SEQUOYAH FUELS
A GENERAL ATOMICS COMPANY

RE: 0526-N.doc

April 12, 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
Response to Request For Additional Information – Reclamation Plan – Ground Water Protection (TAC L52511)

Dear Mike:

Enclosed with this letter is the response to your request for additional information (RAI) dated 3/2/2005 concerning ground water protection described in the Reclamation Plan. Enclosure 1 contains the responses with associated figures, and Enclosure 2 contains excerpts from the Ground Water Monitoring Plan (GWMP) which is responsive to your concerns in the 3/2/2005 RAI.

The location of the disposal cell was specifically chosen to be in an area that had previously been contaminated and was chosen in part to minimize the total area that would be contaminated. Concern was raised in the RAI that elevated residual concentrations of constituents will remain in the groundwater system that could mask any incremental contribution to groundwater quality from a potential leak in the disposal cell liner. While it is possible that some residual contamination could exist in soils and groundwater under the disposal cell, considerable effort will be made to remove most of the soil and groundwater contamination before the cell is constructed. The active corrective action program intended to restore ground water conditions to standards coupled with planned reclamation activities, should reduce existing contamination to a level that allows for detection of any significant leakage from the cell. SFC continues to believe that the proposed cell design and leakage detection system in concert with the groundwater monitoring networks and the corrective action program will protect the health and safety of the public and the environment.

The SFC team is available to meet with your staff and discuss any residual concerns that you might have after review of this response. If you have any questions, don't hesitate to call me at (918) 489-5511, ext. 13.

Sincerely,

John H. Ellis

John H. Ellis
President

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

Enclosure 1

Sequoyah Fuels Corporation
Response to Request for Additional Information
Reclamation Plan Review
Ground Water Protection

GW3 Detection Monitoring

Sequoyah Fuels Corporation (SFC) intends to construct an 11e.(2) byproduct material disposal cell in an area of the facility that currently exhibits soil and ground water contamination. To construct a detection monitoring system, SFC proposes to excavate contaminated soils, backfill the excavation with clean fill, and install point of compliance (POC) wells in clean fill to allow for detection of hazardous or radiological components leaking from the cell. In addition, a leak detection system will be installed below the waste to detect breaches of an overlying synthetic liner.

A REQUEST: Although the POC wells will be installed in clean fill, residual ground water contamination will remain at the cell location. Concentrations of the residual contamination would likely be sufficient to mask potential contamination emanating from the cell in the event of leak. It appears, therefore, that the detection monitoring system may not meet the requirements of 10 CFR 40, Appendix A, Criterion 7A that requires a detection monitoring system that can detect a leak from an impoundment. Furthermore, 10 CFR 40, Appendix A, Criterion 5(E)1, requires that the leak detection system be in addition to, not in-lieu of, a detection monitoring system.

SFC must provide additional information regarding the manner in which the proposed detection monitoring system can meet the requirements of Criterion 7A. Per the introduction to 10 CFR 40, Appendix A, SFC may propose an alternative to the requirements of Criterion 7A. However, in order for the Nuclear Regulatory Commission to approve such an alternative, SFC must demonstrate that it will contain and stabilize the site and be protective of public health, safety, and the environment in an equivalent manner as Appendix A and the standards promulgated in 40 CFR 192.

BASIS: 10 CFR 40, Appendix A, Criterion 5(E)1, states the following: "Where synthetic liners are used, a leakage detection system must be installed immediately below the liner to ensure major failures are detected if they occur. This is in addition to the ground-water monitoring program conducted as provided in Criterion 7."

10 CFR 40, Appendix A, Criterion 7A, states that, "The licensee shall establish a detection monitoring program needed for the Commission to set the site-specific groundwater protection standards in paragraph 5(B)1 of this appendix." Furthermore, "The initial purpose of the program is to detect leakage of hazardous constituents from the disposal area so that the need to set ground-water protection standards is monitored."

10 CFR 40, Appendix A, Introduction states the following: "Licensees or applicants may propose alternatives to the specific requirements in this appendix. ..... The Commission may find that the proposed alternatives meet the Commission's requirements if the alternatives achieve a level of stabilization and containment of the sites concerned, and a level of protection of public health, safety, and the environment from radiological and nonradiological hazard associated with the sites, which is equivalent to, to the extent practicable, or more stringent than the level which would be achieved by the requirements

of this appendix and the standards promulgated by the Environmental Protection Agency in 40 CFR Part 192, subparts D and E."

RESPONSE:

It is recognized that the groundwater monitoring system for the disposal cell can not fit into a neat regulatory package as envisioned by the standard criteria and review guidance. The location of the cell was specifically chosen to be in an area that had previously been contaminated and was chosen in part to minimize the total area that would be contaminated. Because of this, there are issues with groundwater monitoring that are not consistent with placement of a cell on virgin ground as assumed by the criteria and guidance documents.

Two potential sources of groundwater contamination will be present at the site, existing contamination resulting from the historic operation of the plant and the potential contamination from any leakage from the cell. While it is possible that some residual contamination could exist in soils and groundwater under the disposal cell after reclamation, considerable effort will be made to remove most of the soil and groundwater contamination before the cell is constructed. All soil under the cell footprint with uranium concentrations greater than 540 pCi/g will be removed. All groundwater known to exceed 150 pCi/l will be removed and treated, and soil excavated to recover groundwater that exceeds 150 pCi/l will be removed as well. These areas will be backfilled to the desired grade with clean material.

Site investigations indicate that most of the groundwater and soil contamination in the upper terrace/shale 1 aquifer under the cell footprint exists in the utility trenches and granular fill areas which are areas with groundwater that exceeds 150 pCi/l. Since the water and soils from these areas will be removed, it is anticipated that the vast majority of impacted soil and groundwater under the cell will be removed as a result of the cleanup activities. Therefore, while there could be some residual elevated constituent levels in the POC wells, it is expected that the groundwater concentrations after cleanup will be significantly less than current values. Since the residual concentrations will be significantly less than current values, relatively small contributions from a potential leak in the cell will be detectible. Monitoring existing groundwater contamination and the corrective actions associated with it is addressed in previously submitted documents.

Groundwater monitoring and leak detection for the cell, the second source of groundwater contamination, will involve a multi-step process. The process will start with the installation and monitoring of five wells at the locations shown on Figure 1. These wells will be installed soon after the cell has been constructed. They will be monitored monthly for the first year and then quarterly thereafter. The first 3 years of monitoring will generate at least 20 samples which should provide a characterization of groundwater quality for each well prior to any potential impact from the disposal cell. The water from the wells will be analyzed for the constituents listed on Reclamation Plan, Attachment E, Table 7.1. An intra-well statistical evaluation will be conducted to determine the 95% upper confidence limit (UCL) for each constituent and each well.

There is a very high degree of confidence that the water quality in the wells surrounding the cell will not be impacted by seepage from the cell for at least the first three years. This can be asserted for several reasons:

1. The material in the cell will be placed relatively dry and any excess water from precipitation or the emplaced waste will be removed by the leachate collection system.

2. The cell cover system is designed with a store/deplete component, and a composite cap (synthetic liner overlying compacted clay) to restrict stormwater percolation into waste.
3. The cell will be underlain by a synthetic liner that can be expected to perform for at least the first several years, if not forever.
4. The leak detection system beneath the synthetic liner will provide proof that no seepage is occurring past the synthetic liner.
5. An additional level of protection will be provided by three feet of compacted clay under the synthetic liner. If any seepage were to get past the synthetic liner and not be collected in the leak detection system, the compacted clay liner would further restrict and retard any contaminant flow from the cell.

A complete description of the proposed cover and liner systems along with the waste placement techniques is included in the Disposal Cell Specifications and Drawings which were submitted under separate cover (Reclamation Plan, Attachment A).

Ongoing quarterly groundwater monitoring will be evaluated to determine if new data are significantly different from the initial three-year baseline water quality. New groundwater quality results will be evaluated for each constituent in each well to determine if any data point exceeds the baseline UCL for any constituent. If any constituent is greater than the baseline UCL, the wells will be re-sampled and re-analyzed. If the concentration remains greater than the UCL value upon resampling, a complete evaluation of the groundwater situation will be conducted. This will include information regarding the presence and volume of water in the leachate collection system and the leak detection system, the results in the other cell monitoring wells, and results from the monitoring of the other site groundwater monitoring wells. The results of the evaluation will be submitted within 60 days of the confirmation sample results. The evaluation will include a determination of whether or not the cell is leaking and any remedial actions which might be required.

It is recognized that it is possible for a very small leak in the disposal cell to occur that would not be detected by the proposed system. However, if a leak is too small to cause statistically significant changes to groundwater quality, such a leak could not be assumed to have any adverse impact to public health, safety or the environment. Because of the cell design, which includes the liner system, the moisture conditions and placement techniques for the material disposed in the cell and the cover system for the cell, the potential for any seepage and groundwater impact from the cell will be orders of magnitude less than the amount of seepage and groundwater impact caused by historic operations.

The existing groundwater monitoring wells and the active ground water corrective action program (CAP), which was designed to deal with historic contamination, are immediately down-gradient from the proposed disposal cell. The existing wells and CAP, combined with the removal of contaminated soil and water under the cell, the design of the cell itself, and the cell monitoring wells will provide adequate protection of human health and the environment from any unforeseen groundwater impacts that might occur from the disposal cell.

B **REQUEST**: Section 7.0, Attachment E of the Reclamation Plan indicates that three point of compliance (POC) wells are proposed for the disposal cell monitoring network. Such a network assumes that ground water gradients will remain largely unaffected by the presence of an above ground disposal cell. However, topographic alterations, such as disposal cells, can cause localized changes in groundwater gradients because of the higher total hydraulic head in the disposal cover. Such conditions could cause ground water to migrate radially away from the disposal cell for a certain distance before being overcome by the regional groundwater gradient. Therefore, SFC should propose additional POC wells along the disposal cell circumference or provide justification that the three proposed wells will provide sufficient coverage after the disposal cell is built.

BASIS: 10 CFR 40, Appendix A, Criterion 7A states that the initial purpose of a detection monitoring program is to detect leakage of hazardous constituents from the disposal area. Compliance with this criterion is not possible without a sufficient number of wells in the detection monitoring network.

RESPONSE:

There are five proposed wells to monitor groundwater from the cell. The location of these wells is illustrated on Figure 1 and shown on the design drawings for the cell. The wells have been located based on the site specific geohydrologic conditions. Specifically, one well is located east of the cell which is up-gradient, while the other four wells are located west, north-west, south-west and south of the cell. These four directions are down-gradient from the cell.

The cell will have very little or no impact on the local hydrologic condition. Unlike typical tailings impoundments, there will be no hydraulic head within the cell that would cause groundwater to migrate radially from the cell. As stated above, the design and construction of the cell will minimize any potential for any water to flow from the cell. Specifically, the attributes of the cell construction that will minimize any groundwater impacts include:

1. The material in the cell will be placed relatively dry and any excess water from precipitation or the emplaced waste will be removed by the leachate collection system.
2. The cell cover system is designed with a store/deplete component, and a composite cap (synthetic liner overlying compacted clay) to restrict stormwater percolation into waste.
3. The cell will be underlain by a synthetic liner that will restrict any flow from the cell.
4. The leak detection system beneath the synthetic liner will provide proof that no seepage is occurring past the synthetic liner.
5. An additional level of protection will be provided by three feet of compacted clay under the synthetic liner. If any seepage were to get past the synthetic liner and not be collected in the leak detection system, the compacted clay liner would further restrict and retard any contaminant flow from the cell.

Given the nature of the cell and the local hydrologic conditions, the five proposed wells, in conjunction with the monitoring program detailed above, will be sufficient to provide leak detection monitoring.

It should be noted that in addition to the five wells that are specifically proposed for cell monitoring, there are 11 other wells that are completed and will be monitored in the upper terrace material and the Shale 1 layer aquifer. These wells were discussed in the December 30, 2004 response from SFC to NRC. The location of these wells is shown on

Figure 2. As can be seen, eight of the 11 wells are relatively close to the disposal well and could be used to evaluate any potential groundwater impacts from the disposal cell.

C REQUEST: Provide details regarding the manner in which POC wells will be constructed. Examples of such information include well diameter, casing and screen materials, screen slot size, type and thicknesses of filter pack materials, bentonite, and cement grout. Requirements for post-installation well development should also be specified.

BASIS: This information is necessary to evaluate whether the wells will be suitable for ascertaining compliance with 10 CFR 40, Appendix A, Criterion 7A.

RESPONSE:

The Ground Water Monitoring Plan Section 5.2, Monitoring well Construction Criteria, describes the well construction method used by SFC. This method has been used to install the current monitoring system employed at the Facility and will be used to install all new wells required under the GWMP and the Reclamation Plan. Typical well completion records are shown in Appendix B of the Ground Water Monitoring Plan. See Enclosure 2 for excerpts from the GWMP.

D REQUEST: Table 7.1 of Attachment E to the Reclamation Plan lists the water quality constituents to be analyzed during compliance monitoring. Along with the constituent list, SFC must specify the methodology it will use to determine whether or not leakage has occurred from the proposed disposal cell.

