be plugged at a later date. These wells have been designed to be used for monitoring until reclamation activities require that they be plugged and abandoned.

Table 4
Groundwater Monitoring Plan
Sampling and Analysis Schedule

Monitor ID	Location	Groundwater Unit Monitored	Parameters Analyzed
Background Quality Monitoring (Annual Sampling Frequency)			
MW007	Northeast of Main Process Building	Terrace / Shale 1	See Note 1
MW070	NE of DUF4 Building Near Property Boundary	Terrace / Shale 1	See Note 1
MW073	East of OG&E Substation Near Property Line	Terrace / Shale 1	See Note 1
MW007A	Northeast of Main Process Building	Shale 3	See Note 1
MW110A	East of Facility	Shale 4	See Note 1
MW007B	Northeast of Main Process Building	Shale 5	See Note 1
Compliance Monitoring (Annual Sampling Frequency)			
MW008[2]	Between MPB and Administration Building	Terrace / Shale 1	U, NO_3(N), F, As
MW010[2]	Southwest of Main Process Building	Terrace / Shale 1	U, NO_3(N), F, As
MW014[2]	South of Bechtel Building	Terrace / Shale 1	U, NO_3(N), F, As
MW019[2]	South of Loading Dock	Terrace / Shale 1	U, NO_3(N), F, As
MW025[2]	SX Yard North of SX Building	Terrace / Shale 1	U, NO_3(N), F, As
MW035[2]	North of Pond 1 Spoils Pile	Terrace / Shale 1	U, NO_3(N), F, As
MW036[2]	West of Sanitary Lagoon on Pond 1 Spoils Pile	Terrace / Shale 1	U, NO_3(N), F, As
MW040	North of Basin 1 of Clarifier A	Terrace / Shale 1	U, NO_3(N), F, As, Ba
MW042	South of Yellowcake Sump	Terrace / Shale 1	U, NO_3(N), F, As
MW045	Northeast Corner of Pond 2	Terrace / Shale 1	U, NO_3(N), F, As
MW049	South of Fluorisde Sludge Holding Basin 2 (North)	Terrace / Shale 1	U, NO_3(N), F, As
MW053[2]	North of Sanitary Lagoon on Emergency Basin Bank	Terrace / Shale 1	U, NO_3(N), F, As
MW054[2]	West of Pond 1 Spoils Pile at Base of Slope	Terrace / Shale 1	U, NO_3(N), F, As
MW056	Northwest Corner of '86 Incident Sod Storage Area	Terrace / Shale 1	U, NO_3(N), F, As
MW062	South of Fluoride Sludge Holding Basin1 (South)	Terrace / Shale 1	U, NO_3(N), F, As
MW075[2]	South of Incinerator	Terrace / Shale 1	U, NO_3(N), F, As
MW077[2]	NW of DUF4 Building Near Fence	Terrace / Shale 1	U, NO_3(N), F, As
MW079[2]	NE of Bechtel Building on UF6 Cylinder Pad	Terrace / Shale 1	U, NO_3(N), F, As
MW080[2]	West of DUF4 Building in Concrete Pad	Terrace / Shale 1	U, NO_3(N), F, As
MW086[2]	NE Corner of Cooling Tower	Terrace / Shale 1	U, NO_3(N), F, As
MW087	Old Contaminated Solid Waste Burial Area	Terrace / Shale 1	U, NO_3(N), F, As
MW014A[2]	South of Bechtel Building	Shale 2, 3	U, NO_3(N), F, As
MW018A[2]	Southwest Corner of MPB	Shale 2	U, NO_3(N), F, As
MW042A	South of South Yellowcake Sump in Parking Lot	Shale 2	U, NO_3(N), F, As

Table 4
Groundwater Monitoring Plan
Sampling and Analysis Schedule

Monitor ID	Location	Groundwater Unit Monitored	Parameters Analyzed
MW047A	Northwest Corner of Pond 2	Shale 2	U, NO_3(N), F, As
MW048	West of Pond 2	Shale 2	U, NO_3(N), F, As
MW050A[2]	North of Fluoride Basin No. 2	Shale 2, 3	U, NO_3(N), F, As
MW052A	West of Fluoride Sludge Holding Basin 2 (North)	Shale 2	U, NO_3(N), F, As
MW065A[2]	South of Fluoride Clarifier	Shale 2	U, NO_3(N), F, As
MW067A[2]	North Solid Waste Burial Area No. 2	Shale 2	U, NO_3(N), F, As
MW081A	N of DUF4 Building Near Perimeter Fence	Shale 2	U, NO_3(N), F, As
MW121A[3]	Southwest of Pond 2	Shale 2	U, NO_3(N), F, As
2303A	North of Clarifier Basins	Shale 3	U, NO_3(N), F, As
2346	Southwest of Pond 6	Shale 3	U, NO_3(N), F, As
MW012A[2]	Northwest of Main Process Building	Shale 3	U, NO_3(N), F, As
MW049A[2]	South of Fluoride Holding Basin No. 2	Shale 3	U, NO_3(N), F, As
MW057A[2]	Southwest of Pond 2	Shale 3	U, NO_3(N), F, As
MW084A[2]	SW of Misc Digestion on YC Pad	Shale 3	U, NO_3(N), F, As
MW086A[2]	NE Corner of Cooling Tower	Shale 3	U, NO_3(N), F, As
MW089A	Northwest of Fluoride Holding Basin No. 2	Shale 3	U, NO_3(N), F, As
MW115A	South of Pond 2	Shale 3	U, NO_3(N), F, As
MW122A[3]	Northwest of Pond 2	Shale 3	U, NO_3(N), F, As
MW123A[3]	Southwest of Pond 2	Shale 3	U, NO_3(N), F, As
MW124A[3]	South of Pond 5	Shale 3	U, NO_3(N), F, As
MW127A[3]	Southwest of Fluoride Holding Basin No. 2	Shale 3	U, NO_3(N), F, As
MW130A[3]	West of Pond 5	Shale 3	U, NO_3(N), F, As
MW059A	Southwest of Pond 2	Shale 4	U, NO_3(N), F, As
MW062A	South of Fluoride Holding Basin No. 1	Shale 4, 2	U, NO_3(N), F, As
MW097A	West of Pond 2 at Property Boundary	Shale 4	U, NO_3(N), F, As
MW099A	Northwest Corner of Industrial Area in Woods	Shale 4	U, NO_3(N), F, As
MW107	800 Feet West of Pond 5	Shale 4	U, NO_3(N), F, As
MW108	800 Feet Southwest of Pond 5	Shale 4	U, NO_3(N), F, As
MW111A	Northeast Portion of Agland	Shale 4	U, NO_3(N), F, As
MW112A	Southwest Portion of Facility on Agland Field	Shale 4	U, NO_3(N), F, As
MW125A[3]	South of Pond 3 East	Shale 4	U, NO_3(N), F, As

Table 4
Groundwater Monitoring Plan
Sampling and Analysis Schedule

Monitor ID	Location	Groundwater Unit Monitored	Parameters Analyzed
MW126A[3]	Southwest of Pond 5	Shale 4	U, NO_3(N), F, As
MW129A[3]	Southwest of Pond 2 Near Facility West Boundary	Shale 4	U, NO_3(N), F, As
MW059B	Southwest of Pond 2	Shale 5	U, NO_3(N), F, As
MW090B	Northwest of Pond 5 Near Reservoir Weir	Shale 5	U, NO_3(N), F, As
STA04	Southwest of Pond 2 Near Port Road Bridge	Shale 5	U, NO_3(N), F, As
MW098B	West of Pond 2 at Property Boundary (old 004 Path)	Shale 5	U, NO_3(N), F, As
MW100B	West of Fluoride Sludge Holding Basin 2 in 005 Drainage	Shale 5	U, NO_3(N), F, As
MW105B	West of Pond 5	Shale 5	U, NO_3(N), F, As
MW128B[3]	SW portion of the Agland	Shale 5	U, NO_3(N), F, As
Corrective Action Monitoring (Quarterly Sampling Frequency)			
2224A	005 Collection Trench	Shale 3	U, $N0_3$(N), F, As
2224B	005 Monitor Trench	Shale 3	U, $N0_3$(N), F, As
2247	95A Collection Trench	Shale 4	U, $N0_3$(N), F, As
MW095A	Southwest of Pond 2 Near Facility West Boundary	Shale 4	U, $N0_3$(N), F, As
2248	10 Collection Trench	Terrace/Shale 1	U, $N0_3$(N), F, As
MW031	South of Main Process Building	Terrace/Shale 1	U, $N0_3$(N), F, As
Seep and Drainage Monitoring (Quarterly Sampling Frequency)			
2241	005 Drainage - 25 feet East of COE Property Boundary Fence	Shale 5	See Note 4
2242	005 Drainage - Pool Near MW100B	Shale 4	See Note 4
2243	007 Drainage at Drainage from North Holding Basin	Shale 4	See Note 4
2244	004 Drainage - 20 feet East of COE Property Boundary Fence	Shale 4	See Note 4
2245	Seep North of Port Road Bridge and East of 001 Drainage	Shale 4	See Note 4, F
2246	001 Drainage N of Port Road Bridge	Shale 4	See Note 4
Surface Water Monitoring (Annual Sampling Frequency)			
2201	Illinois River - 1600 feet Upstream of 001 Confluence		U, $N0_3$(N), As, Ra-226
2202	Illinois River - 600 feet Downstream of 001 Confluence		U, $N0_3$(N), As, Ra-226
2203	Arkansas River - Upstream Towards Highway 64 Bridge		U, $N0_3$(N), As, Ra-226
2204	Arkansas River - Downstream Near I-40 Bridge		U, $N0_3$(N), As, Ra-226

Note 1: Analyze for antimony, arsenic, barium, beryllium, cadmium, chromium, fluoride, lead, molybdenum, nickel, nitrate(as N), radium-226, selenium, thallium, thorium-230 and uranium
Note 2: Well will be abandoned and plugged as necessary to allow reclamation activities
Note 3: Well installed upon approval of GWMP
Note 4: Analyze for antimony, arsenic, nitrate (as N), lead, thallium and uranium.

Table 5
Monitoring Well Plugging and Abandonment Schedule

Location	Plugging Schedule[1]	Location	Plugging Schedule[1]
2301A	After Approval of GW Monitoring Plan	MW018	After Approval of GW Monitoring Plan
2301B	After Approval of GW Monitoring Plan	MW018A	Maintain until Reclamation
2302A	After Approval of GW Monitoring Plan	MW019	Maintain until Reclamation
2302B	After Approval of GW Monitoring Plan	MW019A	After Approval of GW Monitoring Plan
2322A	After Approval of GW Monitoring Plan	MW020	After Approval of GW Monitoring Plan
2340A	After Approval of GW Monitoring Plan	MW020A	After Approval of GW Monitoring Plan
2341	After Approval of GW Monitoring Plan	MW021	After Approval of GW Monitoring Plan
2342	After Approval of GW Monitoring Plan	MW021A	After Approval of GW Monitoring Plan
2343	After Approval of GW Monitoring Plan	MW022	After Approval of GW Monitoring Plan
2344	After Approval of GW Monitoring Plan	MW022A	After Approval of GW Monitoring Plan
2345	After Approval of GW Monitoring Plan	MW023	After Approval of GW Monitoring Plan
2347	After Approval of GW Monitoring Plan	MW024	After Approval of GW Monitoring Plan
2348	After Approval of GW Monitoring Plan	MW024A	After Approval of GW Monitoring Plan
2349	After Approval of GW Monitoring Plan	MW025	Maintain until Reclamation
2350	After Approval of GW Monitoring Plan	MW025A	After Approval of GW Monitoring Plan
2351	After Approval of GW Monitoring Plan	MW026	After Approval of GW Monitoring Plan
2352	After Approval of GW Monitoring Plan	MW026A	After Approval of GW Monitoring Plan
2353	After Approval of GW Monitoring Plan	MW027	After Approval of GW Monitoring Plan
2354	After Approval of GW Monitoring Plan	MW027A	After Approval of GW Monitoring Plan
2355	After Approval of GW Monitoring Plan	MW028	After Approval of GW Monitoring Plan
2356	After Approval of GW Monitoring Plan	MW028A	After Approval of GW Monitoring Plan
FTP-2B	After Approval of GW Monitoring Plan	MW029	After Approval of GW Monitoring Plan
MW001	After Approval of GW Monitoring Plan	MW030	After Approval of GW Monitoring Plan
MW002	After Approval of GW Monitoring Plan	MW030A	After Approval of GW Monitoring Plan
MW002A	After Approval of GW Monitoring Plan	MW031A	After Approval of GW Monitoring Plan
MW003	After Approval of GW Monitoring Plan	MW032	After Approval of GW Monitoring Plan
MW003A	After Approval of GW Monitoring Plan	MW032A	After Approval of GW Monitoring Plan
MW004	After Approval of GW Monitoring Plan	MW035	Maintain until Reclamation
MW004A	After Approval of GW Monitoring Plan	MW035A	After Approval of GW Monitoring Plan
MW005	After Approval of GW Monitoring Plan	MW036	Maintain until Reclamation
MW005A	After Approval of GW Monitoring Plan	MW036A	After Approval of GW Monitoring Plan
MW006	After Approval of GW Monitoring Plan	MW037	After Approval of GW Monitoring Plan
MW006A	After Approval of GW Monitoring Plan	MW037A	After Approval of GW Monitoring Plan
MW008	Maintain until Reclamation	MW038	After Approval of GW Monitoring Plan
MW008A	After Approval of GW Monitoring Plan	MW038A	After Approval of GW Monitoring Plan
MW009	After Approval of GW Monitoring Plan	MW039	After Approval of GW Monitoring Plan
MW009A	After Approval of GW Monitoring Plan	MW039A	After Approval of GW Monitoring Plan
MW010	Maintain until Reclamation	MW040A	After Approval of GW Monitoring Plan
MW010A	After Approval of GW Monitoring Plan	MW041	After Approval of GW Monitoring Plan
MW011	After Approval of GW Monitoring Plan	MW041A	After Approval of GW Monitoring Plan
MW011A	After Approval of GW Monitoring Plan	MW043	After Approval of GW Monitoring Plan
MW012	After Approval of GW Monitoring Plan	MW045A	After Approval of GW Monitoring Plan
MW012A	Maintain until Reclamation	MW046	After Approval of GW Monitoring Plan
MW012B	After Approval of GW Monitoring Plan	MW046A	After Approval of GW Monitoring Plan
MW013	After Approval of GW Monitoring Plan	MW047	After Approval of GW Monitoring Plan
MW013A	After Approval of GW Monitoring Plan	MW048A	After Approval of GW Monitoring Plan
MW014	Maintain until Reclamation	MW049A	Maintain until Reclamation
MW014A	Maintain until Reclamation	MW050	After Approval of GW Monitoring Plan
MW015	After Approval of GW Monitoring Plan	MW050A	Maintain until Reclamation
MW016	After Approval of GW Monitoring Plan	MW050B	After Approval of GW Monitoring Plan
MW016A	After Approval of GW Monitoring Plan	MW051	After Approval of GW Monitoring Plan
MW017	After Approval of GW Monitoring Plan	MW051A	After Approval of GW Monitoring Plan
MW017A	After Approval of GW Monitoring Plan	MW052	After Approval of GW Monitoring Plan

Table 5
Monitoring Well Plugging and Abandonment Schedule

Location	Plugging Schedule[1]	Location	Plugging Schedule[1]
MW053	Maintain until Reclamation	MW078	After Approval of GW Monitoring Plan
MW053A	After Approval of GW Monitoring Plan	MW078A	After Approval of GW Monitoring Plan
MW054	Maintain until Reclamation	MW079	Maintain until Reclamation
MW055	After Approval of GW Monitoring Plan	MW079A	After Approval of GW Monitoring Plan
MW057	After Approval of GW Monitoring Plan	MW080	Maintain until Reclamation
MW057A	Maintain until Reclamation	MW080A	After Approval of GW Monitoring Plan
MW058	After Approval of GW Monitoring Plan	MW082	After Approval of GW Monitoring Plan
MW058A	After Approval of GW Monitoring Plan	MW082A	After Approval of GW Monitoring Plan
MW060A	After Approval of GW Monitoring Plan	MW083	After Approval of GW Monitoring Plan
MW061A	After Approval of GW Monitoring Plan	MW083A	After Approval of GW Monitoring Plan
MW062B	After Approval of GW Monitoring Plan	MW084	After Approval of GW Monitoring Plan
MW063	After Approval of GW Monitoring Plan	MW084A	Maintain until Reclamation
MW063A	After Approval of GW Monitoring Plan	MW085	After Approval of GW Monitoring Plan
MW064	After Approval of GW Monitoring Plan	MW085A	After Approval of GW Monitoring Plan
MW064A	After Approval of GW Monitoring Plan	MW086	Maintain until Reclamation
MW065	After Approval of GW Monitoring Plan	MW086A	Maintain until Reclamation
MW065A	Maintain until Reclamation	MW087A	After Approval of GW Monitoring Plan
MW066	After Approval of GW Monitoring Plan	MW088A	After Approval of GW Monitoring Plan
MW066A	After Approval of GW Monitoring Plan	MW091A	After Approval of GW Monitoring Plan
MW067	Maintain until Reclamation	MW092A	After Approval of GW Monitoring Plan
MW067A	After Approval of GW Monitoring Plan	MW093A	After Approval of GW Monitoring Plan
MW068	After Approval of GW Monitoring Plan	MW094A	After Approval of GW Monitoring Plan
MW068A	After Approval of GW Monitoring Plan	MW097	After Approval of GW Monitoring Plan
MW069	After Approval of GW Monitoring Plan	MW101A	After Approval of GW Monitoring Plan
MW069A	After Approval of GW Monitoring Plan	MW102	After Approval of GW Monitoring Plan
MW070A	After Approval of GW Monitoring Plan	MW102A	After Approval of GW Monitoring Plan
MW071A	After Approval of GW Monitoring Plan	MW103	After Approval of GW Monitoring Plan
MW072	After Approval of GW Monitoring Plan	MW103A	After Approval of GW Monitoring Plan
MW072A	After Approval of GW Monitoring Plan	MW104B	After Approval of GW Monitoring Plan
MW072B	After Approval of GW Monitoring Plan	MW106	After Approval of GW Monitoring Plan
MW073A	After Approval of GW Monitoring Plan	MW109A	After Approval of GW Monitoring Plan
MW074	After Approval of GW Monitoring Plan	MW113A	After Approval of GW Monitoring Plan
MW075	Maintain until Reclamation	MW114A	After Approval of GW Monitoring Plan
MW075A	After Approval of GW Monitoring Plan	MW116A	After Approval of GW Monitoring Plan
MW076	After Approval of GW Monitoring Plan	MW117	After Approval of GW Monitoring Plan
MW076A	After Approval of GW Monitoring Plan	MW118	After Approval of GW Monitoring Plan
MW077	Maintain until Reclamation	MW119A	After Approval of GW Monitoring Plan
MW077A	After Approval of GW Monitoring Plan	MW120	After Approval of GW Monitoring Plan

[1] Maintain until Reclamation - These wells will be monitored until reclamation activities require abandoning/plugging

Table 6
Summary of Information Used for Establishment of Cleanup Goals

Constituent[1]	Maximum Concentration[2]	MCL Primary[3,4]	Background UPI - Metals[5]	Background UPI - Other[6]	Raffinate Filter Leachate[7]	Pond 4 Sludge TCLP[8]	Clar 4A Sludge TCLP[9]	Cleanup Goal
Antimony, mg/l		0.006	0.005		< 0.22	< 0.06		0.006
Arsenic, mg/l	0.05	0.01	0.005		0.461	0.177	< 0.001	0.05
Barium, mg/l	1.0	2	0.026		< 0.1	0.129	< 0.01	1.0
Beryllium, mg/l		0.004	0.0005		< 0.1	0.018		0.004
Cadmium, mg/l	0.01	0.005	0.007		< 0.1	0.042	< 0.005	0.01
Chromium, mg/l	0.05	0.1	0.007		< 0.24	0.129	< 0.01	0.05
Fluoride, mg/l		4.0		3.5				4.0
Lead, mg/l	0.05	0.015	0.005		< 1.36	0.449	< 0.02	0.05
Mercury, mg/l	0.002	0.002	0.0002		< 0.0002		0.0025	0.002
Molybdenum, mg/l			0.012		13.3	2.44		0.012
Nickel, mg/l			0.023		8.86	10.3		0.023
Nitrate (as N), mg/l		10		3.2				10
Radium-226, pCi/l	5	5		1.0	7.06			5
Selenium, mg/l	0.01	0.05	0.005		< 0.2	0.214	< 0.002	0.01
Silver, mg/l	0.05		0.006		< 0.32	0.011	< 0.01	0.05
Thallium, mg/l		0.002	0.005		0.418	0.258		0.005
Thorium-230, pCi/l				1.2	80.1			1.2
Uranium-Total, µg/l		30		2.5	4.67			30

[1] Potential hazardous constituent identified from review of 10CFR40, Appendix A, Criterion 13.