BASIS: 10 CFR 40, Appendix A, Criterion 7A, states that, "The initial purpose of the program is to detect leakage of hazardous constituents from the disposal area so that the need to set ground-water (sic) protection standards is monitored." Identifying and implementing an appropriate methodology is important for complying with this criterion.

RESPONSE: See response to GW3 A above.

E REQUEST: According to Appendix D, background ground water samples were analyzed for uranium, radium-226, thorium-230, nitrates, and fluoride. Background ground water samples apparently were not analyzed for arsenic, although arsenic is listed as a constituent of concern in Appendix B. Please provide arsenic background ground water concentration data. Also, the discussion of background data collection does not adequately describe the results of the investigation and statistical analysis methods. Please provide the actual results of the background investigation including any statistical analyses performed.

BASIS: 10 CFR 40, Appendix A, Criterion 5B(5), presents the acceptable concentration limits applicable to ground water monitoring programs associated with the disposal of 11e.(2) byproduct material. A background determination is necessary to understand whether or not ground water contamination exceeds the background concentration limit specified in 5B(5)(a).

RESPONSE:

Appendix B in the Ground Water Monitoring Plan describes the background monitoring well system, and provides a statistical evaluation of the background data collected from this system. See Enclosure 2 for excerpts from the GWMP.

GW4 Disposal Cell Cover Protective Layer

A **REQUEST**: According to Drawing 20 of the Reclamation Plan, the bottom 18 inches of the cover will be a protective layer with a minimum particle size of 1 inch. This protective layer presumably serves to drain infiltrating water away from the synthetic liner. However, this protective layer is not described in the text of the Reclamation Plan. SFC should provide details regarding this layer, including grain size distribution, installation specifications, and the purpose of the layer.

RESPONSE:

The protective layer mentioned above will have a maximum particle size of one inch. The drawings and technical specifications (Reclamation Plan Attachment A) describe this material as minus one-inch size, indicating that the maximum (and not minimum) particle size is one inch.

The protective layer is designed to (1) provide a protective layer above the synthetic liner (to protect the synthetic liner from subsequent cover material placement), and (2) provide lateral drainage for infiltrating meteoric water (if it would reach the synthetic liner). The particle size distribution of the protective layer (maximum particle size of one inch) and layer thickness (placed in one 18-inch thick lift) are typical liner manufacturer specifications for a protective layer above an HDPE liner.

The drawings and specifications (Reclamation Plan Attachment A) have been updated to reflect settlement agreement items with the State of Oklahoma, and include additional detail on the grain-size distribution specification for the protective layer material, as outlined below.

100% passing 1-inch size (25.4 mm)

65 - 100% passing No. 4 sieve size (4.76 mm)

30 - 85% passing No. 16 sieve size (1.19 mm)

0 - 50% passing No. 40 sieve size (0.42 mm)

B **REQUEST**: It appears that the median grain size of the protective layer will be substantially larger than that of the remaining, overlying soil cover. As a result, the protective layer could become clogged, reducing its ability to drain infiltrating water. This condition has two potential consequences. Because infiltrating water may not drain quickly, it could be available to seep into the waste material if tears in the synthetic liner exist. Also, pore pressure could begin building up reducing the effective friction angle of the cover/liner interface, potentially destabilizing the cover slope. Please provide additional information regarding the manner in which SFC will preclude clogging of the protective layer or provide justification that it is not necessary to do.

RESPONSE:

As mentioned in the response to GW4 A above, the maximum particle size of the protective layer is one inch, and the median particle size is therefore not significantly larger than that of the overlying soil cover. The drawings and specifications (Reclamation Plan Attachment A) have been updated to include additional detail on the grain-size distribution specification for the protective layer material. The grain-size distribution of the protective layer meets filter compatibility criteria with the overlying soil cover, so that clogging of the protective layer and potential consequences mentioned above are not likely.

Furthermore, the updated drawings and specifications have been modified to include textured HDPE for the cover synthetic liner. This material increases the effective friction angle and calculated factor of safety at the cover/liner interface, including the case of porewater pressure buildup at the cover/liner interface.

C REQUEST: Because of the large grain size of the protective layer particles, the underlying synthetic liner may be susceptible to tearing or puncture damage during protective layer installation. Provide information on how SFC will prevent damage to the synthetic liner during installation of the protective layer.

BASIS: 10 CFR 40, Appendix A, Criterion 6, states that licensees shall place an earthen cover over tailings and wastes and the cover shall be designed to provide reasonable assurance of control of radiological hazards to be effective for 1,000 years to the extent reasonably achievable and, in any case, for at least 200 years.

RESPONSE:

The specifications for the characteristics and placement of the protective layer material are included in Attachment A to the Reclamation Plan. As outlined in the specifications and mentioned above, the protective layer material will be minus one-inch size and placed over the synthetic liner in one 18-inch thick lift (with the material pushed out over the synthetic liner with a small dozer or other suitable equipment). These criteria are consistent with liner manufacturer recommendations for placement of a protective layer over a synthetic liner. Furthermore, the synthetic liner will be inspected if damage is suspected during protective layer material placement and repaired if damage has occurred.

GW5 Disposal Cover Water Balance

REQUEST: Recent research by Albright, et al., indicates that store-deplete (water balance) covers are not completely effective at eliminating seepage through the cover in humid environments. The researchers tested 15 water balance covers in climates ranging from semi-arid to humid. In all cases, water balance covers in humid areas allowed small amounts of water to percolate through the cover after 5 years. However, with time more water would likely permeate the cover due to increased secondary porosity (e.g., from dessication cracking and root penetration). SFC must justify its conclusion that the proposed cover will preclude water penetrating to the cover in light of the above cited research or address the consequences of water penetrating the cover, including its effects on slope stability.

BASIS: 10 CFR 40, Appendix A, Criterion 6, states that licensees shall place an earthen cover over tailings and wastes and the cover shall be designed to provide reasonable assurance of control of radiological hazards to be effective for 1,000 years to the extent reasonably achievable, and, in any case, for at least 200 years. Albright, W.H., Benson, C.H., Gee, G.W., Roesler, A.C., Abichou, T., Apiwantragoon, P., Lyles, B.F., Rock, S.A. Field Water Balance of Landfill Final Covers. Journal of Environmental Quality. American Society of Agronomy. February 2004.

RESPONSE:

First it needs to be noted that the proposed cover system utilizes three independent cover systems (a store and deplete component, a synthetic liner and a compacted clay layer). Each of these components would individually provide a high degree of infiltration control and in combination will provide the highest level of confidence that no infiltration would every enter the contaminated material within the cell. The store and deplete evapo-transpiration cover is only one aspect of the cover system. It is believed that the store and release cover, as designed, would be sufficient on its own to limit infiltration to acceptable levels. The following discussion addresses the specific reference relative to the store and release portion of the proposed cover.

Albright *et al.* (2004) monitored 24 covers at 11 field sites in the United States over approximately 3 years. Eight of the covers they tested were in humid locations. Four of these were conventional landfill covers, with percolation rates of 1.1, 1.4, 6, and 17.1 % of annual precipitation. The two with the lower percolation rates (1.1, and 1.4%, Omaha NE, and Cedar Rapids, IA) were conventional covers with composite barriers, and were purposely designed with punctures in the geomembrane, which resulted in the water transmission. In addition, Albright *et al.* indicate that the two covers were relatively thin, which did not allow for adequate storage of precipitation during intense storm events. The authors state that their results from these two sites may be exaggerated from actual field conditions, but do demonstrate that care must be taken to protect the integrity of the geomembrane during installation.

Simulation modeling of the SFC proposed cover suggests that in the early years after construction percolation in the store and release cover on its own would not totally eliminate all infiltration. After successful establishment and successional development of the vegetation occurs the vegetated cover is expected to consume all of the precipitation.

Two of the conventional covers (with soil barriers) had higher rates of percolation (6 and 17.1% of annual precipitation, Cedar Rapids IA, and Albany GA). At these sites, the authors attribute the percolation to preferential flow. At the Albany site, a 6 week drought desiccated the cover, causing cracks to form. After this drought period, the percolation rate increased dramatically (17%). This cover was comprised of 150mm of clayey topsoil above 450mm of compacted clay. At the Cedar Rapids site, 6% of precipitation resulted in percolation, and was attributed to preferential flow, although data were only available for 1 year. This cover was comprised of 600mm clayey topsoil, over 600mm of compacted clay.

The SFC proposed cover is more that twice the thickness of either of these two covers, and is comprised of coarser grained material in the upper sections. The potential for cracking from drought is minimized by the thick layers of coarser material on top of the compacted clay.

Four of the tested covers were alternative covers, with percolation rates of 6.1, 10.4, 10.5, and 18.4% of precipitation resulting in percolation. The authors indicate that two of these (6.1, and 10.4%, both at Omaha NE) were due to deficient soil water storage capacity relative to intense spring rainfall events. These covers were 112 and 81 mm in thickness. The SFC proposed cover has more than adequate soil water storage capacity for the largest storm events on historical record for the site.

One of the sites (10.5%, Albany GA) was affected by the 6 week drought listed above, and was also comprised of clay soils. The percolation rate at this site is attributed to the cracking of the clay soils during the drought. The percolation rate increased due to preferential flow only after the clay soils became dry and cracked. The SFC proposed cover is more that twice the thickness of this cover, and is comprised of coarser grained material in the upper sections. The potential for cracking from drought is minimized by the thick layers of coarser material on top of the compacted clay.

At the final tested site in a humid location (Cedar Rapids), 18.4% of precipitation resulted in percolation. The authors give no discussion or theory of why this rate was so high. However, there was only one year of data available at the site, indicating that there was not sufficient time at the site for complete vegetation establishment.

The authors caution that their findings in general are only a glimpse of cover performance, and that "caution must be used when making extrapolations" based on their findings.

In conclusion, direct comparisons of the results of this study and the SFC proposed cover are impossible, as there were no tested covers in the study that were near the thickness and textural classes of the proposed cover. The SFC proposed cover is more than twice the thickness of the tested covers in the study by Albright, *et al.* In addition, the study's findings are over a period of less than or equal to three years. This is insufficient time for full above and below ground establishment of the vegetation. Simulation modeling of the SFC proposed cover design indicates that initially there will be percolation until the plant community is full established. Albright, *et al.* point out that as the plant community was becoming established at the Albany, GA, site, percolation was very low, and only increased after a drought period caused the soils to dry and crack. The SFC proposed cover does not have surficial clay soils, and would not be expected to respond with the cracking that was evident in the study site.

The findings by Albright *et al.* indicate that detailed site specific conditions with regards to vegetation and soils should be examined in humid areas when designing a cover. Without caution, a thorough understanding of the site, and care during construction, a cover design will fail to prevent soil water from percolating into the covered material. Throughout the design process of the SFC proposed cover, details for the vegetation, cover soils, and climatic patterns were studied closely in order to develop a design that will protect the integrity of the disposal cell.

GW6 Disposal Cover Vegetation

SFC proposes to construct a self sustaining vegetative cover for the cell. The proposed vegetation includes local trees.

A **REQUEST**: Please provide the botanical names of the tree species you propose to plant on the disposal cell cover. Describe the methodology that was used to select the tree species and provide the basis for your conclusion that the cover thickness is sufficient to prevent root penetration of the waste.

RESPONSE:

In response to input from the State of Oklahoma, tree planting has been eliminated from the proposed revegetation program. In addition, long-term maintenance will be used to keep trees from invading the site.

B **REQUEST**: Please discuss other native or non-native tree species near the site that have the potential to invade the cover. If such species exists, provide information similar to that provided for the species to be planted, including the information requested above. If not, provide the basis for your conclusion.

BASIS: 10 CFR 40, Appendix A, Criterion 6, states that licensees shall place an earthen cover over tailings and wastes and the cover shall be designed to provide reasonable assurance of control of radiological hazards to be effective for 1,000 years to the extent reasonably achievable, and, in any case, for at least 200 years.

RESPONSE:

The tree species in the county that have the potential to invade the cover include:

1. sycamore – *Platanus occidentalis*
2. cottonwood - *Populus deltoides*
3. sweetgum - *Liquidambar styraciflua*
4. water oak - *Quercus nigra*
5. red oak - *Quercus rubra*
6. white oak - *Quercus alba*
7. shortleaf pine - *Pinus echinata*
8. hickory - *Carya ovata*

The long term maintenance of the cover includes annual mowing to prevent tree establishment

GW7 Geology/Hydrogeology

A **REQUEST**: A discrepancy exists between the written geologic descriptions and associated maps contained in Appendix D. Page 3-14 states that Sandstone 1 underlies the Terrace Groundwater System; however, cross-sections contained in Figure 11, Appendix D, and in Figure 14 of the Reclamation Plan show that Shale 1 underlies the Terrace system. Please clarify this discrepancy.

RESPONSE:

There have been numerous conceptual groundwater models used at the site over the last 15 to 20 years. Each of these site models have referred to the geologic conditions in a slightly different manner. The use of similar terminology to represent slightly different geologic layers has caused some confusion. The current site model is the most comprehensive and has divided the groundwater system into the discrete geologic units that exist at the site. That conceptual model is described in the Hydrogeological and Geochemical Site Characterization Report (HGSCR) (Appendix B of the Reclamation Plan).

The term Terrace Groundwater System, as discussed in the request above, refers to the uppermost interconnected aquifer system that is comprised of the upper terrace soils and Shale 1. The Terrace Groundwater System is perched on top of Sandstone 1.