[2] Maximum values for groundwater protection from 10CFR40, Appendix A, Criterion 5C.

[3] EPA National Primary Drainking Water Standard.

[4] The arsenic standard of 0.01 mg/l becomes effective on January 23, 2006. The current arsenic standard Is 0.05 mg/l.

[5] Upper prediction interval for background of RCRA metals from Final RCRA Facility Investigation.

[6] Upper prediction interval for background of non-metals and radiological parameters.

[7] Sample of leachate from raffinate filter press pilot study collected on May 1, 2003.

[8] Toxicity Characteristic Leaching Procedure, SW-846, Method 1311 (TCLP) analysis of raffinate sludge composite from samples collected from Pond 4 on March 24 & 25, 1994.

[9] TCLP analysis of raffinate sludge sample collected from Clarifier Basin 4A on March 23, 1993.

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APPENDIX B

Evaluation of Background Groundwater Monitoring Data

Evaluation of Background Groundwater Monitoring Data

Sequoyah Fuels Corporation

Sequoyah Facility

October 29, 2004

Evaluation of Background Groundwater Monitoring Data
Sequoyah Fuels Corporation

Introduction

Sequoyah Fuels Corporation (SFC) has evaluated the data collected at background groundwater monitoring wells located up-gradient of Facility operations. Since baseline groundwater monitoring was not conducted prior to construction of the Facility, the up-gradient data analyses has been used as proxies for onsite baseline samples. Sample collection and analysis for most of the background monitoring wells began in 1991. Two additional background wells were added during 1995 and one other during 2001. A total of nine background wells will be used for the statistical evaluations.

Constituents of concern that have been routinely analyzed for in the background wells have been arsenic, fluoride, nitrate and uranium. Analysis for additional constituents has been very limited and is not of sufficient quantity to perform statistical evaluations. This statistical evaluation will therefore only consider arsenic, fluoride, nitrate and uranium. Data used for this evaluation was collected between 1991 and 2003.

Groundwater monitoring data has been compiled in dBase, the primary database management software package used for maintaining environmental sampling information by SFC. The data is typically transferred to Excel for sorting and formatting for inclusion in various reports. Some basic statistical evaluations and plotting of analyses have also been completed using Excel. ChemStat[1], an application for the statistical analysis of groundwater monitoring data was used for most of the statistical analysis provided in this evaluation.

Description of Background Monitoring Well System

A map of the site showing locations of the background groundwater monitoring wells is provided as Figure 1. Monitoring wells are typically found as clusters at each location. Each well in a cluster is completed at different depths to monitor separate groundwater systems. Facility hydrogeology is described in the Groundwater Monitoring Plan[2] and in other documents presented with the Reclamation Plan[3]. Wells monitoring the Terrace Groundwater System are identified as "MWXXX" (e.g. MW072). Well identifications that end with an "A" (e.g. MW072A), monitor the Shallow Bedrock Groundwater System and well identifications ending with a "B" (e.g. MW072B) designation monitor the Deep

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[1] ChemStat, Environmental Data Statistical Analysis for Windows, Starpoint Software.

[2] Groundwater Monitoring Plan, Sequoyah Fuels Corporation, May 2003.

[3] Reclamation Plan, Sequoyah Fuels Corporation, January, 2003.

Bedrock Groundwater System. The Terrace Groundwater System includes the terrace deposits and Unit 1 Shale, the Shallow Bedrock System includes Units 2, 3 or 4 Shale, and the Deep Bedrock System includes Unit 5 Shale. Well completion logs for each of the nine background wells are included in Attachment A. Well completion summary information is included in Table 1.

Table 1
Background Well Completion Summary Information

Well ID	Total Depth, ft	Top Sand ft	Screen Bottom, ft	Ground Elev.	Case Top Elev.
MW005	10.9	3.3	10.7	560.7	562.98
MW005A	32.1	15.7	31.6	560.5	563.09
MW007	18.2	7.0	17.8	569.9	572.01
MW007A	35.0	22.0	34.8	570.2	572.63
MW007B	82.8	72.0	82.1	570.3	572.89
MW072	19.2	7.4	18.5	574.2	577.10
MW072A	48.0	21.2	47.4	575.1	577.73
MW072B	90.1	78.1	89.5	574.6	577.23
MW110A	45.0	32.0	44.7	552.6	554.93

Sampling methods and quality control practices are described in the Groundwater Monitoring Plan.

Preliminary Data Analysis

The preliminary data analysis consisted of a review of tabulated analyses and plotted graphical visual aids for evaluating the quality and quantity of background data. The complete set of arsenic, fluoride, nitrate and uranium analyses from 1991 through 2003 for the background groundwater monitoring well locations are included in Table 2. Time series graphs and box plots were constructed from this data. Some of the data was determined to be not representative of background water quality. This data was not included with the data set used to represent background groundwater quality.

A review of the Table 2 and associated time series graphs and box plots identified the following concerns:

1. The minimum detection limit for uranium decreased from 5 µg/l to about 1 µg/l after 1995. The arsenic minimum detection limit was typically reported as 0.005

mg/l but during a few sampling events increased to values between 0.03 and 0.053 mg/l.

2. Some of the analyses clearly appear to be outliers based on a visual inspection of the plotted results. The analyses are well above typical values reported.

3. Following installation of a few of the wells, analyses obtained during the first few sampling events appear to be elevated but decreased with time. This indicates impacts from well construction that is not representative of groundwater quality for these well.

4. Recent analyses of nitrate at MW005 and MW007A were higher than historical values. A review of April 2004 monitoring results indicate that in both instances the analyses have decreased.

Data Analysis

Based on the above concerns some analyses have been removed from the background groundwater data set. High minimum detection limits for uranium (5 µg/l) and arsenic (between 0.03 and 0.53 mg/l) were removed. These high minimum detection limits are not representative of the current laboratory capability and will bias the background water quality. The analyses that are obvious outliers from a visual inspection of the plotted results were considered for removal. These outliers were evaluated using Dixon's test, confirmed to be outliers and removed from the data set. A description of Dixon's statistical test is included in Attachment B. Initial analyses that were impacted following installation of a new well have also been removed from the data set.

Analyses that have been removed from the background data set are highlighted in Table 2. Color shading has been used to indicate the reason for removal of each analysis. A revised set of box plots and time series graphs are presented as Figures 2 - 9. The revised data set will be used to represent background groundwater quality at the Facility.

The box plots and time series graphs (Figures 2 - 9) were reviewed and two significant observations made. The fluoride concentration in the Deep Bedrock Groundwater System is significantly higher than in the Terrace and Shallow Bedrock Groundwater Systems. Analyses of samples collected from wells in the Deep Bedrock system appear to be fairly consistent and support the observation. A natural occurring constituent in this geological formation appears to be causing these elevated concentrations of fluoride. The second observation is that the nitrate concentration in Monitoring Well MW007A is significantly higher than in the other wells. Nitrate analyses in monitoring wells downgradient of MW007A in the Shallow Bedrock Groundwater System were evaluated to determine if these wells also have elevated nitrate concentrations. MW008A and MW021A are located immediately downgradient of MW007A and show very similar results for nitrate. The locations of MW007A, MW008A and MW021A are shown in Figure 10. In addition, concentrations of nitrates plotted on a time series graph appear to have similar trends; see Figure 11.

Descriptive Statistics of Background Monitoring Wells and Groundwater Systems

Basic statistics for the background monitoring wells are presented in Table 3 for arsenic, fluoride, nitrate and uranium. For each groundwater system the total number of measurements, total non-detects, mean and standard deviation are listed. Non-detects have been replaced with the minimum detection limit. Individual monitoring well statistics are also provided. A review of the data indicates that the fluoride concentration in the Deep Bedrock Groundwater System is higher than in the other systems and the nitrate levels appear to be elevated in groundwater sampled from MW007A. These observation are consistent with the graphical analysis.

Upper confidence levels were determined using the guidance in "Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites," USEPA OSWER 9285.6-10, December 2002. The Chebyshev Inequality UCL Method is a non-parametric test for calculation of upper confidence limits from measured sample concentrations. This method was used to calculate a 95% upper confidence limit for each parameter and each groundwater system. Table 4 contains the results of the UCL calculations.

Conclusion

An evaluation of background concentrations of arsenic, fluoride, nitrate and uranium has been completed for the Terrace, Shallow Bedrock and Deep Bedrock Groundwater Systems for data collected between 1991 and 2003. This evaluation has established a framework by which statistical evaluations of the background monitoring data will be completed at the Sequoyah Facility.

Table 2
Background Monitor Well Sample Analyses Removed

Location	Sample Date	Arsenic mg/l	Fluoride mg/l	Nitrate mg/l	Uranium µg/l
MW005	04/25/1991	< 0.005	0.4	0.2	< 5.0
MW005	10/24/1991	< 0.005	1.0	0.9	< 5.0
MW005	04/01/1992			0.7	18.7
MW005	04/14/1993			0.5	< 5.0
MW005	04/19/1994	< 0.050		< 1.0	< 5.0
MW005	10/14/1994	< 0.053			
MW005	04/11/1995	< 0.005	0.2	< 1.0	< 5.0
MW005	04/09/1996			1.1	< 0.6
MW005	04/15/1997	< 0.005	< 0.2	< 1.0	< 1.0
MW005	04/15/1998	< 0.005	0.9	< 1.0	< 1.0
MW005	04/13/1999	< 0.005	0.3	1.2	< 1.0
MW005	04/14/2000	< 0.005	0.2	1.1	< 1.0
MW005	04/12/2001	< 0.005	< 0.2	< 1.0	2.8
MW005	04/11/2002	< 0.011	0.3	2.0	< 1.0
MW005	04/15/2003	< 0.007	< 0.2	3.6	< 1.0
MW005A	04/25/1991	< 0.005	0.9	2.1	< 5.0
MW005A	10/23/1991	< 0.005	0.6	2.0	< 5.0
MW005A	04/21/1992			2.0	< 5.0
MW005A	05/26/1993			1.7	< 5.0
MW005A	04/27/1994	< 0.050		1.8	< 5.0
MW005A	10/14/1994	< 0.053			
MW005A	04/18/1995		0.5	1.1	< 5.0
MW005A	04/16/1996			1.5	< 0.6
MW005A	04/15/1997	< 0.005	0.5	1.0	< 1.0
MW005A	04/15/1998	< 0.005	0.6	1.6	< 1.0
MW005A	04/13/1999	< 0.005	0.5	2.9	< 1.0
MW005A	04/14/2000	< 0.005	0.3	2.0	< 1.0
MW005A	04/12/2001	< 0.005	0.5	< 1.0	< 1.0
MW005A	04/11/2002	< 0.011	0.6	2.1	< 1.0
MW005A	04/15/2003	< 0.007	0.4	2.2	< 1.0
MW007	05/01/1991	< 0.005	1.9	0.9	< 5.0
MW007	10/23/1991	< 0.005	0.8	1.7	< 5.0
MW007	04/01/1992			1.6	25.7
MW007	07/14/1992				< 5.0
MW007	04/14/1993			1.3	< 5.0
MW007	04/19/1994	< 0.050		1.5	< 5.0
MW007	10/13/1994	< 0.053			< 5.0
MW007	04/11/1995	< 0.005	0.7	1.3	< 5.0
MW007	04/09/1996			1.8	< 5.7
MW007	04/15/1997	0.010	0.8	3.0	< 1.0
MW007	04/15/1998	0.007	0.8	1.9	< 1.0
MW007	04/13/1999	< 0.005	0.6	1.5	< 1.0
MW007	04/06/2000	< 0.003	0.9	1.5	< 1.0
MW007	04/12/2001	< 0.005	0.8	< 1.0	12.4
MW007	04/11/2002	< 0.011	0.8	1.6	< 1.0
MW007	04/15/2003	0.007	0.8	2.3	< 1.0

C01

Table 2
Background Monitor Well Sample Analyses Removed

Location	Sample Date	Arsenic mg/l	Fluoride mg/l	Nitrate mg/l	Uranium µg/l
MW007A	05/01/1991	< 0.005	0.7	2.7	< 5.0
MW007A	10/23/1991	< 0.005	0.7	2.5	< 5.0
MW007A	04/21/1992			2.7	< 5.0
MW007A	05/25/1993			2.5	< 5.0
MW007A	04/27/1994	< 0.050		2.7	< 5.0
MW007A	10/13/1994	< 0.053			< 5.0
MW007A	04/18/1995		0.8	2.7	< 5.0
MW007A	04/16/1996			3.1	< 0.6
MW007A	04/15/1997	< 0.005	4.9	3.9	< 1.0
MW007A	04/15/1998	0.006	0.8	4.1	< 1.0
MW007A	04/13/1999	< 0.005	0.6	3.7	< 1.0
MW007A	04/06/2000	< 0.003	0.7	3.6	1.9
MW007A	04/12/2001	< 0.005	1.0	3.5	< 1.0
MW007A	04/11/2002	< 0.011	1.6	5.5	< 1.0
MW007A	04/15/2003	< 0.007	0.7	7.1	< 1.0
MW007B	05/05/1995	< 0.005	0.9	1.7	< 5.0
MW007B	10/10/1995	0.010	2.2	3.5	10.0
MW007B	04/12/1996	0.013	2.1	2.8	6.8
MW007B	10/22/1996	< 0.005	2.3	< 1.0	4.0
MW007B	04/15/1997	0.021	2.7	< 1.0	2.0
MW007B	04/14/1998	0.007	2.6	2.1	2.0
MW007B	04/13/1999	< 0.005	2.5	1.1	< 1.0
MW007B	04/06/2000	0.004	2.4	< 1.0	< 1.0
MW007B	04/03/2001	< 0.005	2.4	< 1.0	< 1.0
MW007B	04/03/2002	< 0.009	3.0	< 1.0	< 1.0
MW007B	04/02/2003	0.007	2.7	< 1.0	< 1.0
MW072	05/09/1991	< 0.005			
MW072	10/23/1991	< 0.005	0.7	1.0	< 5.0
MW072	04/01/1992			1.2	< 5.0
MW072	04/16/1993			2.4	
MW072	04/19/1994	< 0.050		1.3	
MW072	10/14/1994	< 0.053			
MW072	04/12/1995	0.006	0.7	< 1.0	< 5.0
MW072	04/09/1996			1.1	< 5.7
MW072	04/15/1997	0.005	0.7	< 1.0	< 1.0
MW072	04/15/1998	< 0.005	0.9	< 1.0	< 1.0
MW072	04/13/1999	< 0.005	0.5	0.4	< 1.0
MW072	04/06/2000	< 0.003	0.5	0.3	< 1.0
MW072	04/12/2001	< 0.005	0.5	1.2	< 1.0
MW072	04/11/2002	< 0.011	1.0	0.5	< 1.0
MW072	04/15/2003	0.017	0.8	< 1.0	< 1.0

C02

Table 2
Background Monitor Well Sample Analyses Removed

Location	Sample Date	Arsenic mg/l	Fluoride mg/l	Nitrate mg/l	Uranium µg/l
MW072A	05/01/1991	< 0.005	1.7	2.7	< 5.0
MW072A	10/23/1991		0.6	1.1	< 5.0
MW072A	04/15/1992			1.4	< 5.0
MW072A	05/25/1993			1.4	< 5.0
MW072A	04/26/1994	< 0.050		2.2	< 5.0
MW072A	10/14/1994	< 0.053			
MW072A	04/18/1995		0.4	< 1.0	< 5.0
MW072A	04/16/1996			1.3	< 0.6
MW072A	04/15/1997	< 0.005	0.5	< 1.0	< 1.0
MW072A	04/15/1998	< 0.005	0.8	2.0	< 1.0
MW072A	04/13/1999	< 0.005	0.4	0.7	< 1.0
MW072A	04/06/2000	< 0.003	0.4	0.8	< 1.0
MW072A	04/12/2001	< 0.005	0.4	1.6	< 1.0
MW072A	04/11/2002	< 0.011	0.5	1.2	< 1.0
MW072A	04/15/2003	0.008	0.5	< 1.0	< 1.0
MW072B	04/18/1995	< 0.005	2.4	< 1.0	< 5.0
MW072B	10/10/1995	< 0.005	0.9	1.2	< 5.0
MW072B	04/12/1996	< 0.005	1.9	1.1	1.0
MW072B	10/22/1996	< 0.005	2.7	< 1.0	< 1.0
MW072B	04/15/1997	0.008		< 1.0	< 1.0
MW072B	04/14/1998	< 0.005		1.5	< 1.0
MW072B	04/13/1999	< 0.005		0.2	< 1.0
MW072B	04/06/2000	< 0.003		0.6	< 1.0
MW072B	04/03/2001	< 0.005		0.5	3.1
MW072B	04/03/2002	< 0.009		< 0.2	< 1.0
MW072B	04/02/2003	< 0.007		0.7	< 1.0
MW110A	08/23/2001	< 0.030	0.6	< 1.0	3.1
MW110A	10/09/2001	< 0.015	0.5	1.7	1.2
MW110A	04/02/2002	< 0.009	0.8	< 1.0	< 1.0
MW110A	04/30/2003	< 0.007	0.7	1.1	1.2

Key:

🟨 - Removed due to high minimum detection limit report by laboratory

⬛ - Determined to be a statistical outlier and removed

🟦 - Determined to be impacted from well completion and removed

C03

Table 3
Basic Statistics for Background Monitoring Wells for Groundwater Systems - Arsenic

Terrace Groundwater System

Non-Detects Replaced with Detection Limit

Total Measurements	30
Total Non-Detects	24 (80%)
Background Mean	0.00626667
Background Std Dev	0.00293532

There are 3 background locations:

Location	Meas.	Non-Detects	% ND	Mean	Std Dev
MW005	10	10	100	0.0058	0.00193218
MW007	10	7	70	0.0063	0.00249666
MW072	10	7	70	0.0067	0.00416467

Shallow Bedrock Groundwater System

Non-Detects Replaced with Detection Limit

Total Measurements	29
Total Non-Detects	27 (93.1034%)
Background Mean	0.00631034
Background Std Dev	0.00270057

There are 4 background locations:

Location	Meas.	Non-Detects	% ND	Mean	Std Dev
MW005A	9	9	100	0.00588889	0.00202759
MW007A	9	8	88.8889	0.00577778	0.00222361
MW072A	8	7	87.5	0.005875	0.00247487
MW110A	3	3	100	0.0103333	0.00416333

Deep Bedrock Groundwater System

Non-Detects Replaced with Detection Limit

Total Measurements	21
Total Non-Detects	15 (71.4286%)
Background Mean	0.00628571
Background Std Dev	0.00236945

There are 2 background locations:

Location	Meas.	Non-Detects	% ND	Mean	Std Dev
MW007B	10	5	50	0.007	0.00286744
MW072B	11	10	90.9091	0.00563636	0.00168954

Table 3
Basic Statistics for Background Monitoring Wells for Groundwater Systems - Fluoride

Terrace Groundwater System

Non-Detects Replaced with Detection Limit

Total Measurements	28
Total Non-Detects	3 (10.7143%)
Background Mean	0.614286
Background Std Dev	0.269037

There are 3 background locations:

Location	Meas.	Non-Detects	% ND	Mean	Std Dev
MW005	10	3	30	0.39	0.303498
MW007	9	0	0	0.777778	0.0833333
MW072	9	0	0	0.7	0.180278

Shallow Bedrock Groundwater System

Non-Detects Replaced with Detection Limit

Total Measurements	32
Total Non-Detects	0 (0%)
Background Mean	0.628125
Background Std Dev	0.241279

There are 4 background locations:

Location	Meas.	Non-Detects	% ND	Mean	Std Dev
MW005A	10	0	0	0.54	0.157762
MW007A	9	0	0	0.844444	0.304594
MW072A	9	0	0	0.5	0.132288
MW110A	4	0	0	0.65	0.129099

Deep Bedrock Groundwater System

Non-Detects Replaced with Detection Limit

Total Measurements	15
Total Non-Detects	0 (0%)
Background Meas.	15
Background Mean	2.24667
Background Std Dev	0.610464

There are 2 background locations:

Location	Meas.	Non-Detects	% ND	Mean	Std Dev
MW007B	11	0	0	2.34545	0.542888
MW072B	4	0	0	1.975	0.788987

Table 3
Basic Statistics for Background Monitoring Wells for Groundwater Systems - Nitrate

Terrace Groundwater System

Non-Detects Replaced with Detection Limit

Total Measurements	41
Total Non-Detects	10 (24.3902%)
Background Mean	1.28293
Background Std Dev	0.671901

There are 3 background locations:

Location	Meas.	Non-Detects	% ND	Mean	Std Dev
MW005	14	5	35.7143	1.16429	0.805373
MW007	14	1	7.14286	1.63571	0.528579
MW072	13	4	30.7692	1.03077	0.518627

Shallow Bedrock Groundwater System

Non-Detects Replaced with Detection Limit

Total Measurements	46
Total Non-Detects	6 (13.0435%)
Background Mean	2.16304
Background Std Dev	1.2739

There are 4 background locations:

Location	Meas.	Non-Detects	% ND	Mean	Std Dev
MW005A	14	1	7.14286	1.78571	0.524562
MW007A	14	0	0	3.59286	1.3047
MW072A	14	3	21.4286	1.38571	0.568205
MW110A	4	2	50	1.2	0.33665

Deep Bedrock Groundwater System

Non-Detects Replaced with Detection Limit

Total Measurements	19
Total Non-Detects	10 (52.6316%)
Background Mean	0.957895
Background Std Dev	0.425984

There are 2 background locations:

Location	Meas.	Non-Detects	% ND	Mean	Std Dev
MW007B	8	6	75	1.15	0.38545
MW072B	11	4	36.3636	0.818182	0.41429

Table 3
Basic Statistics for Background Monitoring Wells for Groundwater Systems - Uranium

Terrace Groundwater System

Non-Detects Replaced with Detection Limit

Total Measurements	21
Total Non-Detects	20 (95.2381%)
Background Mean	1.06571
Background Std Dev	0.410507

There are 3 background locations:

Location	Meas.	Non-Detects	% ND	Mean	Std Dev
MW005	8	7	87.5	1.1725	0.678544
MW007	6	6	100	1	0
MW072	7	7	100	1	0

Shallow Bedrock Groundwater System

Non-Detects Replaced with Detection Limit

Total Measurements	27
Total Non-Detects	24 (88.8889%)
Background Mean	1.00111
Background Std Dev	0.240166

There are 4 background locations:

Location	Meas.	Non-Detects	% ND	Mean	Std Dev
MW005A	8	8	100	0.94625	0.152028
MW007A	8	7	87.5	1.0625	0.381454
MW072A	8	8	100	0.94625	0.152028
MW110A	3	1	33.3333	1.13	0.121244

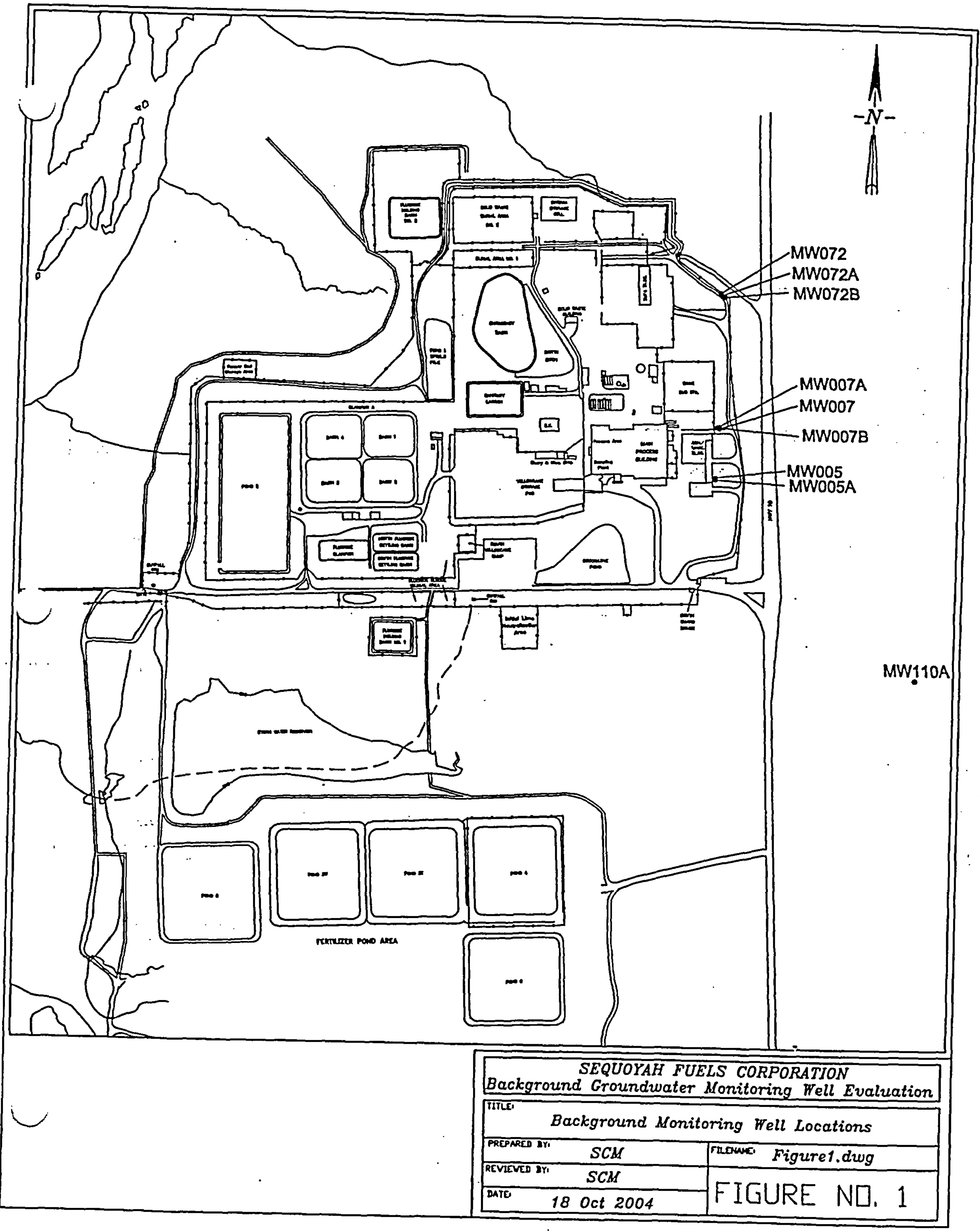
Deep Bedrock Groundwater System

Non-Detects Replaced with Detection Limit

Total Measurements	14
Total Non-Detects	12 (85.7143%)
Background Mean	1.14643
Background Std Dev	0.556578

There are 2 background locations:

Location	Meas.	Non-Detects	% ND	Mean	Std Dev
MW007B	5	5	100	1	0
MW072B	9	7	77.7778	1.22778	0.694654