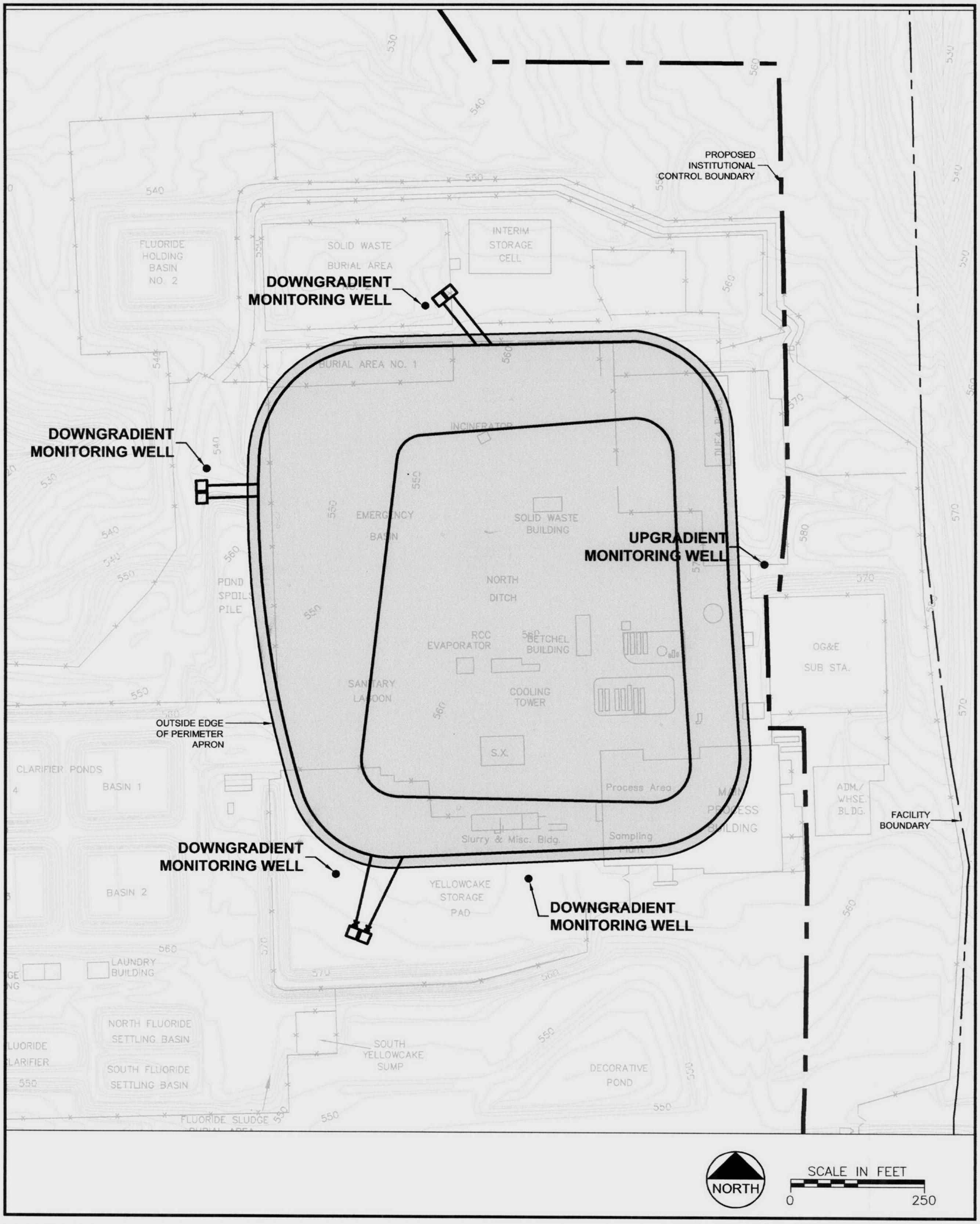
B **REQUEST**: SFC states that the Terrace Groundwater System is perched on the shallow bedrock aquifers. Shale 1, which underlies the Terrace Groundwater System, is considered an aquifer unit as opposed to Sandstone 1 that is an aquitard. Appendix D states there is no hydraulic connection between the shallow bedrock and terrace systems.

If the shale units are aquifers and the sandstone units the aquitards, would not the Terrace and Shale 1 systems be interconnected? If so, please revise appendices B and D to reflect this condition. If Shale 1 and the Terrace Groundwater System are hydraulically separated, provide the justification for calling it a perched zone when it appears to be a large unconfined aquifer that is recharged through infiltration of precipitation.

BASIS: 10 CFR 40, Appendix A, Criterion 5B(1), states that hazardous constituents entering the ground water from a licensed site must not exceed the specified concentration limits in the uppermost aquifer beyond the point of compliance for the compliance period. A clear definition of the uppermost aquifer must be presented in the Reclamation Plan to comply with this criterion.

RESPONSE:

See response above. The underlying "shallow bedrock" is a term that historically was used to describe first encountered consolidated units which were the Sandstone layers 1 - 4, and the lower shale layers (Shale 2-4). Please refer to the HGSCR for the most current site conceptual model.



MFG, Inc.

consulting scientists and engineers

FIGURE 1
CELL MONITORING WELLS

Date:	MARCH 2005
Project:	180734
File:	FIG-MON-WELLS.dwg

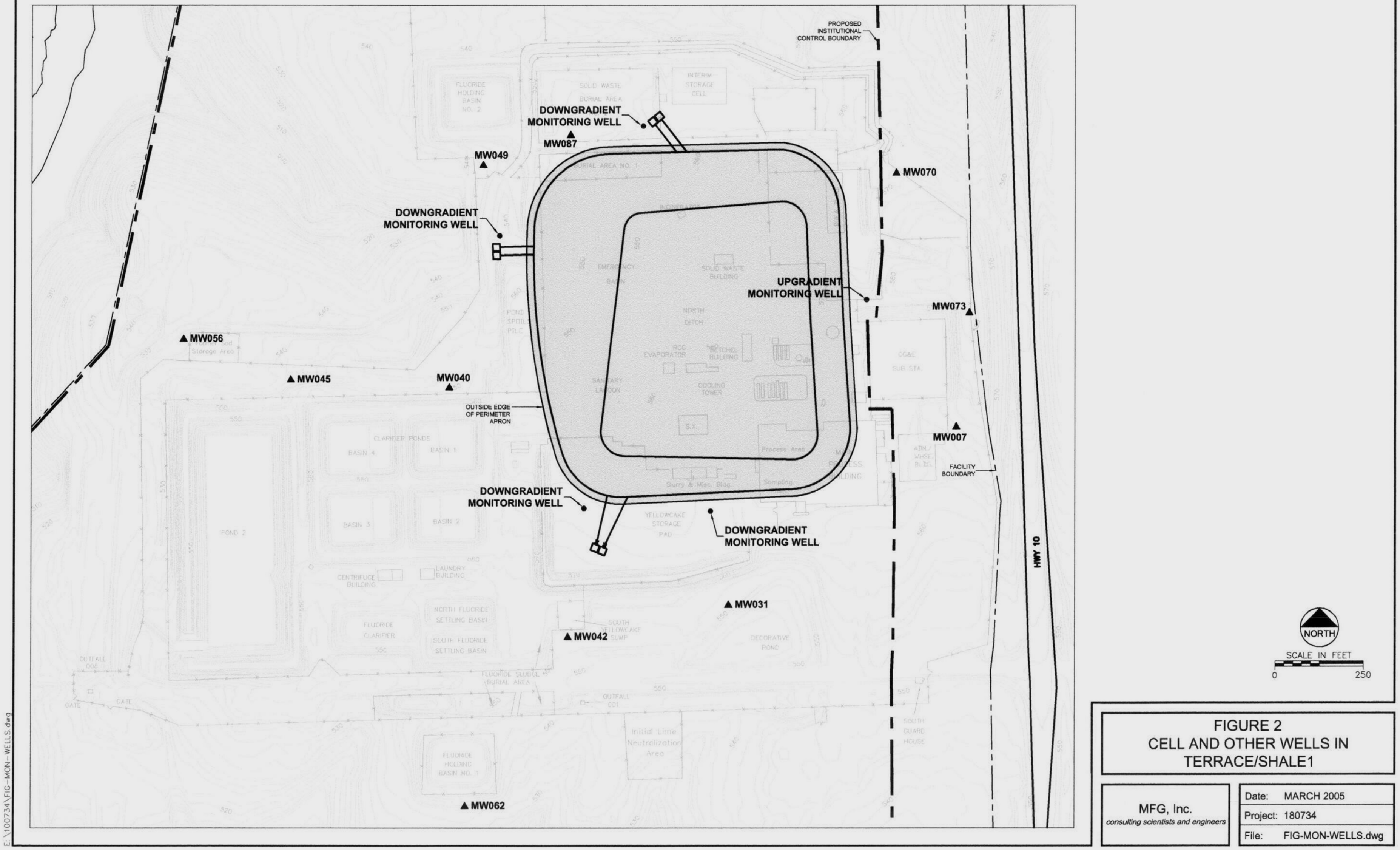


FIGURE 2
CELL AND OTHER WELLS IN TERRACE/SHALE1

MFG, Inc.
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Date:	MARCH 2005
Project:	180734
File:	FIG-MON-WELLS.dwg

E:\100734\FIG-MON-WELLS.dwg

Enclosure 2

Excerpts from The Ground Water Monitoring Plan

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.

Groundwater Monitoring Plan
Appendix B

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

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

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

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

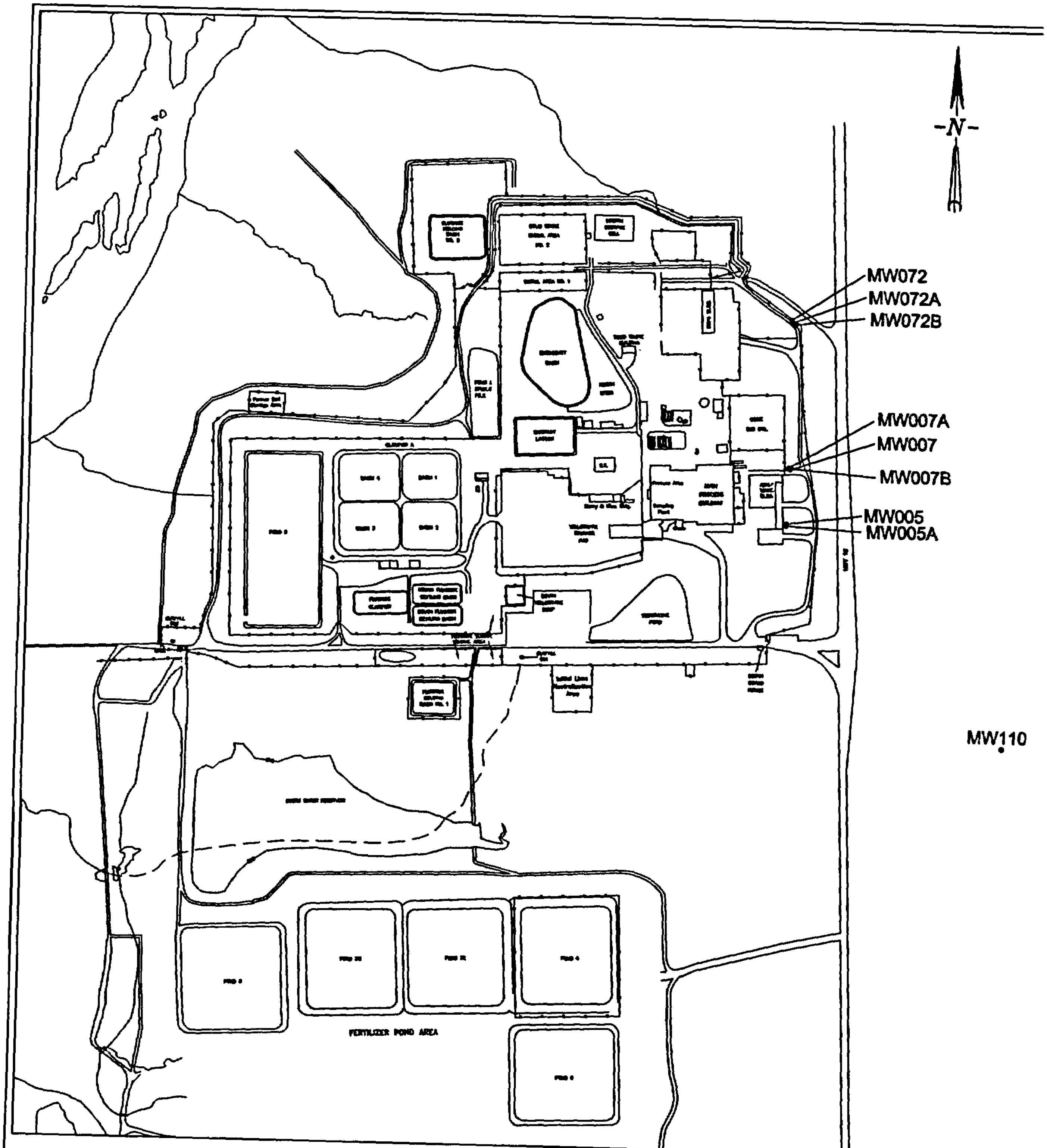
Total Measurements	14
Total Non-Detects	12 (85.7143%)
Background Mean	1.14643
Background Std Dev	0.556578

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

Table 4
Upper Confidence Levels (95%) of Background Water Quality for Groundwater Systems

	Number Meas.	S. Dev.	Mean	UCL
Terrace				
Arsenic, mg/l	30	0.003	0.006	0.009
Fluoride, mg/l	28	0.3	0.6	0.8
Nitrate, mg/l	41	0.7	1.3	1.7
Uranium, µg/l	21	0.4	1.1	1.5
Shallow Bedrock				
Arsenic, mg/l	29	0.003	0.006	0.008
Fluoride, mg/l	32	0.2	0.6	0.8
Nitrate, mg/l	46	1.3	2.2	3.0
Uranium, µg/l	27	0.2	1.0	1.2
Deep Bedrock				
Arsenic, mg/l	21	0.002	0.006	0.009
Fluoride, mg/l	15	0.6	2.2	2.9
Nitrate, mg/l	19	0.4	1.0	1.4
Uranium, µg/l	14	0.6	1.1	1.8



SEQUOYAH FUELS CORPORATION
Background Groundwater Monitoring Well Evaluatior

TITLE: **Background Monitoring Well Locations**

PREPARED BY: SCM
FILENAME: Figure1.dwg
REVIEWED BY: SCM
DATE: 18 Oct 2004

FIGURE NO. 1

Figure 2

Arsenic - Box Plot

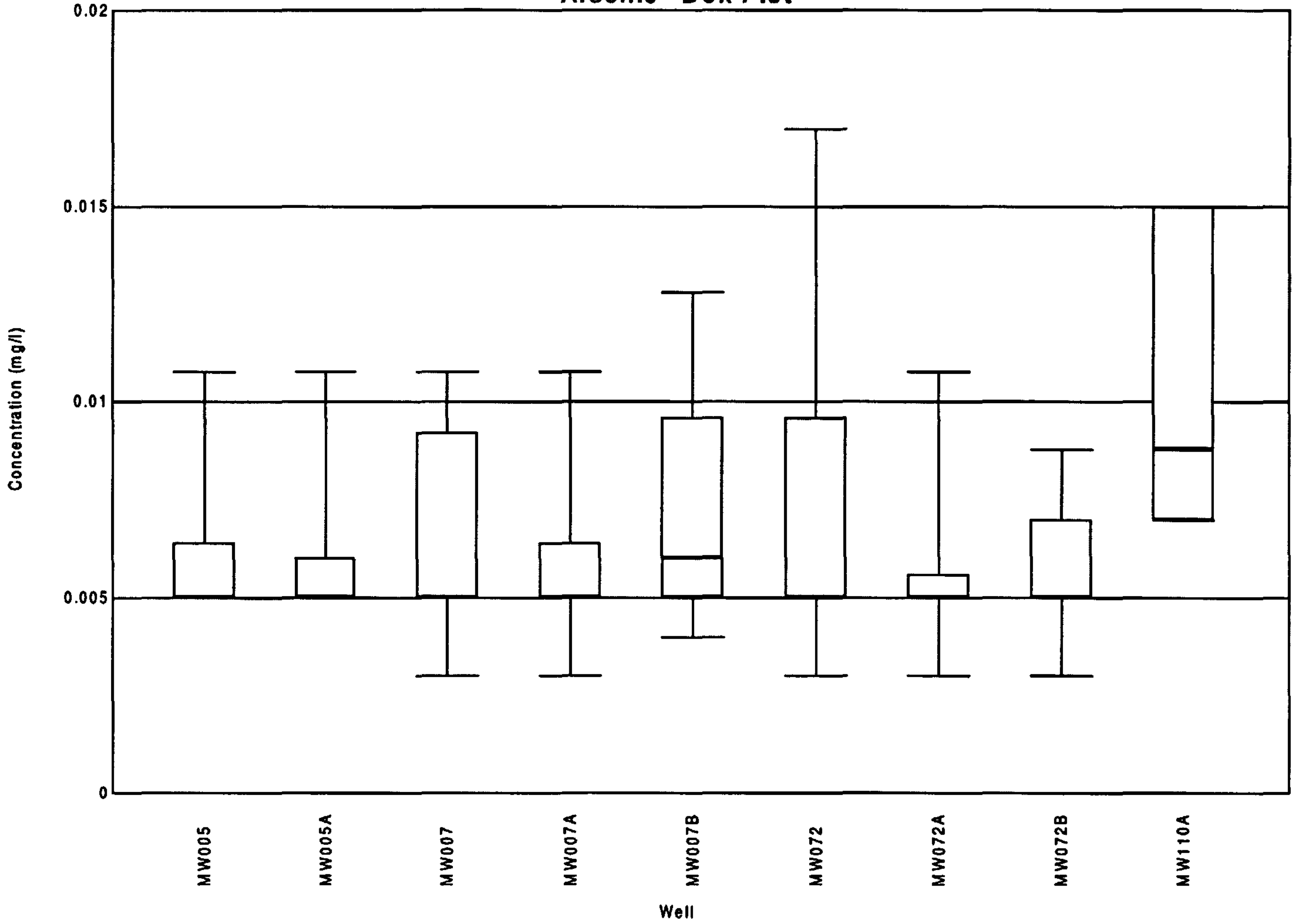


Figure 3

Fluoride - Box Plot

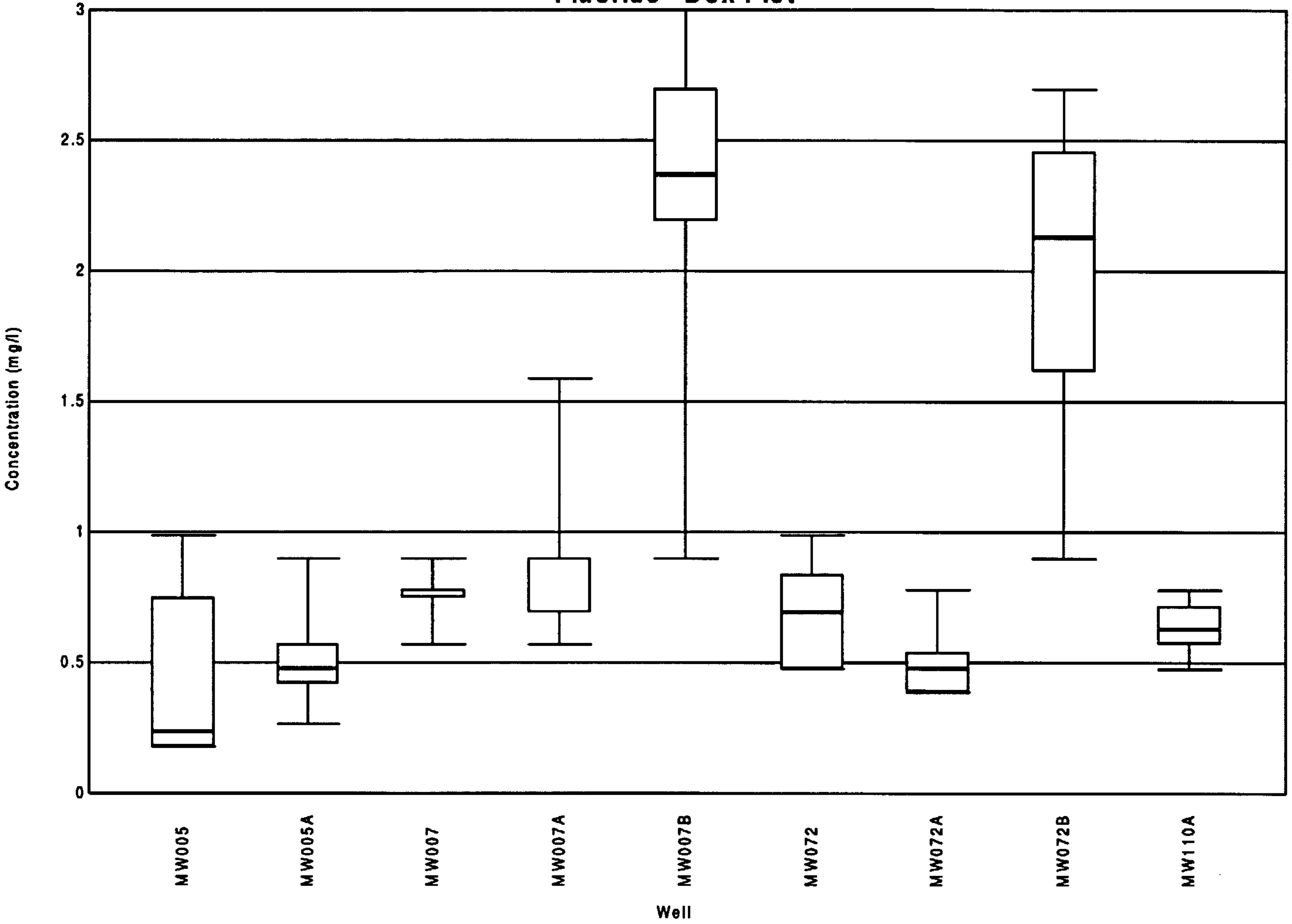


Figure 4

Nitrate - Box Plot

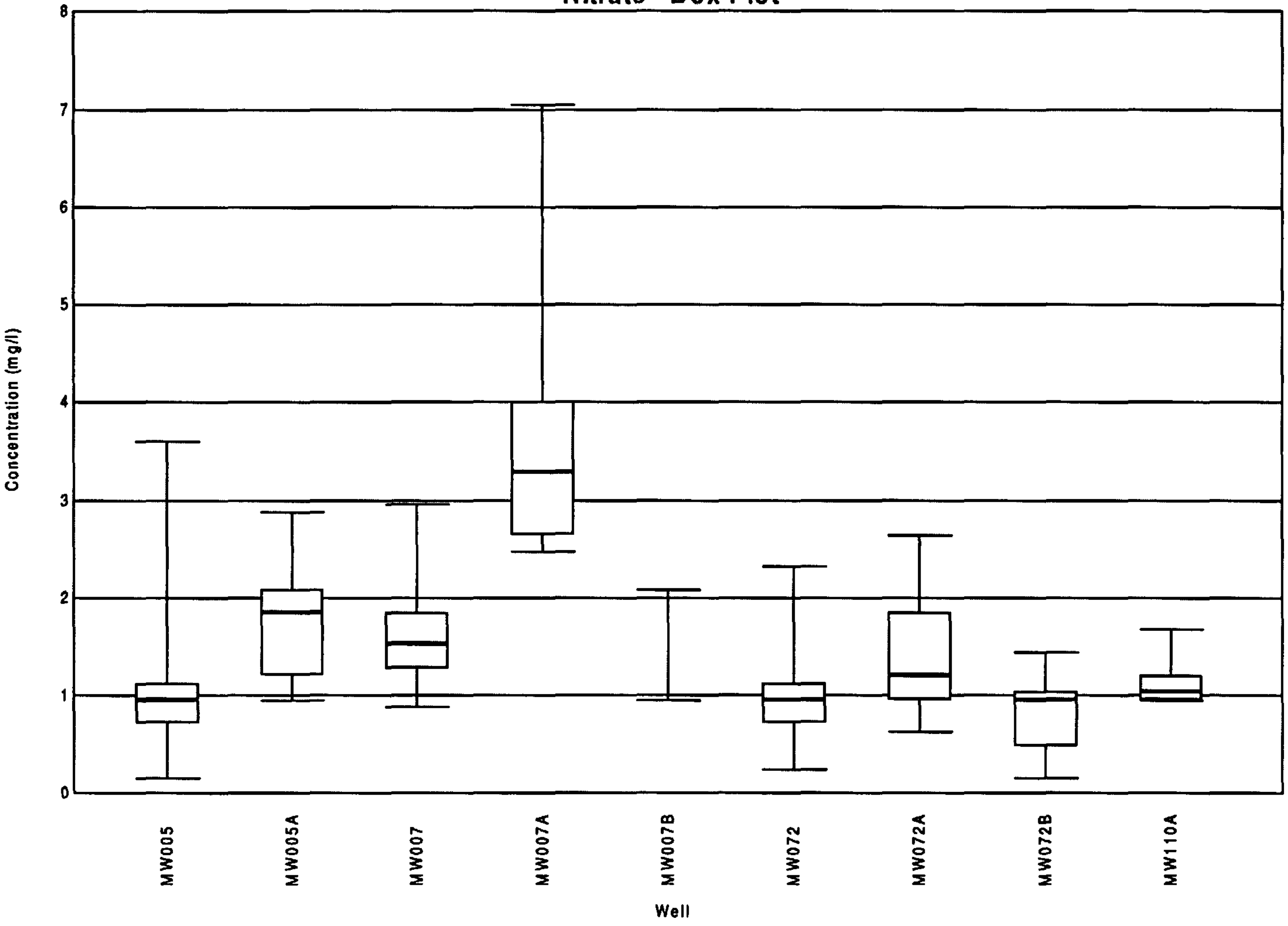


Figure 5

Uranium - Box Plot

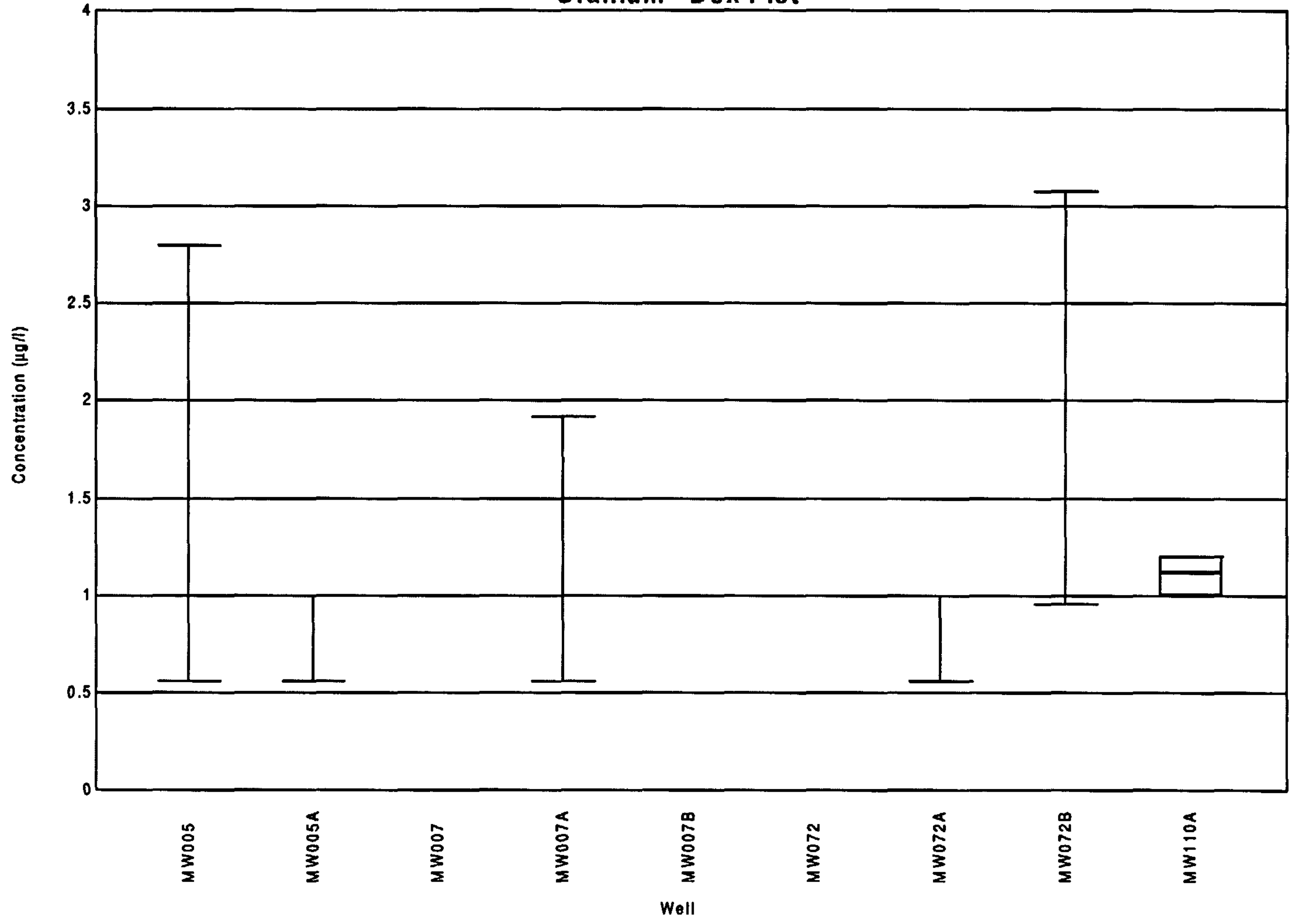
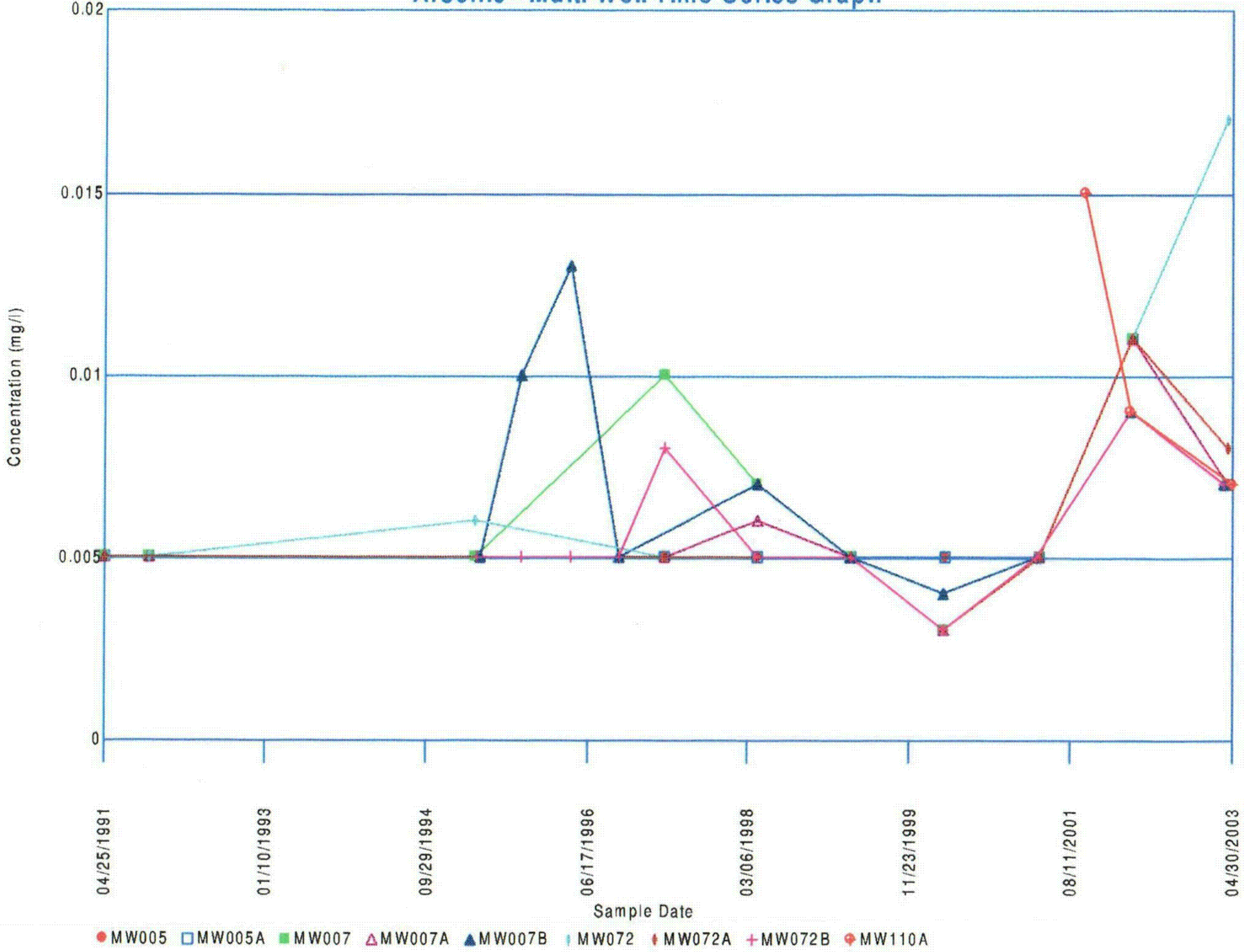