SEQUOYAH FUELS CORPORATION
Background Groundwater Monitoring Well Evaluation

TITLE:
Background Monitoring Well Locations

PREPARED BY: SCM	FILENAME: Figure1.dwg
REVIEWED BY: SCM	FIGURE NO. 1
DATE: 18 Oct 2004	

Figure 2

Arsenic - Box Plot

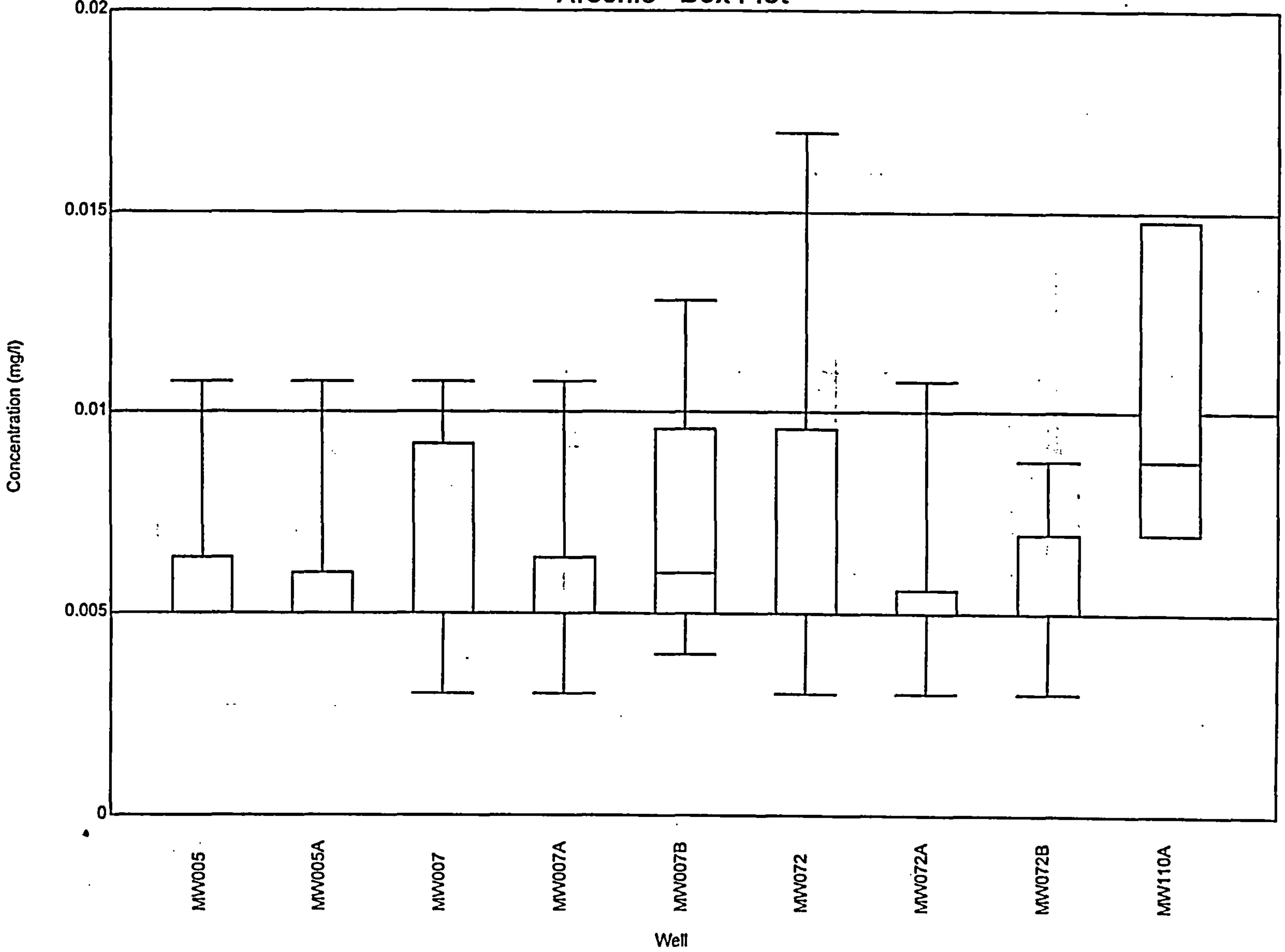


Figure 3

Fluoride - Box Plot

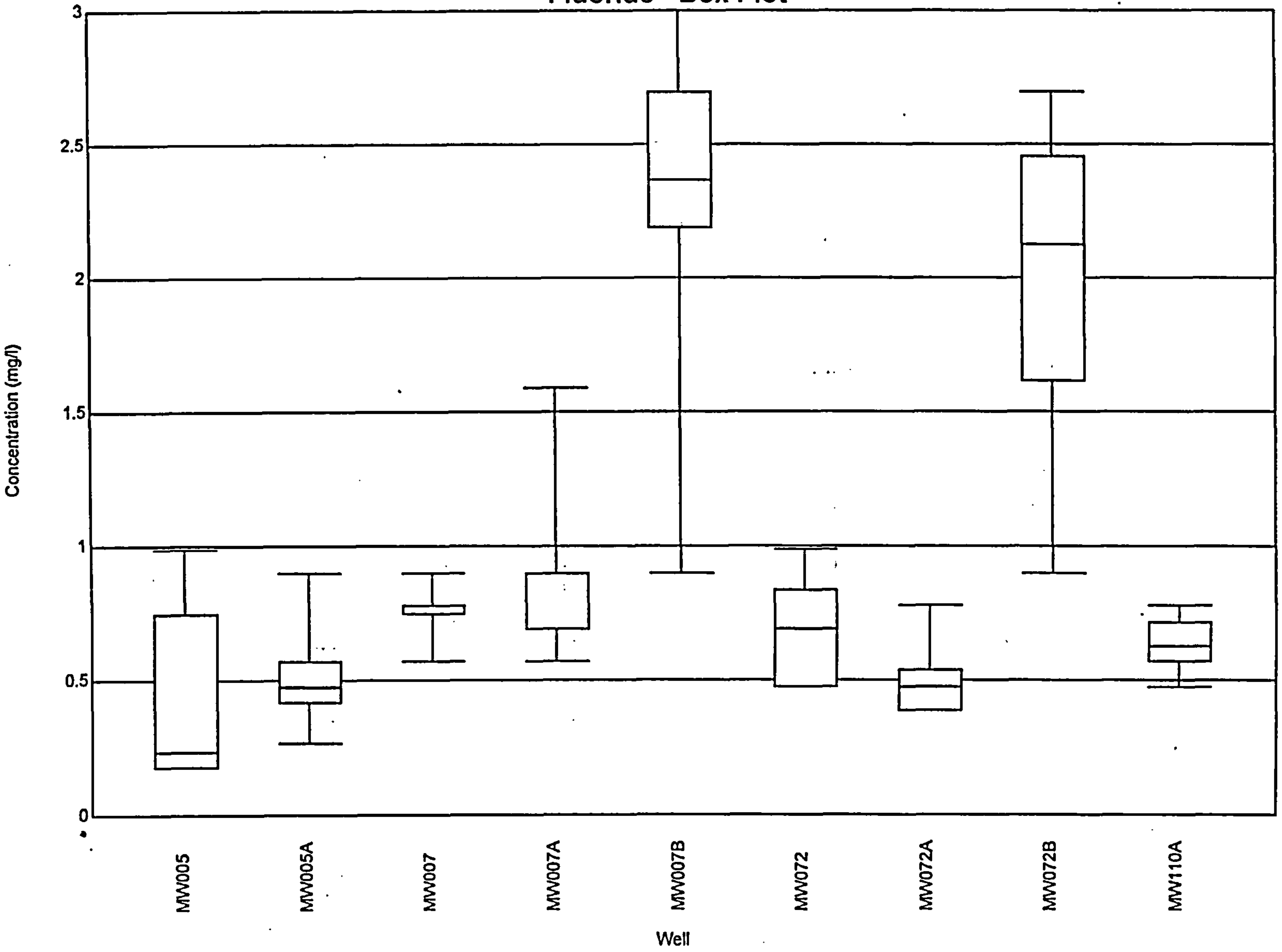


Figure 4

Nitrate - Box Plot

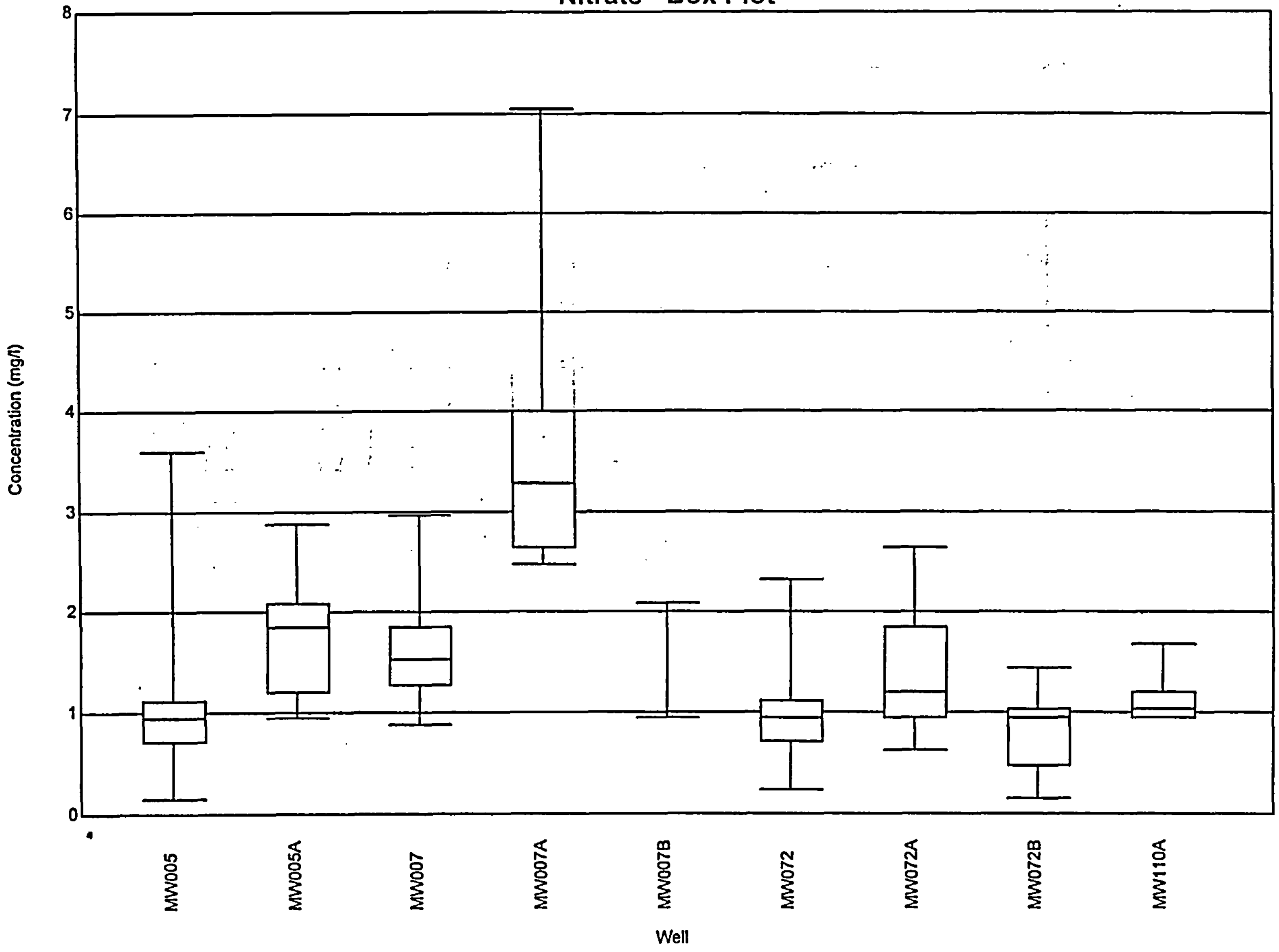


Figure 5

Uranium - Box Plot

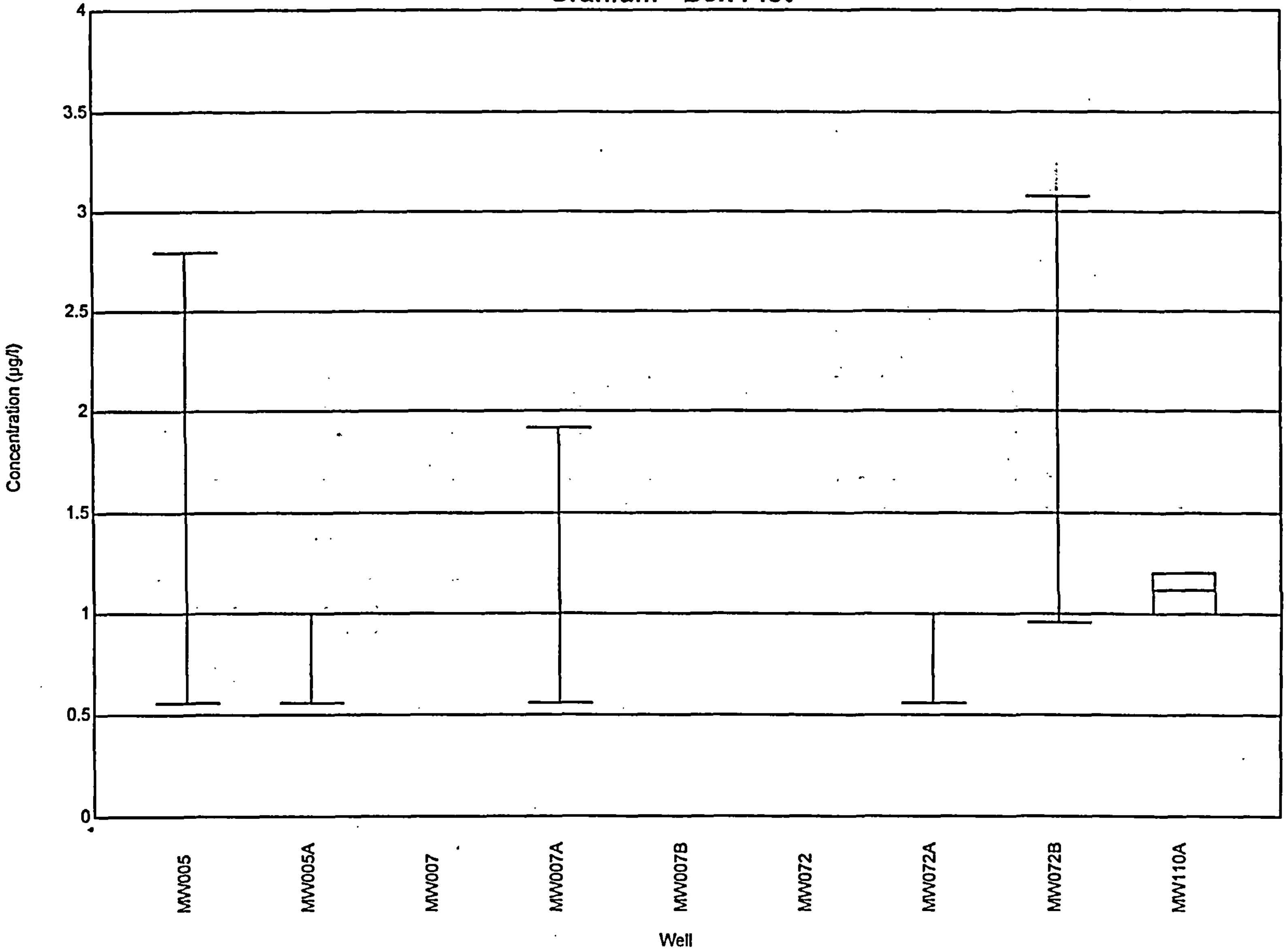
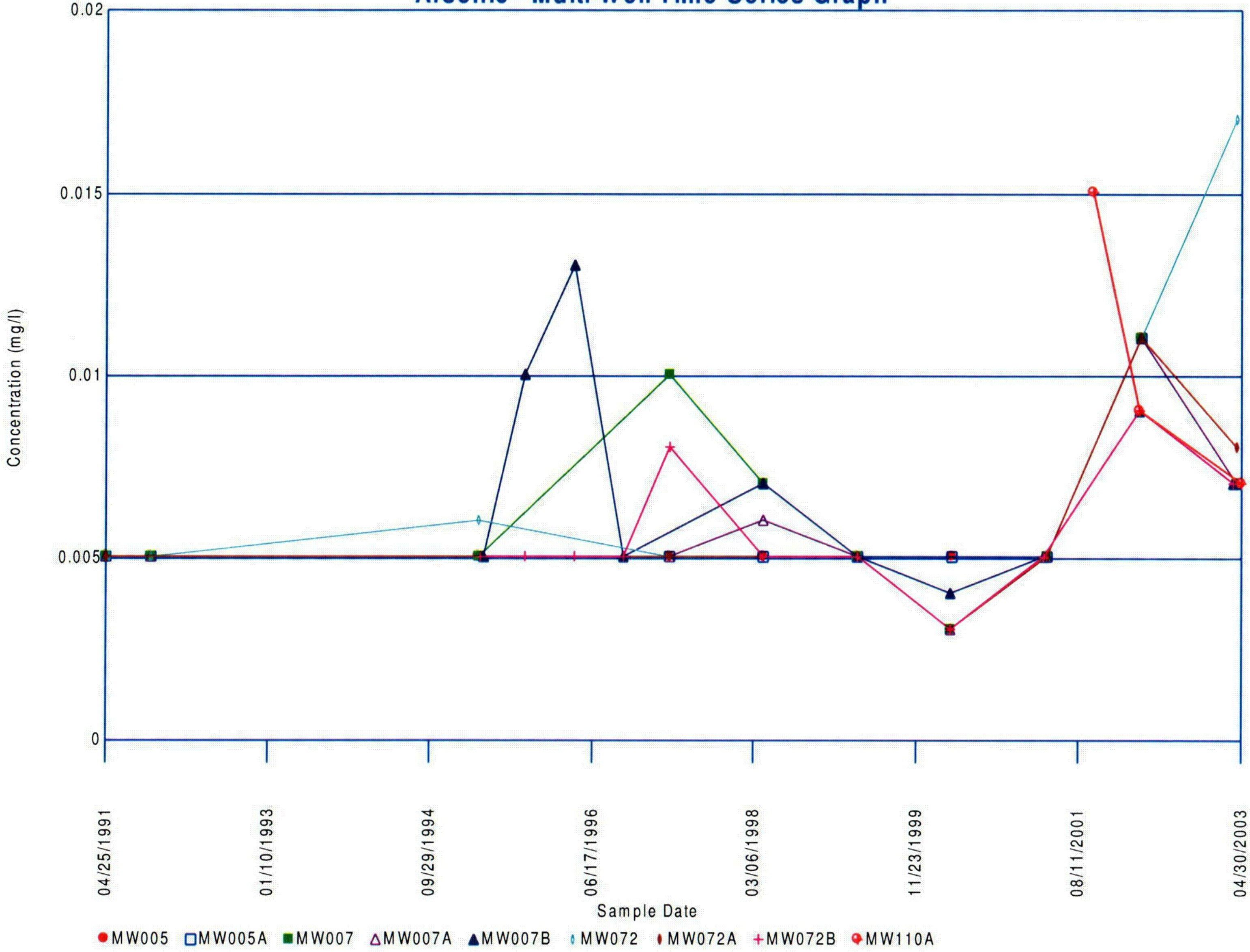