Figure 6

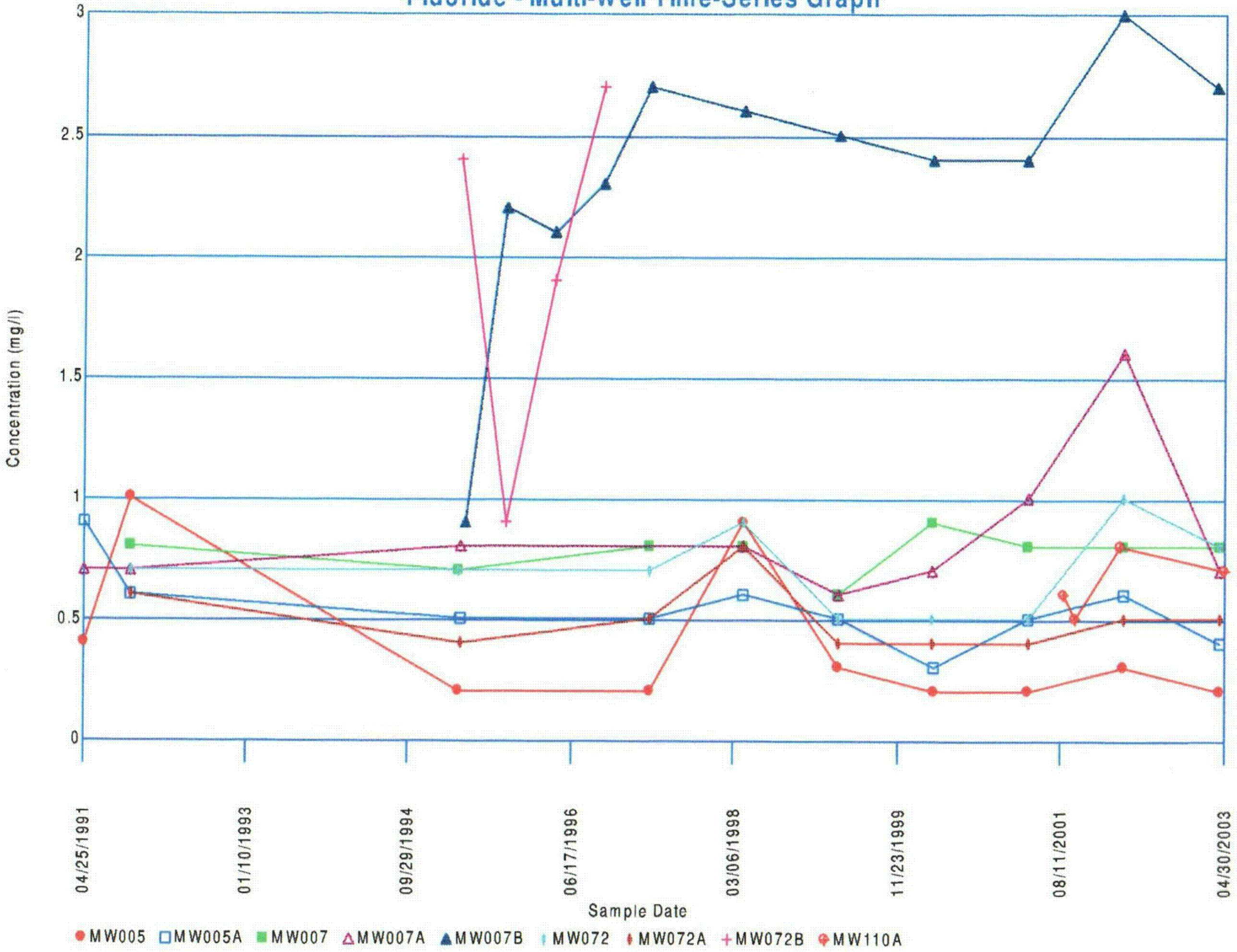
Arsenic - Multi-Well Time-Series Graph



C-01

Figure 7

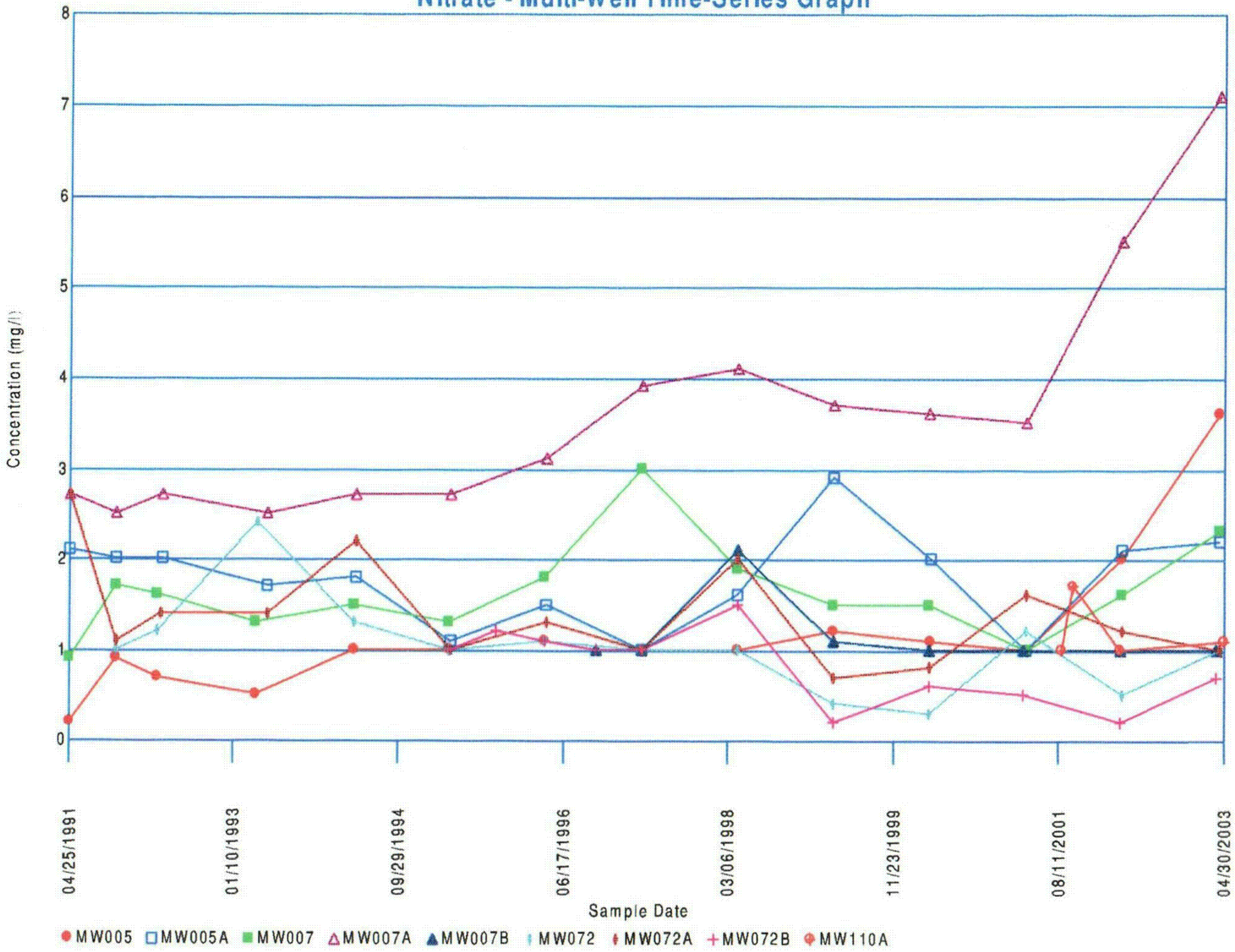
Fluoride - Multi-Well Time-Series Graph



C-02

Figure 8

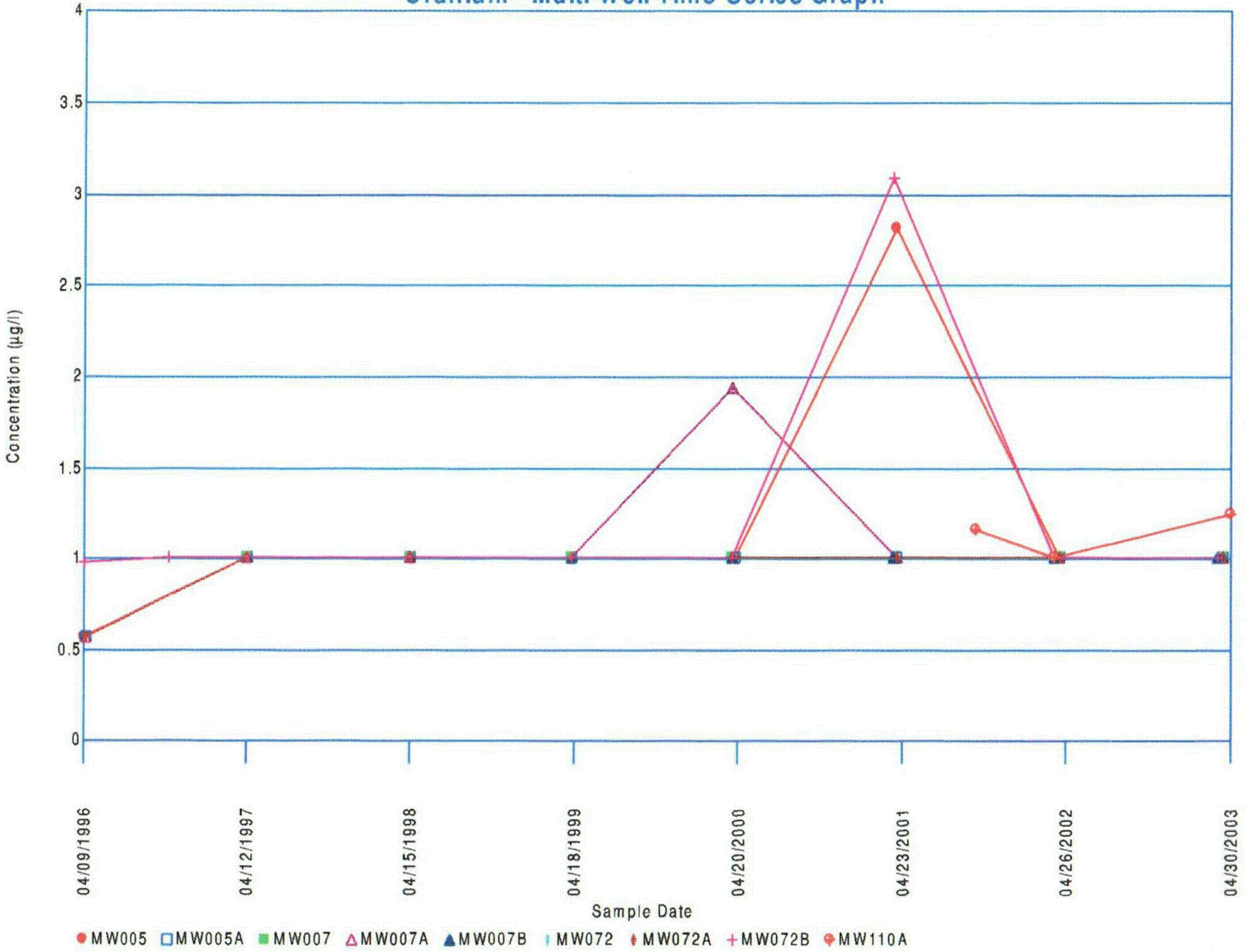
Nitrate - Multi-Well Time-Series Graph



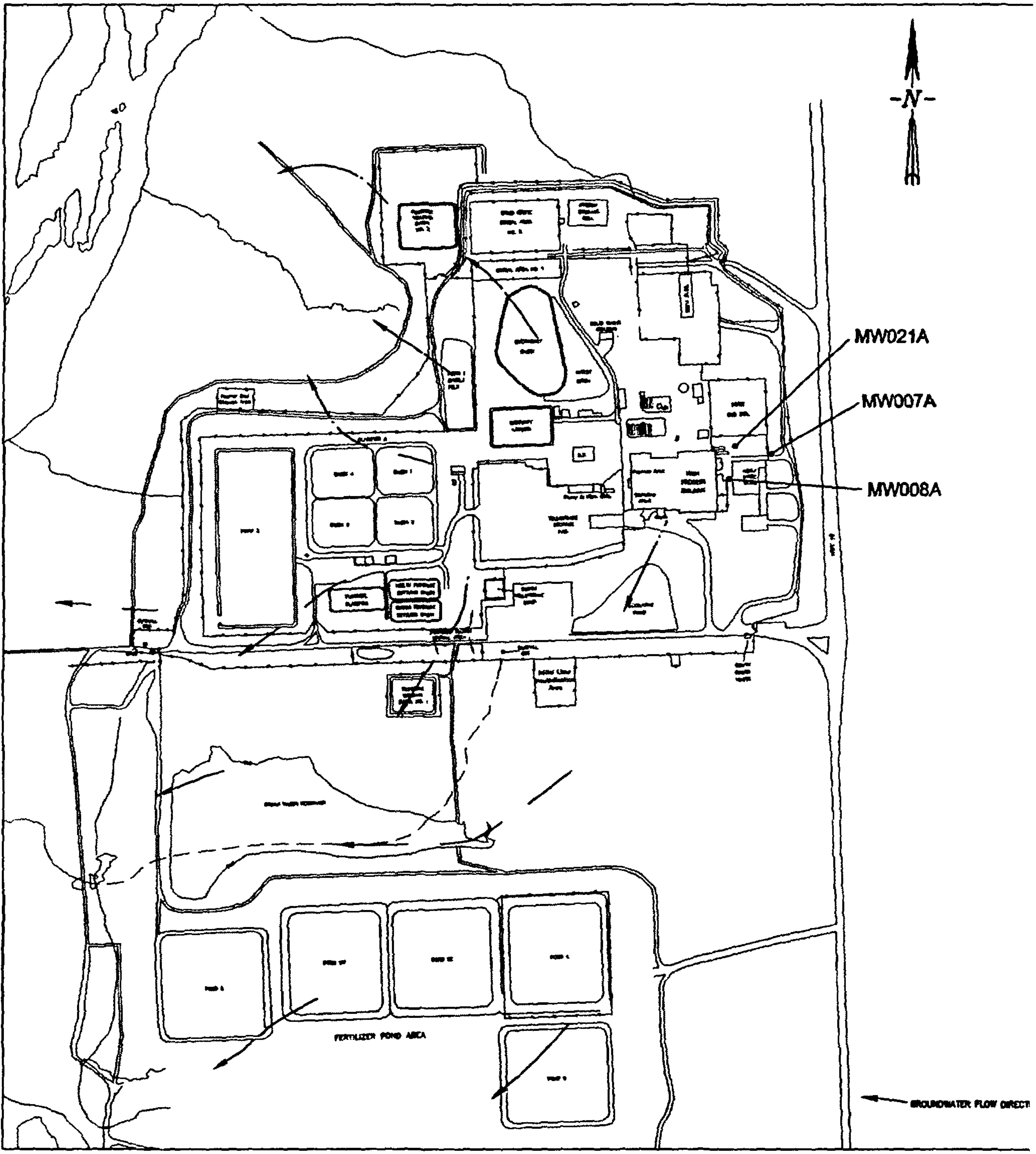
C-03

Figure 9

Uranium - Multi-Well Time-Series Graph



C-04



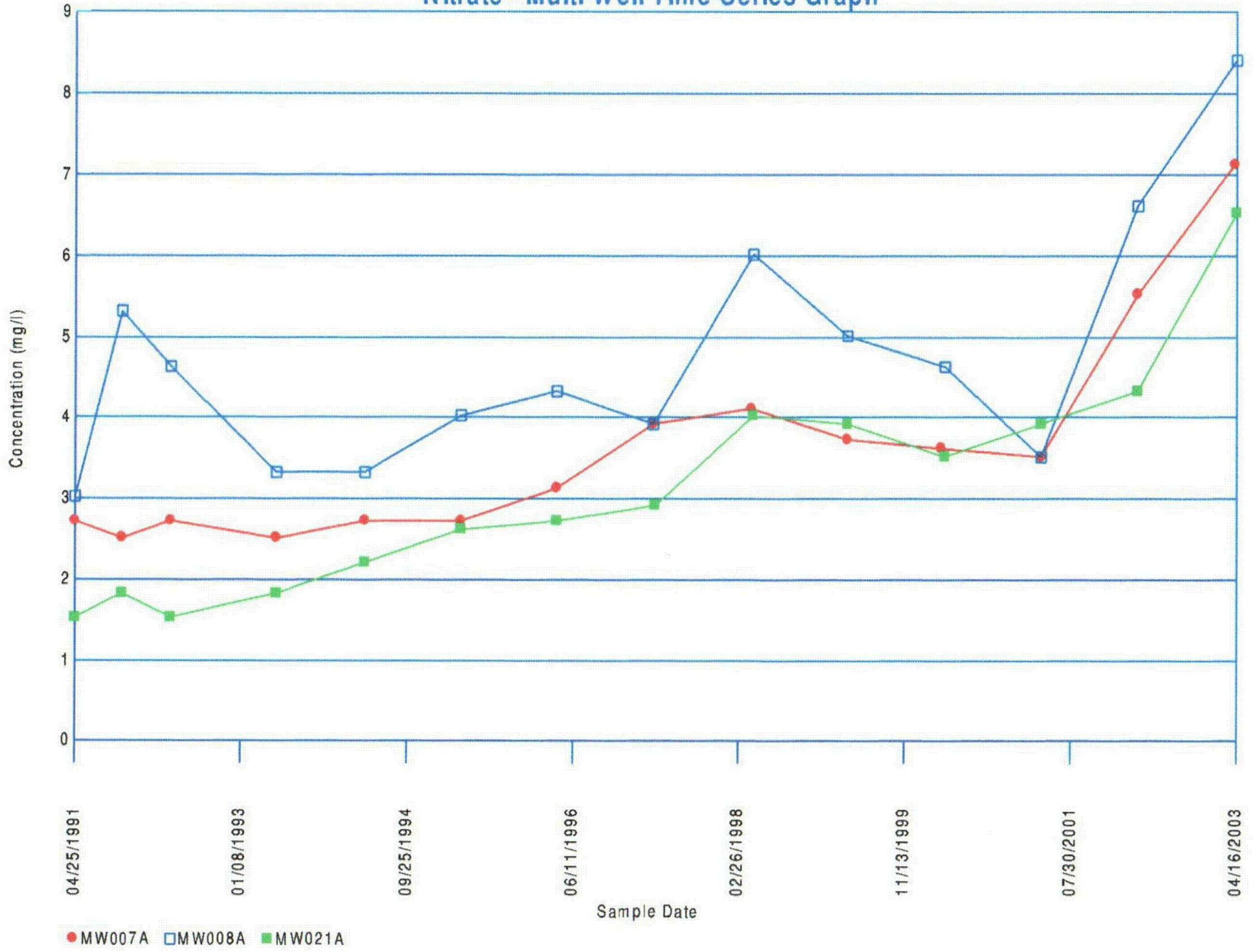
SEQUOYAH FUELS CORPORATION
Background Groundwater Monitoring Well Evaluatior

TITLE: *Location of MW007A, MW008A & MW021A*

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

Figure 11

Nitrate - Multi-Well Time-Series Graph

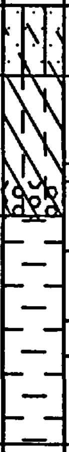


C-05

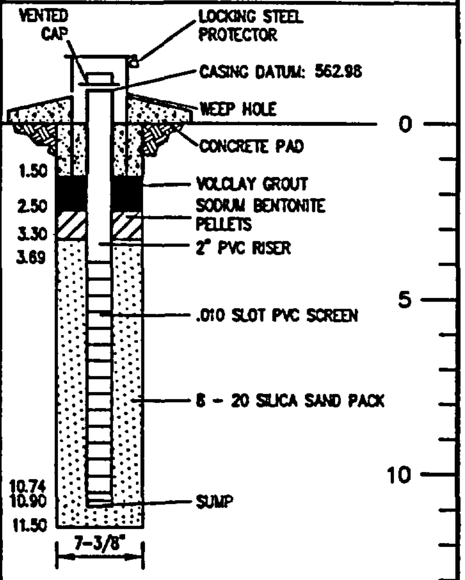
Attachment A

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE	INTERVAL	"N" VALUE
		Start: 8:40 Stop: 9:15 GROUND SURFACE: 560.70					
	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	OL		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	‐ ‐ ‐	WATER TABLE (TIME OF BORING)
☒	STANDARD PENETRATION TEST	L	LABORATORY TEST LOCATION
☐	UNDISTURBED SAMPLE	+	PENETROMETER (TONS/SQ. FT.)
≡	WATER TABLE (24 HOURS)		

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JOB NAME/NUMBER *SEQUOYAH\ 90067*

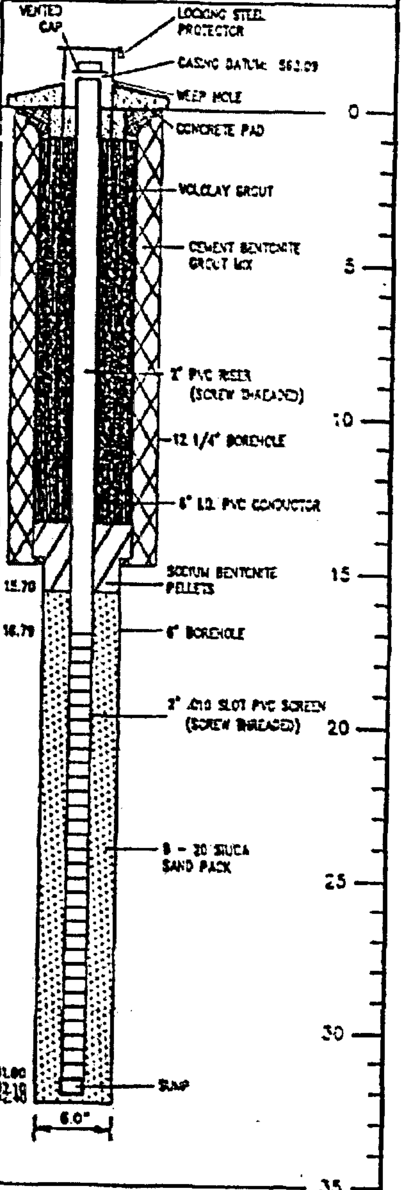
BORING NUMBER *MW005 (BH-10)*

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	GRAPHIC LOG	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 (0.8'), 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 5/8, LIGHT OLIVE BROWN WITH 2.5 Y 7/0, LIGHT GRAY ELIPTICAL LENSES	SHALE		4 NR 5	 2.5	
	12.5	SANDSTONE: VERY FINE GRAIN SAND, 10 YR 5/3, BROWN, HARD	SANDSTONE		NS NS 1		
10/5/90 ▽ 17.4	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 8		
	32.4	T.D. 32.4'					
	35						

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-5A (BH-10 & BH-10A)*

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

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NORMAN, OKLAHOMA 73072
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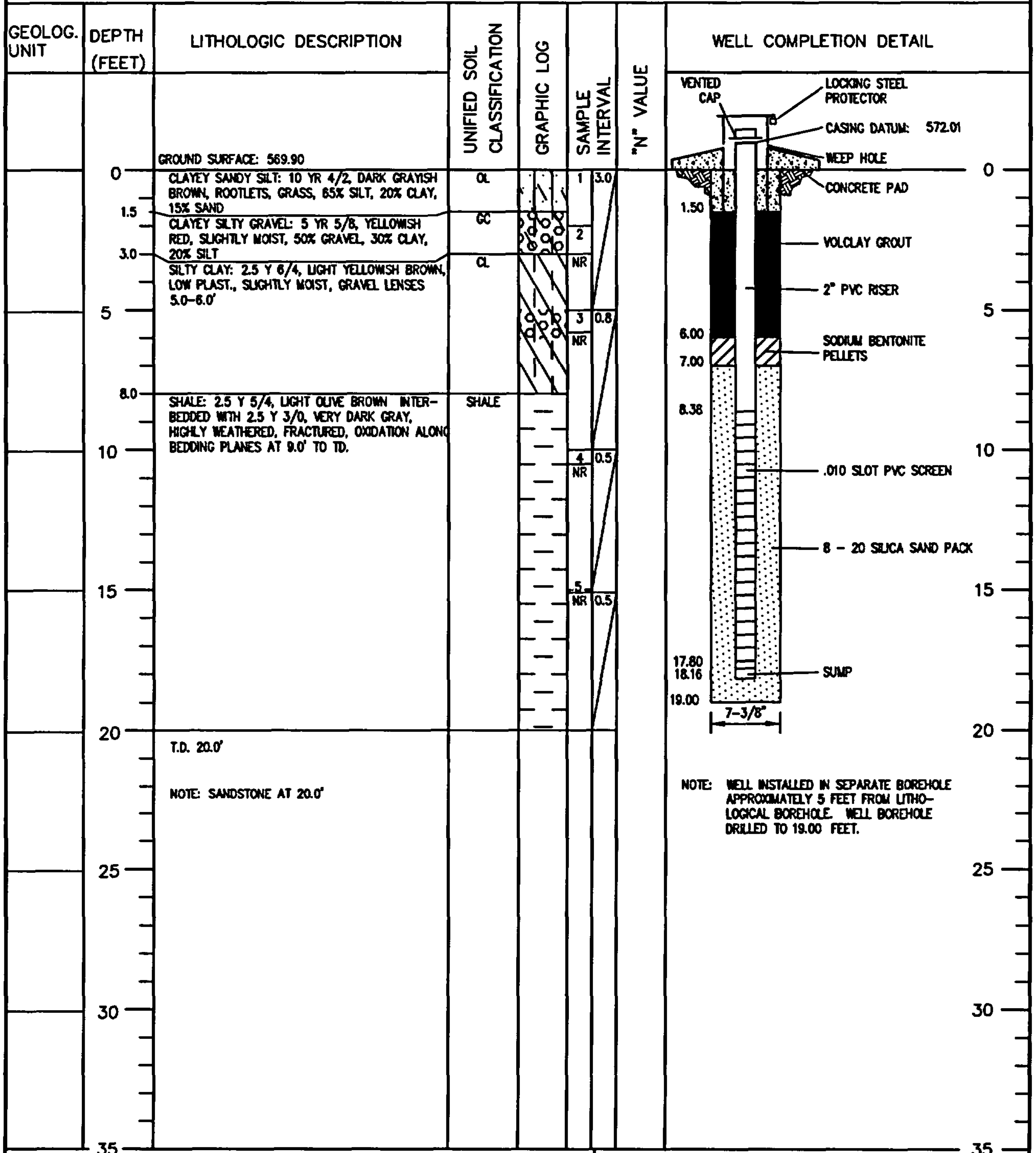
WELL COMPLETION RECORD

GROUND SURFACE: 569.90

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	SAMPLE INTERVAL		"N" VALUE
	0	CLAYEY SANDY SILT: 10 YR 4/2, DARK GRAYISH BROWN, ROOTLETS, GRASS, 65% SILT, 20% CLAY, 15% SAND	OL	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 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	4 NR 5 NR	0.5 0.5	
	20	T.D. 20.0' NOTE: SANDSTONE AT 20.0'				



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.)

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JOB NAME/NUMBER SEQUOYAH\ 90067

BORING NUMBER MW007 (BH-14)

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

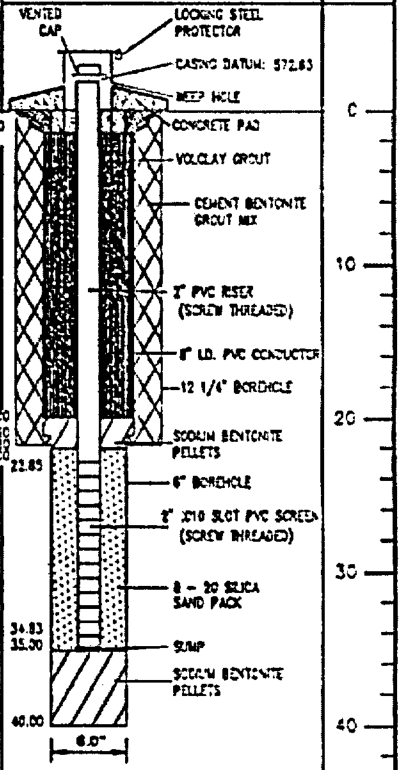
PAGE 1 OF 1

WELL COMPLETION RECORD

GROUND SURFACE: 570.20

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	SAMPLE INTERVAL		"N" VALUE
	0	CLAYEY SANDY SILT: 10 YR 4/2, DARK GRAYISH BROWN, ROOTLETS, GRAVEL, 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., GRAVEL LENSE AT 5.0-6.0', SLIGHTLY MOIST	CL	NR 3 NR	0.8	
10/5/90 ▽ 15.2'	8.0	SHALE: 2.5 Y 5/4, LIGHT OLIVE BROWN, INTERBEDDED 2.5 Y 3/0, VERY DARK GRAY, HIGHLY WEATHERED, FRACTURED, OXIDIZED ZONES, GROUNDWATER AT 15.2-15.4', OXIDATION ALONG BEDDING PLANES AT 8.0 TO T.D.	SHALE	4 NR 5 NR	2.5 0.5	
	20.0	SANDSTONE: 10 YR 5/3, BROWN, VERY FINE GRAIN VERY HARD	SANDSTONE	NS		
	20.8	SHALE: 7.5 YR 4/0, DARK GRAY, VERY HARD, SLIGHTLY MOIST, MINOR VERY FINE GRAIN SAND, INCREASES WITH DEPTH	SHALE	1		
	24.0	SILTY SANDSTONE: VERY FINE GRAIN SAND, 40% SILT, 7.5 YR 4/0, DARK GRAY, SLIGHTLY MOIST, HARD	SILTY SANDSTONE	2 NS		
	29.0	SANDSTONE: VERY FINE GRAIN, 7.5 YR 3/0, VERY DARK GRAY, VERY HARD, SLIGHTLY MOIST	SANDSTONE	3		
	32.0	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				

WELL COMPLETION DETAIL



- ▭ ONE 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-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

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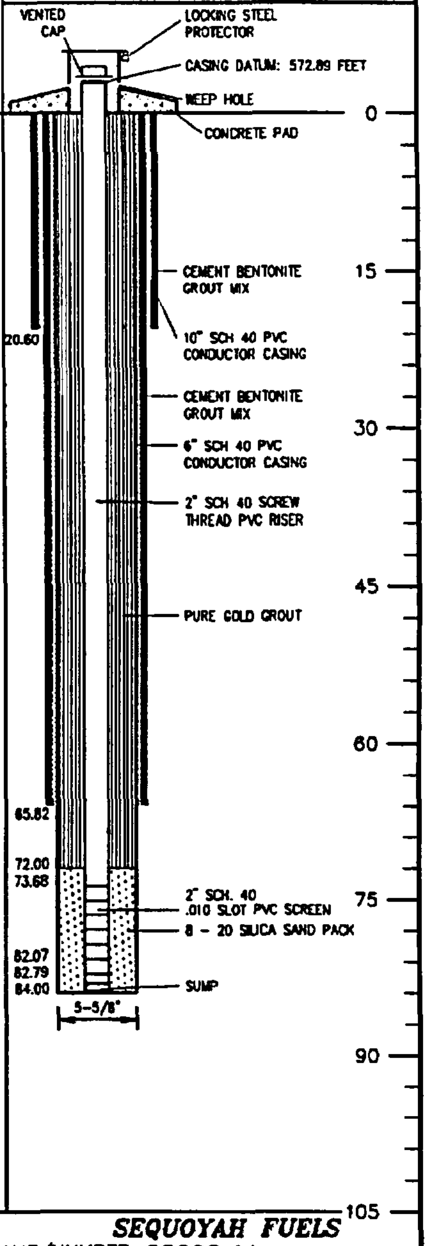
NORMAN, OKLAHOMA 73072
(405) 321-3895