Figure 6

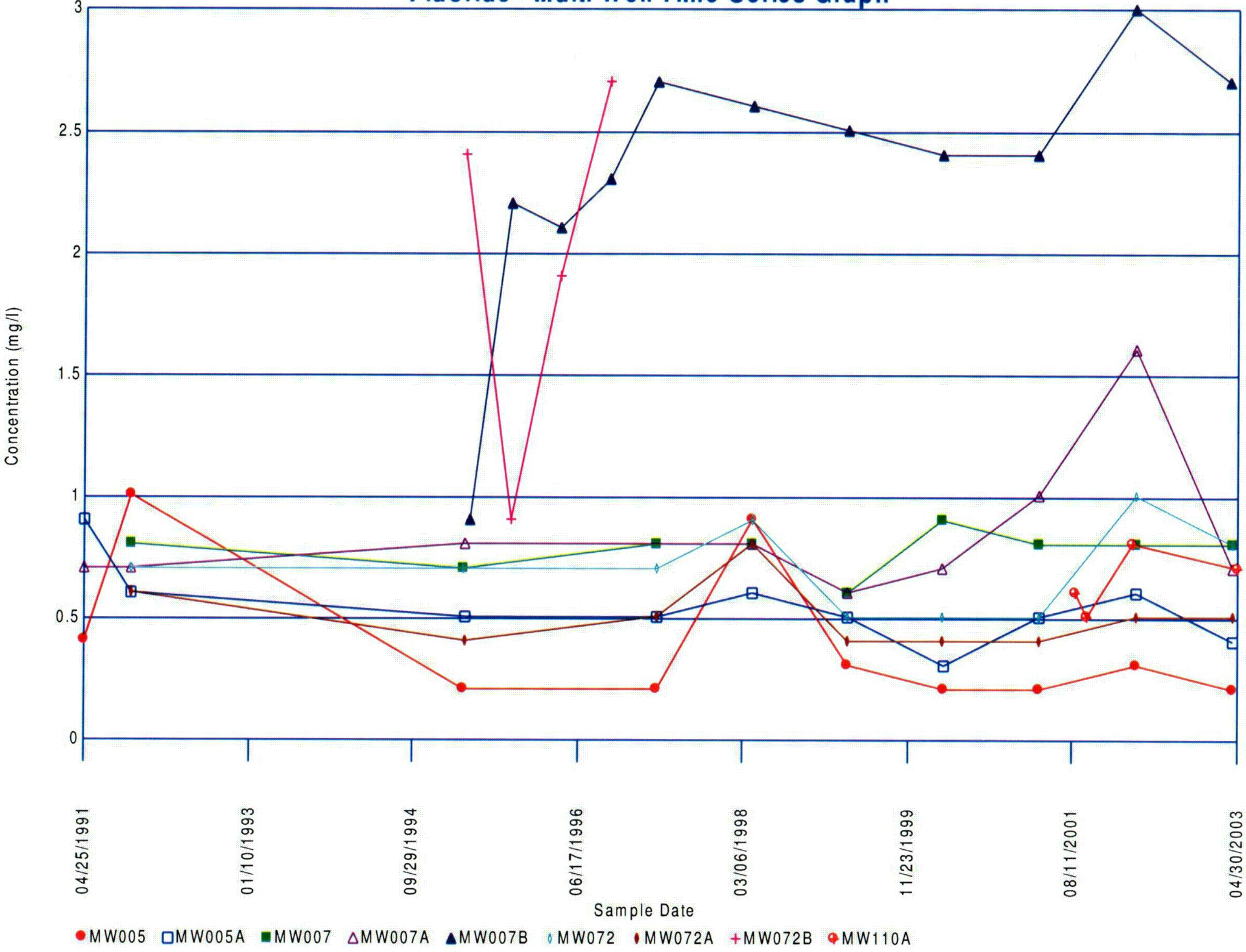
Arsenic - Multi-Well Time-Series Graph



C04

Figure 7

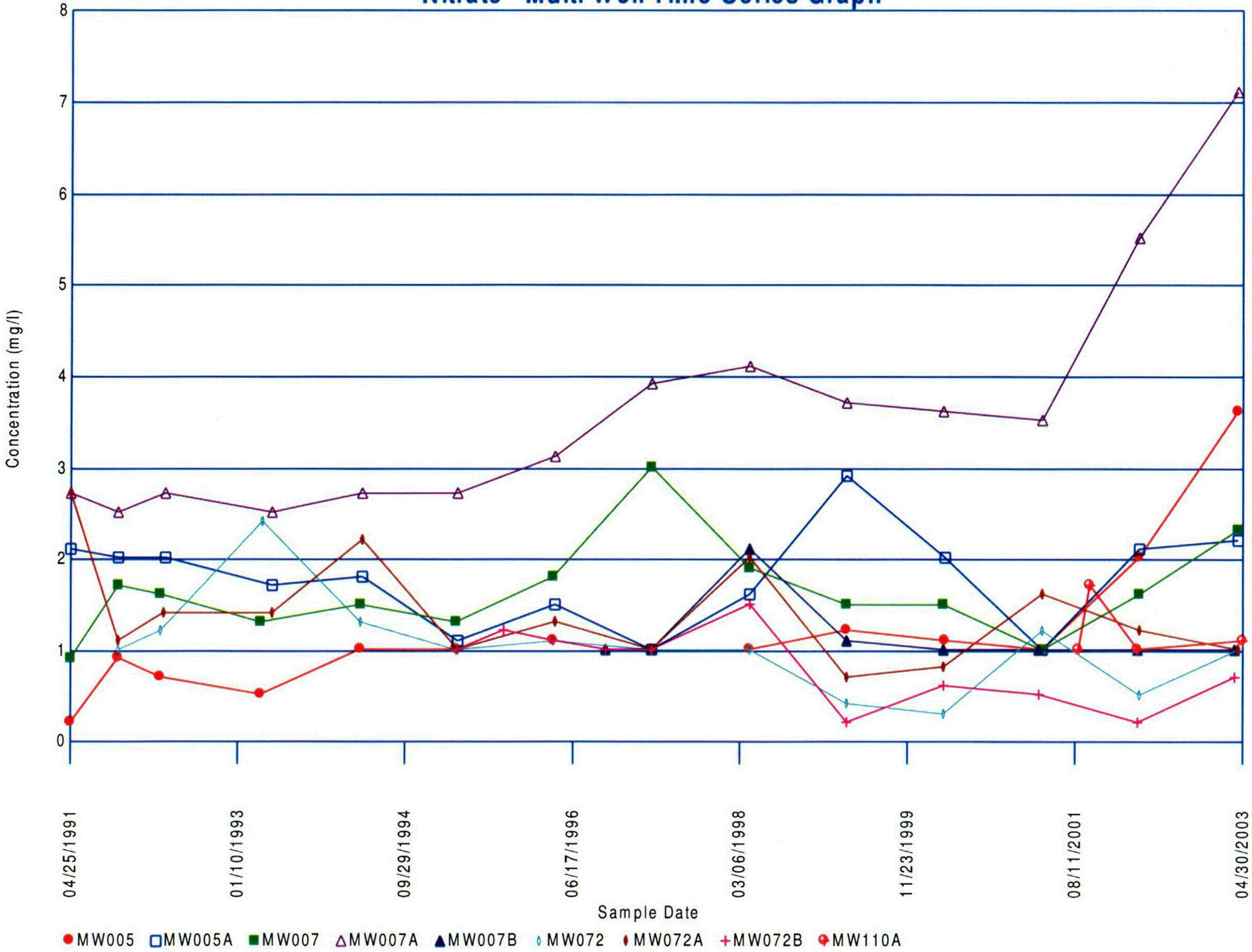
Fluoride - Multi-Well Time-Series Graph



C05

Figure 8

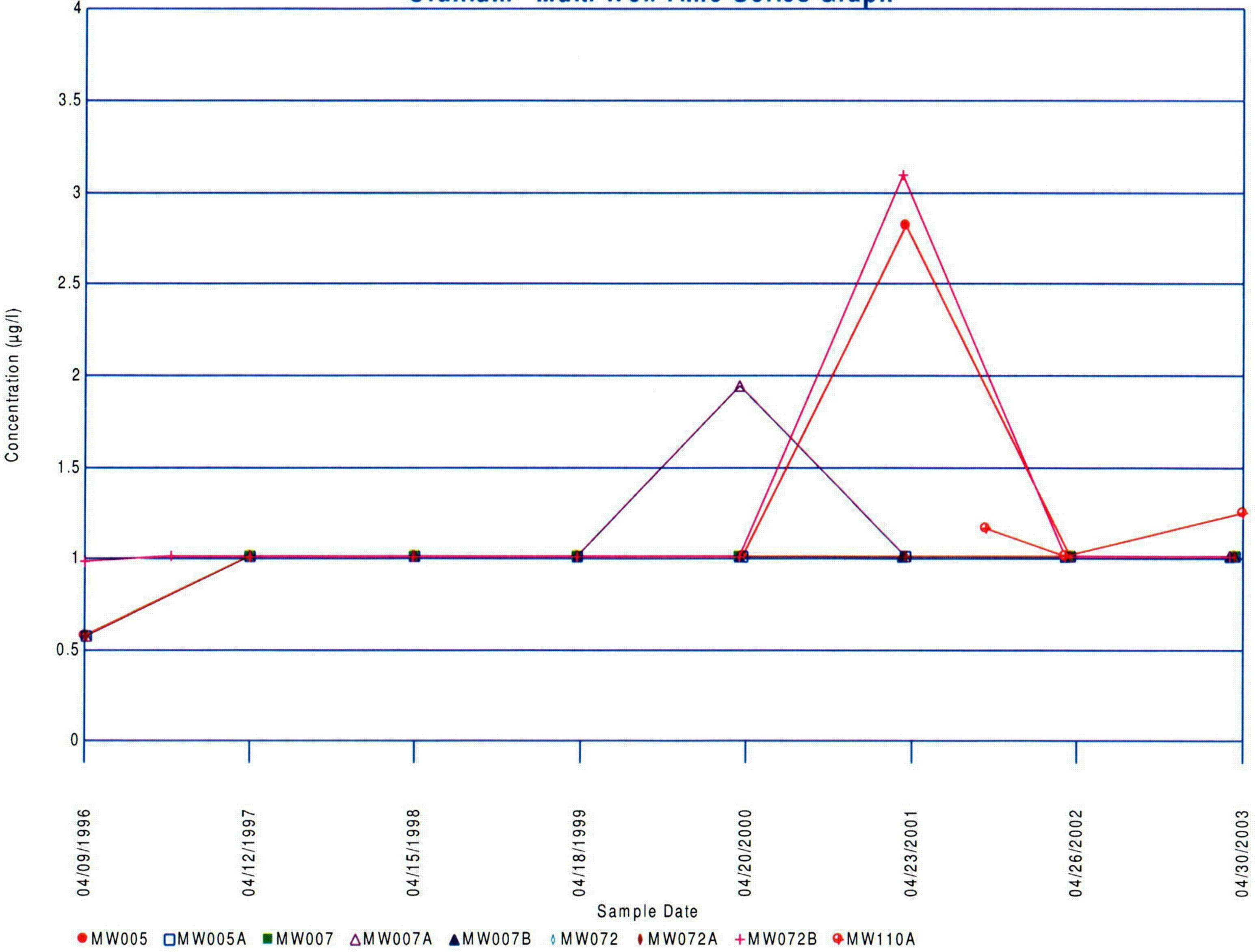
Nitrate - Multi-Well Time-Series Graph



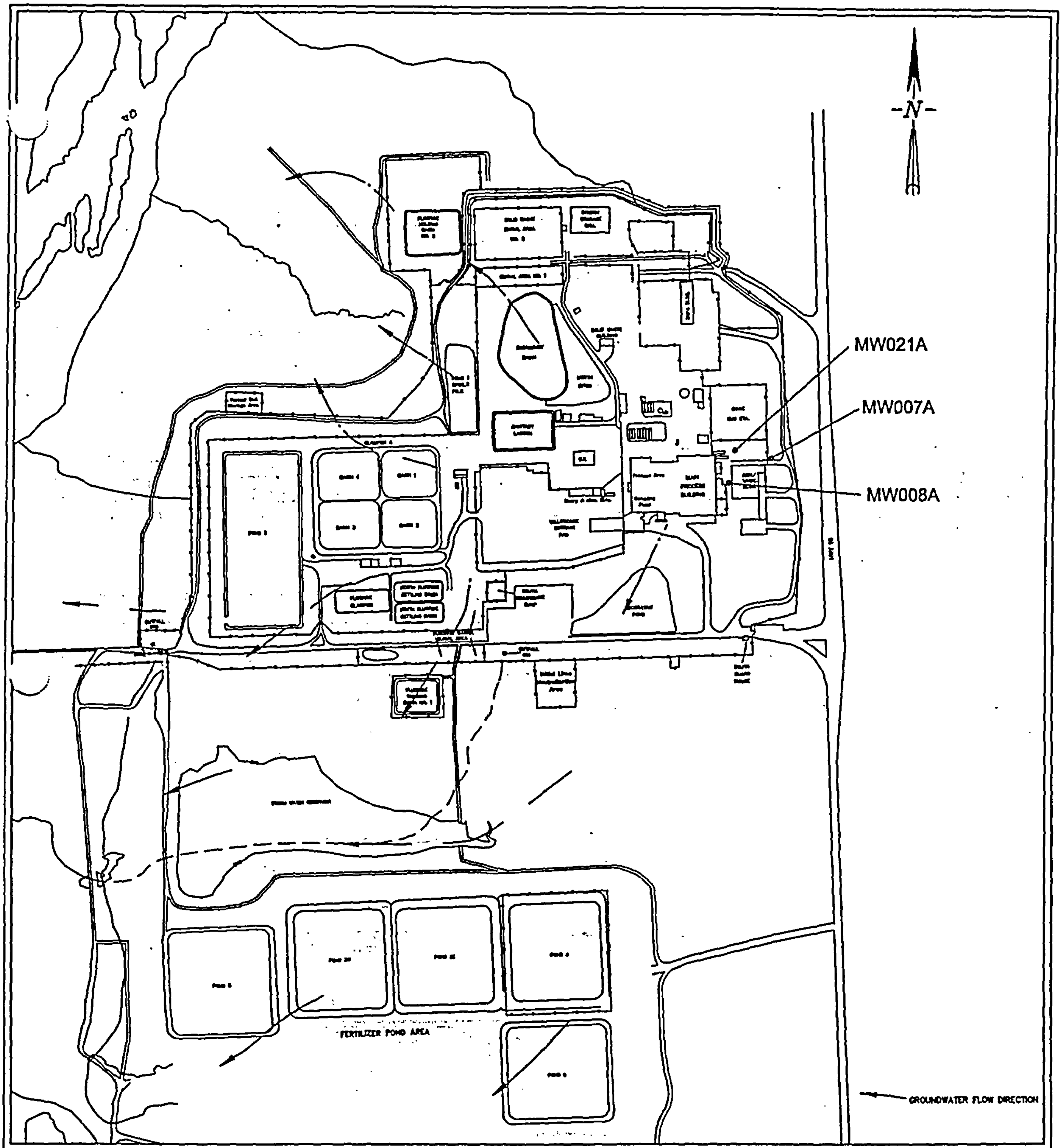
C06

Figure 9

Uranium - Multi-Well Time-Series Graph



C07



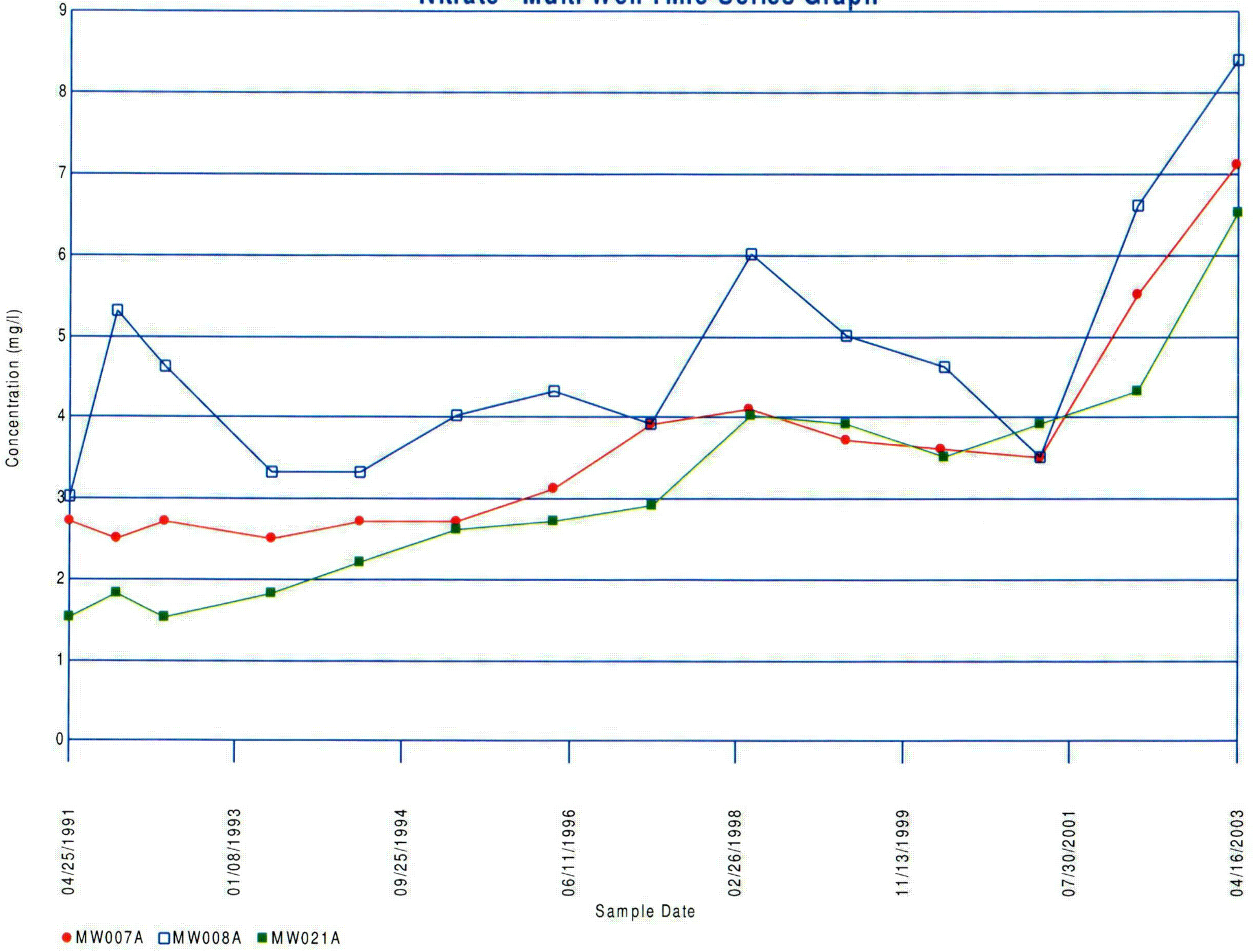
SEQUOYAH FUELS CORPORATION
Background Groundwater Monitoring Well Evaluation

TITLE: Location of MW007A, MW008A & MW021A

PREPARED BY: SCM	FILENAME: Figure1.dwg
REVIEWED BY: SCM	FIGURE NO. 10
DATE: 26 Oct 2004	

Figure 11

Nitrate - Multi-Well Time-Series Graph



C08

Attachment A

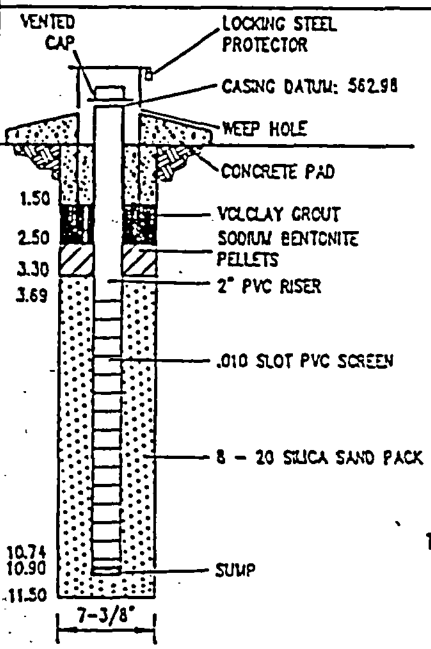
WELL COMPLETION RECORD

Start: 8:40
Stop: 9:15

GROUND SURFACE: 560.70

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE	INTERVAL	"N" VALUE
	0	CLAYEY SANDY SILT: 10 YR 4/2, DARK GRAYISH BROWN, ROOTLETS TO 2.0', TRACE OF GRAVEL, CLAYEY LENSE AT 0.9-1.0', GRADATIONAL LOWER BOUNDARY (0.6'), 60% SILT, 20% CLAY, 20% SAND	CL		1	4.5	
	2.0	SILTY CLAY: 2.5 Y 6/4, LIGHT YELLOWISH BROWN, MOTTLED 2.5 YR 4/8, RED, LOW PLAST., FIRM, SLIGHTLY MOIST, 65% CLAY, 35% SILT, GRAVEL LENSE AT 5.0-6.0'	CL		2 NR 3	 4.0	
	6.0	SHALE: 10 YR 5/8, YELLOWISH BROWN AND 10 YR 3/1, VERY DARK GRAY, FRACTURED AND HIGHLY WEATHERED, CLAY LENSES 2.5 Y 5/6, LIGHT OLIVE BROWN WITH 2.5 Y 7/0, LIGHT GRAY ELIPTICAL LENSES, THICK CLAY SHOWS AT 12.0-12.5'	SHALE		4 NR NR	 0.0	
	12.5	T.D. 12.5' NOTE: SANDSTONE AT 12.5'					

WELL COMPLETION DETAIL



NOTE: WELL INSTALLED IN SEPARATE BOREHOLE APPROXIMATELY 5 FEET FROM LITHOLOGICAL BOREHOLE. WELL BOREHOLE DRILLED TO 11.50 FEET.

▨ CME CONTINUOUS AUGER SAMPLER
☒ STANDARD PENETRATION TEST
☐ UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)

ROBERTS/SCHORNICK
& ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
(405) 321-3895

JOB NAME/NUMBER *SEQUOYAH\ 90067*

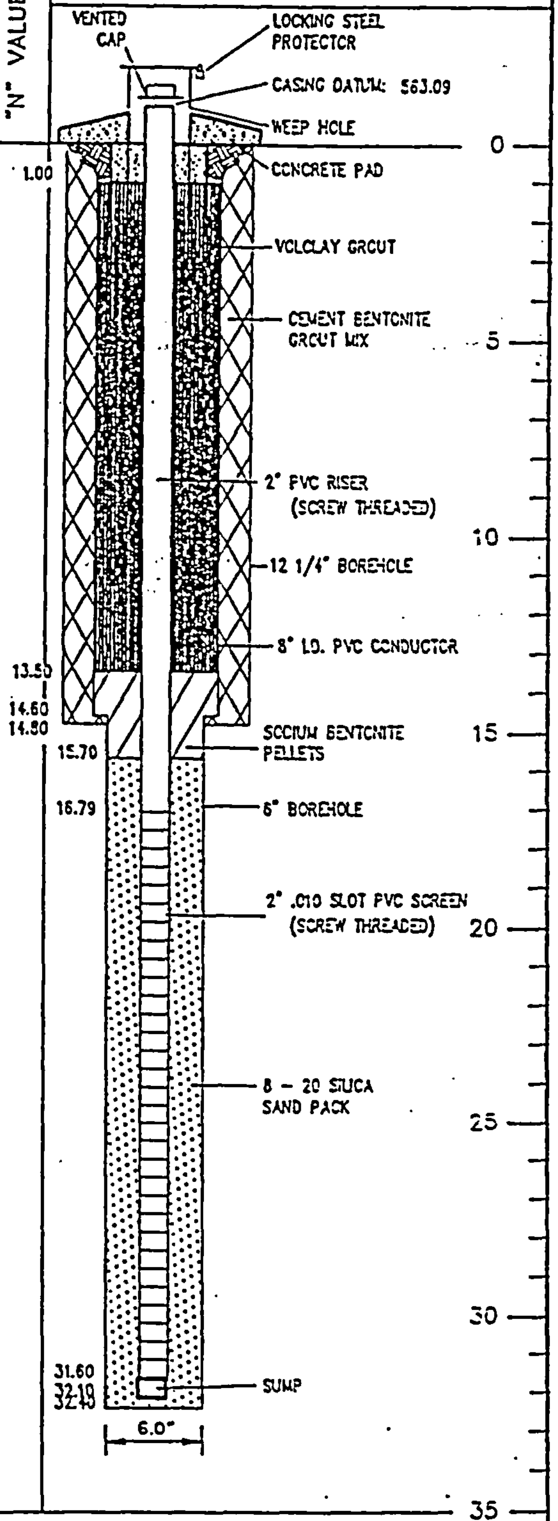
BORING NUMBER *MW-5 (BH-10)*

DATE DRILLED 9/27/90
DRILLING METHOD HSA
DRILLED BY PSI/SE
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: SAR PAGE 1 OF 1

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	SAMPLE INTERVAL		"N" VALUE
		GROUND SURFACE: 560.50				
	0	CLAYEY SANDY SILT: 10 YR 4/2, DARK GRAYISH BROWN, ROOTLETS TO 2.0', TRACE OF GRAVEL, CLAYEY LENSE AT 0.9-1.0', GRADATIONAL LOWER BOUNDARY (0.6'), 60% SILT, 20% CLAY, 20% SAND	CL	1	4.5	
	2.0	SILTY CLAY: 2.5 Y 6/4, LIGHT YELLOWISH BROWN, MOTTLED 2.5 YR 4/8, RED, LOW PLAST., FIRM, SLIGHTLY MOIST, 65% CLAY, 35% SILT, GRAVEL LENSE AT 5.0-6.0'	CL	2 NR 3	 4.0	
9/27/90 ∇ 9.0'	6.0	SHALE: 10 YR 5/8, YELLOWISH BROWN AND 10 YR 3/1, VERY DARK GRAY, FRACTURED AND HIGHLY WEATHERED, CLAY LENSE 2.5 Y 5/6, LIGHT OLIVE BROWN WITH 2.5 Y 7/0, LIGHT GRAY ELIPTICAL LENSES	SHALE	4 NR 5	 2.5	
10/5/90 ∇ 17.4	12.5	SANDSTONE: VERY FINE GRAIN SAND, 10 YR 5/3, BROWN, HARD	SANDSTONE	NS NS 1		
	17.0	SANDY SHALE: VERY FINE GRAIN SAND, 10% SAND 10 YR 4/1, DARK GRAY, SLIGHTLY MOIST, HARD	SANDY SHALE	2		
	18.5	7.5 YR 2/0, BLACK, SLIGHTLY MOIST, HARD	SHALE	3 NS		
	21.0	SANDSTONE: VERY FINE GRAIN, 2.5 Y 4/0, VERY HARD	SANDSTONE	4 5		
	26.0	SANDY SHALE: VERY FINE GRAIN SAND, 2.5 Y 3/0, VERY DARK GRAY, HARD, VERY MOIST	SHALE	6		
	28.0	SILTY SAND: VERY FINE GRAIN SAND, 2.5 Y 3/0, VERY DARK GRAY, VERY HARD	SILTY SAND	7		
	30	SANDY SHALE: VERY FINE GRAIN SAND, 10% SAND, 2.5 Y 3/0, VERY DARK GRAY, HARD, SATURATED	SANDY SHALE	8 9		
	32.4	T.D. 32.4'				
	35					

WELL COMPLETION DETAIL



▭ (diagonal)	CME CONTINUOUS AUGER SAMPLER
⊠	STANDARD PENETRATION TEST
▭	UNDISTURBED SAMPLE
∇	WATER TABLE (24 HOURS)
∇	WATER TABLE (TIME OF BORING)
L	LABORATORY TEST LOCATION
+	PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER *SEQUOYAH\ 90067*

BORING NUMBER *MW-5A (BH-10 & BH-10A)*

DATE DRILLED 10/5/90
DRILLING METHOD AIR ROTARY
DRILLED BY POOL
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR PAGE 1 OF 1

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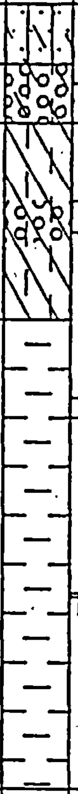
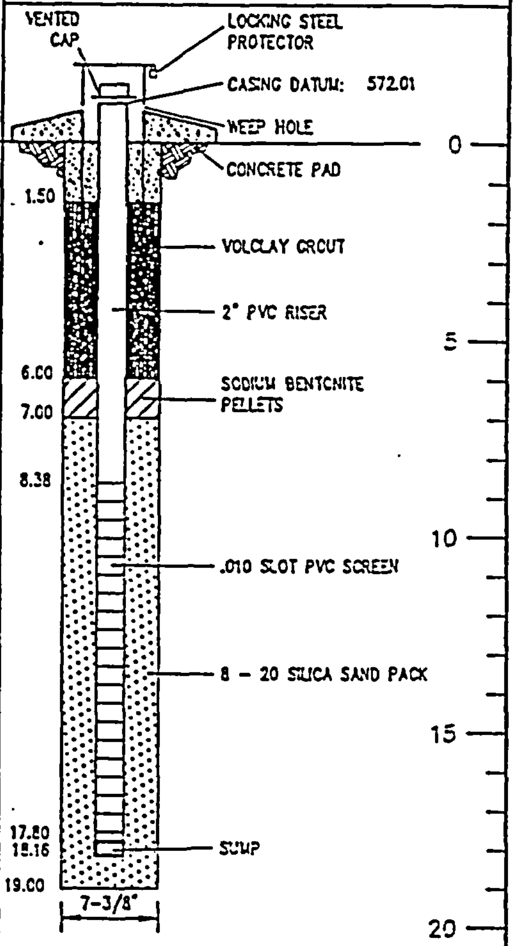
NORMAN, OKLAHOMA 73072
(405) 321-3895

WELL COMPLETION RECORD

GROUND SURFACE: 569.90

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL		"N" VALUE
	0	CLAYEY SANDY SILT: 10 YR 4/2, DARK GRAYISH BROWN, ROOTLETS, GRASS, 65% SILT, 20% CLAY, 15% SAND	CL		1	3.0	
	1.5	CLAYEY SILTY GRAVEL: 5 YR 5/8, YELLOWISH RED, SLIGHTLY MOIST, 50% GRAVEL, 30% CLAY, 20% SILT	GC		2		
	3.0	SILTY CLAY: 2.5 Y 6/4, LIGHT YELLOWISH BROWN, LOW PLAST., SLIGHTLY MOIST, GRAVEL LENSES 5.0–6.0'	CL		NR		
	5				3 NR	0.8	
	8.0	SHALE: 2.5 Y 5/4, LIGHT OLIVE BROWN INTER-BEDDED WITH 2.5 Y 3/0, VERY DARK GRAY, HIGHLY WEATHERED, FRACTURED, OXIDATION ALONG BEDDING PLANES AT 9.0' TO TD.	SHALE				
	10				4 NR	0.5	
	15				5 NR	0.5	
	20	T.D. 20.0' NOTE: SANDSTONE AT 20.0'					
	25						
	30						
	35						

WELL COMPLETION DETAIL



NOTE: WELL INSTALLED IN SEPARATE BOREHOLE APPROXIMATELY 5 FEET FROM LITHOLOGICAL BOREHOLE. WELL BOREHOLE DRILLED TO 19.00 FEET.

▨ CME CONTINUOUS AUGER SAMPLER
☒ STANDARD PENETRATION TEST
☐ UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
\+ PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER *SEQUOYAH\ 90067*

BORING NUMBER *MW–7 (BH–14)*

DATE DRILLED 9/27/90
DRILLING METHOD HSA
DRILLED BY PSI/SE
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: SAR PAGE 1 OF 1

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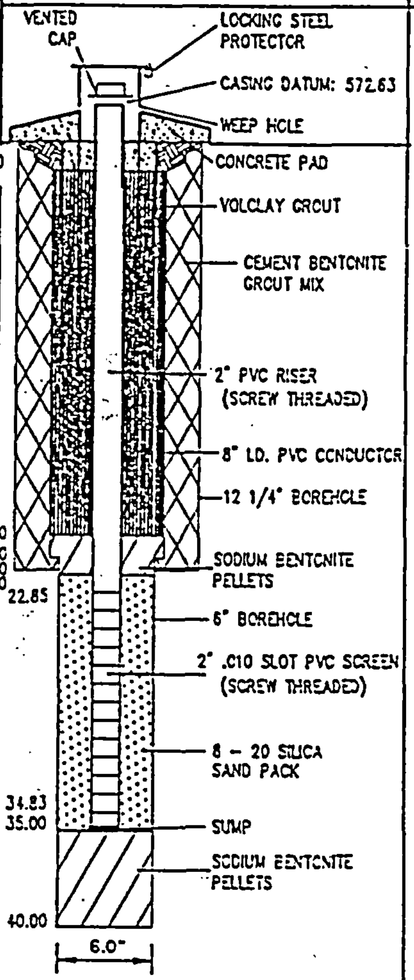
(405) 321-3895

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	SAMPLE	INTERVAL	"N" VALUE
		GROUND SURFACE: 570.20				
	0 – 1.5	CLAYEY SANDY SILT: 10 YR 4/2, DARK GRAYISH BROWN, ROOTLETS, GRAVEL, 65% SILT, 20% CLAY, 15% SAND	CL	1	3.0	
	1.5 – 3.0	CLAYEY SILTY GRAVEL: 5 YR 5/8, YELLOWISH RED, SLIGHTLY MOIST, 50% GRAVEL, 30% CLAY, 20% SILT	GC	2		
	3.0 – 8.0	SILTY CLAY: 2.5 Y 6/4, LIGHT YELLOWISH BROWN, LOW PLAST., GRAVEL LENSE AT 5.0-6.0', SLIGHTLY MOIST	CL	NR 3 NR	0.8	
10/5/90 15.2'	8.0 – 20	SHALE: 2.5 Y 5/4, LIGHT OLIVE BROWN, INTER-BEDDED 2.5 Y 3/0, VERY DARK GRAY, HIGHLY WEATHERED, FRACTURED, OXIDIZED ZONES, GROUNDWATER AT 15.2-15.4', OXIDATION ALONG BEDDING PLANES AT 9.0 TO T.D.	SHALE	4 NR 5 NR	0.5 0.5	
	20 – 20.5	SANDSTONE: 10 YR 5/3, BROWN, VERY FINE GRAIN VERY HARD	SANDSTONE	NS		
	20.5 – 24.0	SHALE: 7.5 YR 4/0, DARK GRAY, VERY HARD, SLIGHTLY MOIST, MINOR VERY FINE GRAIN SAND, INCREASES WITH DEPTH	SHALE	1		
	24.0 – 29.0	SILTY SANDSTONE: VERY FINE GRAIN SAND, 40% SILT, 7.5 YR 4/0, DARK GRAY, SLIGHTLY MOIST, HARD	SILTY SANDSTONE	2 NS		
	29.0 – 32.0	SANDSTONE: VERY FINE GRAIN, 7.5 YR 3/0, VERY DARK GRAY, VERY HARD, SLIGHTLY MOIST	SANDSTONE	3		
	32.0 – 40	SANDY SHALE: 20% VERY FINE GRAIN SAND, 7.5 YR 4/0, DARK GRAY, SLIGHTLY MOIST, HARD	SANDY-SHALE	NS 4 NS		
	40	T.D. 40.0' WATER LEVEL 33.7' AFTER DRILLING				

GRAPHIC LOG

WELL COMPLETION DETAIL



▭ CME CONTINUOUS AUGER SAMPLER

☒ STANDARD PENETRATION TEST

☐ UNDISTURBED SAMPLE

☰ WATER TABLE (24 HOURS)

☰ WATER TABLE (TIME OF BORING)

L LABORATORY TEST LOCATION

\+ PENETROMETER (TONS/SQ. FT.)

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JOB NAME/NUMBER *SEQUOYAH\ 90067*

BORING NUMBER *MW-7A (BH-14 & BH-14A)*

DATE DRILLED 10/5/90
DRILLING METHOD AIR ROTARY
DRILLED BY POOL
LOGGED BY WEP
CHECKED BY BJS
DRAWN BY: SAR

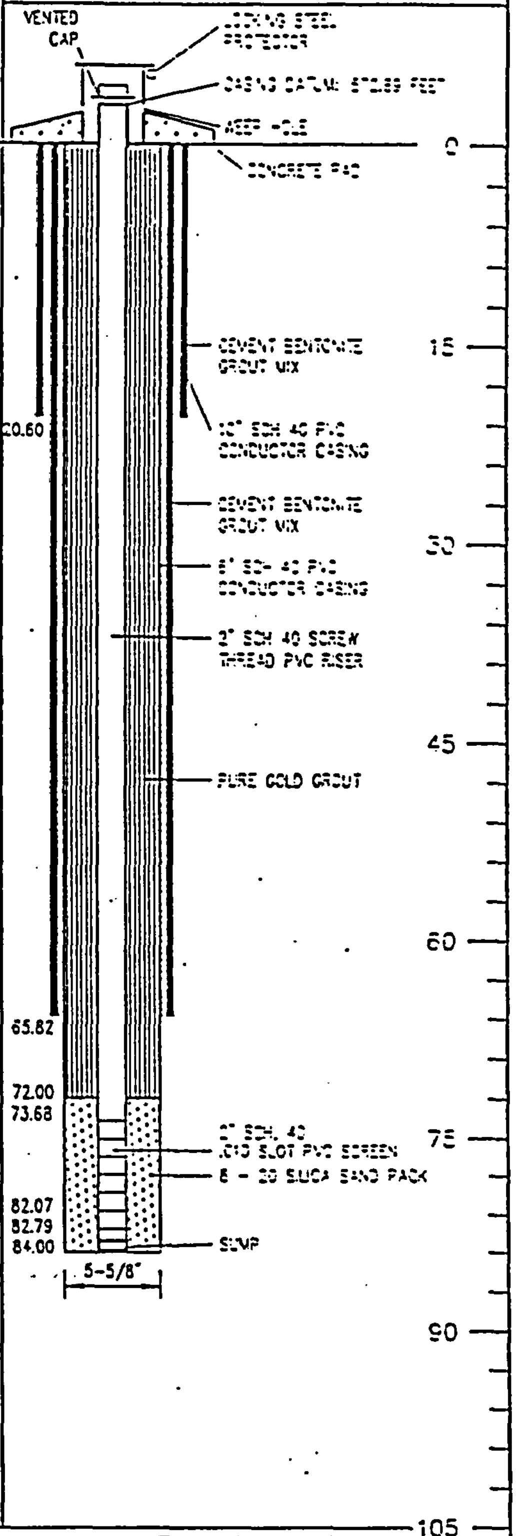
PAGE 1 OF 1

WELL COMPLETION RECORD

GROUND SURFACE: 570.29 FEET

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
	0	CLAYEY SANDY SILT:	ML			
	1.5	CLAYEY SILTY GRAVEL:	GM			
	3.5	CLAY:	CH			
∇ 9.3	7.0	SHALE:	SHALE			
	20.0	SANDSTONE:	SANDSTONE			
	22.4	SHALE:	SHALE			
	24.0	SANDSTONE:	SANDSTONE			
	25.7	SHALE:	SHALE			
∇ 34.53	29.4	SANDSTONE:	SANDSTONE			
	36.8	SANDY SHALE:	SHALE			
	38.5	SANDSTONE:	SANDSTONE			
	45	SHALE:	SHALE			
	61.2	SANDSTONE:	SANDSTONE			
	70.3	SHALE:	SHALE			
	84.0	TOTAL DEPTH: 84.0 FEET FOR COMPLETE LITHOLOGIC DESCRIPTION, SAMPLE INTERVAL AND "N" VALUE SEE BH-113.				

WELL COMPLETION DETAIL



▨ CME CONTINUOUS AUGER SAMPLER
☒ STANDARD PENETRATION TEST
☐ UNDISTURBED SAMPLE
∇ WATER TABLE (24 HOURS)

∇ WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER (TONS/SQ. FT.)
NR: NO RECOVERY

JOB NAME/NUMBER SEQUOYAH FUELS 93092.11

BORING NUMBER MW-7B (BH-113)

DATE DRILLED 2/7/95, 2/27-3/3/95
DRILLING METHOD HSA/AIR ROTARY
DRILLED BY LWC
LOGGED BY MJL
CHECKED BY BJS
DRAWING NO. 93092.11 E01
DRAWN BY: RML
PAGE 1 OF 1

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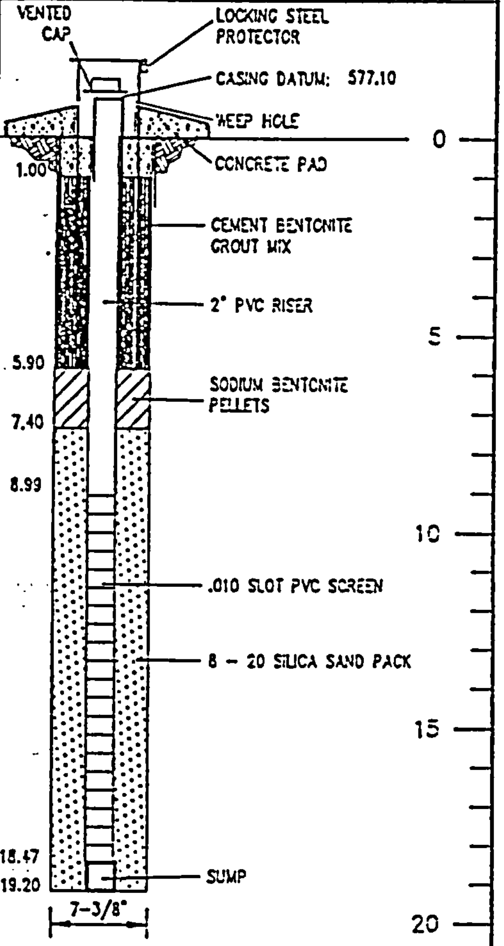
WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 574.22			
	0	TOPSOIL:		1 2.3	
	0.6	GRAVELLY SANDY CLAYEY SILT: BACKFILL, WET, SOFT, MED-LOW PLAST., NON-STRAT., 7.5 YR 4/4 TO 5/8, BROWN TO STRONG BROWN, 10% GRAVEL, 15% SAND, VERY FINE-FINE GRAIN, RND-SUBRND,M 15% CLAY, 60% SILT	ML	NR 2 2.5	
	5	GRAVELLY SILTY CLAY: BACKFILL, 7.5 YR 4/6, STRONG BROWN, MOIST, NON-STRAT., 15% GRAVEL, 15% SILT, 70% CLAY	CH	3 NR	
	9.1	CLAY: 7.5 YR 7/8 TO 7/0, REDDISH YELLOW TO LIGHT GRAY, MOIST, FIRM, MOTTLED, FINE LAMINATIONS, MED PLAST.	CL	4 5.0	
	11.4	WEATHERED SHALE: 7.5 YR 7/8 TO 3/0 TO 7/0, REDDISH YELLOW TO VERY DARK GRAY TO LIGHT GRAY, MOIST, VERY THIN LAMINATIONS 16.7-16.8', REDUCTED FE-ZONE, GRADES TO 7/8 TO 3/0 WITH NO 7/0 BY 14.0'	SHALE	5 6 7 3.5 8 NR 9 1.5	
	20.5	T.D. 20.5'			

WELL COMPLETION DETAIL



NOTE: WELL INSTALLED IN SEPARATE BOREHOLE APPROXIMATELY 5 FEET FROM LITHOLOGIC BOREHOLE. WELL BOREHOLE DRILLED TO 19.20 FEET.