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 570.29 FEET			
	0	CLAYEY SANDY SILT:	ML		
	1.5	CLAYEY SILTY GRAVEL:	GW		
	3.0	CLAY:	CH		
∇ 9.8	7.0	SHALE:	SHALE		
	20.0	SANDSTONE:	SANDSTONE		
	22.4	SHALE:	SHALE		
	24.0	SANDSTONE:	SANDSTONE		
	25.7	SHALE:	SHALE		
∇ 34.58	29.4	SANDSTONE:	SANDSTONE		
	36.8	SANDY SHALE:	SHALE		
	38.5	SANDSTONE:	SANDSTONE		
	45	SHALE:	SHALE		
	61.2	SANDSTONE:	SANDSTONE		
	70.8	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

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JOB NAME/NUMBER **SEQUOYAH FUELS 93092.11**

BORING NUMBER **MW-7B (BH-113)**

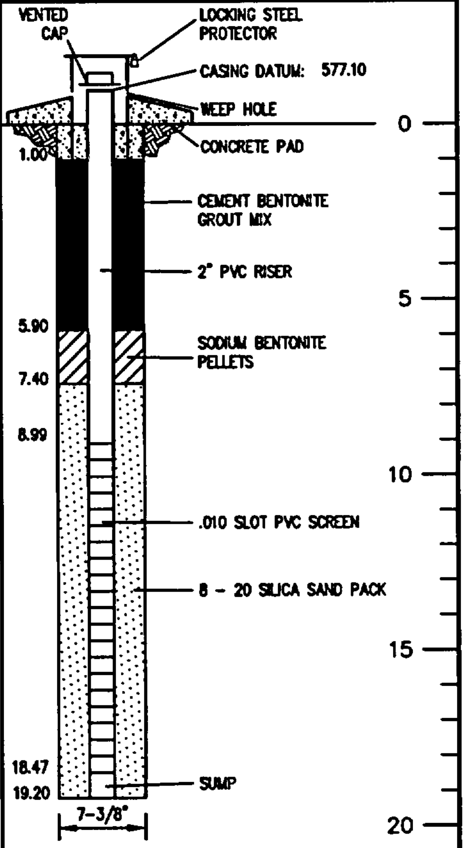
DATE DRILLED 2/7/95, 2/27-3/3/95
DRILLING METHOD HSA/AIR ROTARY
DRILLED BY LWC
LOGGED BY MJ.
CHECKED BY BJS
DRAWING NO. 93092.11 B01
DRAWN BY: RML
PAGE 1 OF 1

WELL COMPLETION RECORD

GROUND SURFACE: 574.22

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	SAMPLE INTERVAL	"N" VALUE
	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

☒ STANDARD PENETRATION TEST

☐ UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

└ LABORATORY TEST LOCATION

+ PENETROMETER (TONS/SQ. FT.)

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NORMAN, OKLAHOMA 73072
(405) 321-3895

JOB NAME/NUMBER *SEQUOYAH\90067*

BORING NUMBER *MW072 (BH-82)*

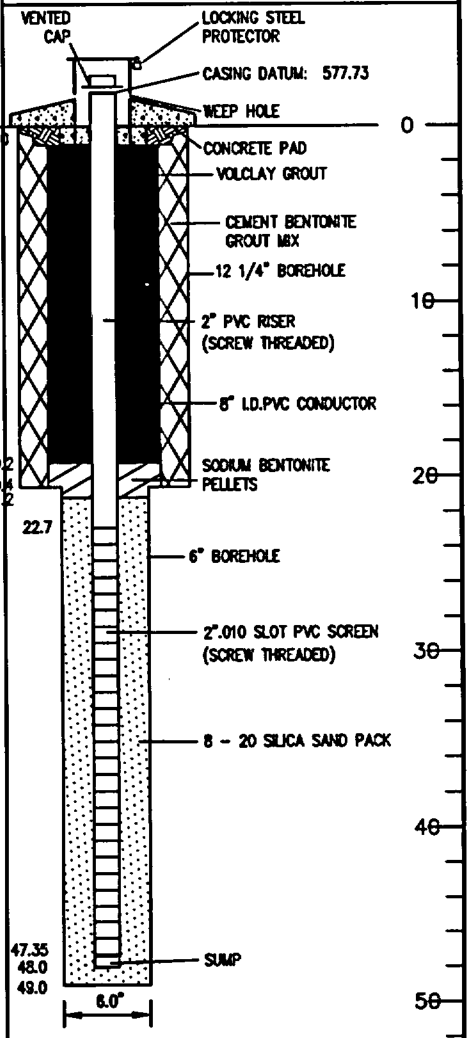
DATE DRILLED 12/10/90
DRILLING METHOD HSA
DRILLED BY PSI
LOGGED BY TPG
CHECKED BY BJS
DRAWN BY: SAR

PAGE 1 OF 1

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 575.10				
	0 0.6	TOPSOIL:				
		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		1 2.3 NR 2 2.5	
	5.0	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 10	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', REDUCED FE ZONE, GRADES TO 7/8 TO 3/0 WITH NO 7/0 BY 14.0'	SHALE		5 6 7 3.5 8 NR	
	19.2	WEATHERED SHALE:	SHALE		9 1.5'	
	20 20.4	CONDUCTOR CASING	SHALE		NS	
		SHALE: 2.5 Y 5/4, LIGHT OLIVE BROWN, SOFT, MOIST TO WET, WEATHERED			1 2 3 4	
29.0'	29.0 30	SHALE: 2.5 Y 2/0, BLACK, SOFT, WET, FISSILE, ORGANIC	SHALE			
		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		5 6 7 8 9 10 11 12	
	40 22.8	SHALE: 2.5 Y 2/0, BLACK, SOFT, WET, FISSILE, ORGANIC	SHALE		13	
	24.5 50	T.D. 49.0'				
	60					
	70					

WELL COMPLETION DETAIL



⧄ CME CONTINUOUS AUGER SAMPLER

☒ STANDARD PENETRATION TEST

☐ UNDISTURBED SAMPLE

WATER TABLE (24 HOURS)

WATER TABLE (TIME OF BORING)

LABORATORY TEST LOCATION

\+ PENETROMETER (TONS/SQ. FT.)

ROBERTS/SCHORNICK

& ASSOCIATES, INC.

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NORMAN, OKLAHOMA 73072
(405) 321-3895

JOB NAME/NUMBER *SEQUOYAH\ 90067*

BORING NUMBER *MW072A (BH-82)*

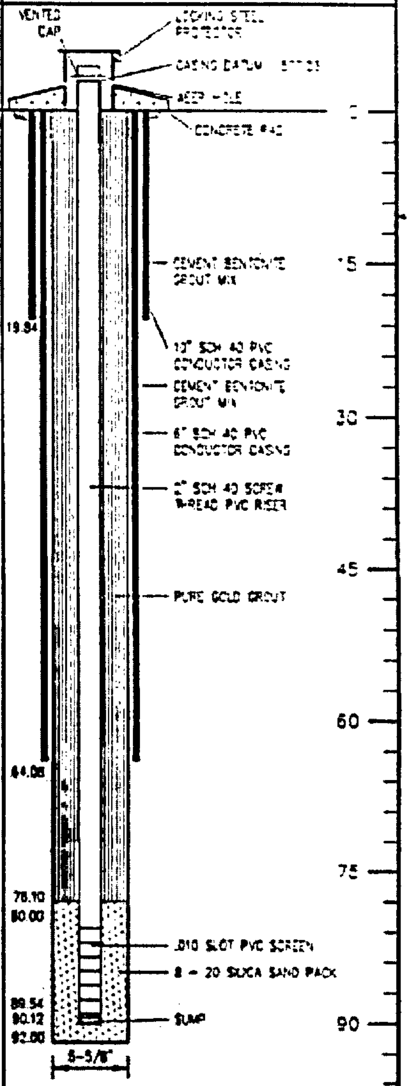
DATE DRILLED 1/14/91
DRILLING METHOD AIR ROTARY
DRILLED BY POOL
LOGGED BY JMB
CHECKED BY BJS
DRAWN BY: SAR PAGE 1 OF 1

WELL COMPLETION RECORD

GROUND SURFACE 574.57 FEET

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
	0	GRAVELLY, SANDY, CLAYEY, SILT	ML			
	2.0	GRAVELLY SILTY CLAY	CL			
	8.0	CLAY	CH			
	8.8	SHALE	SHALE			
∇ 18.80	19.6	SANDSTONE	SANDSTONE			
	20.2	SHALE	SHALE			
	24.3	SANDSTONE	SANDSTONE			
	25.5	SHALE	SHALE			
	28.6	SANDSTONE	SANDSTONE			
∇ 34.45						
	45	SHALE	SHALE			
	59.8	SANDSTONE	SANDSTONE			
	69.4	SHALE	SHALE			
	92.0	TOTAL DEPTH: 92.0 FEET FOR COMPLETE LITHOLOGIC DESCRIPTION, SAMPLE INTERVAL, AND "N" VALUE SEE BH-114.				

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

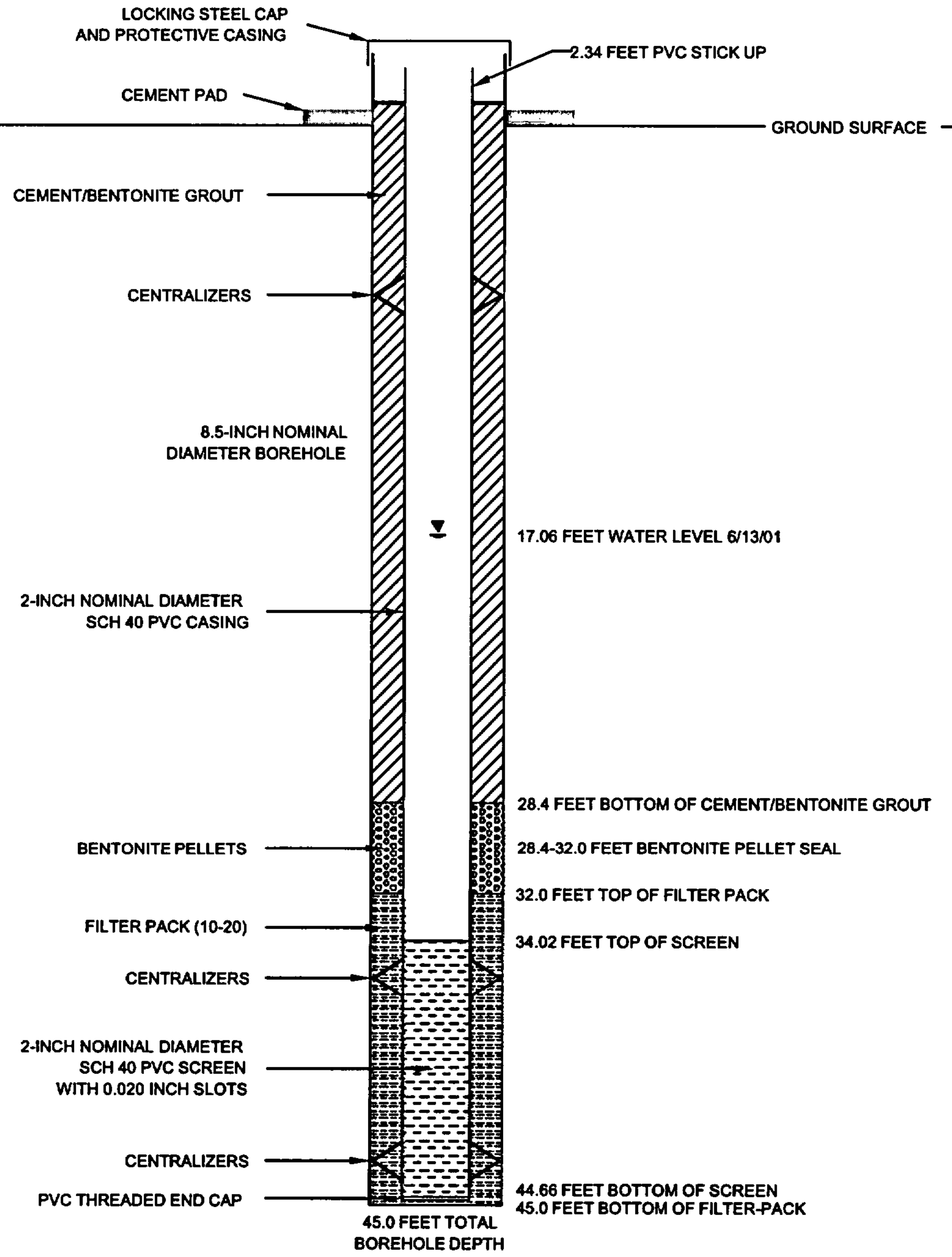
SEQUOYAH FUELS

JOB NAME/NUMBER 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 MJ
CHECKED BY BJS
DRAWING NO 93092922
DRAWN BY: RHL
PAGE 1 OF 1

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



NOTE:
NOT TO SCALE
ALL DEPTHS ARE BELOW GROUND SURFACE

SHEPHERD MILLER
INCORPORATED

MW-110

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

BORING LOG

SHEPHERD MILLER
INCORPORATED

BORING NO.
BH327

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	C O	10:45	0		BLIND DRILED -NO RECOVERY.
2	L L U	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	V I	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	U M	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					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	1 SH	11:31	1.8		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.