▱ CME CONTINUOUS AUGER SAMPLER	WATER TABLE (TIME OF BORING)
☒ STANDARD PENETRATION TEST	L LABORATORY TEST LOCATION
☐ UNDISTURBED SAMPLE	+ PENETROMETER (TONS/SQ. FT.)
WATER TABLE (24 HOURS)	

JOB NAME/NUMBER *SEQUOYAH\90067*

BORING NUMBER *MW-72 (BH-82)*

DATE DRILLED 12/10/90
DRILLING METHOD HSA
DRILLED BY PSI
LOGGED BY TPC
CHECKED BY BJS
DRAWN BY: SAR
PAGE 1 OF 1

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WELL COMPLETION RECORD

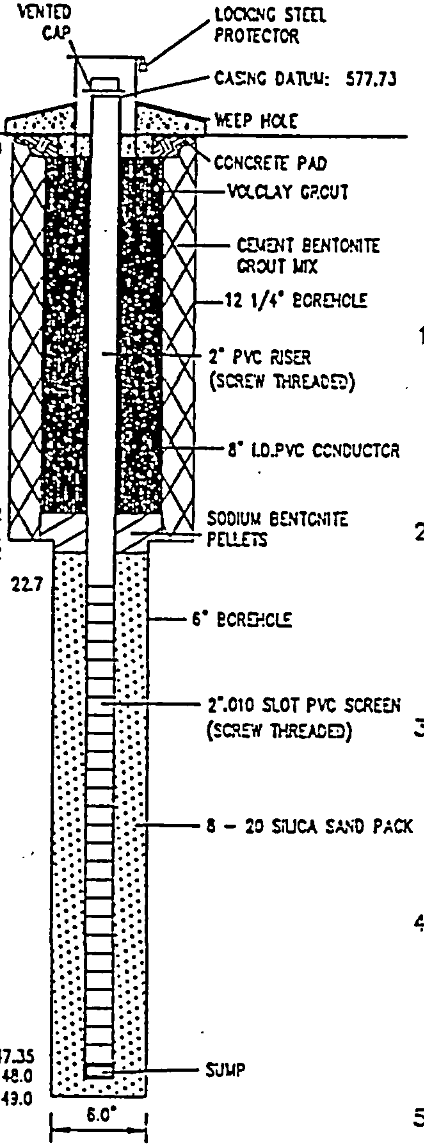
GROUND SURFACE: 575.10

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG
	0.6	TOPSOIL:		
	5.0	GRAVELLY SANDY CLAYEY SILT: BACKFILL, WET, SOFT, MED-LOW PLAST., NON-STRAT., 7.5 YR 4/4 TO 5/8, BROWN TO STRONG BROWN, 10% GRAVEL, 15% SAND, VERY FINE-FINE GRAIN, RND-SUBRND, 15% CLAY, 60% SILT	ML	
	9.1	GRAVELLY SILTY CLAY: BACKFILL, 7.5 YR 4/6, STRONG BROWN, MOIST, NON-STRAT., 15% GRAVEL 15% SILT, 70% CLAY	CH	
	11.4	CLAY: 7.5 YR 7/8 TO 7/0, REDDISH YELLOW TO LIGHT GRAY, MOIST, FIRM, MOTTLED, FINE LAMINATIONS, MED-PLAST.	CL	
	19.2	WEATHERED SHALE: 7.5 YR 7/8 TO 3/0 TO 7/0, REDDISH YELLOW TO VERY DARK GRAY TO LIGHT GRAY, MOIST, VERY THIN LAMINATIONS 16.7-16.8', REDUCED FE ZONE, GRADES TO 7/8 TO 3/0 WITH NO 7/0 BY 14.0'	SHALE	
	20.4	WEATHERED SHALE: CONDUCTOR CASING	SHALE	
∇ 29.0'	29.0	SHALE: 2.5 Y 5/4, LIGHT OLIVE BROWN, SOFT, MOIST TO WET, WEATHERED	SHALE	
		SHALE: 2.5 Y 2/0, BLACK, SOFT, WET, FISSILE, ORGANIC	SHALE	
	22.8	SANDSTONE: 2.5 Y 6/0, GRAY, HARD, SLIGHTLY MOIST, FINE GRAIN. CHANGED COLOR TO 2.5 Y 4/0, DARK GRAY AT 37.5', MODERATELY HARD BECOMES 2.5 Y 2/0, BLACK AND SHALEY AT 43.0'	SANDSTONE	
	24.5	SHALE: 2.5 Y 2/0, BLACK, SOFT, WET, FISSILE, ORGANIC	SHALE	
		T.D. 49.0'		

SAMPLE	INTERVAL
1	2.3
NR	
2	2.5
NR	
4	5.0
5	
6	
7	3.5
8	
NR	
9	1.5
NS	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	

"N" VALUE

WELL COMPLETION DETAIL



▨ CME CONTINUOUS AUGER SAMPLER

☒ STANDARD PENETRATION TEST

☐ UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

L LABORATORY TEST LOCATION

\+ PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER *SEQUOYAH\90067*

BORING NUMBER *MW-72A (BH-82)*

DATE DRILLED 1/14/91
DRILLING METHOD AIR ROTARY
DRILLED BY POOL
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: SAR

PAGE 1 OF 1

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NORMAN, OKLAHOMA 73072
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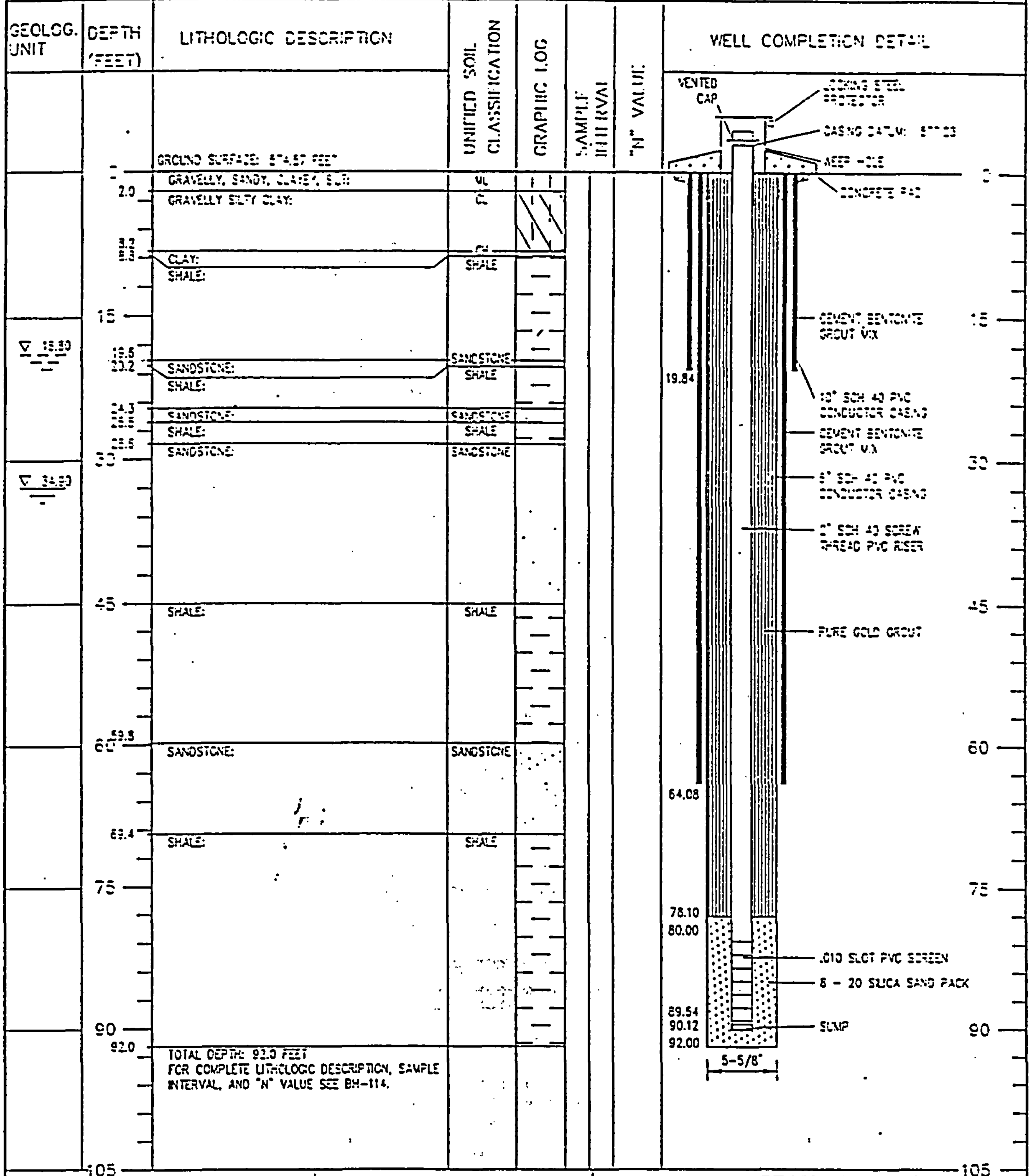
WELL COMPLETION RECORD



▨ CME CONTINUOUS AUGER SAMPLER

☒ STANDARD PENETRATION TEST

☐ UNDISTURBED SAMPLE

▽ WATER TABLE (24 HOURS)

▽ WATER TABLE (TIME OF BORING)

L LABORATORY TEST LOCATION

÷ PENETROMETER (TONS/SQ. FT.)

NR: NO RECOVERY

ROBERTS/SCHORNICK

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(405) 321-3895

JOB NAME/NUMBER *SEQUOYAH FUELS 93092.11*

BORING NUMBER *MW-72B (BH-114)*

DATE DRILLED 2/8/95, 2/17/95, 2/20-24/95

DRILLING METHOD HSA/AIR ROTARY

DRILLED BY LWC

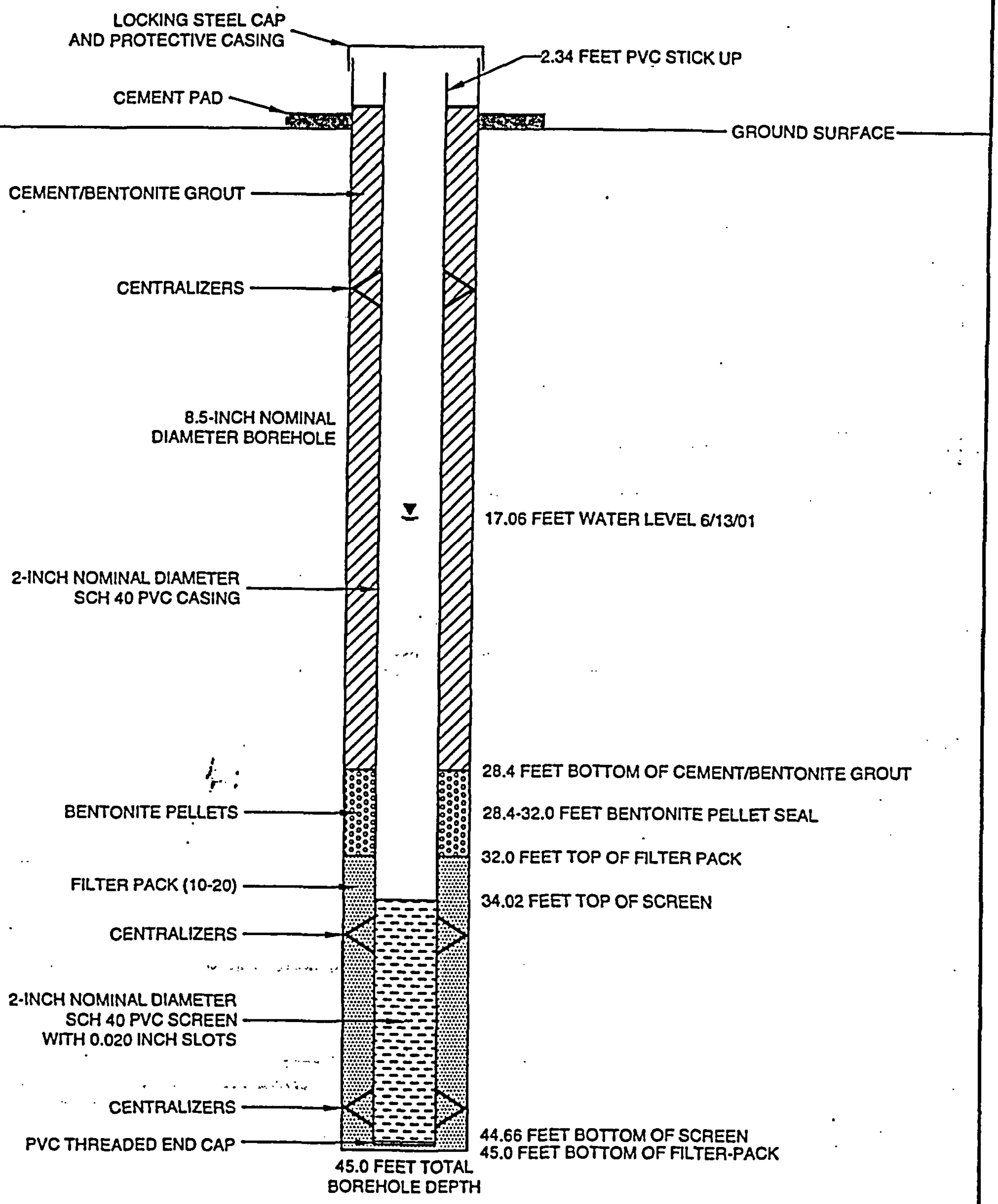
LOGGED BY MJL

CHECKED BY BJS

DRAWING NO. 93092502

DRAWN BY: RML

PAGE 1 OF 1



NOTE:
NOT TO SCALE
ALL DEPTHS ARE BELOW GROUND SURFACE

SHEPHERD MILLER
INCORPORATED

MW-110A

Date:	JUNE 2001
Project:	100734
File:	WC-MW

BORING LOG

SHEPHERD MILLER
INCORPORATED

BORING NO.
BH327 (mw110A)

PROJECT: SEQUOYAH FUELS PAGE: 1 of 2
PROJECT NO.: 100734 DATE: 5/15/01
NORTHING: 194737.5 EASTING: 2838430.0 GROUND ELEVATION: 549.5
DRILLING COMPANY: PETERSON DRILLING METHOD: HSA SPLIT SPOON -CORE
DRILLER: TROY LUCAS LOGGED BY: E. MULLER

DEPTH (FT)	GEOLOGY UNIT	TIME	(FT) RECOVERY	LITHOLOGY GRAPHIC	DESCRIPTION / NOTES
0	COLLUVIUM	10:45	0		BLIND DRILED -NO RECOVERY.
2		11:00	2		SC-SM CLAYEY, SILTY SAND WITH 50 % VERY FINE SAND, 5 % MED. TO COARSE SAND, AND 45 % SILT AND CLAY. SAND SUBRND. TO RND. QTZ. INTERVAL SLIGHTLY COHESIVE, DRY TO SLIGHTLY MOIST, VERY PALE BROWN (10YR, 8/3). ROOTS ABUNDANT THROUGHOUT.
4		11:10	2.5		SC - CLAYEY SAND WITH 70 % VERY FINE SAND, 30 % CLAY, AND AN OCCASIONAL FINE TO MEDIUM GRAVEL. SAND SUBRND. TO RND. QTZ., GRAVEL SUBRND. SS. INTERVAL DRY TO SLIGHTLY MOIST, SLIGHTLY COHESIVE, VERY PALE BROWN (10YR, 8/3).
6		11:20	2.0		MC - SANDY CLAY WITH ABOUT 80 % CLAY AND 20 % VERY FINE, RND. TO SUBRND. QTZ. SAND. INTERVAL SLIGHTLY MOIST, MEDIUM PLASTIC, VERY PALE BROWN (10YR, 8/3) WITH ABUNDANT YELLOWISH BROWN IRON OXIDE STAINING.
7.5	1 SH	11:31	1.8		SHALE - COMPLETELLY WEATHERED. VERY FINE SILT WITH WEAK, SUBPARALLEL, THIN (0.1MM) PARTINGS. INTERVAL SOFT, DRY, FRIABLE, VERY PALE BROWN TO YELLOWISH BROWN (10YR, 8/3) TO (10YR, 5/6).
8					SAME AS 7.5'-8'. REFUSAL AT 10'.
10	1 SS				SANDSTONE - VERY HARD, MASSIVE, CONSISTS OF VERY FINE TO FINE, SUBRND. TO RND. QTZ., SUCROSIC. PALE YELLOWISH BROWN (10YR, 6/2) FROM 10.0' TO 10.4' WITH ABUNDANT IRON OXIDE MINERALS. LIGHT GRAY (N7) WITH MEDIUM DARK GRAY (N4) MOTTLING FROM 10.4' TO 14.8'. REACTS SLIGHTLY IN HCL.
14.8	2 SH	13:00	10.2		SHALE - SANDY SHALE WITH ABOUT 20 % VERY FINE RND. QTZ. SAND. INTERVAL VERY THINNLY LAMINATED, VERY SOFT, CRUMBLES EASILY, DARK GRAY (N3) TO GRAYISH BLACK (N2).
15.7	2 SS				SANDSTONE - MED. HARD, CONSISTING OF VERY FINE, RND. TO SUBRND. QTZ. LIGHT GRAY (N7) WITH MED. DARK GRAY (N4) MOTTLING. REACTS SLIGHTLY IN HCL.
16.7	3 SH				SHALE - SOFT, VERY THINNLY LAMINATED, GRAYISH BLACK (N2). CRUMBLY FROM 16.7' TO 17.1'.
18.9	3 SS				SANDSTONE - MED. HARD, LIGHT GRAY (N7) WITH MED. DARK GRAY (N4) MOTTLING. CONSISTS OF VERY FINE TO FINE, RND. QTZ.
20		17:20	9.9		SANDSTONE - HARD, MED. DARK GRAY (N4), MASSIVE, CONSISTS OF FINE GRAINED, RND. QTZ.
24.2	4 SH				SHALE - BLACK (N1), VERY SOFT, FISSILE.
30					SEE ABOVE.

BORING LOG

SHEPHERD MILLER
INCORPORATED

BORING NO.
BH327

PROJECT: SEQUOYAH FUELS
PAGE: 2 of 2
PROJECT NO.: 100734
DATE: 5/15/01
NORTHING: 194737.5
EASTING: 2838430.0
GROUND ELEVATION: 549.5
DRILLING COMPANY: PETERSON
DRILLING METHOD: HSA SPLIT SPOON -CORE
DRILLER: TROY LUCAS
LOGGED BY: E. MULLER

DEPTH (FT)	GEOLOGY UNIT	TIME	(FT) RECOVERY	LITHOLOGY GRAPHIC	DESCRIPTION / NOTES
30				▥	SHALE - SEE ABOVE.
35	4 SH	18:30	10.0	▥	
40				▥	
40.6				░	SANDSTONE - SHALEY SANDSTONE, SLIGHTLY HARD, BLACK (N1) FROM 40.6' TO 42.3', GRADING TO HARD, MED. LIGHT GRAY (N6) SANDSTONE WITH DARK GRAY (N4), MM THICK PLANAR LAMINATIONS FROM 47.2' TO 47.8'. CONSISTS OF V. FINE, RND. TO SUBRND. QTZ. REACTS SLIGHTLY IN HCL.
45	4 SS	8:55 5/16/01	8.1	░	
50					TD
55					
60					

Attachment B

Dixon's Test for Outliers

For 3 to 25 Samples

Description:

Dixon's test provides a method of screening for outlier concentrations for data sets with 25 or fewer measurements. The method is iterative. In each iteration of the test, the highest or lowest outlier value is revealed. The next iteration is performed on the remaining values. Iterations continue until no data are shown to be outliers.

In each iteration, the highest and lowest critical values are calculated using a formula selected based on the number of data not yet shown to be outliers. These formulas are provided by Gibbons (1994). The critical value is then compared to tabulated comparison values based on the number of measurements now yet shown to be outliers, and the level of significance.

In ChemStat's implementation, Dixon's test can be performed on all wells, all compliance wells, all background wells, or the selected well. This option is available from the right-click menu accessed over the Dixon's test window. Remember that the total number of measurements screened can not exceed 25. Use Rosner's test for greater than 25 measurements.

ChemStat performs Dixon's test at either the 1% or 5% levels of significance. This option is selected from the right-click menu accessed over the Dixon's test window.

Use:
As a method of screening for outlier concentrations for data sets with 25 or fewer measurements.

APPENDIX C

Groundwater Sampling Plan

GROUNDWATER SAMPLING PLAN

Sequoyah Fuels Corporation

Sequoyah Facility

October 29, 2004

TABLE OF CONTENTS

GROUNDWATER SAMPLING PLAN

1.0 PURPOSE

This plan presents the procedures to be followed for groundwater monitoring well sampling, sample management, and sample custody control.

2.0 SAMPLING PROCEDURES

Activities which will occur during groundwater sampling are summarized as follows:

- pre-arrangement of sample analytical requests with analytical testing laboratory
- assembly and preparation of sampling equipment and supplies
- determine statistically significant number of groundwater samples for specific tasks
- groundwater sampling
    - determine sample type (i.e. composite or grab), frequency and number of samples, and proper sampling containers
    - inspection of well
    - water-level measurements
    - well depth measurement
    - measurement of any floating product in well
    - visual inspection of borehole water
    - calculation of purge volume
    - well bore evacuation
    - sampling
- sample preservation and shipment
    - sample preparation
    - on-site measurement of parameters
    - sample labeling including date, time, location, sampler's initials, analyses, and tracking number
- completion of sample records (field log book)
- completion of chain-of-custody records
- sample shipment

Detailed sampling procedures are presented in the following sections.

2.1 Equipment Assembly and Preparation

Prior to the sampling event, all equipment to be used (listed in Table 1) will be assembled, and its operating condition verified, calibrated (if required), and properly cleaned (if required). In addition, all record-keeping materials will be prepared.

2.1.1 Equipment Check

This activity includes the verification that all equipment is in proper operating condition. Also, arrangements for repair or replacement of any equipment which is inoperative are made.

2.1.2 Equipment Calibration

Where appropriate, equipment will be calibrated according to the manufacturer's specifications prior to field use. Equipment for making on-site measurements are pH, specific conductance, and temperature of water.

2.1.3 Equipment Cleaning (Decontamination)

All portions of sampling and test equipment which will contact the interior well casing will be thoroughly cleaned before use. This includes water-level tapes or probes, pumps, tubing, bailers, lifting line, test equipment for on-site use, and other equipment or portions thereof which are to be immersed. The procedure for initial equipment cleaning is as follows:

- clean with tap water and phosphate-free laboratory grade detergent, brush if necessary;
- rinse thoroughly with tap water;
- rinse thoroughly with distilled water;
- equipment cleaned prior to field use will be recleaned after transfer to the sampling site unless carefully wrapped for transport.

Non-dedicated equipment (such as water level or interface probes) which contacts the interior well casing before evacuation of the casing water will be rinsed thoroughly with distilled water (or hexane rinse if organics are noted) between wells. Dedicated bailers will be rinsed thoroughly with distilled water between sampling events. All other equipment which contacts the interior well casing during or after evacuation of the well casing water should be cleaned between well sampling use in accordance with the above detailed procedures.

Any necessary deviation from these procedures will be documented in the permanent record of the sampling episode.

Laboratory-supplied sample containers will be cleaned and sealed by the laboratory before shipping. Pre-cleaned sample containers may be purchased instead of using laboratory supplied containers that require cleaning by Facility personnel.

2.2 Groundwater Sampling Procedures

Special care will be exercised to prevent contamination of the groundwater and extracted samples during the sampling activities. The two primary ways in which such contamination can occur are:

- contamination of a sample through contact with improperly cleaned equipment; or
- cross-contamination of the groundwater through insufficient cleaning of equipment between wells. This could occur if non-dedicated sampling equipment is used.

To prevent such contamination, all sampling equipment will be thoroughly cleaned before each use at different sampling locations in accordance with Section 2.1:3.. In addition to the use of properly cleaned equipment, three further precautions will be followed:

- a clean pair of new, disposable latex (or similar) gloves will be worn each time a different well is sampled; and
- sample collection activities will proceed progressively from background area to the downgradient area or from wells which are least affected by contaminants progressively to wells most affected by contaminants.

The following paragraphs present procedures for the several activities which comprise groundwater sample acquisitions. These activities will be performed in the same order as presented below. Exceptions to this procedure will be noted in the permanent sampling record.

2.2.1 Groundwater Level and Well Depth Measurement

Prior to the water-level and well depth measurements, each well will be inspected thoroughly for signs of damage. Any damage to or repairs needed on the well must be noted in the field log book.

Using a pre-cleaned water level meter, the groundwater surface will be measured from the casing datum to the nearest 1/8 inch (0.01 foot). The datum, usually the top of the inner well casing, is described in monitor well records. A permanent mark or scribe will be visible on inspection of the inner casing. The depth to the bottom of the well must also be measured and referenced to the same datum as the water-level measurement. These measurements will be recorded in the field log book. The date and time of the water-level measurements must also be recorded.

2.2.2 Visual Inspection of Well Water

Prior to well evacuation, but after water level and well depth measurements, a small quantity of water will be removed with a bailer in a manner which will not totally immerse the bailer. The recovered sample is representative of the top of the water column in the well casing. This technique can determine the presence of immiscible contaminants that accumulate at the top of the water column. The water will be inspected for the presence of a floating film or other indications of contamination. Any distinct sample color or odors will be noted. The thickness of any floating immiscible or dense phase products will be measured and recorded in the field log book. All observations regarding odor or visual evidence of contamination will also be recorded in the field log book.

2.2.3 Well Casing Evacuation

The water standing in a well prior to sampling may not be representative of in-situ groundwater quality. Therefore, the standing water in the well and sand filter pack must be removed so that formation water can replace the stagnant water. Using the depth-to-water, well depth, and filter pack interval (assume a porosity of 30%) calculate the volume of groundwater to remove from each well. Three casing volumes (including filter pack porewater) must be removed before sampling. The following equations should be used to calculate the volume of groundwater to be removed prior to sampling:

(1) $v_c = \pi r_c^2 h_c \times 7.48 \times 3$

v_c = Three (3) volumes of water in casing storage, gallons

r_c = radius of casing, feet

h_c = length of water column in casing, feet

7.48 = conversion factor from cubic feet to gallons

3 = casing volumes, and

(2) $v_s = (\pi r_s^2 h_s - \pi r_c^2 h_{cs}) \times 7.48 \times 3 \times 0.30$

where: v_s = Three (3) volumes of water in sand pack interval, gallons

r_s = radius of drilled borehole, feet

h_s = length of sand pack interval, feet

r_c = radius of casing, feet

h_{cs} = length of casing/screen in sand pack interval, feet

0.30 = estimated porosity of sand pack

Adding the 3 casing groundwater volumes to the 3 sand porewater volumes equals the amount of water that must be purged from the well prior to sampling. After the first casing volume is purged, pH, conductivity, and temperature measurements will be taken and recorded. An additional set of pH, conductivity, and temperature measurements will be taken after the final casing volume is purged to insure that the water quality in the well has stabilized. If these measurements indicate water quality has not stabilized, then additional casing/sand pack pore water volumes will be removed until stable readings are obtained. All purged groundwater will be collected and managed in accordance with state and federal regulations.

If a well is incapable of yielding 3 casing volumes, then the well will be evacuated to dryness and allowed to recover until the next day prior to sampling. Water levels prior to purging, after purging and prior to sampling will be recorded in the field log book. The purged water will be tested for pH, temperature, and conductivity and compared to the groundwater sample to insure that the water quality in the well had stabilized. If the pH, temperature, or conductivity have not stabilized then additional purging of the well will be required.

The wells can be purged using clean stainless steel or teflon bottom discharge bailers. A clean monofilament nylon line will be used to lower the bailer into the well. Special care will be taken to insure that the bailer or bailer line does not contact the ground. Alternatively, a properly cleaned non-aerating pump system can be used for purging such as a bladder and/or peristaltic pump. Another method which may be used is a Brainard-Kilman hand pump system.

During groundwater collection, no equipment or lifting lines will be allowed to contact the ground. If equipment or lifting lines contacts the ground, they will be replaced or recleaned prior to use.

2.2.4 Sample Extraction

A bailer constructed of stainless steel or teflon will be used to extract water samples from the well. It is much preferable that bailers be <u>dedicated</u> to specific wells. A bailer must be recleaned in accordance with Section 2.1.3 if it was previously used to collect an immiscible phase sample or used to sample more than one (1) well. A new, clean monofilament nylon line should be used during each sampling event. Care must be taken to prevent either the bailer or lifting line from contacting the ground surface and becoming potentially contaminated during sampling. Care will be taken during insertion of sampling equipment to prevent undue disturbance of water in the well. The bailer will be lowered into the water gently to prevent splashing and extracted gently to prevent creation of excessive turbulence in the well. The sample will be poured directly into appropriate containers. While pouring water from a bailer, the water will be carefully poured down the inside of the sample bottle to prevent significant aeration of the sample.

If a significant immiscible layer remains in the well following purging, then care must be taken to avoid sample bias by sampling directly from the top of the water column. A sample of the immiscible layer should have previously been taken.

Excess water collected during sampling will be placed in a container for proper disposal as described in Section 2.2.4.

2.2.5 On-Site Parameter Measurement

Certain chemical and physical parameters in water can change significantly within a short time of sample acquisition. These parameters cannot be accurately measured in a laboratory located more than a few hours from the Site, and therefore will be measured on-site with portable equipment. Examples of these parameters are:

- pH;
- specific conductance;
- temperature;

Measurement of these parameters will be obtained from unfiltered, unpreserved, "fresh" water collected by the same technique as the samples taken for laboratory analyses. The measurements will be made in a clean glass container separate from those intended for laboratory analysis. The measured sample will be disposed of as described in Section 2.2.4. The measured values will be recorded in the field log book.

2.3 Sample Preservation

Water samples will be properly prepared for transportation to the laboratory under refrigeration and chemical preservation, if necessary. The laboratory providing sample containers will have added any necessary chemical preservatives to the sealed containers provided. While in the field, all collected samples must be placed in ice filled chests. Table 2 is a list showing appropriate sample containers, preservatives, and holding/extraction times for several parameters. The preservatives; sample containers, and holding times listed in Table 2 will be followed during groundwater sample collection.

2.4 Container and Labels

Containers and appropriate container lids will be provided by the analytical testing laboratory. The containers will be filled and container lids will be tightly closed. The following information will be legibly and indelibly written on the label:

- sample identification,
- sampling date,
- sampling time,
- sample collector's initials, and
- preservatives used.

Complete the chain-of-custody form, include sample collectors name, facility name, laboratory name, sample identification, sampling date, sampling time, description of sample, parameters, and any special instructions.

2.5 Sample Shipment

Typically, the concentration, volume shipped, and type of compounds present in the groundwater from the Facility are considered by the U.S. Department of Transportation (D.O.T.) to be non-hazardous. Thus, the following packaging and labeling requirements for the sample materials are usually appropriate for shipping the sample to the testing laboratory:

- preserve samples with ice and cool to 4°C,
- package sample so that is does not leak, spill, or vaporize from its packaging;
- attach chain-of-custody forms inside sample shipment container;
- label package; and
- complete shipping papers.

Under certain circumstances, such as elevated concentrations of uranium, the D.O.T. has an action limit. Radioactive material is defined as any material having a specific activity greater than 0.002 microcuries per gram. Radioactive materials have additional shipping requirements that will be followed.

2.6 Chain-of-Custody Control

After samples have been obtained, chain-of-custody procedures will be followed to establish a written record concerning sample movement between the sampling site and the testing laboratory. Each shipping container will have a chain-of- custody form completed by the site sampling personnel packing the samples. The chain-of-custody form for each container will be completed in triplicate. One copy of this form will be maintained at the site, and the other two copies will be shipped with the samples to the laboratory. One of the laboratory copies will become a part of the permanent record for the sample and will be returned with the sample analyses.

A copy of a sample chain of custody form is shown in Appendix F.

2.7 Sampling Records

To provide complete documentation of sampling, detailed records will be maintained. These records will include the information listed below:

- sample location (facility name);
- sample identification (well number and/or sample number);
- sample location map or detailed sketch;
- date and time of sampling;
- sampling analysis and method;
- field observations of
    - sample appearance,
    - sample odor
- weather conditions;
- sampler's identification; and
- any other information which is significant.

Groundwater sampling information will be recorded in the field log book.

3.0 ANALYTICAL METHODS

Groundwater samples will be analyzed using the appropriate, EPA approved methodology in accordance with methods outlined in SW846, "Test Methods for Evaluating Solid Waste", published by the EPA or a similar EPA approved method. Water samples collected from monitoring wells also include one (1) replicate per day. The decision of which sample to split will be made by sampling personnel. The split or replicate sample will be given a designation which will not be confused with other samples to be tested. A trip blank sample of reagent grade water will be shipped from the laboratory to the Site and will be returned to the laboratory for analysis. The blank will not be opened in the field. The trip blank will be used when volatile organic analyses are conducted. One equipment blank sample will be prepared in the field each sampling day. Equipment blank (rinse) samples will be obtained by pouring distilled water into a cleaned sampling bailer and then filling a sample container in the same manner that would be used for a groundwater sample. This is done in the field at the time of sample collection.

The laboratory performing the analyses will have a QA/QC program which specifies procedures and references to be used. As a minimum, the program will contain:

1. Laboratory instrument calibration procedures and schedules.
2. Specification of adherence to accepted test methods.
3. Equipment inspection and servicing schedules.
4. The regular use of standard or spiked sample analyses.
5. Operator or analyst training procedures and schedules.
6. A program of continuous review of results, procedures, and compliance with the QA/QC program.
7. Documentation of compliance with the program.

APPENDIX D

Project Plan for Plugging Abandoned Wells

Project Plan for Plugging Abandoned Wells

Sequoyah Fuels Corporation

Sequoyah Facility

October 29, 2004

Project Plan for Plugging Abandoned Wells

Introduction

SFC has characterized the groundwater conditions at the Facility, and has developed a site-specific model from this characterization data to use as a management tool for groundwater remediation. Monitoring well completion records have been reviewed against the predictive model to evaluate the need for existing groundwater monitoring wells. This review is described in Section 5 of the Ground Water Monitoring Plan (GWMP). Existing wells that are no longer needed to monitor changes in groundwater quality will be plugged and abandoned in accordance with the procedure outlined below.

Regulatory Requirements

Historically, SFC has utilized well plugging techniques and guidance suggested in the EPA guidance document entitled, "Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells" (600/4-89/034, 1989). SFC committed through the GWMP to utilize the EPA guidance for well plugging techniques (Section 8, GWMP). State regulations pertaining to well plugging are contained within Oklahoma Water Resources Board Rules and Regulations, Subchapter 11, Plugging and Capping Requirements for Wells and Test Holes. The above cited Oklahoma regulations are similar to EPA's and will be followed.

Well Plugging Procedure

If the top of the screen is less than 20 feet below land surface, or the well does not meet current construction standards:

1. The casing will be removed or drilled out by over-drilling of the casing. The same size auger used to drill the borehole will be used to drill out the casing.
2. Cement grout will be placed from the bottom of the well to an elevation four (4) feet below land surface.
3. The remaining four (4) feet to land surface will be backfilled with compacted uncontaminated soil.

If the top of the well screen is 20 feet or more below land surface, and the well meets current minimum construction standards, then the casing need not be removed:

1. Cement grout will be placed in the well through a tremie pipe and filled or pumped from the bottom upward to within four (4) feet of land surface or to land surface.

2. The remaining four (4) feet to land surface will be backfilled with compacted uncontaminated soil.

Documentation

Proper documentation of each plugged well will be recorded and maintained by the Environmental Dept. Copies of the field logs will be included in the progress reports to the EPA. All material removed from the hole will be managed in compliance with all state and federal regulations and Facility procedures.

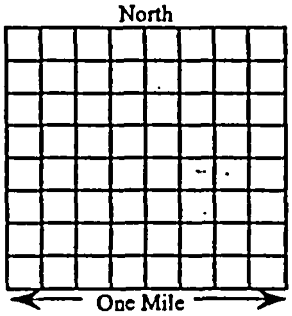
A plugging report will be completed and filed with the Oklahoma Water Resources Board within sixty days after the date of plugging. The form titled "Plugging Report for Groundwater and Monitoring Wells", copy attached, will be used.

PLUGGING REPORT FOR
Groundwater and Monitoring Wells

Oklahoma Water Resources Board
3800 North Classen Boulevard
Oklahoma City, OK 73118
Telephone (405) 530-8800

Do Not Write In This Space
Well Record ID Number ____________

Legal Location of Water Well or Boring



Each square is 10-acres
Please Plot Well Location

Section ________

Township ________ ☐ North ☐ South Range ________ ☐ WIM ☐ EIM ☐ ECM

*** After August 1, 2003 a measured latitude and longitude may be substituted for the Legal Description**

Latitude ________________ Longitude ________________

Date collected (latitude and longitude), if different from date the well was drilled: ____________

Method latitude and longitude was collected: ☐ GPS-uncorrected data, ☐ GPS-corrected data (WASS), ☐ GPS-corrected data (DGPS), ☐ GPS-corrected to base station

County ______________________ Variance Request No. (if applicable) ______________

WELL OWNER – NAME AND ADDRESS

Well Owner ______________________________ Phone ______________

Address/City/State ______________________________ Zip ________

TYPE OF WELL OR BORING BEING PLUGGED

☐ Groundwater Test Hole ☐ Groundwater well ☐ Geothermal/Heat Pump ☐ Geotechnical Boring ☐ Monitoring well

USE OF WELL BEFORE PLUGGING *Indicate the use of the well being plugged, to the best of your knowledge.

Use of well: ______________________________

PLUGGING INFORMATION

Date Well or Boring Was Plugged: ____________ Total depth of well being plugged (feet): ________

Was the well contaminated or was it plugged as though it was contaminated? ☐ Yes ☐ No

If the well or boring was plugged as if it was contaminated, was the casing removed or perforated? ☐ Yes ☐ No

Backfilled with:

☐ Native Materials, ☐ Clean Washed Sand, ☐ Other Describe: ____________

Backfilled from ________ feet to ________ feet

Grouted with:

☐ Cement Grout, ☐ Cement Grout/Bentonite, ☐ H.S. Bentonite Grout, ☐ Bentonite Pellets, ☐ Bentonite Granules/Chips

Grouted From ________ feet to ________ feet Was Grout Tremied? ☐ Yes ☐ No

Grouted with:

☐ Cement Grout, ☐ Cement Grout/Bentonite, ☐ H.S. Bentonite Grout, ☐ Bentonite Pellets, ☐ Bentonite Granules/Chips

Grouted From ________ feet to ________ feet

CERTIFICATION

The work described above was done under my supervision. This report is correct to the best of my knowledge.

Firm Name ______________________________ D/PC No. ____________

Operator Name ______________________________ OP No. ____________

______________________________ Date ____________
Signature